ISBN: 978-81-953600-2-4

Agricultural Science

Research and Reviews

Volume I

Editors

Dr. Rajendra V. Salunkhe

Dr. Shrikant D. Kalyankar

Dr. Laxmikant N. Borkar

Dr. Parashurama T. R

Bhumi Publishing

First Edition: 2021

Agricultural Science: Research and Reviews

Volume I

(ISBN: 978-81-953600-2-4)

Editors

Dr. Rajendra Vishnu Salunkhe
Department of Zoology,
Arts, Science and Commerce College,
Indapur, Dist. Pune (M.S.)

Dr. Shrikant Deorao Kalyankar
Govt. College of Dairy Technology,
Udgir - 413 517
Dist. Latur (M.S.)

Dr. Laxmikant N. Borkar
Department of Botany
Shivprasad Sadanand Jaiswal College,
Arjuni/Mor, Dist. Gondia (M.S.)

Dr. Parashurama T. R
Department of Botany,
Kumadvathi First Grade College,
Shikaripura, Karnataka

Bhumi Publishing

2021

First Edition: 2021

ISBN: 978-81-953600-2-4

Published by:

Bhumi Publishing,

Nigave Khalasa, Kolhapur 416207, Maharashtra, India

Website: www.bhumipublishing.com

E-mail: bhumipublishing@gmail.com

Book Available online at:

https://www.bhumipublishing.com/books/

PREFACE

We are delighted to publish our book entitled ***"Agricultural Science: Research and Reviews Volume I"****. This book is the compilation of esteemed articles of acknowledged experts in the fields of basic and applied agricultural science.*

The Indian as well as world population is ever increasing. Hence, it is imperative to boost up agriculture production. This problem can be turned into opportunity by developing skilled manpower to utilize the available resources for food security. Agricultural research can meet this challenge. New technologies have to be evolved and taken from lab to land for sustained yield. The present book on agriculture is to serve as a source of information covering maximum aspects, which can help understand the topics with eagerness to study further research. We developed this digital book with the goal of helping people achieve that feeling of accomplishment.

The articles in the book have been contributed by eminent scientists, academicians. Our special thanks and appreciation goes to experts and research workers whose contributions have enriched this book. We thank our publisher Bhumi Publishing, India for taking pains in bringing out the book.

Finally, we will always remain a debtor to all our well-wishers for their blessings, without which this book would not have come into existence.

- Editorial Team

Agricultural Science: Research and Reviews Volume I

ISBN: 978-81-953600-2-4

CONTENTS

Sr. No.	Chapter and Author(s)	Page No.
1	**A Compendious Review on Medicinal Value of Traditionally Used Foods** K. Abarajitha and L. Uthira	1 – 9
2	**Treatment of Inflammatory Bowel Disease using Nutritional Crops** Vinod Kumari	10 – 22
3	**Documentation on Ethnic Medicinal Plants and Their Consumption in India – A Review** Naveena Reddy S and L. Uthira	23 – 30
4	**Study of Ethnomedicinal Plants From Melghat Tribal Region, Amravati District** U. R. Kokate	31 – 34
5	**Medicinal Plant *Asparagus Racemosus*: a Boon for Women's Health** A. N. Shende	35 – 40
6	**Eleven Strong Ethnomedicinal Immunity Boosters: To Beat Covid-19 Among Tribals of East Nimar** Shakun Mishra	41 – 44
7	**Environmental Impact of Using Cellulosic Ethanol** Enakshi Guru	45 – 55
8	**Night Soil Waste Management Techniques and Case Studies** Jayashree R, Kamini S. and Mahalakshmi M. R	56 – 60
9	**Plant Disease Control and Management** Maruti S. Darade	61 – 70

10	**Medical Geographic nformation Systems (Medical GIS): A Review** Ashutosh Mishra and Jai Kumar	71 – 78
11	**Effects of Weather and climate on Pests Outbreak** Debasmita Das, Soumya Sthitapragyan and Nirmala Patel	79 – 86
12	**An Overview of Agricultural Labourer: Problems and Solution** Ramshankar Varma	87 – 94
13	**Crop Insurance Schemes for Farmers** Yamini Raut and Vikas Bhandari	95 – 112
14	**Strengthen Agriculture through Sericulture Industry** Sarika R. Varpe	113 – 118
15	**Agro Tourism A New Prospectus For Agriculture Development** Abhijeet Bajirao Pawar	119 – 125
16	**Effectiveness of Vetiver Grass Constructed Wetland Technology for the Treatment of Spray Painting spent wash from Automobile Service Stations** G. Dhanya, Vinod Gopal V and D. S. Jaya	126 – 139
17	**A review on the Significance of Organic Fertilizers** D. J. Vanmare	140 – 150
18	**Eco-friendly Prepared Azo Compound by N-Phenyl Glutarimides' Seedling Germination (SG) Activities on Mung Bean** Ravindra S. Dhivare and Shankarsing S. Rajput	151 – 159
19	**Organic Farming: An Overview** Suman Kantwa and Kamal Mahala	160 – 168

A COMPENDIOUS REVIEW ON MEDICINAL VALUE OF TRADITIONALLY USED FOODS

K. Abarajitha* and L. Uthira

Department of Nutrition and Dietetics,

PSG College of Arts and Science, Coimbatore

*Corresponding author E-mail: abarajitha@psgcas.ac.in

Abstract:

Indigenous methods in treating medical conditions have been followed for a long period of time. Rural and indigenous people serve as a carrier of knowledge about the traditional medicine system to the modern world. With advancement in the technology and lack of documentation, the traditional medicine system became myths. The alkaloids or active components present in various functional foods are responsible for certain medicinal properties including anti-carcinogenic, anti-viral, immune boosting and anti-tumor effects. Various local herbs and foods were used in treatment of ailments in different countries. The survey on utilization of foods for medicinal purposes revealed that the rural and indigenous people used most of the locally available plants (roots, bark/ stem, fruits, leaves) for the treatment of common diseases and disorders. This review focused on medicinal properties of foods as a sole ingredient/bioactive component utilized by indigenous people of Japan, Korea, Malaysia, Thailand, China, Africa, United Kingdom and South America. Further, the medicinal value of food with other ingredients and cooking may change which need to be evaluated to obtain accuracy.

Keywords: Indigenous foods; Traditional medicine; Medicinal foods; Therapeutic plants

Introduction:

Traditional knowledge is the ancestral knowledge and wisdom passed down from one generation to another generation by the folklores and cultural habits. UNESCO defines traditional knowledge as “a cumulative body of knowledge, know-how, practices and representations maintained and developed by people with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldviews [1].

Around the world, knowledge on the culinary system is one among the most common indigenous traditional knowledge. Rural and indigenous people do not see food and medicine as separate branches but rather find it as a continuum as food apart from its physiological benefits it is always seen as an emotional connection to culture and social beliefs [2].

Due to modernization, urbanization and lack of scientific backgrounds to support the medicinal values of food, its importance was neglected considering it as mere folklore tales and superstitious beliefs. It is crucial to fill this gap between food, medicine and ethno-botanical research in order to interpret the traditional knowledge on food owing to its healing properties for effective usage of foods as medicine.

Though this present review was taken with an objective to recognize several studies undertaken around the world to bridge the importance of diet with therapeutic values, it also aimed to understand and enhance the utilization of food as a preliminary source to lead a healthy life.

Review:

Ginseng is a perennial plant which is cultivated in Korea, Japan, China and Russia. According to the country of origin they are classified as 5 different types (*Panax quinquefolius*L. (American ginseng); *Panax japonicus* C. A. Meyer (Japanese ginseng); *Panax notoginseng* (Burk) F. H. Chen (Sanchiginseng); *Panax trifolius*L. (Dwarf ginseng); *Panax vietnamensis* Ha et Grushv; and *Panax pseudoginseng*.). According to Shennong [3] during Liang dynasty ginseng is reported to have a life prolongation effect which is attributed to its activity against the development of cancers. The anticarcinogen activity of ginseng was investigated in newborn mice injected with carcinogens such as 9,10-dimethyl-1-1,2-benzanthracene (DMBA), urethane, aflatoxin B1, N-2-fluorenyl-acetamide (FAA), and tobacco smoke condensates. Weaning mice were orally administrated with red ginseng extract. The mice sacrificed at 28 weeks possessed a 22% decrease in the incidence of lung adenoma (urethane and red ginseng extract). The effect of red ginseng extract in DMBA injected mice (48 weeks) provided 21% decrease in incidence of lung adenoma and 63% decrease in the incidence of Hepatoma while the mice sacrificed at 56 weeks administered with aflatoxin and red ginseng extract exhibited 29% decrease in incidence of lung adenoma and 75% decrease in the incident of Hepatoma. These findings provide a hope for ginseng as a potential tumor inhibitor and a hope for human cancer prevention [4, 5].

The difference in anticarcinogenic activity between white and fresh ginseng as well as the variation in activity on aging of ginseng were evaluated which proved that there is a significant difference [6, 7, 8]. On analysis, sanchi ginseng inhibited early antigen activity activation of

Epstein-Barr virus in Raji cells, induced by TPA and N-butyric acid; pulmonary tumorigenesis in mice induced by 4-nitroquinoline-N-oxide and glycerol and diethylnitrosamine induced liver cancer. Mammary adenocarcinoma induced by N-methyl-N-Nitrsourea has been inhibited from a tissue culture biomass tincture obtained from *Panax ginseng*. In summary, incidence of tumor is inhibited by the administration of ginseng in rodents tissues (lung, liver and mammary glands) [9, 10, 11].

The relationship between the consumption of ginseng and risk of cancer has been investigated among 905 pairs of cases and controls by interviewing method. Among the 905 pairs, 62% of cases and 75% of controls had a history of ginseng intake. The test revealed that there is a significant decrease in the cancer cases in relation with the ginseng intake in both male and female. Comparing the ginseng that is sliced/juiced/tea, ginseng extracts and powder was more effective in action. The results of the study strongly agree with the hypothesis that ginseng exhibits cancer protection activity. An editorial article by Lancet showed an example of cancer chemoprevention of ginseng which reduces the risk of all cancer types. This is a best example of non-organ specific approach [12, 13]. The study was extended to study the dose-response relationship which had the positive impact, i.e. increase in intake of ginseng for longer period reduced the risk considerably. However, the intake of ginseng had no effect in cancers of female breast, uterine cervix, urinary bladder, and thyroid gland. In smokers, the intake of ginseng exhibited a decrease in cancer of lung, lip, oral cavity, pharynx and liver compared to that of non-smokers [14].

Ganoderma lucidum (GL), a edible mushroom has been used in Korea, Japan, China and other Asian countries as an auspicious herb for the promotion of health and longevity. This species of fungus possesses many oxygenated triterpenes compounds present only in them. The fruiting body is reported to have anticarcinogenic effect (Yuan's Model) [15, 16, 17, 18], hence the presence of similar effect in mycelia of GL was evaluated since they possess similar components. Newborn mice (within 24 hrs) were injected with Benzo(a)pyrene at a dose of 0.5 mg per mouse. The extract of mycelia was obtained and administered at a dose of 2/10mg per ml for a period of six weeks after weaning. The results showed that the total fraction of GL exhibited significant inhibition for incidence of lung adenoma, thus confirming the presence of anticarcinogenic effects similar to that of fruiting body [19].

A survey was conducted among the tribal community of peninsular Malaysia for the utilization of macrofungi. A questionnaire was used to collect information about the macrofungi from the people of 70 villages (Orang Asli – indigenous communities). The survey revealed that

31 species of macrofungi was considered as edible and while 14 species were used for medicinal purposes. One of the most used species was *Lignosus* sp which cures a variety of ailments such as treatment of asthma, cancer and food poisoning. It is also used as an antipyretic, antitussive and general tonic. The second most popular species is *Xylaria polymorpha* which is used in young children to stop bed-wetting [20].

Soybean is a protein rich food consumed by humans for its nutritional significance. There are different varieties of products taken by East Asians. Soy paste, doenjang were studied for antimutagenic effects on various carcinogens. The results showed that Doenjang exhibited strong antimutagenic effects against aflatoxin B1 and N-methyl-N'-nitro-N-nitrosoguanidine. The active compound of antimutagenic activity was found to be Linolenic acid [21]. Similarly, the Japanese soybean product, Miso exhibited significant antimutagenic activity [22] and reduced the incidence of mammary cancer induced by M-nitroso-N-methylurea. The number of tumors in two stage carcinogenesis of mouse skin was significantly reduced with soybean milk protein whereas Shoyu (Japanese style fermented sauce) showed anticarcinogenic activity against benzo(a)pyrene induced mouse forestomach neoplasm [23].

A comparative study among the daily and non-daily consumers of soybean paste in Japan showed that there is a reduced mortality rate for daily consumers for stomach cancer significantly. A study conducted in Hawaiian showed a decrease in the incidence of uterine corpus carcinoma on consumption of tofu or other soybean products. These studies show a relation between reduction of risk of cancer and soybean consumption [24, 25, 26].

Tea, a common beverage consumed worldwide contains components that pose as an anticarcinogen [27]. A component in tea (*Camellia sinensis*) called epigallacatechin gallate (EGCG) is reported to inhibit promotion of tumor in mouse skin by teleocidin. Tumor in the mice was induced by the application of 50µg DMBA at initial stage and 2.5µg teleocidin twice a week. A combination of EGCG (85%); Epicatechin (10%) and epicatechin gallate (5%) was administered for mice which reduced the percentage of tumor bearing mice from 53% to 13%. At the end of 25 weeks number of tumors per mouse was reduced from 2.1 to 0.1 [28]. The inhibition can be attributed to the present of polyphenolic compounds in green and black tea that possess antioxidant and antiproliferative effects [29, 30, 31, 32, 33].

Kombucha, with slight sweet and sour flavor is a popular beverage prepared typically by fermenting sugared black, green or oolong tea for minimum 3 days [34]. However, ethnic groups of Mexico made use of white oak leaves for medicinal purposes also used it to prepare kombucha analagoues. When kombucha prepared from white oak leaves was investigated for anti-inflammatory and anti-oxidant activities, the results showed decrease in oxidative stress which is

a reflection of phytochemical action. The assessment of pro-inflammatory factors α-TNF and IL-6 levels were also reduced [35].

The indigenous people of Thailand (Thai karen and lawa) were subjected to the survey for the knowledge on the wild food plants. The results showed that they utilize 124 species of wild food plants in their diet in the form of fruit, vegetable, seasonings or beverage. Among the wild food plants one third was used for medicinal purposes. Karen used 36 species while Lawa used only 9. In Lawa, Roots of *celastrus paniculatus, Harrisonia perforata, Rubus ellipticus* var. *obcordatus* and *Leea indica* were decocted and drunk for treatment of diarrhea. The bark of *senegalia rugata* (Lam.) was used for the treatment of toothache by chewing and keeping in the mouth. The bark of *Ficus auriculata* was decocted and drunk for the treatment of bloating and colic. In Karen, diarrhea was treated with bark of *Syzygium cumini* and *Bischofia javanica.* Shoots of *Adenia heterophylla* were cooked and taken for the treatment of the common cold while the leaves of *Centella asiatica* were eaten raw to treat abdominal trauma. Additionally, ripe fruits of *Camellia tenii* and *Melastoma malabathricum,* a raw snack was used in the treatment of cough and fruits of *rubus rufus, Heteropanax fragrans* (cooked) were used as a laxative [36].

Sage (*Salvia officinalis),* a European traditional medicine was described as "singularly good for the head and brain and quicken the nerves and memory" by Gerard of 16th century, while Culpeper described it as the one which also heals the memory, warming and quickening the senses. Due to less available clinical trials and justification, they are less commonly used in the treatment of cognitive disorders. However conditions such as menopausal and cold symptoms are treated with sage [37].

Traditional African medicine serves as a primary source of treating medical conditions and is believed by 80% of both rural and urban populations [38]. A study conducted by Joseph kahumba and team collected the information from the local markets of Madagascar where such medicines are sold. According to their observation, the leaves of *Eucalyptus citriodora* were used for its respiratory and antiseptic properties. *Aloe vahombe* leaves serve as immunostimulant; bark of *Cedrelopsis grevei* has aphrodisiac property and used as tonic. *Zeamais* (Silk) was used as diuretic; *Aphloia theiformis* leaves have antipyretic activity. For deworming seeds of *Combretum albiflorum* were used, while bark of *Reventsara aromatica* pose as a respiratory antiseptic and antibiotic. Rhizome powder of *Curcuma longa* has action against jaundice and leaves of *Mollugo nudicaulis* have antitussive property. Another traditional medicine stall in Congo was studied. From the study it was found that fruits of *Solanum incanum*

L. were used in treatment of gonorrhea and hernia while fruits of *Diplorhynchus condylocarpon* were used for treating abdominal pain and wound healing [39].

Ethnic groups in South America (E.g. Ecuador, Peru, Bolivia) extensively use herbal medicine. It is reported that there are nearly 75 plant families with pharmacological properties particularly in Loja (south Ecuador) in 2006 whereas in 2007, a list of 270 species of plants with such properties was established. Guangalo (*Gynooxys verrucose)*, a shrub from *Asteraceae* family is reported to have positive effects on treatment of skin infections and wound healing. A compound called Dehydroleucodine in Guangalo possesses anti-allergen activity which explains the activity of it. However, further studies are required to confirm this [40].

Conclusion:

Several successful research studies both *in vitro* and *in vivo* were carried out worldwide pertaining to the therapeutic value of plants and its products that are used in day-to-day life by folks around the world. This review however focussed on works that provided data on medicinal property exhibited by individual food ingredients/ bioactive components of sole ingredient and not food as a whole. Food is a combination of various ingredients that is prepared with different methods so, from the present review work, it can be concluded that research studies to determine, the therapeutic value of food as a recipe and percentage of medicinal property exhibited by a food ingredient after cooking should be encouraged to show more accuracy and reliability to verify the role of diet in health.

References:

1. International Council For Science. 2002. Science, Traditional Knowledge And Sustainable Development. Icsu: Unesco.
2. Pieroni, A., and Price, L. 2006. Eating And Healing: Traditional Food As Medicine. Crc Press.
3. Jing, T.H. and S.B.A. Jing. 1982. Simplified Version of Shennong's Ancient Chinese Medical Book, Liang Dynasty of China, Circa 500 A.D., Munkwangdoso. Taipei. P. 40.
4. Yun, T.K., Y.S. Yun and I.W. Han. 1980. An experimental study on tumor inhibitory effect of red ginseng in mice and rats exposed to various chemical carcinogens. Proc. 3rd Int. Ginseng Symp. Korea Ginseng Research Institute Press. Seoul. Pp. 87–112.
5. Yun, T.K., Y.S. Yun and I.H. Han. 1983. Anticarcinogenetic effect of long-term oral admnistration of red ginseng on newborn mice exposed to various chemical carcinogens. Cancer Detect. Prev. 6: 515–525.

6. Yun, T.K and Y.S. Lee. 1994. Anticarcinogenic effect of ginseng powders depending on the types and ages using yun's anticarcinogenicity test(I). Korean J. Ginseng Sci. 18: 89–94.
7. Yun, T.K. and Y.S. Lee. 1994. Anticarcinogenic effect of ginseng extracts depending on the types and ages using yun's anticarcinogenicity test(Ii). Korean J. Ginseng Sci. 18: 160–164.
8. Yun, T-K. Y-S. Lee, H-K. Kwon and K.J. Choi. 1996. Saponin contents and anticarcinogenic effects of ginseng depending on types and ages in mice. Acta Pharm. Sin. 17: 293–298.
9. Konoshima, T., M. Takasaki and H. Tokuda. 1996. Anti-tumor-promoting activities of the roots of notoginseng(1). Nature Med. 50: 158–162.
10. Wu, X.G. and D.H.J. Zhu. 1990. Influence of ginseng upon the development of liver cancer induced by diethylnitrosamine in rats. J. Tongji Med. Univ. China 10: 141–145.
11. Bespalov, V.G., V.A. Aleksandrov, V.V. Davydov, A. Yu. Limanko, D.S. Molokovskii, A.S. Petrov, L.I. Slepyan and Ya G. Trilis. 1993. Mammary carcinogenesis suppression by ginseng tissue culture biomass tincture. Bull. Exp. Biol. Med. 115: 63–65.
12. Yun, T.K. and S.Y. Choi. 1990. A case-control study of ginseng intake and cancer. Int. J. Epidemiol. 19: 871–876.
13. Editorial. 1992. Cancer screening and prevention: organ vs. Non-organ specific? Lancet 33: 902–903.
14. Yun, T.K. and S.Y. Choi. 1995. Preventive effect of ginseng intake against various human cancers: a case-control study on 1987 pairs. Cancer Epidemiol. Biomarkers Prev. 4: 401–408.
15. Yun, T.K. S.H. Kim and Y.R. Oh. 1987. Medium-term (nine weeks) method for assay of preventive agents against tumor. J. Korean Cancer Assoc. 19: 1–7.
16. Yun, T.K. and S.H. Kim. 1988. Inhibition of development of benzo(a)pyrene-induced mouse pulmonary adenoma by natural products in medium-term bioassay system. J. Korean Cancer Assoc. 20: 133–142.
17. Yun, T.K. 1992. Usefulness of medium-term bioassay determining formation of pulmonary adenoma in nih(gp) mice for finding anticarcinogenic agents from natural products. J. Toxicol. Sci. (Japan) 16: (Suppl. 1) 53–62.
18. Yun, T.K. and Y.S. Lee. 1993. Effect of ganoderma lucidum on mouse pulmonary adenoma induced by benzo(a)pyrene. J. Korean Cancer Assoc. 25: 531–538

19. Yun, T-K. and Y-S. Lee. 1997. Anticarcinogenicity of ganoderma lucidum. J. Korean Assoc. Cancer Prev. 2: 108–112.
20. Kardooni, R., Kari, F. B., Yahaya, S. R. B., andYusup, S. H. (2014). Traditional knowledge of orang asli on forests in peninsular malaysia.
21. Park, K-Y., S-H. Moon, H-S. Cheigh and H-S. Baik. 1996. Antimutagenic effects of doenjang (Korean Soy Paste). J. Food Sci. Nutr. 1: 151–158.
22. Asahara, N., X.B. Zang and Y. Ohta. 1992. Antimutagenicity and mutagen-binding activation of mutagenic pyrolysates by microorganisms isolated from japanese miso. J. Sci. Food Agric. 58: 395–401.
23. Gotoh,T., K. Yamada, A. Ito, H. Yin, T. Kataoka and K. Dohi. 1998. Chemoprevention of n-nitroso-n-methylurea-induced rat mammary cancer by miso and tamoxifen, alone and in combination. Jpn. J. Cancer Res. 89: 487–495.
24. Hirayama, T. 1982. Relationship of soybean paste soup intake to gastric cancer risk. Nutr. Cancer 3: 223–233.
25. Hirayama, T. 1990. Life-style and mortality. In contributions to epidemiology and biostatistics. J. Wahrendorf, Ed.: 6: 1–137. Karger. München, Germany.
26. Goodman, M.T., L.R. Wilkens, J.H. Hankin, L-C. Lyu, A.H. Wu and L.N. Kolonel. 1997. Association of soy and fiber consumption with the risk of endometrial cancer. Am. J. Epdidemiol. 146: 294–306.
27. Muto, Y., H. Moriwaki, M. Ninomiya, S. Adachi, A. Saito and H. Fujiki Et Al. 1996. Prevention of second primary tumors by an acyclic retinoid, polyprenoic acid, in patients with hepatocellular carcinoma. N. Engl. J. Med. 334: 1521–1567.
28. . Yoshizawa, S., T. Horiuchi, H. Fujiki, T. Yoshida, T. Okuda and T. Sugimura. 1987. Antitumor promoting activity of (-)epigallocatechin gallate, the main constituent of "tannin" in green tea. Phytother. Res. 1: 44–47.
29. Fujita, Y., T. Yamane, M. Tanaka, K. Kuwatas, J. Okuzumi, T. Takahashi, H. Fujiki and T. Okuda. 1989. Inhibitory effect of (−)-epigallocatechin gallate on carcinogenesis with N-Ethyl-N′-Nitro-N-Nitrosoguanidine In Mouse Duodenum. Jpn. J. Cancer Res. 80: 503–505.
30. Xu, Y., C.T. Ho, S.G. Amin, C. Han and F.L. Chung. 1992. Inhibition Of Tobaccospecific Nitrosamine-Induced Lung Tumorigenesis In A/J Mice By Green Tea And Its Major Polyphenol As Antioxidants. Cancer Res. 52: 3875–3879.

31. Narisawa, T. and Y. Fukaura. 1993. A very low dose of green tea polyphenols in drinking water prevents N-Methyl-N-Nitrosourea-Induced Colon Carcionogenesis In F 344 Rats. Jpn J. Cancer Res. 84: 1007–1009.
32. Yamane, T., T. Takahashi, K. Kuwata, K. Oya, M. Inagake, Y. Kitao, M. Suganuma and H. Fujiki. 1995. Inhibition Of N-Methyl-N′-Nitro-N-Nitrosoguanidineinduced Carcinogenesis By (-)-Epigallocatechin Gallate In The Rat Glandular Stomach. Cancer Res. 55: 2081–2084.
33. Yang, C.S., G-Y., Yang, M-J. Lee and L. Chen. 1997. Mechanistic considerations of the inhibition of carcinogenesis by tea. In food factors for cancer prevention. H. Ohigashi, T. Osawa, J. Terao, S. Watanabe and T. Yoshikawa, Eds.: 113–117. Springer. Tokyo
34. Leal, J. M., Suárez, L. V., Jayabalan, R., Oros, J. H., and Escalante-Aburto, A. (2018). A review on health benefits of kombucha nutritional compounds and metabolites. Cyta-Journal Of Food, 16(1), 390-399.
35. Vázquez-Cabral, B. D., Larrosa-Pérez, M., Gallegos-Infante, J. A., Moreno-Jiménez, M. R., González-Laredo, R. F., Rutiaga-Quiñones, J. G. and Rocha-Guzmán, N. E. (2017). Oak Kombucha Protects Against Oxidative Stress And Inflammatory Processes. Chemico-Biological Interactions, 272, 1-9.
36. Punchay, K., Inta, A., Tiansawat, P., Balslev, H., andWangpakapattanawong, P. (2020). Traditional knowledge of wild food plants of thai karen and lawa (Thailand). Genetic Resources And Crop Evolution, 1-23.
37. R Howes, M. J., and J Houghton, P. (2012). Ethnobotanical treatment strategies against alzheimer's disease. Current Alzheimer Research, 9(1), 67-85.
38. Kasilo, O. M., Trapsida, J. M., Mwikisangenda, C., Lusamba-Dikassa, P. S., Régional Pour L'afrique, B., and World Health Organization. (2010). An overview of the traditional medicine situation in the african region. African Health Monitor, 7-15.
39. American Association For The Advancement Of Science. (2015). The art and science of traditional medicine part 3: The Global Impact of Traditional Medicine. Science, 350(6262), 871-871.
40. Scovassi, A. I., andGuamán Ortiz, L. M. (2013). Traditional medicine: an ancient remedy rediscovered. Biochempharmacol, 2(110), 2167-050.

TREATMENT OF INFLAMMATORY BOWEL DISEASE USING NUTRITIONAL CROPS

Vinod Kumari

Panipat Institute of Engineering and Technology,

Panipat, Haryana

Corresponding author E-mail: dahiyavinod123@gmail.com

Bowel disease is a collection of systemic disorders with gastrointestinal inflammation [1]. The sickness of Crohn's disease can impact the gastrointestinal tract; while colitis, which is a main cause of inflammation in the bowels, reveals the elements of both Crohn and ulcerative colitis. Inflammatory bowel disease is mostly associated with two diseases: ulcerative colitis that affects only the large colon [2].

The actual cause of IBD is not known, although IBD is caused by an immune system that is dysfunctional. An appropriate immune system is used to safeguard the body by attacking invading organisms such as viruses and bacteria. In IBD the immune system improperly acknowledges the biodegradable cues that induce gastrointestinal tract inflammation [3]. There also seems to be a genetic element, which is more likely to be developed by someone with a genetic history of IBD.

Inflammatory bowel disease is diagnosed with a combination of endoscopy and colonoscopy examinations such as contrast media radiograph (CMR), magnetic resonance imaging (MRI), or a computed topographical (CT) analysis and imaging studies [4]. Doctors may also perform blood tests to confirm the illness or check faecal samples to determine that the problems are not triggered by an infection.

Treatment of Inflammatory Bowel Disease:

Specificsort of drugs could be habituated to cure IBD: aminosalicylates, corticosteroids, immunomodulators and the latest IBD class – the 'biologics.' In order to prevent infections, several immunizations for IBD patients are advised [5]. Severe IBDs may necessitate abscission to get rid of damaged parts of the duodenal system, but progress with medicines means operations are less common than they were a couple of decades ago. Given that pseudorubella and ulcerative colitis infect various regions of the GI tract, operating techniques in the two disorders are distinct [6].

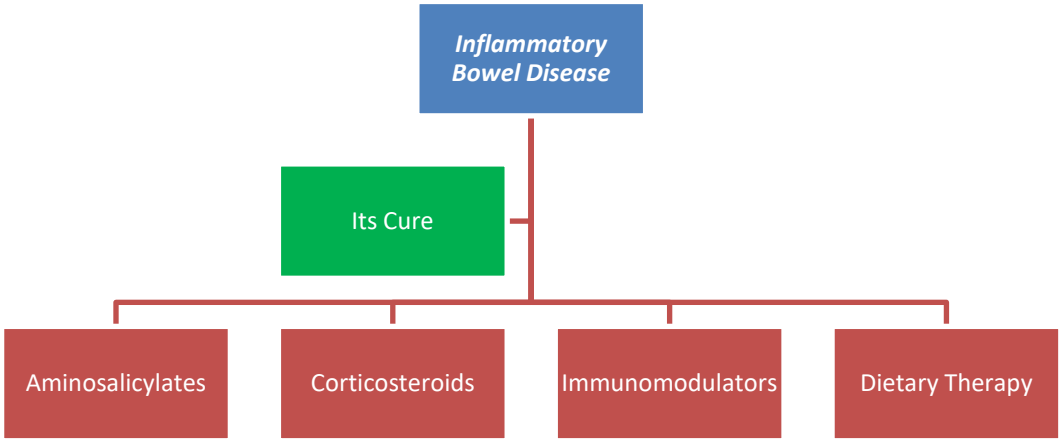


Figure 1: IBD and its cure

Dietary Therapy role in the treatment of Inflammatory Bowel Disease:

There really is no specific dietary therapy for UC patients however few (<5 percent) may ameliorate with pasteurized milk and certain people may benefit from fibre supplementation through proctitis and proximal constipation. High residue food (example: citrus, nuts or uncooked vegetables) may lead to bolus blockage in patients with small bowel CD structuring [7]. All IBD patients are at risk of dietary deficiencies that need to be replaced, especially if active or significant.

In the last 20 years, it has been obvious that alternative therapy is a liquid formula diet in children with CD, in adults with a large amount of bowel disease, and in people with poor responses or preference to prevent corticosteroids [8]. It is either elemental, gluten or peptide or polymeric (protein full, and therefore not intolerant). This is the only food source for 4-6 weeks. This method is likely as successful as short-term corticosteroid therapy in roughly 60% of patients.

Unfortunately, many patients weaken after a normal diet (50 percent at six months). It remains to be proven regardless of the fact that this can be halted by a judiciousreincorporation into the nursing industry of particular foods that are not intolerant to individual patients or by the fragmentaryutilization of additional nasogastric nutrient nourishment over short periods [9].

The cost and disagreeable taste of many preparations available for CDs, often necessary nasogastric tube feeding and the lack of adherence of many sufferers with it also restrict the success of enteral feeding as primary therapy for CCD. Such therapy does, however, give the motivated fraction of patients to whom it belongs a useful option.

UC and CD nutritional deficiencies correction:

Vitamin B12: Vitamin B12 deficiency has beenconsidered as chronic, and a prospective of chronic disease due to the fact that caecumsoreness and small intestinal bacterial overgrowth might limit vitamin B12 absorption [10].

Vitamin B6: Vitamin B6 amount in patients with IBD are significantly differ from controls; smaller amountis linked to irritations, swelling and metabolic disturbances. Even Though folate-B12-dependent molecular genetics removes some homocysteine, the majority of homocysteine is transformed to cystathionine in a process mediated by vitamin B6[11].

Vitamins E and C: Vitamin E and C levels in the blood are frequently low in people with IBD. Patients with steady, active chronic disease received 800 IU of alpha-tocopherol and 1000 mg of vitamin C per day, which reduced oxidative stress indicators.

Vitamin A: Even though carotenoids and retinol levels are lower in sufferers with vigorous chronic disease, this appears to be due to inflammation and a decrease in spread of retinol binding protein rather than malabsorption.

Vitamin D: In individuals with CD, lowlevels cholecalciferol in human blood, the primary vitamin D metabolite, are prevalent, and are linked to starvation and lack of sunlight. In patients with active illness, using 1000 IU of vitamin D each day for a year reduced bone loss. The underlying determinants for bone loss in IBD patients are the consequences of inflammatory markers and glucocorticoid medication, which is being evaluated in patients with IBD who use vitamin D additives. [12].

Vitamin K: Vitamin K inadequacy has indeed been found in ileitis and colitis patients undergoing treatment with sulfasalazine or antibiotics. [13].CD patients had significantly lower serum vitamin K levels than normal controls, which is linked to higher margins of undercarboxylated osteocalcin, suggesting a low vitamin K condition within bone. Undercarboxylated osteocalcin is inversely associated to lumbar spine bone density in CD patients. The optimal vitamin K dose for deficit repair is unknown. Even at large doses, sufferers with prolonged illness may not be able to absorb oral supplements of vitamin K.

Folic Acid: Limited Folic acid, a probable characteristic featurefor verydeep vein thrombosis, it may also be considered as aprimary consequential factor for inflammatory bowel disease [14].

Calcium: Calcium supplementation is recommended to the people with IBD, especially those taking glucocorticoids, to maintain bone density.

Zinc: Acrodermatitis, impaired performance of zinc-dependent enzymes like thymulin and metallothionein, reduced muscle zinc levels, and pretty terrible taste sensitivity are all signs of decreased plasma zinc thresholds in persons with chronic illness. Zinc absorption is low, while

zinc excretion in the faeces is high. In patients with symptomatic disease, 220 mg of zinc sulphate per day significantly increases plasma zinc and thymulin activity.

Selenium: Inadequate selenium levels have been associated to greater TNF-alpha levels and lesser glutathione peroxidase, an antioxidant enzyme, in chronic disease patients. Individuals who might have a little intestinal resection are now at a higher risk for complications related to selenium deficiency, thus their concentrations must be checked and selenium supplementation must be used, if required.

Magnesium: Magnesiuminsufficiency is a risk factor for IBD because of reduced oral intake, nutritional deficiencies, and increased intestinal losses owing to diarrhoea [15].

Chromium: Chromium in urine excretion is increased by glucocorticoid medication, and 600 micrograms of chromium picolinate per day can reverse steroid-induced diabetes in adults, dropping mean blood glucose from 260 to 180 milligrams per decilitre. Supplementing with chromium may help people with reduced glucose tolerance who are taking glucocorticoids [16].

Iron: Anaemia affects around 30% of IBD patients [17]. Iron shortage due to blood loss, cytokine-induced reduction of erythropoiesis, and drug adverse effects are among the causes. It's also thought that iron deficiency boosts the IFN-gamma response in TH-1-driven inflammation, which could lead to cancer.

Fish oils: According to biochemical investigations, 25% of IBD patients have signs of essential fatty acid insufficiency [18]. Fish oil supplementation reduces methotrexate-induced intestinal mucosal damage in experimental rats. Omega-3 fatty acids promote wound healing in intestinal epithelial cells in tissue culture.A fish oil formulation containing 3230 milligrams of eicosapentaenoic acid (EPA) and 2480 milligrams of docosahexaenoic acid (DHA) per day reduced discomfort and reduced levels of leukotriene B4 (LTB4) in rectal dialysates in individuals with UC, resulting in improved UC therapy. Fish oil capsules contain EPA, which inhibits the production of leukotriene B4, thromboxane A2, prostaglandin E2, platelet activating factor, and interleukin-1[19]. In patients with inactive CD, an enteric coated fish oil preparation that is better tolerated than normal preparations have been shown to decrease the recurrence rate significantly.

Treatment of Inflammatory Bowel Disease using Nutritional Crops:

Fruits:

Fresh fruits are often abundant in fibre and anti-oxidant vitamin C, aside from carbohydrates. Fruits also contain phenolic acids, that are ingested through the intestinal lining and could be anti-oxidant and anti-inflammatory [20]. Apples, blueberries, oranges, lemons,

citrus fruits, mangos, kiwis, and plums have the highest levels of chlorogenic acid, a phenolic acid [21]. Raspberry seed flour, which also contains phenolic acid, reduces hepatic stress and adipose tissue inflammation caused by a high-sucrose diet [22]. A more contemporary meta-analysis based on five randomized trials [24,97,89,65] found a remarkabletransposed relationship between fruit consumption and the risk of chronic disease (Relative Risk 0.49; 98 percent CI: 0.48–0.68; I2 = 38%) . When the connection was examined in subgroups based on daily servings, it persisted.

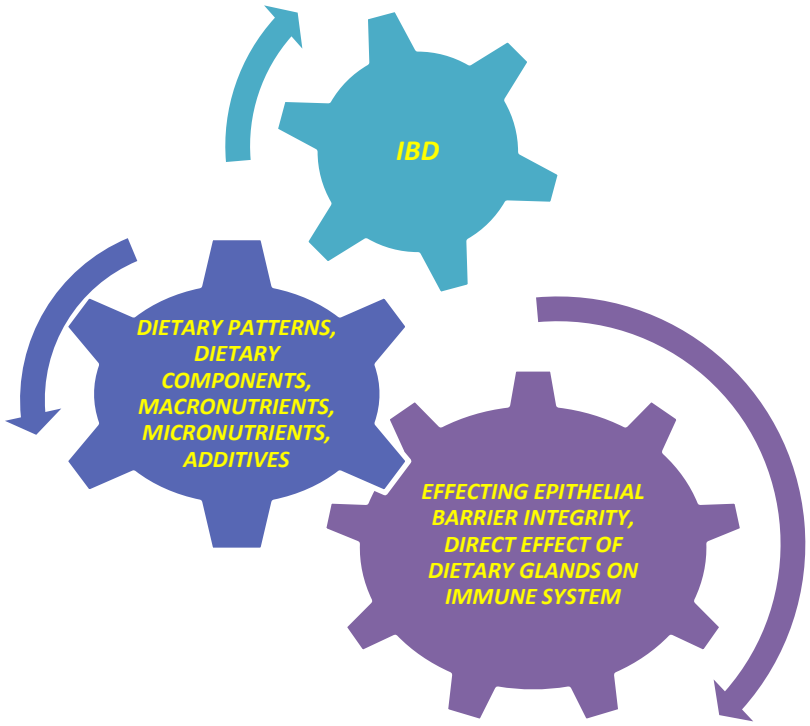


Figure 2: Diet in treatment of IBD

Vegetables:

Cruciferous veggies:

In persons with IBS, cruciferous veggies like kale are known to produce bloating. Indole-3-carbinol is found in brussel sprouts, Belgian beans, cabbage, broccoli, and kale, and it stimulates the aryl hydrocarbon receptor (AHR). In mice models, broccoli feeding increased intestinal AHR activity, decreased Erysipelotrichaceae bacteria population, and hindered colitis [23]. 3,3 Diindolylmethane (DIM), which is also found in cruciferous vegetables, enhanced the transepithelial electrical resistance of human Caco-2 cells, restoring intestinal permeability [24].

Mushrooms:

Mushrooms have been used as a form of anti-inflammatory medicine since ancient times. A combined extract of basidiomycetes mushrooms reduced inflammatory symptoms in IBD patients [25]. Mushroom glucan helps with IBD by regulating cytokine profiles and phagocyte function, as well as improving protection against inflammation, infections, and sepsis [26].

Corn:

Corn consumed as a vegetable was found to have favourable effects on 45 percent of CD patients, despite the fact that it was tolerated by very few. Other kinds of corn, such as corn flakes, corn crackers, and popcorn, were also linked to ill health effects [27]. These findings support prior research by identifying maize as one of the important dietary components that certain people with CD may need to avoid. This could be due to the concentration of fructoseunder the seed's outer coat. Corn's specific polyphenol component could potentially be linked to the ill health effects shown in all of these investigations [28].

Sweet Potato:

Sweet potato (Ipomoea batatas L.) is the fifthmajor significant food crop in the world [29]. Purple sweet potato is a healthy food that belongs to the sweet potato family; its tubers contain vitamins including tocopherol and -carotene, as well as amino acids, minerals, and dietary fibre [30]. It also possesses anti-inflammatory compounds such as phenolic acids, anthocyanins, and polyphenols. Anti-inflammatory effects are also found in its polysaccharide.

Legumes:

Patients who consumed more beans/legumes had aninnocuous risk of UC [31]. Potatoes aggregated with legumes were found to provide protective effects in 128 adult IBD patients (80 with progressive disease and 48 in abrogators) in cross-sectional research. In this study, sufferers in the highest quadrant for legume utilization had a 72 percent slighter risk of active disease as compared to those with lowest quartile.Although legumes may provoke the symptoms, they are still allowed in the second phase of the exclusion diet for CD patients experiencing bursts. Some legumes such as lentils and split peas are allowed, but others such as chickpeas and soybeans are not [32, 33].

Potatoes:

Potato skins include glycoalkaloids (solanine and chaconine), which easily passes through the cholesterol-containing membranes, causing epithelial barrier integrity to be compromised. Glycoalkaloids are concentrated when potatoes are fried. Despite the fact that two studies in mice showed that glycoalkaloids increased intestinal permeability in a dose-dependent

manner [34], a cross-sectional study in 134 adult IBD patients (90 with progressive disease and 44 in abrogators) found that potatoes aggregated with legumes had protective effects [35].
Everyday consumption of three freshly peeled boiled and chilled potatoes are required in the diet for chronic patients. Potatoes and yams are forbidden on the SCD diet [36].

Cereals:

There were no statistically significant relationships between grain consumption and IBD recurrence [37]. Patients with chronic disease were less likely to consume whole grains, and both CD and UC patients were more likely to consume refined grains [38]. Daily muesli eating was found to reduce the chances of CD but not UC in a case control analysis of 298 incident IBD cases [39].

Wheat:

In a research study of 267 recurrent IBD cases and 387 control participants, regular eating of whole wholemeal bread resulted in a significant reduction of CD and UC [40]. Wheat bran contains 58 percent non-starch polysaccharides (NSP) derived from arabinoxylans, cellulose, and -glucans [41]. Wheat bran was very well accepted which may be beneficial to people with IBD, but this should not be used as an alternative of medicine [42]. It also protects against colon cancer, which is a type of cancer that is frequent in IBD patients [43].

Oats:

Oats are a high-carbohydrate cereal with added dietary fibre and beta-glucans. Unlike grains, maize, and corn, oats are gluten-free. In 1978 research of 51 UC patients given 35 g of oat per day, it was discovered that high bran consumption was less successful than a medicine group in maintaining cure rate in adults with UC [44].
They did not, however, compensate for the variations in UC patients; oat bran may be unsuccessful for individuals with severe indications, but it may be beneficial for those with mild dementia, and the oat bran dose was insufficient when compared to certain other investigations [45].

Quiona and Amarnath:

Quinoa and amaranth kernels are gluten-free pseudo wholegrains originated to the Andean region of South America. In addition to a high proportion of dietary fibre and moderate protein, quinoa and amaranth include polyunsaturated fatty acids and a plethora of anti-inflammatory phytonutrients [46]. Quinoa consumption improved clinical signs in a rat model of colitis by decreasing gut microbiota dysbiosis and increasing abundances and biodiversity [47]. Methanol extracts of dried amaranth leaves and seeds eradicated pathogenic microorganisms S. aureus and E. coli, as well as the fungi Fusarium solani and Rhizopus oligosporus [48].The

probiotic efficacy of quinoa and amaranth was evaluated using in vitro cultures of human faecal microbiome. In the mammalian intestine microbiota, both quinoa and amaranth boosted the development of statistically significant microbial species. As the bacterium cells grew, the SCFAs (acetate, propionate, and butyrate) increased, which correlated to a decrease in pH.

Herbs and Spices:

IBD patients frequently use herbal medications, albeit many of them are based on ancient notions or beliefs. Polyphenols are found in many dried herbs, including thyme, oregano, and basil, and ginger and cumin have anti-inflammatory properties. Several trials were found in a systematic evaluation of herbs in individuals with IBD [49].

Discussion:

A review of the literature on the consequences of nutrients and food groups on the development and progression of IBD revealed mixed outcome for diversified foods, and stillthe impacts of each food on IBD is yet to be verified. Patients with IBD, on the other hand, are eager to learn what they should consume and what they should refrain from, with the aim to avoid revocation. Despite the fact that the literature was not examined in a systematic manner and that sufficient studies of excellent quality are still available for all nutrients and food groups, this research does provide a thorough summary of all possible popularavailable best data on nutrients and food groups. This review will assist individuals with IBD in selecting foods that may be advantageous over others in the disease's regression while avoiding foods that may cause the disease to progress.The current level of evidence on nutrients and food grains in the management of IBD is presented in this thorough review.

Conclusion:

The rising frequency of IBD in industrialised and emerging countries is mostly due to a unhealthy lifestyle, particularly a emulsified and junk diet. Increased fat and/or protein intake, reduced fruit and vegetable intake, and increased use of emulsifiers or other binding compounds are among the most prominent candidate variables for causing inflammation in healthy persons' intestines. However, it is currently unknown which of these individual nutritional determinants is the primary cause of the recent epidemiological surge in IBD.

Despite the abundance of books and websites on nutrition and IBD, there is little data to back up restrictive dietary therapies in IBD patients. As a result, instead of restricting and/or

supplementing certain dietary components, our current suggestions to our patients should focus on and support a healthy and balanced diet based on unprocessed foods.

References

1. Vavricka, S. R., Manser, C. N., Hediger, S., Vögelin, M., Scharl, M., Biedermann, L., and Frei, P. (2013). Periodontitis and gingivitis in inflammatory bowel disease: a case–control study. Inflammatory bowel diseases, 19(13), 2768-2777.
2. Thoreson, R., and Cullen, J. J. (2007). Pathophysiology of inflammatory bowel disease: an overview. Surgical Clinics of North America, 87(3), 575-585.
3. Powell, N., Walker, M. M., and Talley, N. J. (2017). The mucosal immune system: master regulator of bidirectional gut–brain communications. Nature reviews Gastroenterology and hepatology, 14(3), 143-159.
4. Maaser, C., Sturm, A., Vavricka, S. R., Kucharzik, T., Fiorino, G., Annese, V., and Stoker, J. (2018). ECCO-ESGAR guideline for diagnostic assessment in inflammatory bowel disease. Journal of Crohn's and Colitis.
5. Wilckens, V., Kannengiesser, K., Hoxhold, K., Frenkel, C., Kucharzik, T., and Maaser, C. (2011). The immunization status of patients with IBD is alarmingly poor before the introduction of specific guidelines. Scandinavian journal of gastroenterology, 46(7-8), 855-861.
6. Cleynen, I., Boucher, G., Jostins, L., Schumm, L. P., Zeissig, S., Ahmad, T., and International Inflammatory Bowel Disease Genetics Consortium. (2016). Inherited determinants of Crohn's disease and ulcerative colitis phenotypes: a genetic association study. The Lancet, 387(10014), 156-167.
7. Rampton, D. S. (2000). Management of difficult inflammatory bowel disease: where are we now?. World journal of gastroenterology, 6(3), 315.
8. Escher, J. C., Taminiau, J. A., Nieuwenhuis, E. E., Büller, H. A., and Grand, R. J. (2003). Treatment of inflammatory bowel disease in childhood: best available evidence. Inflammatory bowel diseases, 9(1), 34-58.
9. Thompson, J., and Gazzola, A. (2017). IBS: Dietary Advice To Calm Your Gut. Sheldon Press.
10. Miele, E., Shamir, R., Aloi, M., Assa, A., Braegger, C., Bronsky, J., and Staiano, A. (2018). Nutrition in pediatric inflammatory bowel disease: a position paper on behalf of the Porto Inflammatory Bowel Disease Group of the European Society of Pediatric

Gastroenterology, Hepatology and Nutrition. Journal of pediatric gastroenterology and nutrition, 66(4), 687-708.

11. Škovierová, H., Vidomanová, E., Mahmood, S., Sopková, J., Drgová, A., Červeňová, T., and Lehotský, J. (2016). The molecular and cellular effect of homocysteine metabolism imbalance on human health. International journal of molecular sciences, 17(10), 1733.
12. Lima, C. A., Lyra, A. C., Rocha, R., and Santana, G. O. (2015). Risk factors for osteoporosis in inflammatory bowel disease patients. World journal of gastrointestinal pathophysiology, 6(4), 210.
13. Krasinski, S. D., Russell, R. M., Furie, B. C., Kruger, S. F., Jacques, P. F., and Furie, B. (1985). The prevalence of vitamin K deficiency in chronic gastrointestinal disorders. The American journal of clinical nutrition, 41(3), 639-643.
14. Romagnuolo, J., Fedorak, R. N., Dias, V. C., Bamforth, F., and Teltscher, M. (2001). Hyperhomocysteinemia and inflammatory bowel disease: prevalence and predictors in a cross-sectional study. The American journal of gastroenterology, 96(7), 2143-2149.
15. Balestrieri, P., Ribolsi, M., Guarino, M. P. L., Emerenziani, S., Altomare, A., and Cicala, M. (2020). Nutritional aspects in inflammatory bowel diseases. Nutrients, 12(2), 372.
16. Ravina, A. L. E. X. A. N. D. E. R., Slezak, L. A. Z. O., Mirsky, N. I. T. S. A., Bryden, N. A., and Anderson, R. A. (1999). Reversal of corticosteroid-induced diabetes mellitis with supplemental chromium. Diabetic Medicine, 16(2), 164-167.
17. Cappellini, M. D., Musallam, K. M., and Taher, A. T. (2020). Iron deficiency anaemia revisited. Journal of internal medicine, 287(2), 153-170.
18. Seyedian, S. S., Nokhostin, F., and Malamir, M. D. (2019). A review of the diagnosis, prevention, and treatment methods of inflammatory bowel disease. Journal of medicine and life, 12(2), 113.
19. Socha, P., Ryzko, J., Koletzko, B., Celinska-Cedro, D., Woynarowski, M., Czubkowski, P., and Socha, J. (2005). Essential fatty acid depletion in children with inflammatory bowel disease. Scandinavian journal of gastroenterology, 40(5), 573-577.
20. Jain, S., Buttar, H. S., Chintameneni, M., and Kaur, G. (2018). Prevention of cardiovascular diseases with anti-inflammatory and anti-oxidant nutraceuticals and herbal products: an overview of pre-clinical and clinical studies. Recent patents on inflammation and allergy drug discovery, 12(2), 145-157.
21. Vinayagam, R., Jayachandran, M., and Xu, B. (2016). Antidiabetic effects of simple phenolic acids: a comprehensive review. Phytotherapy research, 30(2), 184-199.

22. Kang, I., Espín, J. C., Carr, T. P., Tomás-Barberán, F. A., and Chung, S. (2016). Raspberry seed flour attenuates high-sucrose diet-mediated hepatic stress and adipose tissue inflammation. The Journal of nutritional biochemistry, 32, 64-72.
23. Singh, G. (2019). The gut microbiota in homeostasis and inflammation. The University of Manchester (United Kingdom).
24. Campmans-Kuijpers, M. J., and Dijkstra, G. (2021). Food and Food Groups in Inflammatory Bowel Disease (IBD): The Design of the Groningen Anti-Inflammatory Diet (GrAID). Nutrients, 13(4), 1067.
25. Kim, J. Y., Le, T. A. N., Lee, S. Y., Song, D. G., Hong, S. C., Cha, K. H., and Kang, K. (2019). 3, 3′-Diindolylmethane improves intestinal permeability dysfunction in cultured human intestinal cells and the model animal Caenorhabditis elegans. Journal of agricultural and food chemistry, 67(33), 9277-9285.
26. Schwartz, B., and Hadar, Y. (2014). Possible mechanisms of action of mushroom-derived glucans on inflammatory bowel disease and associated cancer. Annals of translational medicine, 2(2).
27. Triggs, C. M., Munday, K., Hu, R., Fraser, A. G., Gearry, R. B., Barclay, M. L., and Ferguson, L. R. (2010). Dietary factors in chronic inflammation: food tolerances and intolerances of a New Zealand Caucasian Crohn's disease population. Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis, 690(1-2), 123-138.
28. Jakobek, L. (2015). Interactions of polyphenols with carbohydrates, lipids and proteins. Food chemistry, 175, 556-567.
29. Tao, X., Gu, Y. H., Wang, H. Y., Zheng, W., Li, X., Zhao, C. W., and Zhang, Y. Z. (2012). Digital gene expression analysis based on integrated de novo transcriptome assembly of sweet potato [Ipomoea batatas (L.) Lam.]. PloS one, 7(4), e36234.
30. Zannou, A., Gbaguidi, M., and Ahoussi-Dahouenon, E. (2017). Synthesis of research on sweet potato (Ipomoea batatas) with a view to its valorization: A review. International Journal of Chemical Science.
31. Choi, Y., Larson, N., Steffen, L. M., Schreiner, P. J., Gallaher, D. D., Duprez, D. A., and Jacobs Jr, D. R. (2021). Plant-Centered Diet and Risk of Incident Cardiovascular Disease During Young to Middle Adulthood. Journal of the American Heart Association, 10(16), e020718.
32. Lewis, J. D., and Abreu, M. T. (2017). Diet as a trigger or therapy for inflammatory bowel diseases. Gastroenterology, 152(2), 398-414.

33. Yang, X., Darko, K. O., Huang, Y., He, C., Yang, H., He, S., and Yin, Y. (2017). Resistant starch regulates gut microbiota: structure, biochemistry and cell signalling. Cellular Physiology and Biochemistry, 42(1), 306-318.
34. Patel, B., Schutte, R., Sporns, P., Doyle, J., Jewel, L., and Fedorak, R. N. (2002). Potato glycoalkaloids adversely affect intestinal permeability and aggravate inflammatory bowel disease. Inflammatory bowel diseases, 8(5), 340-346.
35. Mishra, S., Monro, J., and Hedderley, D. (2008). Effect of processing on slowly digestible starch and resistant starch in potato. Starch-Stärke, 60(9), 500-507.
36. Hou, J. K., Lee, D., and Lewis, J. (2014). Diet and inflammatory bowel disease: review of patient-targeted recommendations. Clinical Gastroenterology and Hepatology, 12(10), 1592-1600.
37. Tasson, L., Canova, C., Vettorato, M. G., Savarino, E., and Zanotti, R. (2017). Influence of diet on the course of inflammatory bowel disease. Digestive diseases and sciences, 62(8), 2087-2094.
38. Lo, C. H., Lochhead, P., Khalili, H., Song, M., Tabung, F. K., Burke, K. E., and Ananthakrishnan, A. N. (2020). Dietary inflammatory potential and risk of Crohn's disease and ulcerative colitis. Gastroenterology, 159(3), 873-883.
39. Hansen, T. S., Jess, T., Vind, I., Elkjaer, M., Nielsen, M. F., Gamborg, M., and Munkholm, P. (2011). Environmental factors in inflammatory bowel disease: a case-control study based on a Danish inception cohort. Journal of Crohn's and Colitis, 5(6), 577-584.
40. Tangrea, J. A. (1996). Vitamin D status and risk of large bowel cancer. The Johns Hopkins University.
41. Maes, C., and Delcour, J. A. (2001). Alkaline hydrogen peroxide extraction of wheat bran non-starch polysaccharides. Journal of Cereal Science, 34(1), 29-35.
42. Currò, D., Ianiro, G., Pecere, S., Bibbò, S., and Cammarota, G. (2017). Probiotics, fibre and herbal medicinal products for functional and inflammatory bowel disorders. British journal of pharmacology, 174(11), 1426-1449.
43. Bansal, P., and Sonnenberg, A. (1996). Risk factors of colorectal cancer in inflammatory bowel disease. American Journal of Gastroenterology (Springer Nature), 91(1).
44. Limketkai, B. N., Wolf, A., and Parian, A. M. (2018). Nutritional interventions in the patient with inflammatory bowel disease. Gastroenterology Clinics, 47(1), 155-177.
45. Camilleri, M., Ford, A. C., Mawe, G. M., Dinning, P. G., Rao, S. S., Chey, W. D., and Chang, L. (2017). Chronic constipation. Nature reviews Disease primers, 3(1), 1-19.

46. Liu, W., Zhang, Y., Qiu, B., Fan, S., Ding, H., and Liu, Z. (2018). Quinoa whole grain diet compromises the changes of gut microbiota and colonic colitis induced by dextran Sulfate sodium in C57BL/6 mice. Scientific reports, 8(1), 1-9.
47. Ahmadi, S., Nagpal, R., Wang, S., Gagliano, J., Kitzman, D. W., Soleimanian-Zad, S., and Yadav, H. (2019). Prebiotics from acorn and sago prevent high-fat-diet-induced insulin resistance via microbiome–gut–brain axis modulation. The Journal of nutritional biochemistry, 67, 1-13.
48. Tang, Y., and Tsao, R. (2017). Phytochemicals in quinoa and amaranth grains and their antioxidant, anti-inflammatory, and potential health beneficial effects: a review. Molecular Nutrition and Food Research, 61(7), 1600767.
49. Ng, S. C., Lam, Y. T., Tsoi, K. K. F., Chan, F. K. L., Sung, J. J. Y., and Wu, J. C. Y. (2013). Systematic review: the efficacy of herbal therapy in inflammatory bowel disease. Alimentary pharmacology and therapeutics, 38(8), 854-863.

DOCUMENTATION ON ETHNIC MEDICINAL PLANTS AND THEIR CONSUMPTION IN INDIA – A REVIEW

Naveena Reddy S* and L. Uthira

Department of Nutrition and Dietetics,

PSG College of Arts and Science, Coimbatore

*Corresponding author E-mail: naveenaofficial@gmail.com

Abstract:

Traditional medicinal plant knowledge is the display of close relationship between the plants and human population over the generations. Since then human have been using these plants as food and also as medicine to cure various ailments. The present study was aimed to collect the information of the medicinal plants used for various culinary and medicinal purposes across the country. The significance of such plants was mostly known by the elderly people of the tribal community and passed to generation through oral communication. There is a greater chance of loss of this valuable information unless documented. Various surveys conducted across India documented the medicinal plants along with their therapeutic property and usage in culinary systems. Significant scientific background on such utilization is yet to be conducted. Hence further advanced researches are recommended to provide a scientific evidence for the medicinal properties of such plant species for better utilization.

Introduction:

UNESCO defines Traditional knowledge as "Knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language and agricultural practices, including the development of plant species and animal breeds".[1]

Indian subcontinent is a wealth with indigenous folk knowledge pertaining to the areas of natural resources, agriculture, astrology, food and medicine. India with more than 1700 species of plants is considered a treasure of ethno-botanic resources.[2,3]Ethno medicinal facts are

ancestral wisdom transmitted generation after generation over time. Ethno-botanic wealth recognized and utilized by ethnic people used in numerous traditional health medicines and diet to treat ailments including headache, skin disorders, fever, cough, snake bite, rheumatoid arthritis, dysentery, diabetes and respiratory disorders[4] since time immemorial portrays the significance of food as medicine.

Ancient people understanding the emotional, physiological and culture interconnection of food/diet did not separate the concept of diet and medicine and rather acknowledged them as continuum as health is a state of physical, mental and social wellbeing.[5] This resulted in the raise of Indian Ayurveda and Siddha medical practices that is found to be reliable means for disease/disorder prevention, control and cure.

Modernization and lack of documentation of indigenous folks' healing acquaintances highly influenced the role of food in therapeutic practices and therefore it is obligatory to investigate the therapeutic properties expressed by the foods/food ingredients to accredit and utilize the ideas and practices of ethnic groups.

The main objective of this systemic review is to summarize various studies conducted at manifold geographical sites of India to document Indian populace's insight on diverse ethno-botanic groups and their medicinal attributes.

Review:

Medicinal plants and their usage by the Chang tribes in Tuensang District of Nagaland was collected for documentation during the period of July 2015 to June 2016. The information on distribution of the indigenous plants was obtained from the villagers and local traditional healers. The present study recorded a total of 33 medicinal plants (31 genera and 26 families) which was given in table 1. The collected plants were classified according to habitat of growth (trees / shrubs / herbs / climbers) which showed that among the 33, 40% were herbs. While classified based on the part of consumption, fruits (36%) and leaves (33%) were dominant. The medicinal plants were highly used as astringent, antiseptic, laxative and for treatment of dysentery, diarrhoea, jaundice, deworming.(6)

Similarly, the food habits of Angami Nagas of Nagaland were studied for documentation of ethnic food habits. By various methods of data collection, the information on 29 wild edible plants used by Angami Nagas in their traditional dishes were obtained. Diverse culinary practices were carried out by Angami Nagas. Various traditional recipes like Galho, axoni, tathu, modi, ghabe, galkemeluo were prepared using these traditional plants. The people prefer these traditional plants rather the fried foods. The importance of these foods was well taught and knowledge was passed from generation to generation.(7)

Table 1: Medicinal plants of Cheng Tribe and Uses

Sr.No.	Scientific Name	Common Name	Part used	Uses
1	*Allium Chinense*	Japanese scallion	Bulbs and leaves	Stomach ache, reduces cholesterol.
2	*Amaranthus spinosus*	Prickly amaranth	Whole plant	Laxative, antipyretic and pile problems.
3	*Averrhoa carambola*	Star fruit	Fruits	Jaundice and astringent.
4	*Begonia palmata*	Begonia	Roots	Astringent, haematemesis.
5	*Cinnamomum camphora*	Camphor	Whole plant	Muscular pain, rheumatism.
6	*Centilla asiatica*	Indian pennywort	Whole plant	Rheumatism, skin disorder, Syphilis,
7	*Colocasia esculenta*	Cocoyam	Corms	Insect sting, burns, injuries, internal haemorrhages.
8	*Curcuma augustifolia*	Hidden ginger	Rhizomes	Fever, jaundice, stomach ulcer.
9	*Discentra scandens*	Yellow bleeding heart	Tubers	High blood pressure, diabetes, malaria, dysentery.
10	*Dolichos lablab*	Hyacinth bean	Whole plant	Fever, abdominal pain, antiseptic.
11	*Eryngium foetidum*	Long coriander	Leaves	Jaundice, Liver disorders, skindiseases, condiments.
12	*Ficus semicordata*	Drooping fig	Fruits	Diarrhea.
13	*Hodgsonia heteroclite*	Oil nut	Leaves and nuts	Fever, Diarrhea, dysentery.
14	*Ipomoea batata*	Sweet potato	Leaves and tubers	Burns, diarrhea.
15	*Litseacitrata*	litsea	Bark and seeds	Pain reliever, astringent, antiseptic.
16	*Luffa cylindrical*	Sponge gourd	Fruits and seeds	Liver diseases, menstruation problems, Anemia, Anthelmintic.
17	*Lycopersicum esculentum*	Cherry tomato	Fruits	Skin irritation, gastric problems Antiseptic.

18	*Mahonia nepalensis*	Barberry	Roots, bark and fruits	Duiretic, dysentery.
19	*Manihot esculenta*	Tapioca	Tubers and leaves	Headache, diarrhea, malaria, fodder
20	*Melissa officinalis*	Lemon balm	Whole plant	Mosquito repellent, de-worming.
21	*Mentha spicata*	Garden mint	Leaves	Stimulant, jaundice, toothache, de-worming, food beverages.
22	*Momordica balsamina*	Balsam apple	Leaves, fruits and seeds	Diabetes and vegetable.
23	*Momordica foetida*	Spiny gourd	Roots	Headache, insect sting.
24	*Moringa oleifera*	Drumstick tree	Root, bark, leaves, flowers and fruits	Urinary problems, rheumatism, laxative and tonic.
25	*Parkia roxburghii*	Tree bean	Tender pods and bark	Diarrhea and dysentery.
26	*Phyllantus acidus*	Star goose berry	Fruits and leaves	Antipyretic, jaundice.
27	*Plantago asiatica*	Chinese plantain	Whole plant	Expectorant, laxative, anti-septic.
28	*Prunus cerasoides*	Wild Himalayan cherry	Bark and fruit	Bodyache, astringent.
29	*Rhododendron arboretum*	Rhododendron	Flowers	Diarrhea, dysentery.
30	*Rhus semialata*	Nutgall	Fruits	Headache, fever, indigestion, stomach ache, vomiting, food poisoning.
31	*Solanum indicum*	Indian nightshade	Fruits and roots	Asthma, cough, bronchitis, constipation, dropsy.
32	*Solanum melongena*	Eggplant	Leaves and bark	Hemorrhage, asthma, dysentery.
33	*Zanthoxylum armatum*	Toothache tree	Leaves and fruits	Fish poison, condiments, Toothache.

Source: Jamir H &Tsurho K, 2017.[6]

North East Asia is a home to about 225 tribal communities which is one of the hotspots for biodiversity in world. A study was conducted in Mandwi town of Tripura State for knowledge of traditional medicinal plants. Traditional healers and elderly people actively participated in the survey to provide the information on the medicinal plants. The investigated showed that local communities used 51 species with medicinal importance for different diseases. Among the 51 species of plants, leaves (31.9%) were most commonly used while 41% of the medicinal plants were herbs. Majority of the medicinal plants were used for the treatement of dysentery, body pain, cough and tooth ache. The study also recommended for the documentation of the traditional knowledge which may be lost unless preserved well.(8)

Traditional knowledge about the medicinal plants used by local population of Kapurthala District, Punjab was carried out to collect the information on locally used medicinal plants. Various study designs were used to collect the information from local inhabitants of randomly selected 12 villages. As the result 55 plants species were documented among which 40% of them were used as fruits. On classification according to nature of plants 36.36% of the collected medicinal plants were herbs. The author also signifies the importance of documentation to avoid loss of traditional knowledge due to modernization.(9)

Ethnomedicinal values of plants used by a major tribal community of Arunachal Pradesh (Khamptis) were collected for documentation. Standard questionnaire were used for field survey through which a diversified medicinal plants were identified with their property of treating various diseases. A total of 37 species were identified where most of them were used for treating lung diseases. These plants were used in different methods for drug preparation and unique application. Based on the parts of the plant leaves were most commonly used part of plant among the 37 species. Documentation of these can be utilized for the pharmaceutical sector.(10)

Knowledge on the traditional medicinal plants in the rural women population of Tumkar District, Karnataka was surveyed by Lavanya R and Pattar P V.(11) The study revealed that there were 32 species of plants used for various purposes by traditional healers. Considering the various parts leaves were most frequently used part while the herbs have the largest proportion (44%) among the 32 species. They are prepared in different methods which were used for treating Infertility, Diarrhea, Ear pain, Diabetes, gastric problems, breathing, jaundice, typhoid, tooth decay and fractured bones.

An investigation on medicinal plants as therapeutics by the tribal community people of Coimbatore District was studied. The survey investigation collected and documented the 47 ethnic medicinal plants with various curative properties against diseases such as leprosy, burns, bruises, wound healing, itching etc., The study stated that the tribal health practitioners consider

the factors such as age, physical status, health condition before the initiation of treatment.[12] Additionally the study provided the information of other tribal communities. The paliyar tribes of Anaimalai hills used 55 different species for the treatment of various health conditions.[13] Similarly, another study byMuthukumarasamy et al.,[14] stated that paliyar tribes used 21 medicinal plants for treating gastro intestinal disorders. People from Aboriginal community tribes used 13 different medicinal plants for the treatment of anemia, diabetes, malaria, tuberculosis, whooping cough, jaundice, asthma, fever and headache.[15]

The investigation of local from Bargarh district of Odisha for knowledge on ethno medicinal plants was conducted by collecting the data from local educated villagers, local healers (Physicians), old women and medicinal plants vendors. The survey resulted in the collection of 55 plant species to treat oral and tooth ailments. Among the 55 species, highest usage was for tooth stick (24), followed by gum diseases (16) and pyorrhea (11). The plants were processed as powder or juice / oil or chewed directly for different uses.[16]

Kumari *et al*.,[17] in her studies detailed traditional pickling methods of various indigenously used fruits and vegetables including *galgal, lingri, aaroo,* plum, *lasura, dehu, kachnar and beedana.* However, there are only limited studies pertaining to the nutritional, functional and nutraceutical properties of the fruits and vegetables used as main ingredient in pickling by people of Himachal Pradesh.

Soybean on investigation by Hsieh[18] showed functional properties like anti-inflammatory, anti-oxidant, hypocholesteremic and anti-proliferative activities due to the presence of phytosterols and phytoestrogens (isoflavones, anthocyanins, genistein and daidzein). Soybean with 3 g and 7 g of glycine and arginine helps in reducing blood insulin level while its fibre content is useful in controlling plasma glucose level.Effect of soybean on insulin moderator action, hypertension, thrombosis in atherosclerosis and hypercholesterolemia favours individuals with type 2 diabetes. Fermented soybean with around 126 *Bacillus* isolates including, *Bacillus subtilis, B. cereus, B. licheniformis, B. thuringiensis, B. circulans* and *B. sphaericus* considered as probiotic[19] was found to be utilized by Northeastern tribes of India as Aagya by Galo tribes, peron naming by Adi tribe of East Siang district yanniperung by Apatani tribes, bari by Bhutia tribe of Arunachal Pradesh and Kinema by tribes of Sikkim hill.[20]

Conclusion:

Traditional medicines have been utilized by human population for the treatment of various diseases.[21] India is a diversified country with numerous medicinal plant diversity. The documentation of the information on such valuable plant species has been lacking since they are passed through generation from elderly people to younger people. The present study collected a

significant variety of medicinal plants utilized across the country for treating various medicinal conditions or consumed on a daily basis in their diet. Due to modernization and lack of advanced scientific analysis of their medicinal properties, certain plants are excluded. There is a growing concern to prevent the loss of such valuable knowledge from our traditions before they are completely lost. Further providing scientific verification on such medicinal plants (properties) can improve the utilization of them in a wider scale.

References:

1. Djoghlaf, A. (2006). Secretariat of the Convention on Biological Diversity. Protected Areas in Today's World: Their Values and Benefits for the Welfare of the Planet. http://uis.unesco.org/en/glossary-term/traditional-knowledge
2. Jain, S. K., and Mudgal, V. (1999). A hand book of ethnobotany. Bishen Singh Mahendra Pal Singh.
3. Dutta, B. K., and Dutta, P. K. (2005). Potential of ethnobotanical studies in North East India: An overview.
4. Samydurai, P., Jagatheshkumar, S., Aravinthan, V., and Thangapandian, V. (2012). Survey of wild aromatic ethnomedicinal plants of Velliangiri Hills in the Southern Western Ghats of Tamil Nadu, India. International journal of medicinal and aromatic plants, 2(2), 229-234.
5. Pieroni, A., and Price, L. (2006). Eating and healing: traditional food as medicine. CRC Press.
6. Jamir, H., and Tsurho, K. (2017). Documentation of medicinal plants and its uses by Chang tribe in Tuensang District, Nagaland. Journal of Medicinal Plants, 5(4), 170-174.
7. Singh, A. B., and Teron, R. (2017). Ethnic food habits of the Angami Nagas of Nagaland state, India. International Food Research Journal, 24(3), 1061.
8. Debbarma, M., Pala, N. A., Kumar, M., and Bussmann, R. W. (2017). Traditional knowledge of medicinal plants in tribes of Tripura in northeast, India. African Journal of Traditional, Complementary and Alternative Medicines, 14(4), 156-168.
9. Kaur, J., Kaur, R., and Nagpal, A. K. (2017). Documentation of Traditional Knowledge on Medicinal Plants used by Local Population of Kapurthala, Punjab (India). J Chem Pharm Res, 9, 351-5.
10. Sen, P., Dollo, M., Choudhury, M. D., and Choudhury, D. (2008). Documentation of traditional herbal knowledge of Khamptis of Arunachal Pradesh.

11. Lavanya, R., and Pattar, P. V. (2017). Traditional knowledge on folk medicine by rural women in Chikkanayakanahalli Taluk, Tumkur district, Karnataka. International Journal of Herbal Medicine, 5(2), 05-10.
12. Saradha, M., and Samydurai, P. (2017). Documentation of aboriginal traditional knowledge and inherent indigenous therapeutic plants of Coimbatore District, Tamil Nadu, India. Kongunadu Research Journal, 4(1), 114-120.
13. Sivakumar, A., Subramanian, M.S., Karunakaran, M. and A. Burkanudeen, (2003). Ethnobotany of Poliyars of Anaimalai hills, Tamil Nadu. J. Econ. Taxon. Bot **27**: 679-685.
14. Muthukumarasamy, S., Mohan, V.R., Kumaresan, S. and V. Chelladurai, (2003). Herbal medicinal plants used by Paliyars to obtain reliegf from gastro-intestinal complaints. J. Econo. Taxo. Bot. 27: 711-714.
15. Lakshmi Narasimhudu and Venkata Raju (2013). Medicobotanical properties of Phyllanthus species (Euphobiaceae) used by the aboriginal adivasis of Eastern Ghats, Andra Pradesh. Indian J. Trad. Know 12(2): 326-333.
16. Sahu, M., and Sahu, A. R. (2017). A preliminary report on the traditional practice for dental and oral health care in Bargarh district of western Odisha, India. J. Med. Plants Stud, 5, 120.
17. Kumari, A., Angmo, K., and Bhalla, T. C. (2016). Traditional pickles of Himachal Pradesh.
18. Hsieh, C. C., Fernandez-Tome, S. and Hernandez-Ledesma, B. (2017). Functionality of Soybean Compounds in the Oxidative Stress-Related Disorders. In Gastrointestinal Tissue. Academic Press, 339-353.
19. Sarkar, P. K., Hasenack, B., and Nout, M. J. R. (2002). Diversity and functionality of Bacillus and related genera isolated from spontaneously fermented soybeans (Indian Kinema) and locust beans (African Soumbala). International Journal of Food Microbiology, 77(3), 175-186.
20. Singh, A., and Singh, R. K. (2007). Cultural significance and diversities of ethnic foods of Northeast India.
21. Chah, K.F., Eze, C.A., Emuelosi, C.E. and C.O. Esimone, (2006). Antibacterial and wound healing properties of methanolic extracts of some Nigerian medicinal plants. J. Ethnopharmacol104: 164 -167.

STUDY OF ETHNOMEDICINAL PLANTS FROM MELGHAT TRIBAL REGION, AMRAVATI DISTRICT

U. R. Kokate

Arts, Science and Commerce College,

Chikhaldara, Dist. Amtavati 444807

*Corresponding author E-mail: drujwalakokate@gmail.com

Abstract:

Melghat Forest is Dry deciduous type forest.Forest has biodiversity in flora and fauna. Melghat means meeting of ghats. Melghat lies on the southern shoots of the Satpuda range of hills. This part of Satpuda is known as Melghat; consists of succession of hill and vallies. Rare and endemic flora of North, East and Western Ghats are also found here. The entire area of the Melghat is covered by the forest of the "Dry deciduous Teak Forest." The forest of Melghatis dry tropical forest. Tectonagrandis is the most important and dominant species. The environment of Melghat forest is favourable for the flourishes of plants.Present study include the study of medicinal plants from Melghat region.

Keywords: Medicinal plants, Ethnomedicine, Ethnovetarnary, Tribes, Melghat.

Introduction:

The forest of Melghat is mostly of the Dry Deciduous type and one of the important forests of Vidarbha region of Maharashtra in India. The flora shows much more diversity with change in topography. The vegetation varies considerably with the change in altitude, soil, temperature, humidity, and rainfall. The average rainfall varies from 1300 mm to 1450 mm, the temperature range varies from 13 to 41 degree celcious and humidity varies from 48 % to 100%. The soil is also of different types like alluvial, Lateritic, Gritty-loam and clayey. In Melghat tribal like Gond, Korku, Nihall, Gaolan are uses the ethnomedicinal plants from long year ago. They are depending on forest for their food as well as for the fodder. They use forest produce for their domestic needs of firewood, timberforest produce like fruits, gum, flowers and fodder, medicinal plants for themselves as well as ethno-vetarnary. The main source of income is from labour and rainy season agriculture. They use forsest wood for making the tools for theiefarming. They aument their income by collecting Mauha flowers, charoli seeds, and gum like dhawada, tendu leaves and musali.

Traditionally tribes had been use forest produce for ethnomedically and ethnovetarnary from a century. The tribes of Melghat has takes the crops like gram, rajgira, Kutki, maize, jawar, potato, Dhan etc.

The most prominent festival of tribes especially Korku is Holi. They celebrate the Holi with enthusiastic for that they also dependend on the Forest for dry woods and cow dungs for fire.For this festival their preparation start before a month in advance,involves men and women dancing, singingand beating drums.For the festival Tribes collect donations from every family in the form of grains, goats, wine etc. In the 5 day celebration of Holi, members of the tribes erect a long wooden pole in the village and along the main road, and collect the money tied to the pole.On the Holi they play with colours. They celebrate Holi for 5 days.

Tribes of Melghat also celebrate the festival like Ran bhave and Chikhalb have to appeasethe God of rains.Korku also celebrated Dasera for workship of plant like Apata.

Observation:

While studing about the tribes of Melghat region and the ethnomedicinal and ethnovtarnary use by tribes following some important are studied.

Discussion:

Agricultural ecosystem in Melghat rural area composed of annual cultivated crops with reference to sustabitlity of soil. The average rain fall of Melghat area is 1200 -1300mm. Soil is red, murmi. The crops are in annual pattern.The tribes of MelghatKorku, Bhill,gavlon used the forest minor produce with relation to ethnobotany and ethnovetarnary aspects. In agricultural ecosystem, some of the herbaceous and busy weeds are considered as the medicinal plants and they are used in the remedy of various diseases of domestic cattle and human being.

Some of the plants are antipyurtic, laxative, used in gastric problems. From the ancient era it is observed that the culture and tradition of tribes shows that agricultural ecosystem and forest ecosystem shows close resemblance with each other and they shows the socio eco potential.Forest produce used by the tribs like bamboo, Sagvan for agriculture instruments, for their huts etc.tribes totally dependen on the forest for their life.

Table 1: Medicinal plants of Melghat region and its uses

Sr. No.	Botanical Name	Family	Common Name	Use of Plant
1	*Digera muricata L*	Amaranthaceae	Getan	Used as a vegetable
2	*Boerrhavia defuse L*	Nyctaginaceae	Punarnava	Used as Health tonic
3	*Vitex nigundo L*	Lamiaceae	Chinese chastetree	Oil is medicinally usable Plant also used for the fencing
4	*Leptadenia reticulate Retz*	Asclepiadaceae	Doodhkandi	Increses milk in domestic cattles
5	*Andrographis paniculata*	Acanthaceae	Bhuinimb	Antipyretic, increase disease resistance power
6	*Cucuma amada Roxb.*	Zingiberaceae	Ambehalad	Antiseptic, increase disease resistance power, use in cough and cold
7	*Curcuma psedomontana*	Zingiberaceae	Ran Haldi	Antiseptic, increase disease resistance power, use in cough and cold
8	*Helictoris isora L*	Malvaceae	Muralsheng	Gastric disorder
9	*Ruta graveolnse Linn*	Rutaceae	Sitap	Use in worm
10	*Ocimum canumsims*	lamiaceae	Janglitulas	Antiseptic, management of insects in rural ara
11	*Ricinus communis L*	Euphorbiaceae	Castor	Laxative
12	*Adhatoda vasica Linn*	Acanthaceae	Adulsa	Cough, cold, skin diseases, fever
13	*Cassia fistula*	Amaltas	Caesalpinoidae	Piles, increase in digestive problems
14	*Withania somnifera L*	Solanaceae	Ashavgandha	Use in Joint pain, energetic
15	*Terminalia belIrica Roxb.*	Solanaceae	Behada	Cough,cold, asthama, one of the important ingredient in Trifalachurn
16	*Terminalia chebula Retz*	Combretaceae	Hirda	Increases disease resistance, skin diseases, piles, stomach problems
17	*Agle marmelos L*	Rutaceae	Bel	Stomach problems
18	*Semicarpus anacardium L.*	Anacardiaceae	Bibva	Oil use in joint pain
19	*Cymbopogaon martini Wats.*	Poaceae	Tikhadi	Oil useable in paralysis for malish,also usable in cosmatics, perfumery
20	*Rauvolfia serpentina L*	Apocynaceae	Sarpgandha	Usable on High blood pressure

Refernece:

1. Bhogaonkar, P. Y. and V. D. Devarkar (2002). Some unique ethnomedicinal plants of Korkus of Melghat Tiger Reserve (Maharashtra). Ethnobotany 14, 16-19.
2. Dhore, M. A. and P. A. Joshi (1988), Flora of Melghat Tiger Reserve 1-24.
3. Dinesh Khedkar, Nitin Atre (2019). Medicinal flora of melghat for asthma: A review Journal of Pharmacognosy and Phytochemistry, 8(2): 2091-2095
4. Sakarkar, D. M. U., M. Sakarkar, N. M. Sakarkar, V. N. Shrikhande, J. V. Vyas and R. S. Kale (2004). Medicinal plants used by the tribes for hair disorders in Melghat forest of Amravati District Maharashtra.
5. Kokate, U. R. and G. D. Muratkar (2012). Diversity of Medicinal plants from Melghat Forest, Multilogic in Science, Vol. II (2): 61 – 67.

MEDICINAL PLANT *ASPARAGUS RACEMOSUS*: A BOON FOR WOMEN'S HEALTH

A. N. Shende

Department of Biology,

D. K. M. Mahavidyalay, Kurkheda, Dist - Gadchiroli (M.S.)

Corresponding author E-mail: shendearuna3@gmail.com

Abstract:

Asparagus racemosus, traditionally knows as Shatavari means "who possesses an acceptable to many". In Ayurveda it is considered a versatile female tonic.In spite of being a rejuvenating herb it is beneficial in female infertility, as it increases libido, cures inflammation and even moistens dry tissue of the sexual organs, ovulation, prepare the womb for conception and enhances folliculogenesis, Shatavari is act as post-partum tonic by increasing lactation and normalizing the uterus and changing hormones. *A. racemosus* the main Ayurveda boon tonic for women's health as is *Withania* for the men's health.

Keywords: *Asparagus racemosus*, Shatavari, Medicinal plant, Women health, Ayurveda.

Introduction:

Asparagus racemosus is Shatavari means "who possesses an acceptable to many" it is considered boon for women's health as a general tonic and a female reproductive tonic. In Ayurveda this amazing herb known as the"Queen of Herb" because it promotes love and devotion. Shatavari is the main Ayurvedic rejuvenative tonic for the women, as is *Withania* for the male. *Asparagus racemosus* was previously included under the family Liliaceae, but now it has been shifted to a newly created family i.e. Asparagaceae. This medicinal plant is known in India by common name such as Shatavari, Satmuli, Satavar etc. It is a woody climber which grows to a height of 1-2m. The leaves are of pine needle shape, small but uniform and have tiny white flowers arranged in the form of small spikes (Fig.1 a b & c). The roots are tuberous, succulent, finger shaped and clustered (1, 2, 3, 4) Shatavari is known to possess a wide range of phytochemical constituents (5).

Material and Methods:

Study Area:

Kurkheda is a village and tehsil in the Gadchiroli district in the Indian state of Maharashtra. It is located at average elevation of 240 meters (790 feet), has dance forest covered in and around kurkheda availability of medicinal plants also.

Medicinal Plant material collected from the kurkheda tehsil. Methods has been used for the collect this information by interviewing the traditional healers who have recommended and provideshatavarikalp, shatavri tonic to the women.(9) This information is documented for the women who are struggling with low libido or irregular period's etc. shatavari is nothing less than a boon. This Ayurvedic herb is associated with women's health which has many benefits.

***Asparagus racemosus* Whole Plant**

Plant with Flower

Leaves

Root

Results and Discussion:

Medicinal plant *Asparagus recemosus* is a boon for women. Their overall reproductive health is very important. Reproductive health is essential to health, not only for giving birth to a baby, but also for keeping the menstrual cycle and bodily hormones in balance. But for women who have problems of irregular periods in addition to low libido or women who have troubled by weight gain, shatavari plant is a boon for them.

In Ayurveda it is called Rasayana or whole body tonic for women, Shatavari is an excellent treatment for many ailments, which include increasing milk production, reducing the symptoms of menopause. It has been used for centuries in ancient Ayurvedic medicine as a

healer to improve lifestyle. It is bitter and sweet in taste. Traditional healers often recommended taking it in the form of powder or powder with milk. The oil found in this herb makes it easy to digest and eat. This mountain her will breathe life into the veins.

Chemical constituents of *Asparagus racemosus* (Shatavari):

In Ayurveda, Shatavari has an ideal herb for all women's health problem:

- Shatavari plant extract are a rich source of vitamins A,B1,B2,C, E, Calcium, magnesium and folic acid. Too many women are diagnosed with a slight or chronic vitamin B deficiency. Vitamin B deficiency leads to fatigue and weakness among women's.
- Shatavari roots have alkaloids such as Asparagamine. Saponins, in particular, play an integral part in boosting female libido and rebuilding immune system.
- Chemical constituents in Shatavari leaves are Flavonoids and Rutin. Flavonoids help regulate cellular activity and fight off free radicals that are the primary causes of oxidative stress.
- Other chemical elements in Shatavari are essential oils, tyrosine, arginine, tannin, and resin. Menstruation-induced headaches can sometimes be unbearable. Tannin prompts your body to release serotonin to relieve your headache without consuming medicines.

Shatavari is an effective herb for female reproductive hormones. It is also known to cure their sexual problems. Apart from this, it is also helpful in managing many chronic diseases. Shatavari has not one or two such but many health benefits.

Benefits of *Asparagus racemosus*:

The terms woman and lifestyles have now become synonymous. An unhealthy way of life could cause unnecessary hassles and bring the onset of numerous chronic diseases. Unhealthy lifestyles are a growing concern among women of all ages. Be it mental health or sexual health, satavari, when added to women's diet, proves to be a powerful ingredients. Let's list some of the many benefits of shatavari for women.

- Cure Gastic Problems.
- Effective in Fertility
- Beneficial for low libido
- For PCOS
- Beneficial in Breastfeeding

Shatavari for Gastric Problems:

Ever had acidity issues when you are in the middle of your menstrual cycle. Shatavari help with that too! No one likes an upset stomach. Shatavari prevents gas formation in the alimentary canal that reduces abdominal pain. Moreover, it is a proven herb for curing ulcers and diarrhea. The recommended amount is 1-2grams a day, twice a day for most of women.

Shatavari for PCOS:

PCOS is caused by an imbalance of hormones in a woman's body, studies say that when women take 5grams of shatavari with milk, their hormones are balanced out. Shatavari naturally increases the antioxidants and it improves menstruation and reduces fertility.

Shatavari for Effective on Fertility:

Every woman likes a satisfying orgasm. Shatavari is known to enhance the desire or sex among woman, is a known trick to manage infertility among women, prevent miscarriages, and make sure of time ovulation.

Shatavari for Low Libido:

Libido is vital to engage in sex. A lack of Libido among women could mean absolute disinterest in sexual activities and its inability, even if you want to have sex. Shatavari is known libido booster. It is also beneficial for women suffering from anxiety or depression. Research also shows shatavari benefits for female fertility. Shatavari has soothing and relaxing effects make it such a popular adaptogenic herb.

Shatavari for Weight Gain:

Does shatavari increase weight? Bloating is synonymous with getting your periods. Shatavari is responsible for minimizing water weight from your body and removing toxins. However, for lean women, Shatavari Churna is a great way to gain weight due to its balya properties and maintain strength, eliminating weakness. However, be sure to take it in moderation.

Shatavari for Diuretic Effects:

Diuretics are also known as water pills. They augment waterproduction in your body and manage to flush it out, hence, detoxifying you. An excess of fluids may imbalance the heart. Shatavari is a popular diuretic, even in Ayurveda, where about 3,200 milligramof shatavari are consumed, minus the acute side effects.

Shatavari for Cough Relief:

Cough is a common condition of human health. If a cough is what you suffer from, drink shatavari juice with warm water and experience the curative effects.

Shatavari for Immune System:

If you want to boost your immune system, Shatavari can help you in many ways. It stimulates the immune cells in your body and boosts immunity in suppressed conditions. It enhances the ability to fight infections and viruses.

Shatavari for Anti- Aging:

Shatavari has caused significant ripples in the Skinceutical field as it is considered a replacement for retinol, a popular anti-aging remedy used by women globally. Shatavari actively boosts collagen production in your body, diminishing wrinkles and fine lines. Automatically and over time, you will notice firmer, healthier plumper, and fresher-looking skin.

Shatavari Beneficial for Breastfeeding:

Many new mothers choose Shatavari for breast milk. As a popular galactagogic, Shatavari boosts the milk production among lactating mother, aiding them through this process. Shatavari granules for lactation have the same effects.For increasing production of breast milk take the shatavari powder ¼ -1/2 a teaspoon consume with milk or honey, twice daily.

Conclusion:

Asparagus racemosus is an important medicinal plant having traditional importance as it is used in the indigenous system; traditional practices are proven by various experimental studies. This depicts the plant with tremendous potential in both healthcare and trade. Considerable work has been done to explore the biological activity and medicinal applications of the plant, still there are available countless possibilities of pharmacological applications which needs to be explored. The medicinal plant *A. racemosus* has a boon for women who are struggling with low libido or irregular periods. This Ayurvedic herb is associated with women's health has been revealed many benefits.

References:

1. Chopra RN, Chopra IC, Handa KL, Kapur LD. (1994). Indigenous drugs of India. Calcutta: Academic Publishers, pp.496.
2. Mandal SC, Pulok K, Mukherjee, Nandy A, Pal M, Saha BP. (1996). Physico-chemical characteristics of tincture from Asparagus racemosusWilld. Ancient Science of Life, 16(2): 160-165.
3. Thakur RS, Puri HS, Husain A. (1989). Major Medicinal Plants of India. Lucknow, Central Institute of Medicinal and Aromatic Plants, pp. 78-81.

4. Sharma PC, Yelne MB, Dennis TJ. (2000). Database on medicinal plants used in Ayurveda. Delhi: Documentation and publication Division, Central Council for Research in Ayurveda and Siddha, Vol-I, pp. 418-430.
5. Kundu M, Mazumdar R, Kushwaha M, Chakraborthy G. (2011). Standardization profiles of roots of *Asparagus racemosus* Wild. Pharmacologyonline, 3:587-592.
6. Sharma K, Bhatnagar M. (2011). *Asparagus racemosus* (Shatavari): A versatile female tonic. Int.J. Pha .and Biological Archives, 2(3):855-863
7. Singla R, Jaitak V. (2014). Shatavari (*Asparagus racemosus* Wild): A review on its cultivation, morphology, phytochemistry and pharmacological importance; IJPSR, Vol. 5(3):742-757.
8. Ponnaiah J, S.K, Tagore JK. (2018). Medicinal plants used for fertility and menstrual disorders by the women belonging to the Nilgiris tribe community of southern India; IJSRR, 7(4), 601-608.
9. Jain SK. (1981). Glimpses of Indian Ethnobotany. New Delhi: Oxford and IBH Publishing Co.
10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3215317/
11. https://www.medicalnewstoday.com/articles/322043
12. https://pubmed.ncbi.nlm.nih.gov/29635127/
13. https://www.researchgate.net/publication

ELEVEN STRONG ETHNOMEDICINAL IMMUNITY BOOSTERS: TO BEAT COVID-19 AMONG TRIBALS OF EAST NIMAR

Shakun Mishra

Department of Botany,

S. N. Govt. P. G. College,

Khandwa, 450001 Madhya Pradesh, India

Coreesponding author E-mail: dr.shakunmishra2012@gmail.com

Abstract:

This ancient medicinal science had assured long ago that plant extracts could do a lot to build up the body. Here eleven strong immune ethnomedicinal plants are described naming Rinjua, Hathizara, Dokarbel, Neem (Limb), Hingan, Munga, Kenwanch, Ban Tulsi, Tulsi, Pongamia (Karanj) and Giloy. According to Ayurveda, our body can resist infections only when all the seven layers of our body's tissues (Rasa, Mansa, Rakta, Medha, Manjja, Asthi and Shukra) are strong. When the seven layers are working together, our immunity will be boosted.

Keywords: Ethnomedicinal plants, immunity boosters, East Nimar, COVID-19,

Introduction:

On the re-organization of states, Madhya Bharat region was merged in Madhya Pradesh. The western part of old Prant Nimar eventually became a part of Madhya Pradesh. In new Madhya Pradesh Nimar was divided into two independent districts i.e. East Nimar and West Nimar. In this division, Khandwa district situated in the East was named as East Nimar with Khandwa as the districts headquarter. The district has 3 Tehsils viz Khandwa, Harsud, and Pandhana. The name Nimar happens to be spelt in certain books as Nimaur. In course of time and by stages Nimwar, Namavur or Nimaur may have assumed the simple form, Nimar. It is generally said that the name is derived from the '*neem*' tree (*Azadirachta indica)* which is very common in the district.

East Nimar is situated in the South West corner of Madhya Pradesh. It lies between 21^0 05' and 22^0 25' N Latitude and between 75^0 57' and 77^0 13' E Longitude and 304 M above sea level. It is bounded by Betul, Hoshangabad and Amravati (Maharashtra) districts on the East, Buldhana (Maharashtra) and Amravati districts on the South West and Khargone and Dewas districts on the West and North. The total geographical area is 10779 km^2 out of which forest

occupies 3516 km2 (32.63%). It lies between the valleys of Narmada and Tapti rivers and occupies a strip of mixed hill and plain country.

Materials and Methods:

The areas selected for study were those where the concentration of these ethnic groups is believed to be intense. During investigation, frequent field trips were made to the remote villages. The field trips were so planned as to cover maximum sites of the study area. After establishing good rapport with local practitioners, the ethnomedicinal information was collected. The plants of significance were collected in vegetative as well as in blooming conditions and identified with the help of Flora and other literature (Jain and Rao 1977; Chopra, *et al* 1956; Cookie, 1957; Haines, 1974; Flora of M. P., Vol. I. 1993; Flora of M. P., Vol. II. 1997; Flora of M. P., Vol. III. 2001.)

Enumeration:

1. *Acacia leucophloea* (Roxb.) Willd. MIMOSACEAE. T.N.-Rinjua

Uses:

One teaspoon decoction of bark is given orally twice or thrice a day for 3 days in vomiting, cough, bronchitis and also used as booster of Covid-19.

2. *Achyranthes aspera* L.,Sp. AMARANTHACEAE. T.N.- Hathizara/Ifil Zara / Kutari

Uses:

Half cup decoction of entire plant is given twice a day in pneumonia, cough and also used as booster of Covid-19 for 15 days to 6 months, depending upon severity of the disease.

3. *Ampelocissus latifolia* (Roxb.) Planch. VITACEAE. T.N.- Dokarbel/Kandvel/Nardel

Uses:

Half teaspoon stem powder is given orally with water twice daily to cure pneumonial fever and also to boost Covid -19.

4. *Azadirachta indica* A. Juss. MELIACEAE. T.N.-Limbosi/Limb / Nimann Marra

Uses:

Decoction of leaves is widely used as an immunity booster. It is very effective in keeping the body safe from various harmful pathogens.

5. *Balanites aegyptiaca* (L.), Delile. BALANITACEAE. T.N.- Hingan/Hingana/Hinganghat

Uses:

Seeds of two fruits, rock salt and dried rhizome of *Zingiber officinale* (ratio 1:1:1) are finely ground and made into tablets. One tablet is given twice a day to cure pneumonia, tuberculosis and also boost Covid-19.

6. *Moringa oleifera* Lamk. MORINGACEAE. T.N.- Sainjna/Senjna/Mungna.

Uses:

Half cup of young leaf juice consume twice a day for 21 days to boost Covid- 19.

7. *Mucuna pruriens* (L.) DC. FABACEAE. T.N.- Kenwanch/Kanchkuri/Kaunch.

Uses:

Root with root of *Ziziphus mauritiana* (in equal amount) is crushed. 10 gm mixture is given with cow's milk in tuberculosis to adults and to boost Covid-19.

8. *Ocimum basilicum* L., Sp. LAMIACEAE. T.N.- Ban Tulsi/Modadi /Babui Tulsi.

Uses:

Simply chew a few leaves in empty stomach to cure Covid-19.

9. *Ocimum tenuiflorum* L., Sp. LAMIACEAE. T.N.- Tulsi.

Uses:

0.2 gm seed powder is given with milk in fever, cough, cold and also boost Covid-19.

10. *Pongamia pinnata* (L.)Pierre. FABACEAE. T.N.- Karanj.

Uses:

Soaked seeds are strung in a sacred thread and the necklace is tied around patient`s neck for treatment of cold, coryza,cough (Kukkur-Khansi, Kali-Khansi) and to cure Covid-19.

11. *Tinospora cordifolia* (Willd.) Miers ex Hook. MENISPERMACEAE. T.N.- Gulvel/Gudvel /Usnaide veli.

Uses:

Two inches long seven stem pieces are soaked in water overnight. Next morning these are mashed and filtered. Filtrate is given for 21 days on empty stomach in fever, cough and also boost Covid-19.

Conclusion:

The different stages of life i.e. birth, childhood, puberty, marriage, parenthood, death and cremation of the dead of the tribes have their own peculiarities. Their close association with various plants and related traditional knowledge can be, envisaged in their practices. The present study revealed that tribals (Korku, Gond and Nihal) are more knowledgeable about the plant wealth and their surroundings. The plants like *Ampelocissus latifolia, Azadirachta indica, Pongamia pinnata, Ocimum tenuiflorum* and *Tinospora cordifolia* are commonly used by all the tribal groups to boost immunity.

Acknowledgement:

The author is also grateful to her supervisors Dr. C.M. Solanki and Dr. S.K. Mahajan for encouragements; to Dr. Mukesh Jain, Principal S.N. Govt. P.G. College, Khandwa for their constant support and guidance.

References:

1. Chopra. R.N.; Nayar, S. L. and Chopra I.C. (1956). Glossary of Indian medicinal plants, C.S. I.R. New Delhi.
2. Cookie T. (1957). Flora of the presidency of Bombay, vol. I – II
3. Flora of M. P., Vol. I. (1993). Pteridophytes and Angiosperms. Botanical Survey of India. Calcutta.
4. Flora of M. P., Vol. II. (1997). Angiosperms. Botanical Survey of India. Calcutta.
5. Flora of M. P., Vol III (2001). Angiosperms and Gymnosperms. Botanical Survey of India. Calcutta.
6. Haines, H.H. (1974). The Botany of Bihar and Orissa, part VI
7. Jain, S. K. and Rao, R. R. (1977). A handbook of field and herbarium method, today and tomorrow, Oxford and IBH Publishing Company, New Delhi.

ENVIRONMENTAL IMPACT OF USING CELLULOSIC ETHANOL

Enakshi Guru

Department of Physics,

Sarojini Naidu College for Women,

Kolkata, West Bengal, India

Corresponding author E-mail: enakshiguru@gmail.com

Abstract:

Agricultural waste like rice straw, sugarcane bagasse, corn cobs, or widely available grasses switchgrass, miscanthus can be ideal feedstock for producing Cellulosic Ethanol. Improvised techniques to produce cellulosic ethanol give environmental benefits. Using ethanol as a biofuel will reduce the requirement of Fossil fuel. The emission of greenhouse gases in biofuel production is less than gasoline and a little lessthan biofuel obtained from food crops.

Keywords: cellulosic feedstock, bioethanol, life cycle analysis, environmental pollution.

Introduction:

The importance of alternative fuels is necessary as the rapid depletion of fossil fuel cannot be replenished soon if it is overused. The cost of petroleum is rising day by day.Moreover, it causes global warming when we use petrol as fuel. Biofuels, which are environmental-friendly, are taking their place as an alternative fuel. Low-value biomass that contains a high value of cellulose can be used as biofuel. Biofuel is cost-effective from any other fossil fuel like petroleum, coal, or any natural gas. It has significantly fewer environmental hazards compared to conventional fossil fuels. The most used liquid biofuel is Ethanol (C_2H_5OH) or ethyl alcohol, obtained by fermentation of sugar or starch. Ethanol, a renewable biofuel, is colourless, clear alcohol made from various biomass materials called feedstocks. Fuel ethanol feedstocks include crops and grains with high starch and sugar content, such as corn sugar cane, sugar beets, sorghum, andbarley. First-generation ethanol is made from the food crop, but second-generation cellulosic ethanol is obtained from weeds, switchgrass, miscanthus, rice straw, wood chips, corn cobs and stocks residues, and forestry residues as sawdust, and even from municipal waste. Cellulosic Ethanol is commonly made from sugarcane bagasse, a waste product of sugar processing, or from switch grasses, miscanthus named C4 crops, which have high biomass yield and can be cultivated even in infertile land. Cellulosic ethanol production requires less energy,

fertilizers, and water to grow than grains. Thesetypes of grass and weeds possess the features of resistance to aridity, high photosynthetic yield, and a high rate of CO_2 capture.

In the United States, corn is produced in large amounts, and hence its price is low. In the USA, corn is the primary feedstock for fuel ethanol [1]. Brazil, the world's second-largest fuel ethanol producer, uses sugar cane to produce ethanol [2]. Wheat is a majorcrop in Europe, and hence it is used as an ethanol feedstock. However, it is not appreciable to use agricultural land for the purpose of biofuel feedstock. Using farming land to prepare feedstock of bioethanol can be solved if one uses agricultural waste likecorn cobs [3,4], sugarcane bagasse, and rice straw [5,6]. The wild switchgrass [7,8], miscanthus [9] are the best option. However, the technology of extracting ethanol fromcellulosic substances is complicated and not well developed.

In this review paper, Life cycle analysis for assessing environmental effects using cellulosic bioethanol is studied. It is observed that corn-based ethanol reduces life cycle CO_2 emission on average 34%, which can be reduced more with cellulosic ethanol. Different reports on the environmental hazard due to Gasoline use, which can be reduced by using cellulosic ethanol, have been analyzed.

Effect of an increasing rate of Fossil fuel consumption:

With the increasing GDP growth and abundant lifestyle, the consumption of oilincreases. It is seen from Table1, consumption of fuel in the USA is the highest. Afterthe USA, China, and Europe, India is the fourth-largest consumer of crude oil. In the data from 2015 to 2019, global use of crude oil increased by 6.5%. A maximum rise inuse is seen in India (24%) before China (18%).

Table 1: Oil consumption: million barrels per day [Source: BP Statistical Review 2020]

Year	World GDP Growth rate (%)	World	USA	China	Europe	India	Rest of the world
2015	3.49	94.87	19.53	11.97	14.71	4.23	44.43
2016	3.29	96.73	19.69	12.32	15.02	4.63	45.07
2017	3.76	98.40	19.96	12.92	15.37	4.86	45.29
2018	3.57	99.89	20.49	13.45	15.35	5.12	45.48
2019	2.76	100.96	20.47	14.13	15.31	5.27	45.78

Continuous depletion of fossil fuel forced usage of alternate resources for fuels. Also, the import cost of crude oil will be reduced if we can use alternative fuel. This target can be

achieved by adopting biofuel, implementing the energy efficiency norm. The reserve of fossil fuel is going down, and greenhouse gas like carbon dioxide emission increases. Emission of CO_2 includes fossil fuel combustion from various uses like fuel used in transport, industry, power generation, etc.

Table 2 shows greenhouse gas emissions (CO_2) from different world countries, which pollute our environment. It is seen from the data that the release of CO_2 increases more and more every year, which causes serious environmental threats. Due to the ample consumption of fuel, Carbon dioxide emission is also high (15%) in India and China (7%). Since 2015 after the endorsement of the Paris agreement, the pressure on all governments to make a more significant commitment to reduce emissions is increasing. The world's largest CO_2 emitter, China, announced in September 2020 that it would target net-zero Carbon dioxide emission by 2060. India has yet to announce net zero- emission. However, India Government encourages using ethanol as a transport fuel forthe last 20 years. The government of India targets to reduce carbon footprint by 30-35%by the year 2030. For this purpose, cellulosic ethanol is the potential energy source thatcan help fulfill India's target.

Table 2: CO_2 emission in million Tons. This emission is through consumption of oil, gas, and coal for combustion related activities [Source: BP Statistical Review 2020]

Year	World	USA	China	Europe	India	Rest of the world
2015	32787	5141	9186	4210	2149	12101
2016	32936	5042	9138	4263	2443	12050
2017	33280	4983	9298	4305	2330	12364
2018	34008	5116	9507	4246	2452	12687
2019	34169	4964	9825	4111	2480	12789

Availability of feedstock of cellulosic ethanol in different countries:

In the United States, corn is produced in large amounts, and its price is also low. In the USA, corn is the primary feedstock for fuel ethanol [1]. Brazil, the world's second- largest fuel ethanol producer, uses sugarcane for producing fuel ethanol [2]. Wheat is amajor crop in Europe, and hence it is used as an ethanol feedstock. However, it is not appreciable to use food crops and agricultural land for the purpose of biofuel feedstock. The problem of using farming land for preparing feedstock of bioethanol can be solved if one uses agricultural waste like corn cobs [3,4], sugarcane bagasse, rice straw [5,6], the wild switchgrass [7,8], and miscanthus [9]. USA

manufactures Cellulosic Ethanol from corn stover, algae, miscanthus, switchgrass. Sugarcane bagasse is used as cellulosic feedstock in Brazil. In Europe, cellulosic ethanol is produced from rice straw and husk, wheat straw, and Arundo donax, mainly used in Italy, Spain. In Finland, sawdust is used as feedstock.

A concern in India is not using more farming land, and more food crops, for ethanol feedstock. So, rice straw, wheat straw, sugarcane bagasse is the more suitable feedstockof second-generation ethanol. Although the technique of extracting ethanol from cellulosic feedstock is challenging for India, another problem is to collect the feedstock.Rice straw is an abundant source of feedstock, but its supply to the industry is another problem for India. Three major states in India, Punjab, Hariyana, Uttarpradesh, produce huge feedstock with high silica content. The time gap (only 15 to 20 days) between riceharvest and straw collection and sowing new crops (wheat) is so less, that farmers usually burn the rice straw, which reduces the supply of feedstock and causes environmental pollution.

In Table 3, the production and consumption of ethanol by different countries in 2017, 2018, and 2019 are listed.

Table 3: Ethanol production and consumption by different country (units thousand barrels/day) [Source: BP Statistical Review 2020]

	2019		**2018**		**2017**	
	Production	**Consumption**	**Production**	**Consumption**	**Production**	**Consumption**
USA	1029.25	949.23	1049.66	USA	1029.25	949.23
Brazil	540.87	547.56	522.73	Brazil	540.87	547.56
China	74.29	75.72	50.22	China	74.29	75.72
Canada	33.60	55.14	30.27	Canada	33.60	55.14
India	41.36	41.36	27.57	India	41.36	41.36

From Table1, it is clear production and consumption are consistently high in the USA. India is in 5th position to produce ethanol. So drastic measures should be taken to increase the production of ethanol to reach the target.

Environmental effects during the production of ethanol from lignocellulosic source:

Getting ethanol is to ferment starch and sugars of corn, sugarcane, and sugar beets by yeast. Fermented sugar turns into alcohol by fermentation. However, the process of producing ethanol from cellulosic materials like switchgrass is complicated than the processes employed

for sugar-based ethanol. [8]. The method of pre-treatment, enzymatic hydrolysis, fermentation, and recovery are the main steps of life cycle analysis [Figure 1].

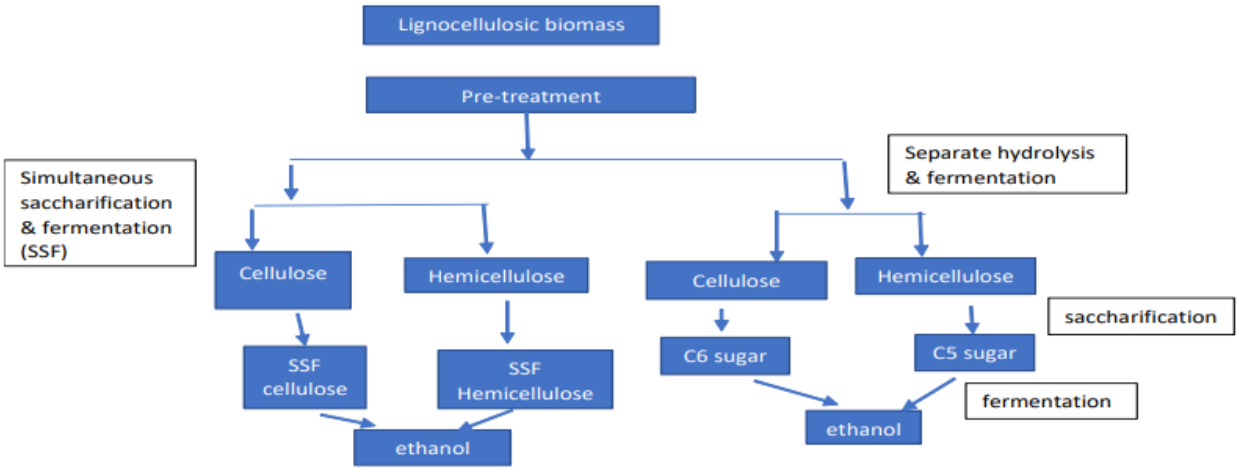


Figure 1: Flow chart for ethanol production

Before the fermentation process can start, the Enzymes must break up the complex cellulose structure. This two-step process of breaking the cellulosic material is separate hydrolysis, and simultaneous saccharification followed by fermentation increases the complexity of converting the cellulosic biomass into ethanol. The three main components of lignocellulose are cellulose, hemicellulose, and lignin. At first, cellulose and hemicellulose break into sugar by catalyst (catabolic enzyme) or hydrolysed enzymatically in a hydrolysis reactor. This process is called pre-treatment technology. Several pre-treatment methods, e.g., chemical, biological, physical, and even combination of all three, break up the lignocellulose. To covert lignocellulosic raw material into fermentable sugar can be done by the following process:

1. **Pre-treatment of cellulose and hemicellulose:**

In this process, with the help of brown, white, and soft rot fungi, cellulose and hemicellulose degrade into lignin. The rate of lignocellulose hydrolysis is also low. With the help of fungal treatment, the yield will be more, but the process will take much time. This pre-treatment is a biological process and environment friendly. No chemicals are used, and energy inputs are sufficiently low.

2. **Acid or enzymatic hydrolysis of Polysaccharides into simple sugar:**

In enzymatic pre-treatment, the action of endoglucanases and exoglucanases on solid substrate releases oligosaccharides in the first stage. In the second stage, liquid oligosaccharides are converted to cellobiose and glucose in the presence of the enzyme.

In the acid hydrolysis process, concentrated or diluted or sulphuric acid is used.This dilute acid is used for a very short time under high pressure and temperature, while concentrated sulphuric acid is used at moderate temperatureand pressure for a longer time. However, the dilute acid treatment process is better than enzymatic hydrolysis for environmental consideration

Then in the next step, fermentation is done by ethanologenic yeast, which separates enzymatic hydrolysis and fermentation (SHF) and ultimately produces ethanol.

Currently, technologies are available to convert the large fraction of energy in biomassinto liquid fuels efficiently and cost-effectively. The long-term potential of cellulosic ethanol is linked to the ability of producers to create Ethanol fuels using the catalytic process that is cost-effective and competitive with the alternative. An estimate of the Department of Energy (DOE) shows that the cost of cellulose enzymes in ethanol production is between $0.30-0.50 per gallon of ethanol than the chemical catalysts cost in the petroleum industry to produce gasoline $0.01 per gallon. Optimization of advanced bio-hydrocarbon production processes technology is necessary for allowing biorefineries to operate at commercial volumes.

Study of CO_2 emission in Life cycle analysis of ethanol from different feedstock:

The life cycle starts from raw material extraction to every step of ethanol production, manufacturing, distribution, use, and ultimately disposal or recycling [11]. In the flow chart of Figure 2, CO_2 emission and absorption in a different step of the life cycle are shown. Agricultural biofuel, i.e., corn and sugarcane, emits more carbon-di-oxide thancellulosic biofuel during its biofuel-making process. These biofuels can be burned directly to generate electricity or converted to liquid fuels.

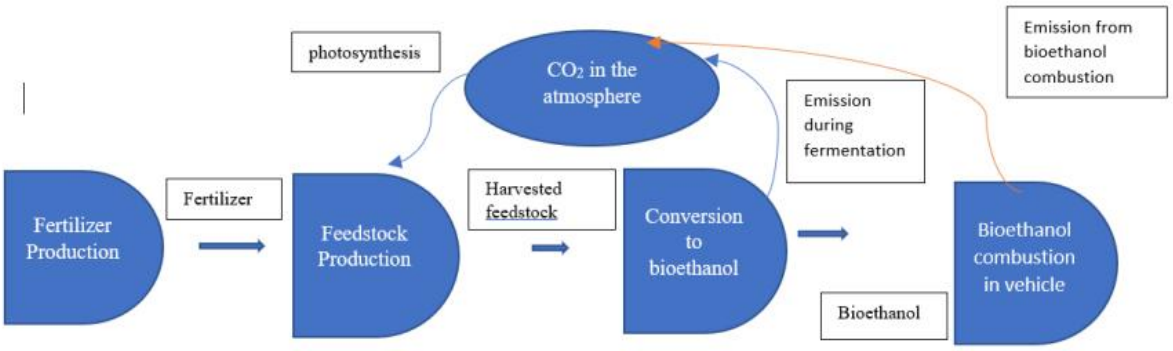


Figure 2: The flow chart shows the fate of CO_2 during the life cycle analysis of Bioethanol

$$\%\ CHG\ reduction = \frac{CHG\ emission_{gasoline} - CHG\ emission_{ethanol}}{CHG\ emission_{gasoline}} \times 100\%$$

In the following (Table 4), it is clearly seen that CO2 emission (greenhouse gas) reducesby 19 % when corn base ethanol is used and when cellulosic ethanol from switchgrassis used, CO2 emission reduces by 35%. So, it is advantageous to use ethanol from switchgrass

Table 4: % of CO2 gas emission during LCA analysisof Ethanol from crops and grasses

Corn	Sugarcane	Switchgrass	Miscanthus
19.1	40.8	35.6	24.1

In Figure 3, CO2 emission during the life cycle of corn ethanol, sugarcane ethanol, switchgrass ethanol, and miscanthus ethanol was studied [4]

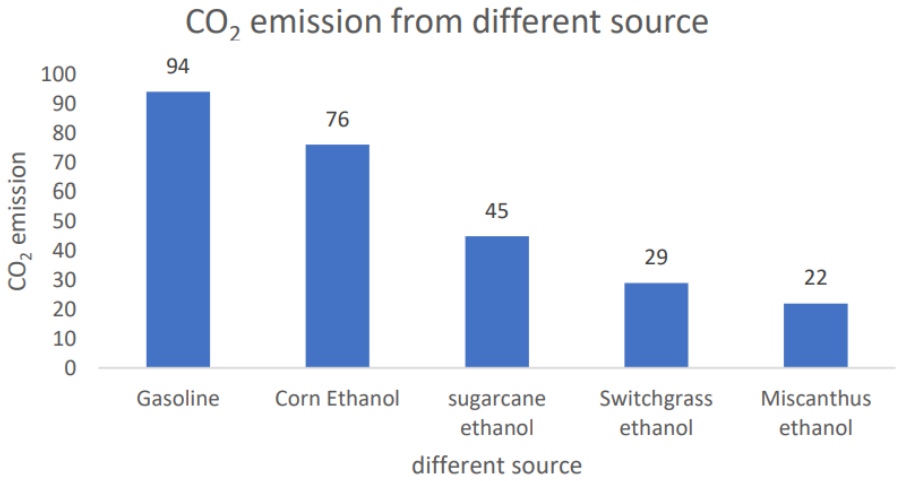


Figure3: This chart shows the CO2 emission becomes less as we study LCA of First-generation ethanol than gasoline and it becomes very less when we study LCA of second-generation ethanol

Environmental benefit of Cellulosic Ethanol over Gasoline:

Emission of CO_2 includes the combustion of fossil fuel from various uses like fuel usedin transport, industry. Table 5 shows greenhouse gas emissions (CO_2) from different world countries, which pollute our environment.

Table 5: **CO_2 emission in million Tons. This emission is through consumption of oil, gas, and coal for combustion related activities. [Source: BP Statistical Review 2020]**

Year	World	USA	China	Europe	India	Rest of the world
2015	32787	5141	9186	4210	2149	12101
2016	32936	5042	9138	4263	2443	12050
2017	33280	4983	9298	4305	2330	12364
2018	34008	5116	9507	4246	2452	12687
2019	34169	4964	9825	4111	2480	12789

It is seen from the data that the release of CO_2 increases more and more every year, which causes serious environmental threats. Plants store carbon-di-oxide from the air during photosynthesis and hence reduce the CO_2 in the air. As a renewable energy source, plant-based biofuels cause less pollution. Thus global warming is less, and greenhouse gases emitted in the combustion of this gas are also less and removed earlier from the air by photosynthesis of growing plants. Ethanol-producing crops, cereals, and grasses, i.e., plant-based biofuels, reduce the CO_2 of the air. Grass and other plants also reduce soil erosion and restore fertility to degraded land. Using farming land for growing biofuel is less preferred as it may lead to a food grain shortage. However, grass can be grown on any ground, may not be fertile land also. Hence, ethanol extract from biofuel is an environmentally friendly process and acts as a renewable energy source. The government of India targets to reduce carbon footprint by 30-35% by the year 2030. Some weighting factors are analyzed by different researchers like Global Warming Potential (GWP), which measures CO_2 and other greenhouse gas emissions. Acidic Potential (AP), which measures sulfur dioxide emission during enzyme production; Eutrophication potential (EP), which measures environmental impact due to excessively high nutrient, Ozon Layer Depletion Potential (ODP), which measures the decrease in the total volume of the ozone layer in the atmosphere caused by the chlorinated or brominated substance. Human Toxicity Potential (HTP) is also measured, and the term is self-explanatory. It was studied that ethanol-blended fuel performed better than gasoline in terms of Fossil Fuel Depletion, Global Warming Potential, and human toxicity potential. [11]. Results are summarized in Table 6.

Table 6: Some weighted factors related to environmental pollution are measured and summarised [15]

Term	E10	E85
FDP	6% lower	70% lower
GWP	10% lower	72-75% lower
HTP	6-7% lower	72-75% lower
ODP	4.5-6.8% higher	51.9-78.2% higher
AP	30-50% higher	3.3-5.5% higher
EP	5.2-7% higher	42.4-64% higher

In comparison with gasoline, ethanol-blended fuels performed better in terms of FDP, GWP, HTP. However, the performance of gasoline is good when ODP, AP, and EP aremeasured. In one report [12] in LCA analysis of ethanol from switchgrass, they plottedEcotoxicity potential and Human toxicity Potential values for the different ratios of Ethanol with Gasoline, shown in Fig 4. The result matches with F.Lui *et al.'s* s work [11]. About 1.54 kilos of CO_2 are produced when a liter of pure ethanol is combusted. In comparison, petrol produces around 2.3 kilos per liter, which implies a more significant carbon footprint.

Conclusion:

Ethanol-blended fuel is well established across the globe. Brazil, the USA, and Europeit is widely used because of their statutory requirements and legacy. Most cars can runon blended fuel up to 5% to 20% ethanol (E10) without modifying the conventional IC(Internal Combustion) Engine commonly used in the vehicle. The IC engine may require slight modification for the higher Ethanol blend like E85 (where the fuel contains 83 – 85% Ethanol). E100 (where 100% ethanol is present) is used in countrieslike Brazil. Even ten years back, the country had a fleet of 14.8 million flex-fuel automobiles and light trucks, and 1.5 million flex-fuelled motorcycles, that use E100. Ethanol fuel as a blend in gasoline and neat ethanol fuel help reduce overall life-cycle greenhouse gas emissions replacing traditional gasoline, lead to less summer smog and ozone-depleting substances, and lower discharges of heavy metals.

Ethanol from cellulosic material like switchgrass shows promise for the future compared to conventional ethanol from sugar or corn. Besides being energy efficient, the cellulosic

material has other advantages, such as it does not take away the farmland used for food grain production. However, cellulosic ethanol production is currently emerging technology and will require continued technological advancements andreduced costs to become commercially viable. Therefore, developing advanced processoptimization technology and inventing low-cost catalysts for cellulosic ethanol production is the key to success.

The government of India targets to reduce carbon footprint by 30-35% by the year 2030. This target can be by adopting biofuel, implementing the energy efficiency norm.The government of India proposed that 20% ethanol will be blended with petrol and 5% with diesel. In India, abundant feedstock and less production cost help move towards sustainable and commercial biofuel production. A strong focus on technologybuilding to develop second-generation biofuel in India opens an avenue for research work.

References:

1. Ziska, L.H., G. Brettrunion, M. Tomecek, S.A.Prior, H.A. Torbet, R.Sircher, (2009). An evaluation of cassava, sweet potato, and field corn as potential carbohydrate sources for bioethanol production in Alabama and Maryland, Biomass and Bioenergy, vol. 33, issue 11, pages 1503-1508
2. Seabra J., Macedo I.C, Chum H.L., Faroni C.E, Sarto C.A, (2011). Life cycle assessment of Brazilian sugarcane products: GHG emissions and energy use, BiofuelsBioproducts and Biorefinery, vol.5: pages 519–32.
3. Luo L, Van der Voet E, Huppes G. Udo de Haes H. (2009). Allocation issues in LCA methodology: a case study of corn stover-based fuel ethanol. The International Journal of Life Cycle Assessment, vol.14, pages 529–39.
4. Wang M, Han J, Dunn JB, Cai H, Elgowainy A. (2012). Well-to-wheels energy use and greenhouse gas emissions of ethanol from corn, sugarcane and cellulosic biomass for US use., Environmental Research Letters; vol 7, number 4, OA
5. Sreekumar, A., Y. Sastri, P. Wadelkar, M. Patil, A. Lali, (2020). Life cycle assessment of ethanol production in rice straw-based biorefinery in India. Clean technology and environment policy, 22,409-422
6. Singh, R., M.Srivastava, A.Sukla, (2016). Environmental sustainability of bioethanol production from rice straw India: A review. Renewable and Sustainable Energy Reviews, vol54, page 202-216
7. Spatari S, Zhang Y, Maclean HL, (2005). Life cycle assessment of switchgrass—and corn stover-derived ethanol-fueled automobiles.. Environmental Science and

Technology; vol 39; pages 9750–8.

8. Scown CD, Nazaroff WW, Mishra U, Strogen B, Lobscheid AB, Masanet E. (2012). Life-cycle greenhouse gas implications of US national scenarios for cellulosic ethanol production., Environmental Research Letters:vol7, number1, OA
9. Lask, J., M. Wagner, L. M. Trindade, I.Lewandowski, (2018). Life cycle assessment of ethanol production from miscanthus: A comparison of production pathways at two European sites, GCB-Bioenergy, https://doi.org/10.1111/gcbb.12551
10. Borrion, A.L., Marcelle, C. Mc Manus Geoffrey, P.Hammond, (2012). Environmental life cycle assessment of lignocellulosic conversion to Ethanol: A review. Renewable and Sustainable Energy Reviews, volume 16, issue 7, Pages4638-4650
11. Liu, F., M.D. Short, J.P.A. Gaitan, X. Guo, J. Duan, (2020). Environmental lifecycle assessment of lignocellulosic ethanol-blended fuels: A case study, Journal of Cleaner Production, vol 245, pp 118933
12. Bai,Y., L.Lin, E.Voet, et al., (2010). Life cycle assessment of switchgrass- derived ethanol as a transport fuel. International Journal of Life Cycle Assessment, vol 5, page,468-477

NIGHT SOIL WASTE MANAGEMENT TECHNIQUES AND CASE STUDIES

Jayashree R*, Kamini S. and Mahalakshmi M. R

Department of Soils and Environment,

Agricultural College and Research Institute,

Madurai - 625 104

*Corresponding author E-mail: jayashree.r@tnau.ac.in

Introduction:

It was in 1724, and two groups of Japanese villages were discussing over a sewage issue. The dispute was about waste removal, but not quite in the way one would imagine. The residents in the village are voluntalirily coming to discuss and work with the disposal option. The word night soil is important and value added product and increased soil fertility and reduce soil degradation. Despite such known benefits its use is now decreasing with modernisation. When compared to other organic fertilizers, night soil tends to give a quick response, especially when used as top dressing [1]. Fields planted with night-soil are fertile for more than two years. It is possible to get good harvests on the same plot for three years consecutively without applying other fertilizers. The use of unprocessed human excreta as fertilizer is a risky practice as it may contain disease-causing pathogens. These risks are reduced by proper sludge management, e.g. via composting. The safe reduction of human excreta into compost is possible. Some municipalities create compost from the sewage sludge [2]. The night soil is managed with different methods and recycled to enrich the nutrients.

Treatment options for night soil:

The safe recycle and treatment methods are diversion of urine and drying of excreta (which is done with urine-diverting dry toilets) Composting (composting toilets or external composting processes) Sewage sludge treatment technologies fecal sludge treatment processes, such as sludge drying beds, constructed wetlands. Anaerobic digestion with biogas production, Waste-to-energy process and Omni Processor

Reuse options:

The most common type of reuse of excreta is in the field of agriculture. This is also called a "closing the loop" approach for sanitation with farming. It is a central aspect of the ecological sanitation approach.

- Fertilizer in farming and fruit crops: for example using recovered and treated water for fertilizer and soil conditioner.

- Energy: for example in digestion process to produce biogas; or producing combustible fuels.
- Night soil can be used as livestock feed and also utilized as raw material for paper boards production.

Nutrient content in night soil:

- Night soil is human excreta, which is very rich in plant nutrients. It is found that fresh human excreta contain about 1.5 per cent urea 1.1 per cent phosporous 0.5 per cent potassium and 1.0 per cent Calcium oxide.
- Human urine contains about 0.6 per cent Nitrogen, 0.1 per cent phosporous 0.5 per cent potassium and 0.3 per cent Calcium oxide.
- The pathogens in the human excreta destroyed by heat application [3].

ECOSAN Concept!

"Ecological sanitation systems – The nutrients can be recycled to improve crop growth and yield.. This ecosafe application of night soil management brings soil health with sustainable sanitation. Through this sustainable system, we can reduce the cost of fertilizer production. Night soil has maximum urea and, we can utilize as manure and also minimize water pollution.

Use of night soil, minimize the introduction of pathogens from human excreta into the water cycle (groundwater and surface water) - for example groundwater pollution.

Biomethanation:is an option for Energy production from waste

- It is a method of degrading organic waste material into organic fertilizer. This process is taken place in the absence of oxygen. This is improved waste management option.
- Generation of biogas, methane evolved as fuel that can be easily used for energy generation and production of heat.

The use of human excreta for biogas generation:

The additional inoculam is not necessary for methane generation as night soil obtained from anaerobic digeation in the human system itself. The methane generation using night soil is almost same as cattle manure digestion. The drawback in the night soil management is low C/N ratio, so need to increase C/N ratio to 25-30. This is very difficult in night soil waste management. To bring the required C/N ratio rice straw and rice husk is added.

Night soil waste management:

In India night soil waste management is done by three methods. Either burial in the ground alone or with town refuse Composting of night soil along with town refuse and anaerobic digestion

Methods of night soil Composting:

Bangalore method:

ICAR and Indian Institute of Science, Bangalore developed a method, known as the hot fermentation process due to the generation of heat in the process to decompose the waste. In this Method long trenches are dug each with a depth of 1m and width of 1.5-2.5m. The layers were made upto 30cm with alternate night soil (5cm) and solid waste upto 25cm thickness and the heap is covered with earth firm. The process starts in a week and temperature was maximum upto 15-21 days. Due to thermophilic temperature, pathogenic microorganisms are destroyed and gases such as ammonia, methane, CO_2 and N released in the process and escaped to the atmosphere. The degraded product is odourless with high nutritive value. The groungwater may receive leachate product from compost.

Mechanical composting:

It is a process in which the compost is manufactured in a short period of time with use of waste materials and night soil. Segregation is done in the starting stage to remove rags,bones and metals The composting process is taken in controlled conditions such as pH, temperatura ans aeration. The night soil may be added through a rectangular hole (12”x6”) in the toilet. The toilets are maintained in a dry condition to decrease moisture. The faeces are covered with animal dung after certain period. The nutrients ate enhanced with the addition of animal dung. The two toilets are alternatively used for manure preparation. The toilets has special door to open and collect manure and then it can be applied to the field. This method permits appropriate time to degrade the night soil and it is mixed with soil for growing agricultural crops. . The process was completed within 4-6 weeks and it is converted to humus like material. Now the product is ready for marketing

Case studies of ECOSAN Pilot projects in India:

Pilot Project 1: Ecofriendly publc toilet Centre - Rajendra Nagar, Bangalore

Implementation of the eco-friendly sanitation project in 1999

In 1999, the eco-friendly public toilet centre was designed in such a way that squatting slabs were raised about 1.5 meters above ground level and drilled with 3 holes and excreta, urine and water used for primary washing hands can be collected. Collection of these was done in barrels that were stored in compartments below the squatting slabs. Faecal matter was co-composted with waste paper and biodegradable waste; urine was applied as nitrogen-rich liquid fertilizer to banana plantations after storage.

Pilot Project 2: Navsarjan vocational training Institute, Dhalit Sakthi Kendra

Night-soil based biogas plant

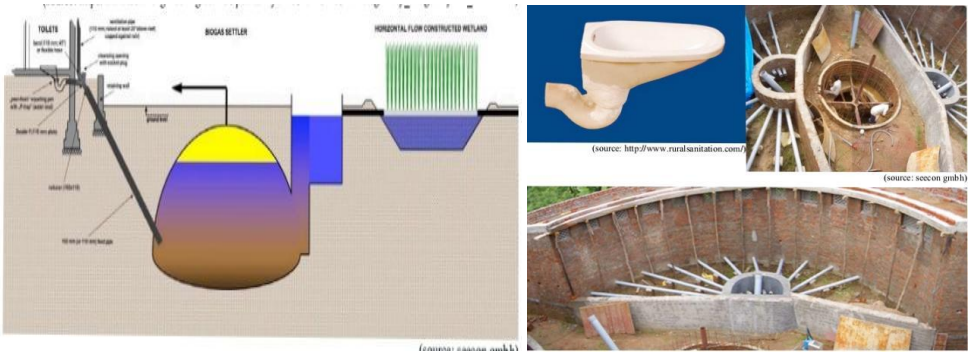
A new common sanitation complex comprising 22 toilet cabins and an adjoint biogas plant for the hygienically safe treatment of blackwater and recovery of valuable energy in form of biogas has been constructed. The toilet cabins and facilities for washing hands are arranged in 2 semi-circles, providing access to the night soil based biogas plant that is located in the centre point of the sanitation complex. Blackwater from the ladies and gents toilets is collected in 2 separate hoppers that drain the water to the biogas plant. An additional chamber is provided for mixing of animal manure and water.

Design assumptions:

- Number of possible users is about 300 persons per day (students, staff members, variable number of guests attending workshops/meetings)
- Specific black water production: ca. 3.5 litres per person per day (incl. urine, feces, cleansing and flush water)

Design of biogas plant:

- A floating-drum type biodigester that is provided with a water jacket has been constructed. The
- Reactor capacity of the biogas plant is ca. 28 m3 (inner diameter: 2,75 m; height: 4,80 m).



The semi-circular arrangement of toilet cubicles has the following advantages over a circular design:

- Each toilet can be individually linked to the biogas plant ., via a steep sloped feed pipe.
- Going for a 2 anaerobic treatment units (each being roughly half the size of a common one) may be more expensive than going for a single treatment unit only, but individual feed pipes Having a steep slope will reduce change of blockages.

- Going for individual, steep sloped, feed pipes may reduce height of plinth level and therefore construction costs.
- The anaerobic treatment unit is easily accessible for operation and maintenance (e.g. lifting of drum with a crane).

ECOSAN Pilot project 3: Navsatjan primary schools

Urine-Diversion Dehydration Toilets Although originally designed to be Urine-Diversion Vermicomposting Toilets, it took only small changes to adapt the existing design of the toilets for their use as Urine-Diversion Dehydration Toilets. Considering cleansing habits, squatting slabs had to be designed to facilitate source-separate collection of urine, excreta and cleansing water. To harvest the finished "compost", the ecotoilets are made to work in batches Daily deposits are to be made from the "toilets" into the processing chambers that are situated below the squatting slabs. After each use, the moisture content was reduced by applying wood ash, saw dust, soil, etc., Specially designed rectangular plate cover was used to close 3-hole system plate and it prevent the entry of water to the collection system and chamber.

References:

1. Oinam, S.S., Y.S. Rawat, R.S. Khoiyangbam, K. Gajananda, J.C. Kuniyal, and S.C.R. Vishvakarma (2005). Land use and land cover changes in Jahlma watershed of the Lahaul valley, cold desert region of the north. Ecosan Res.42-45
2. Mashauri, D.A., M.A Senzia (2002). Reuse of nutrients from ecological sanitation toilets as a source of fertiliser. Water Resources Engineering Department, Dar es Salaam, Tanzania. 22-27
3. Jonsson, H., A.R. Stinzing, B. Vinneras, and E. Salomon (2004). Guidelines on the Use of Urine and faeces in Crop Production. EcoSanRes., 1-35.

PLANT DISEASE CONTROL AND MANAGEMENT

Maruti S. Darade

Department of Botany,

Govt. Vidarbha Institute of Science and Humanities,

Amravati – 444604 (M.S.) India

Corresponding author E-mail: marutidarade@gmail.com

Introduction:

A disease caused to plant affect on normal growth and physiological functioning. The disease is the disturbance in normal healthy condition of plant. It causes morphological, anatomical and metabolic change and loss. The fungal infection and disease development varies depending upon the environmental conditions and season. The intensity of disease development also depends on the species of pathogen and variety of plant. The diseases may develop due to biotic cause. The biotic organisms may be from fungal, bacterial, viral, phytoplasma and animal categories. The biotic cause may be climate, soil type, geographical factors, chemical properties etc. The crop yield production and global trade is affected due to crop diseases. The ever increasing rate of human population compelled a man towards intensification of agriculture and maximum crop yield to meet demand of food scarcity all over the world. The excessive use of chemical fertilizers has increased. The disease organisms are controlled by use of insecticides and pesticides. There are improved methods and technology for control of disease and its management of disease in the field. The crop protection techniques are practiced for economic and ecological significance.

To control plant diseases, knowledge of disease cycle of pathogen, host-pathogen interactions and environmental factors are necessary. The disease control can be made through adopting proper transport, storage and marketing practices. The sustainable crop protection practices are helpful to crop growers to produce safe and organic food. The sustainable plant protection practices are of great economic and ecological significance for enhancement of crop yield. There are many biological and cultural management practices used to protect the plant from disease infection and development. The integrated approach of disease causing insect and pest can be applied in plant protection practices. The integrated approach may include biological, chemical and cultural practices of disease prevention and control. The integrated approach is efficient and economical for better crop quality, high yield and sustainable development. The

approach emphasizes on the healthy crop production. The priority is given for control of disease through biological approach than the use of chemical measures. The sustainable plant protection practices require joint efforts of experts, advisors, growers, authorities and researchers. The molecular methods have made it possible to detect, identify and understand the exact causal organisms and strain of various plant diseases. The methods of bioinformatics and computerized analysis of data which is related to plant diseases may be used to develop particular models that are useful for disease forecasting.

Classification of Plant diseases:

The plant diseases can be categorized on the basis of factors of environment and causal agents or organism. The plant diseases may be divided on the basis of non-infectious agents and infectious agents or biotic factors.

I) Diseases caused by non- infectious agents:

The non-infectious diseases may arise suddenly and may be caused due to environmental conditions which may be in excess or deficient. The disease can be developed due to non availability or inbalance of abiotic factors like light, air, humidity, water, minerals in the soil, soil acidity or alkalinity, high or low temperatures, pesticides injury, poisonous chemicals present in the air or soil, mechanical and electrical ways etc. The wrong way and season of pre-harvest and post harvest storage conditions result in loss of crop yield. The diseases and injuries caused by non-infectious agents result in heavy loss of vegetables, fruits, oil seed, cereals and variety of crops. The adverse environmental conditions result in damage of healthy tissues of plants.

Symptoms of the disease:

The plant shows various symptoms of disease due to varied conditions of abiotic factors. The high temperatures may cause scald on leaves of corn, cotton and bean. The leaves may show formation of cankers. The frost injury is common to many plants. The temperatures above freezing point may cause necrosis or localized tissue death and silvering to some crop is shown. The freezing condition by night develop dead bark cankers or vertical frost cracks on the leaves. . The conditions of drought and dry winds with prevalence of high temperature shows symptoms to the plant like stunting, wilting, blasting, marginal scorching of leaves. The dieback of shoots can be seen to the plant. The leaf scorch and sudden flower drop can be observed. The symptoms of disease can be observed due to status of soil, water level, flooding, water logging, and injured root system. The fluctuation in soil moisture and temperature causes' blossom rot of flowers. The poor aeration may cause blackheart disease in stored potatoes. The deficiency of mineral nutrients such as nitrogen, potassium, phosphorus, sulphur, calcium, , magnesium , boron, iron, manganese, copper, zinc and molybdenum causes disease to plants. The deficiency of minerals may cause stunting, , scorching, malformation of leaves, abnormal coloration, premature leaf

fall, bud fall and flower collapse. The other symptoms may be delayed maturity or failure of bud, flower and fruit development. The shoot dieback of plant may be caused. The excess amount of any minerals can damage plants directly or indirectly and shows deficiency symptoms.

The application of chemicals for increase of crop yield and to prevent pathogens, insects, pests and to kill the weed affect on the normal healthy growth of plant. The disease can be developed due to excessive use of fertilizers, herbicides, fumigants, growth regulators, insecticides, miticides, fungicides, nematicides, and surfactants help as disease causing agents. The variety of pollutants such as sulphur dioxide, fluorine, ozone, and peroxyacetyl nitrate are toxic to plant development. The plants are more sensitive to sulphur dioxide due to its accumulation in leaves. The nitrogen oxides and hydrocarbons damage the susceptible plants. The lightning in the sky, hail, high winds, ice and snow loads, machinery and various cultural practices seriously injure the plants and yield. The wound created due to the hail wounds are created through which pathogens can enter and cause the disease.

II) Diseases caused by infectious agents:

There are hundreds of thousands of pathogens that causes different kinds of diseases to the plants. The pathogens are from the strains and species of viruses, viroids, bacteria, mycoplasmas , phytoplasma, fungi, nematodes and also parasitic plants.

1) **Fungi:**

The fungi are the most common causal organism of plant disease. They lack chlorophyll pigment and do not prepare its own food material. The fungal organism produces naked mass of thread like filaments of many hyphae that constitute mycelium. The fungal pathogens causes diseases to plant like rot, blights, wilts, leaf spots, rusts, smut etc. They form lesions on plant part, Curling, mildew, anthracnose, cankers, scabs etc.

2) **Bacteria:**

The bacteria are plant pathogenic organism. reproduces by cell division and multiply quickly to form colonies. They become severe and cause various types of diseases to plants such as leaf spot disease, tumour like galls, crown gall, fire blight, wilting, soft rots etc.

3) Viruses:

The disease causing plant viruses are the ultra minute particles constitute of genetic material surrounded by a protective protein coat called a capsid. They are replicated only in living cell. The normal functioning of plant is affected. They causes diseases like stunting, chlorosis, mottling, puckering, ring spot and mosaic disease. They are transmitted by vectors.

4) Phytoplasma:

The Phytoplasma are specialized bacteria lacking cell walls. They reproduce in living plant tissue. They cannot isolated and cultured in a laboratory culture media. They can be seen only under electron microscope. The disease caused to plants by these organism shows symptoms like stunted growth, chlorosis and yellowing of plant.

5) Nematode:

The plant parasitic nematodes are non-segmented microscopic elongated and thread like worms. They possess a needle like tubular structure that pierces the plant cells to get nutrients from the cell. They live in the soil and causes severe damage to plant through piercing root system. The infection caused by nematodes shows symptoms like swollen knots at infected sites on the roots system. There are some species of nematodes that inhabit the bulbs, buds, stems, leaves, or flowers.

6) Parasitic Plants:

There are many parasitic plants that parasitize number of flowering plants causes loss of host plant These plants are Mistletoe, Cuscuta, Dodder, Witch weed.

i) Mistletoe:

These are semi-parasitic plants feed on trees and obtain water and minerals with the help of root like structures called as haustoria. The haustoria are pierced and sent into vascular tissue of the inner bark and getting nutrition from host plant e. g. *Phorodendron*, *Viscum* and *Arceuthobium* species. The infection caused by parasitic plants shows symptoms like stunted growth or death of host plant. The seedlings and young trees shows stunted growth, deformed host plant parts. The host may be killed. The typical witches-broom like structures are formed. The host plant may show crown or spindle-shaped swellings of organs and trunk. The cankers may be observed to the infected plant.

ii) Cuscuta:

There are hundreds of species *Cuscuta*. They are also known as strangle weed, devil's-hair, pull down, hell-bind, love vine and gold thread. It is leafless plant parasite with yellow to orange threadlike stems which twine around host plant. By spread and extending towards the nearby plants and gets attached to host plant by means of apprresorium. It obtains nutrition by means of haustoria till yellowish orange patch is formed.

iii) Witch weeds:

It is small plant parasitic weed. These weed species are from the genus *Striga*. It parasitize the roots of many host plants such as maize, sorghum, sugarcane, rice and other cereal grains and grass and sedge families. The infection to host plant shows the symptoms like stunted growth, wilt, yellowing, reduces crop yield.

Plant disease control:

Plant disease can be controlled through practice of different approaches such as Regulatory, Genetic, Cultural, Biological, organic and chemical control.

1) Regulatory control:

The regulatory control approach of plant diseases is based on exclusion or quarantine measures to prevent the spread of a disease into new locality or area. The exotic diseases or a pest poses a significant threat to new locality. If new pathogen is brought into an area then the native plants may not defend it. The introduced pest may not have natural predators in the new area to population check. The exotic pathogen or invasive pests have a lot of disease and damaging impact. The regulation of exotic organisms may help to reduce threat of disease incident.

2) Genetic control:

The techniques of genetic engineering may be useful to manipulate genetic material of a host cell in order to produce a new trait in an organism. The genes of plants, microbes and animals can be recombined into living cells. The genes can be inserted into genome of other organism in view of control the disease development. The production of pathogen-resistant transgenic plants can be achieved to enhance disease resistance. The insertion of genes in host tissues helps to enhance resistance against disease causing organism such as viruses, fungi and insects. The host plant considered resistant to one disease may become susceptible to other diseases or pathogen. The disease resistant plant may become infected if the pathogenic variant is different.

3) Cultural control:

The cultural practices which favour naturally occurring antagonist and exploit beneficial action are effective in reducing disease. e. g. Incorporation of green manure. The saprotrophic microorganisms feed on the green manure and depriving the potential pathogens. The suppressive soils harbour antagonists that compete with the pathogen for food thereby causing starvation that limit the population of pathogen. The antagonists produce substances that inhibit or kill potential pathogens. The Cultural disease control strategies are practiced to prevent the conditions for disease incidence. The cultural practices involves a combination of preventing the conducive environment for pathogen multiplication. The rotation of plants in different locality is one of the method to break disease chain. The destruction of old and diseased plants is helpful practice of disease control. The growing of resistant and susceptible plants together may help to reduce or slow the spread of disease. The training of plants promote healthy

aeration, light penetration creates healthy environment which discourages infection of host plants. The growing of plants in the right locality gives better chance of disease resistant.

4) Biological control:

Biological control is the way of suppression of populations of disease causing pathogens with the help of other living organisms. The isolates of beneficial microorganisms effective against the plant pathogens are selected and multiplied on culture media to fight against the pathogens. The approach of biological control helps to protect crops from diseases. The indirect interaction of microorganism against pathogens is a way of increase the competition for nutrients and space which help to reduce the population of pathogens. The protection from disease can be achieved through colonization of host roots prior to pathogen invasion. The way of application, its rate, timing, precautions growing season are effective practices of biological control.

5) Organic control:

The approaches of organic methods of plant disease control involve growing and maintaining healthy plants without application of synthetic fertilizers, pesticides and hormones. The things which are found in nature can be used to inhibit or prevent the activity of plant pathogens. The chemicals extracted from plants are organic used for control of disease. The protective organic sprays and dusts can be applied to foliage, fruits and ornamentals prevent infection.

6) Chemical control:

There are synthetic chemicals can be used to prevent and control of various plant diseases. The chemicals are used to kill or inhibiting the growth of disease causing pathogens. The chemicals can be used to control bacteria are the bactericides, to control fungi are the fungicides, to control nematodes are the nematicides and to control pest are the pesticides. The chemicals can be applied to seeds, foliage, flowers, fruits or soil. The chemicals may be eradicants type which is used to kill the pathogens. The chemicals may be therapeutic type which is applied to combat the infection which is in progress. The chemicals can be used in soil treatments to kill soil inhabiting pathogens such as viruses, nematodes, fungi, and bacteria. The eradication may be done by using steam or chemical fumigants. The soil can be treated well before planting the crops. The seeds, bulbs, corms and tubers cam be treated with chemicals to eradicate disease causing pathogens. The main objective of chemical control is to prevent the crops from disease attack and pest's attack

Principles of plant disease management:

Integrated approach of disease management is the best approach to maximize the success of disease control. The management of plant diseases primarily depends on the biology of the

specific pathogen and host plant. Plant disease management is based on several important principles. There are some methods, measures, strategies and tactics used in the control and management of plant diseases. The correct diagnosis of a disease is necessary to identify the pathogen of specific disease. The effective disease management can happen if there is knowledge of disease cycle and cultural requirements of the host plant. The tactics are the significant in reduction of initial inoculums, infection rate and reduction of the duration of disease. The prevention or prophylaxis and Therapy or treatment or cure of disease is the basic principles of disease management. The prevention is the management tactics applied before infection. The quarantine measures are applied to prevent introduction of an inoculums or disease causing organism. The therapy or curative measures are taken when the plant is infected. The heat or chemical treatment to the vegetative plant parts may be used to eliminate fungi, bacteria, nematodes or viruses that are established within the plant material. The Chemotherapy can be practiced against infected or diseased plant for control or eradicate infection. The antibiotics may be infused into plant to reduce severity of diseases caused by phytoplasma. The fungicides can be injected into the infected plants to control the severity and multiplication of pathogens.

The plant disease can be managed and controlled by adopting the principles of exclusion, eradication, protection and immunization.

1) **Exclusion:**

This practice includes keeping of pathogens or vectors and infected plants in disease free locality or area. It help to prevent the disease spread in other healthy area. The measures are taken to prevents the introduction of a disease-causing agent or pathogen into a region or agricultural field. The pathogens may be moved with their host plants or with soil, packing material or shipping containers. The exclusion of pathogen is made to produce pathogen free seed or planting stock. The isolation of locality, field inspections and removal of infected plants or plant part are the key aspect of exclusion to produce and maintain pathogen free stocks. The use of disinfectant for cleaning of agricultural implements and removal of contaminated material or debris exclude the pathogens from disease development.

2) **Eradication:**

The eradication includes eliminating, destroying or inactivating a disease causing organism after it has become established. This practice constitutes Destruction of infected plants or plant parts, Disinfection of storage bins, containers, and equipments. The soil disinfection by fumigation or pasteurization or solarisation or drenching helps in reduction of pathogen. The infection can be reduced through sanitation, removing diseased plants or plant parts, crop rotation, elimination of weed and other susceptible plants alter the disease incidence and

discouraging or prevention of vectors. This principle can be applied to individual plant or seed lots or fields or regions. The eradication also includes removing infested soil, fumigation of infested fields and use of infected field for domestic purpose. There may be removal or burning of diseased plants or entire infected field. es and destruction of entire crops. It includes destroying weeds that are reservoirs of various pathogens and disease carrier vectors. The soil fumigation can be made with the help of chemicals such as carbon disulfide, methyl bromide, or chloropicrin which kill the disease causing pathogens. The fumigants like metam-sodium can be injected into the soil. The practice of crop rotation may be frequently used to reduce the population of the burning of pathogen in the field can help in reduction of pathogens from the field. The inactivation of initial source of inoculums and removal of alternate hosts are best practices of disease management.

3) Protection:

This approach establishes a chemical or physical barrier between the host and cause of disease. The fungicidal dusts, insecticides, pesticides, nematicides, fences and other physical barriers are useful practices of disease management. This principle denotes the establishment of a barrier between the pathogen and host plant or susceptible plant part of the host. It involves the application of certain cultural practices which modifies the environment, tillage, drainage, irrigation, pH alteration of soil. It includes the change of sowing date of plant or depth of seeding, spacing pattern of plants, pruning and thinning of target plants help to escape infection and reduces severity of disease. The Bordeaux mixture or Copper sulphate fungicide is widely used for protection of plant from disease development. The fungicides such as thiram, captan, and the bisdithiocarbamates are important in protection of plant from fungal diseases. The principle of protection aims in reduction of the level of initial infection through the use of toxicant.

4) Resistance:

This principle includes the use of disease resistant varieties of plants The resistance can be achieved applying the principles of genetic engineering in host plant due to which plant can easily defend the attack of pathogen and disease development. The resistant of plants may be of two types such as 1) The Vertical resistance provides high level resistance or immune capacity fight against the pathogen. 2) The Horizontal resistance is a lower level of resistance or tolerance to more strains of pathogens. The use of disease-resistant varieties of plants is a good and ideal method of plant disease management. The disease resistant varieties can be obtained through physical and chemical mutation breeding.

5) Therapy:

It is one of the methods of plant disease management which is achieved through incorporating a chemical into the physiological processes of the plant to reverse the progress of disease development. The disease development can be hampered through thermotherapy, chemotherapy.

6) Avoidance:

This is one of the approaches of plant disease management which includes the use of cultural practices to avoid infection. The practices of planting date selection, seedbed preparation, and water management practices help to avoid disease development. The susceptibility of host plant to disease development may be due to poorly drained soil, shady growth and other environmental factors. The adequate irrigation and fertilization is helpful to avoid disease incidence. The plants are handled carefully to avoid injury because the injury may help for entry of pathogen inside the host. The approach of avoidance reduces the disease. It help to reduces the rate of production of inoculums, rate of infection and rate of development of pathogen. The use of early maturing varieties is useful to avoid infection.

7) Integrated disease management:

It is one of the practices of disease management. It includes the application of a combination of different strategies, tactics and approaches to manage the plant diseases. It may include site selection and preparation, use of disease resistant varieties, crop rotation, modification of environment through drainage, irrigation, pruning, thinning, shading, use of insecticides and pesticides. This principle also includes the use of traditional crop growing practices, monitoring of temperature, moisture, soil pH, nutrients, disease forecasting. These different tactics or approaches or measures are applied in a coordinated integrated and harmonized manner to reduce the disease effect and yield loss. The balanced use of chemical fertilizers, irrigation practices helps to grow healthy and vigorous plants. The adoption of crop rotation, tillage and use of chemicals are essential to control on the disease development.

Conclusion:

Plant diseases have caused severe yield loss of different agricultural crops grown all over the world. The plant diseases are caused by different pathogens such as fungi, bacteria, viruses, phytoplasma, nematodes etc. The disease development may be due to environmental factors and physiological factors of host plant. The plant diseases can be controlled by various methods of disease control such as regulatory, cultural, genetic, biological, organic and chemical control. The agricultural crop Plants can be genetically engineered to obtain disease resistant plants

against plant pathogens. The cultural practices can be modified to manage the diseases infection and development. The plant diseases can be managed through applying principles like exclusion, eradication, resistence, avoidance etc. The integrated disease management can be a useful way for control and management of disease and disease development. The use of pathogen-free stocks, sufficient light management, and exposure of plants to sufficient air are helpful to eliminate sources of infection. The water management, adequate nutrition, sanitation practices are helpful to overcome on disease incidence and disease development. The disease management practices can be determined through disease forecasting and disease modelling.

Future perspective:

A systematic study and disease forecasting with the help of mathematical models would be helpful in control and management of plant diseases. The integrated approach of disease management may be a step towards efficient plant disease management. The use of insecticides, pesticides is not economically justified because the chemical kills the beneficial microorganisms in the soil. The crop growers must be flexible towards the use of disease resistant varieties and crop rotation practices to face and adjust with the future challenges regarding loss of crop yield and increasing demand of food. The practice of integrated approach of disease management is the need of time. The application of different strategies may help in reduction disease incidence with respect to varied environmental conditions. The duration of disease infection and development can be reduced by growing early maturing varieties of plants. The improper diagnosis of disease leads to loss of crop yield. The principles and applications of genetic engineering can be applied to develop vigorous and disease resistant plants.

References:

1. Fry, W. E. (1982). Principles of Plant Disease Management. Academic Press, New York.
2. Maloy, O. C. (1993). Plant Disease Control: Principles and Practice. Wiley, New York.
3. Arneson, P. A. (2001). Plant Disease Epidemiology.
4. Jacobsen, B. (2001). Disease Management. Pages 351-356 in: Encyclopaedia of Plant Pathology, O. C. Maloy and T. D. Murray, eds. Wiley, New York
5. Maloy, O. C. and A. Baudoin. (2001). Disease Control Principles. Pages 330-332 in: Encyclopaedia of Plant Pathology. O. C. Maloy and T. D. Murray, eds. Wiley, New York.

MEDICAL GEOGRAPHIC INFORMATION SYSTEMS (MEDICAL GIS): A REVIEW

Ashutosh Mishra[1] and Jai Kumar[2]*

[1]Department of Computer Application, C. M. P. Degree College, Prayagraj.

[2]Centre for Geospatial Technologies, Vaugh Institute of Agricultural Engineering and Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

*Corresponding author E-mail: jaikumar0070@gmail.com

Abstract:

Medical geographic information systems (Medical GIS) have proven to be incredibly effective in gaining a better grasp of the wider picture of public health. The field has a significant potential to comprehend not just differences, but also parallels in global population health. The major purpose of combining medical geography, public health, and informatics is to better understand how a variety of health conditions affect populations and the trends that these populations follow. This practical technique has evolved into a recognized and advancing framework for assessing medical and epidemiological phenomena ranging from cholera to cancer since the 1990s. Geographical information systems (GIS), disease surveillance, big data, and analytical approaches such as the Geographical Analysis Machine (GAM), Dynamic Continuous Area Space Time Analysis (DYCAST), cellular automata, agent-based modelling, spatial statistics, and self-organizing maps are all instruments that support this field. These devices continue to have a significant impact on the mission to improve global health care, as seen by their good effects on disease mapping. While traditional GIS applications in public health are static and lack real-time components, incorporating a space-time animation in these instruments will be transformative as technology and data evolve.

Keywords: GIS, Geographic Information Systems, Medical Geography, Epidemiology, Public Health, Spatial Epidemiology, Mapping.

Introduction:

Every year the population of the world is affected by new diseases and epidemics. A solid framework for our increased ability to monitor and determine these disorders is the medical geographical information systems (GIS) discipline [1]. The study of medical geography dates

back to the first known doctor, Hippocrates, and goes back to now through the 1900s, a much longer history as most know. Early history leads us to consider current examples of GIS, influences on public health, space-time mapping and the future of this big data field. The development of medical GIS from early illness maps to digital maps is a lengthy and evolving path. These maps have given us an insight into diseases that range from cholera to cancer, while at the same time enhancing our awareness of global health problems. As current technology continues to flourish, medical GIS continues to be a permanent approach to people and to the world in which we live [2].

History a Brief:

Medical GIS is founded on medical geography and is founded in a number of ancient civilizations such as China, Greece and India, possibly the very first in the literature by the first doctor Hippocrates in the Fifth Century AD, who was one of the first to observe human and environmental relations.

Medical geography originated from French physicians during the 18th century1 following the arrival of modern thematic mapping, and the first illness map created by German physicist Leonhard Ludwig Finke in 1792,2, which was an important instrument to understand the incidence and spread of infectious diseases and identify the links between diseases and spatially distributed surroundings. Much early medical cartography was concerned with the English cholera outbreak that started in 1831 and lasted for a number of decades.

During the First Wave of the epidemic, Dr. Robert Baker mapped the incidence of cholera in Leeds, England. He utilized the map to find higher incidence rates among the city's most densely inhabited districts and locations where sanitation was lacking. In 1848 Dr. Thomas Shapters presented a dot density plan in Exeter, which used different symbols for deaths occurring in various years, containing 1,100 deaths caused by cholera.

In 1952, in the Cholera mapping series of the British Isles, German geographist Augustus Petermann created the geographical range of the epidemic in 1931-33, to detect environmental or local variables that may affect disease diffusion. Dr Johann Snow, regarded as the dad of contemporary epidemiology, proved the water-borne genesis of cholera by charting death from cholera in London during the severe outbreak in 1850 on maps, perhaps the most renowned example of early medical geography.

In addition to cases of disease, he also drew water pumps and concentrated around the town to establish the closest proximity of the Broad Street pump to the region with the highest concentrations of cases. With the removal of the pump, a new case was almost immediately

removed in the region, which demonstrated that drinking water was a major cause of the pandemic. These early mapping approaches were immensely helpful in clarifying the geospatial correlations of the occurrence and transmission of diseases.

Limited technology and data collecting were the main obstacles for early doctors/medical geographers [3]. Maps had to be made by hand that made it hard to reproduce, and medical professionals were able to map disease patterns first, it was they, not geographers. But with the turn of the century, that changed.

In the late 19th and early 20th centuries, medical geography saw a transformation from a mostly descriptive to an analytical science followed by an explosion of new journals and academic organizations. A series of contributing factors affected this advancement, including large-scale migration of people to new locations, exposure to previously unknown diseases and the rise of medical colleges and periodicals that could disseminate more information about diseases more immediately [4].

Increasingly sophisticated medical research and new scientific technologies have also proven to be crucial for the spread of the field, progress made by increasing funding from governments and private institutions and innovations in mapping including the implementation of improved mechanical equipment and the wider availability of the basic maps on which statistical information can be drawn up.

In the mid-20th century, some major fundamental theorists such as Jacques M. May inspired contemporary medical geography as a subject. May stressed that the illness was the result of interactions between disease variables (including causative agents, vectors, hosts, reservoirs and human beings) and geographical considerations (at the physical, biological, and social level).

He also developed a research plan for the topic that included:

"(1) a census of known things and a discussion of each of the issues raised by the table.

(2) A disease study against its surroundings, as an illustration of the endemic epidemic.

(3) A geographical study with relation to its disease.

In order to develop a valid statistical approach to compute the prevalence of diseases, this need require sample population research."

GIS in medicine:

In the later part of the 20th century, rapid advances in computer technology resulted in a huge revolution in medical geography and current medical GIS. By the end of the 1960s, various

computer mapping programs, which were able to more quickly and efficiently update information, were revolutionized, spurring the development of current automated mapping processes. Maps can now be made more faster and more accurately than ever, and the diffusion of disease can be mapped and analyzed more readily.

"An approach based on knowledge of patterns of population motion makes it possible to study cultural interactions with the environment without preconceptions compartmenting inadequately obtained from other places or cultures."

By means of these maps, geographical and medical data were objectively examined. A new wave of analytical methodologies was brought forth in the early 1970s, which made testing hypothesis more crucial.

Researchers increasingly desired to describe not only illnesses and their propagation, but also human conduct and environmental interactions.More complex models could be utilized to examine spatial information by increasing computerized statistical packages. By the middle of the 1980s, computer mapping technology had advanced to the point that it was possible to combine non-spatial data, known as "attribute data," to spatial point data in digital maps, resulting in the development of the modern desktop-based GIS [5, 6].

GIS could now be used to assess statistically if these points tended to cluster in certain regions, and whether disease patterns were significantly connected with other characteristics of human interactions, in addition to mapping point density. While statistical relationships like these can't prove cause and effect, they can help us better understand disease trends.

A geographic information system (GIS) is a computer system that can acquire, store, analyze, and display geographically linked data. In other words, it's a type of informatics for storing and managing data that's been classified by location.

Because of its ability to combine physical, biological, cultural, demographic, or economic information, GIS have been utilized in a wide range of sectors, including natural, social, engineering, and especially medical sciences. The Geographic Analysis Machine (GAM), developed in 1987 by Openshaw and his colleagues and used to evaluate the locations of clusters of Leukemia in 1983, is one of the earliest important medical GIS tools.

“There were four primary components to this system: (1) a spatial hypothesis generator; (2) a significance assessment mechanism; (3) a GIS to handle spatial data retrieval requests; and (4) a geographical display and post map processing system,” according to the researchers [7, 8].

Searching for Leukemia Clusters is the title of a paper published in the journal Leukemia. An investigation was conducted using a Geographical Analysis Machine8 to see if residing near

a nuclear facility increased the incidence of childhood cancer.Openshaw was able to demonstrate the clustering effects of Leukemia and other cancers using the GAM [9].

He also discovered that in their approach, some clusters established in prior studies were not statistically significant.Despite the fact that GAM proved to be an effective tool, Openshaw cautioned that utilizing GAM alone would not be sufficient to determine the causes of leukemia, and that more "nongeographic micro investigations to identify causal agents involved" were required. Despite these drawbacks, the GAM demonstrated how effective modern geographic computing tools may be when applied to real-world public health problems.

GIS is now used in public health in a traditional way:

GIS combines research methods and analytic tools from medical geography and spatial epidemiology, and it is now applied in a wide range of health science applications. The number of epidemiological studies using GIS has increased dramatically over the last decade, particularly in the areas of health disparities, resource availability, and health-related activities, as well as in more foundational topics like cancer and environmental epidemiology.

GIS is used by epidemiologists to measure proximity, aggregation, and clustering, as well as geographical smoothing, interpolation, and regression. The detection of disease clusters, which refers to nonrandom geographical distributions of disease cases, incidence, or prevalence, is the most prominent application of GIS in these domains.

To discover numerous types of clustering, a variety of analytical and statistical tools have been developed.

These include (1) global clustering, in which no cluster areas are pre-specified and cluster presence is determined empirically, (2) local clustering, in which specific small-scale clusters are statistically evaluated, and (3) focal clustering, which evaluates clustering around a pre-determined point such as an environmental hazard[10].

In epidemiology, GIS has been widely used for disease surveillance and intervention monitoring.

Local and national governments can readily detect the distribution and spread of disease across geographic regions, improve intervention location planning, and track their efficacy by mapping disease instances in geographic space.

GIS has been successfully used in the monitoring and control of onchocerciasis in Guatemala, trypanosomiasis in Africa, and malaria in Israel and Mexico, in combination with other technologies such as global positioning systems (GPS) and remote sensing.

Health Services and Geographic Information Systems:

Medical geographers can use GIS to examine the spatial distribution and accessibility of health services in addition to typical epidemiological uses.Modern political pressures and growing gaps in health services have pushed many administrations to rethink health care systems to fit current health care needs, making it an essential subject for medical geography.

GIS can be used in a variety of ways to visually represent health service consumption and to account for the many issues associated to geographic limits that may prevent an individual from receiving optimal health care. Models of location-allocation are used to determine how gaps in health services might be closed in specific communities.

To detect and facilitate patient travel, existing health services are mapped alongside road networks. Cultural, social, and economic constraints, as well as location, have a substantial role in determining access to health care; 16 merely providing more services do not immediately enhance population access. Using these tools, on the other hand, has a lot of promise for improving health resource distribution and finding service shortages.

In order to establish the best feasible placement of new services and to identify certain regions that are underserved, valuable data such as population distribution,17 income, and poverty levels can be visually shown.

These variables can be computed and modelled to forecast future health-care accessibility challenges and service requirements.

The gravity model, for example, considers not only the Euclidean distance between individual residences and health care providers, but also price, quality of service, accommodations, and cultural appropriateness in order to determine which facilities offer more ‘attractive' health care services to specific subsets of the population; and thus, identify which facilities offer more ‘attractive' health care services to specific subsets of the population; and thus, identify which facilities offer more ‘attractive' health care services to specific subsets of the GIS allows policymakers to better identify potential risk factors and prevent disease, in addition to studying the physical locations of health service providers. In Taiwan, a recent study involving risk assessments and influenza health planning highlighted the utility of GIS in public health planning and illness prevention.

Researchers were able to calculate the population covered by existing services in Miaoli County by combining population distribution, elevation, land cover, location, and capacity of existing health services. After that, raster and vector data were utilized to simulate a pandemic flu outbreak and identify which sections of the county required more resources.

Current Limitations of GIS:

While GIS has grown in popularity among medical geographers and epidemiologists, there is rising worry about the technology's capabilities and application in medical research[11]. Some have claimed that current commercial off-the-shelf (COTS) GIS software such as ArcGIS and MapInfo lack the tools needed to conduct thorough epidemiological research, and that few spatial studies have adequately demonstrated any unique or significant contributions of GIS to the field of epidemiology.Due to the current GIS software program's lack of complex statistical capabilities, most health researchers use GIS for only limited functions, while performing statistical analyses using outside programs such as SPSS or SAS.20 Furthermore, most spatial analysis techniques were developed for non-health fields, and thus are not well-suited to the types of count and aggregate data.The remainder of this paper will examine new innovations in the field that aim to overcome these constraints, as well as our predictions for the future of the subject.

Conclusions:

Medical Geographic Information Systems (GIS) is a bridge between biomedical and social sciences. The demand for GIS in the health industry is growing in lockstep with advances in disease prevention. It's a useful method for identifying and mapping medically susceptible populations, health outcomes, risk factors, and their relationships. GIS's ability to combine disease information with environmental and spatial data makes it a valuable tool in the advancement of global healthcare.

Additionally, using GIS technologies, mapping apps, and Big Data, health companies may now visualize, analyze, interpret, and show complex geo-location data. These new technologies have opened the door to previously unthinkable modelling methodologies.

This is an exciting time for medical GIS because of ongoing advancements in GIS and Big Data, and it will be fascinating to see how new technology, analytical approaches, and data sources will define the discipline's future.

References:

1. Kumar, J. Sahoo S., Bharti B.K. and Walker S. (2021). Spatial distribution and impact assessment of Covid- 19 on human health using geospatial technologies in India. International Journal of Multidisciplinary Research and Development, 7(5), 57-64.

2. McLeod KS. (2000). Our sense of Snow: the myth of John Snow in medical geography. Social Science & Medicine. 50:923–935.
3. Koutsopoulos K. Athens: Papasotiriou Publishing; (2002). Geographic information systems and spatial analyses.
4. New York: United Nations (2000). Department of Economic and Social Affairs, Statistics Division, Studies in Methods. Handbook on geographic information systems and digital mapping.
5. Maniatis G. Thessaloniki: Zitis (2006). Geographic information systems: land registry.
6. Abbott L.T, Argenati C.D. (1995). GIS: a new component of public services. The Journal of Academic Librarianship.251–6.
7. Crampton J. (2001). The history of distributed mapping. Cartographic Perspectives, 35:48–65.
8. Cooke D.L. Foresman T, (1998). Topology and TIGER: the Census Bureau's contribution. History of Geographic Information Systems: Perspectives from the Pioneers.
9. Koutsopoulos K. 2nd Edition. (2005). Athens: Papasotiriou Publishing. Geographic information systems and spatial analyses. [Google Scholar]
10. Koutsopoulos K. Athens: Papasotiriou Publishing; (2005). Applications of ArcGIS 9x in common words. [Google Scholar].
11. Kumar, J, Bharti, B.K. and Walker, S. (2021). spatial distribution of post covid-19fungal infection (mucormycosis) and influence on human health in India utilizing geospatial technology, Int. J. Agriworld, 2 [2]: 1-9.

EFFECTS OF WEATHER AND CLIMATE ON PESTS OUTBREAK

Debasmita Das*, Soumya Sthitapragyan and Nirmala Patel

Gandhi Institute of Engineering and Technology (GIET) University,

Gunupur, Odisha 765 022

*Corresponding author E-mail: debasmitadas@giet.edu

Abstarct:

The influence of Meteorological weather parameters and climatic change has a significant effect on the outbreak of different crop pests. Climate change is of great concern to agriculture production worldwide and is among the most burning topic in today's society. Climatic parameters (increased temperatures, rising atmospheric CO_2) and weather parameters (Temperature, rainfall, wind and light) plays very important role on agricultural crop production and also on outbreak of pests. Weather parameters have greater influenceon the development rate, survival, fitness and level of activity of particular insects. It also controls the phenology, distribution, size and continuity of pest populations, migration and their establishment and the initiation of pests outbreak.Climatic change result in an expansion of their geographic distribution, increased survival during overwintering, increased number of generations, altered synchrony between plants and pests, altered interspecific interaction, increased risk of invasion by migratory pests, increased incidence of insect-transmitted plant diseases, and reduced effectiveness of biological control, especially natural enemies. Hence, this results in serious risk of crop economic losses, as well as brings a challenge to human food security. As a major driver of pest population dynamics, adaptive management strategies are required to deal with the changing status of harmful pests. Several priorities can be identified for future research such as modified integrated pest management tactics, monitoring climate and pest populations, and the use of modelling prediction tool.

Keywords: weather, climate change, pest population, pest management

Introduction:

Weather refers to the physical state of atmosphere at a particular time over a given place. It is the instantaneous condition of atmosphere at a given place. It is highly variable, so constantly changes. Climate is defined as the sum of the different weather conditions of a place from day to day or climate may be defined simply as average state of weather. Climate refers to

the description of aggregate weather conditions. It also includes deviations from average condition as well as the extreme weather conditions. Weather parameters and Climatic change is a key driver of most insect-pests, crop diseases, and results in will alteration of distribution, abundance and management of endemic pests and disease. Climate change has become a major concern for agricultural communities worldwide. The agricultural process consists of three main parts, pathogen, host, and environmental conditions, where the relation between them is the main key for the occurrence of infection from its absence, where climate change has great effect on all these factors.

Changes in weather parameters greatly affect crop production and susceptibility to pests as well as insect pest longevity.Climate change affects crop pests and disease susceptibility which in turn affects crop health, and these changes cause deviations in farming practices as to cope with the effects of these changes and to prevent a decline in productivity.

According to IPCC's latest report, global mean temperature would rise between 0.9 and 3.5oC by the year 2100. Climate change has the potential to modify host physiology and resistance and to alter the stages and rates of development of the pests. The most likely impacts would be shifted in the geographical distribution of the host, pest and pathogen, change in the physiology of host-pest and pathogen interactions and change in crop losses. New pest and disease complexes may arise and some pest and diseases may cease to be economically important if warming causes a pole ward shift of agro climatic zones and host plant migrate into new regions. The pathogen would be following the migrating hosts and may infect vegetation of natural plant communities not previously exposed to the often more aggressive strains of agricultural crops. The mechanism of pest and pathogen dispersal, suitability of the environment for dispersal, survival between seasons, and any change in host-physiology and ecology in the new environment will largely determine how quickly pest and pathogens become established in a region.

Weather parameters controls pests development rate, survival, fitness and level of activity of individual insects. Phenology, distribution, size and continuity of insect populations, migration and their establishment and the initiation of insect outbreaks could also be controlled by weather. Weather influence may be immediate, cumulative, direct, indirect, time lagged. Indirect effects arise through host quality and parasite population. Temperature, humidity and wind playsimportant dynamic roles in insect life. Solar radiation and photoperiods have lesser effects on the pest population dynamics.

The direct impacts could be observed on pests reproduction, development, survival and dispersal, whereas indirectly affects the relationships between pests, their environment and other

insect species such as natural enemies, competitors, vectors and mutualists. Insects are poikilothermic organisms, i.e., the temperature of their body depends on the temperature of the environment. Thus, temperature is probably the most important environmental factor affecting insect behaviour, distribution, development and reproduction. Therefore, it is very likely that the main drivers of climate change (increased atmospheric CO2, increased temperature and decreased soil moisture) could significantly results in affecting the pestspopulation dynamics causing significant losses of crop yield.Climate change creates new ecological niches that provide opportunities for insect pests to establish and spread in new geographic regions and shift from one region to another. The complexity of physiological effects exerted by rising temperatures and CO2 can profoundly affect interactions between agricultural crops and insect pests. Therefore, farmers can expect to face new and intense pest problems in the coming years due to the changing climate. The spread of crop pests across physical and political bound arises threatens food security and is a global problem common to all countries and all regions

Influence of weather parameters on pests outbreak:

Effect of temperature on pests:

Each species of insect has a temperature range within which it can survive well. That temperature range is called as the tolerate zone. Within this zone, there are different optimal temperature ranges for a variety of major functions. Exposure to a temperature toward the upper or lower limit of the tolerable zone will usually result in mortality if it persists for a longer time. At extremes of the tolerable zone, death will occur after a short duration of exposure. Most insects have an upper temperature tolerance between 40 to 50^0C. It has been observed that no known insect or pest couldsurvive at temperature higher than 63^0 C. Whereas some pests adapt themselves with the surrounding environment to survive several months of hot, dry weather in a dormant state condition called as summer diapauses.The absolute minimum temperature that any pest can tolerate or survive has not been well defined but is almost certainly lower than -30^0C temperature. Ex- Bark beetle survives at minimum temperature of -29^0C during winter. Insects have the ability to function at higher temperature but it reduces their life span and vice versa in lower temperature. Temperature may also determine the time of flight, height of flight and thus the spread and direction of the transporting wind as well as flight duration

Effect of moisture/ rain on pests:

The moisture content in the habitat of insect / pests directly determines whether the pest could survive or not. Also,it has indirect effects on populations of pests through its influence on growth and development of the crop.Environmental moistures in the form of atmospheric humidity, rainfall, snow, hail, dew, soil moisture and surface water have direct impact on the water balance of the pests. Hence, when the moisture content in the atmosphere changes, the pestssusceptibilityto fungal disease, bacterial disease and viral diseases also varies. Wet atmospheric conditions results in spread of more insect pathogens and may also affects the survival and virulence. Heavy rainfall sometimes results in light mortality, either directly through knock down, saturation or flooding or by providing favorableconditions for diseases to occur. Excess rain may also could washes aphids from their host plants. Strong violent thunderstorms may cause death of some insects like beetles and bugs. Rain also plays dynamic role in altering a host's susceptibility to wind borne insects and disease vectors.

Effect of wind on pests:

Wind is an important weather parameter that plays a significant rolein outbreak of pests. It is a major component of broad weather patterns that give rises to development of fronts and convergence zones. Low pressure systems and anticyclones that takes place in temperate regions or polar region determines pestsmigration trajectories; whereas the trade winds as well as monsoons helps in determination ofinsects trajectories in the regions of tropical and subtropical areas.Wind also causes displacement of pests and therefore affects their population changes by influencing the numbers of insects moving into or out of a region. Hence, many pathogens and pests appear to undertake enormous migrations covering hundreds if not thousands of km on occasions. They perform this feat by exploiting the wind as an external source of energy. Strong wind could also results in pets mortalityas fast moving winds carries the pests to unfavourable places, which is completely out of their habitat range where they could not survive.

Effect of light on pests:

Though this parameter is not a true climatic factor, but it is interrelated with solar radiation and temperature.Photoperiodism have a larger impact in controlling the processes that are directly related toinsects survival as the intensity of light intensity greatly influences the behaviour of pests.The day length also acts as a signal or trigger by pests to enter diapause during potentially abnormalweather conditions like summer heat, winter cold and drought conditions. For example- Wild bean weevil has whole life cycle of 75 to 80 days, when it

receives 15-16hrs of day light per day night cycle. The migratory capacity of pests maygets influenced more by the day length during development phase than by temperature.

Influence of weather parameters on outbreak of some major crop pests:

1. Aphids:

- The weather parameters, especially temperature and rainfall (moisture)playssignificant role in Aphids population.Aphids are highly sensitive to changes in temperature.
- Higher temperature causes increase in aphidspopulation to a greater extent in the absence of the predator.
- The population of aphids decreases at temperature below 20^0C and temperatureabove 25^0C, whereasif temperature increases from 20 to 22^0C, then the aphids population dynamics increases rapidly.
- Sugarcane aphid - (*Melanaphissacchari)* in sorghum could not able to tolerate temperature more than or equal to 45^0C in the post rainy season.
- Aphids that are found in the tropical region show remarkable adaptability to climate regulating their population dynamics.
- Aphids infestation becomes high when there is substantial increase in minimum temperature and during evening humidity prevails accompanied by occasional rainfall.

2. Grasshoppers:

- With increase in atmospheric temperature, the growth and development rates,nymphal development, adult mass, size and egg production rate of grasshoppers increases to a larger extent.
- During hot summer season, Grasshoppers size becomes larger. That is the reason why northern sidesgrashopper grow faster.
- The population of grasshoppers gets supressed during prolonged drought conditions.

3. Locusts:

- The distribution of locusts is variable as they could travel very long distances and could colonize at new habitats.
- Locusts are known for their destructive capacity as they are capable of sudden appearances and causes severe damage to the standing crops in the farmer's field.
- Due to increased frequency of sufficient rainfall, they could easily survive and hence, populations become maximum in areas where rain water is enhanced by runoff and flooding.

- Locust avoids thermal extremes.

4. Cotton bollworms:

- If temperature falls below10^0C or increases more than 37.5^0 C, then eggs of cotton bollworm won't hatch.
- At temperatures higher than 37.5^0C, the mortality rate of larvae and pupae gets increased.
- Development of larvae becomes successful at all temperatures between 15^0C to 35^0C.
- When the relative humidity increases, then the larval period and adult longevity decreases.
- In India, the Pink boll worm (*Pectinophoragossypiella*) requires temperature range of 26.7^0C to $31.4^0$and 62.2 to 77.7% relative humidity is required for its growth and development.

5. Fruitfly:

- The infestation of fruit fly is higher in regions where the daily maximum temperature does not exceed 38^0C during summer. When the maximum temperature exceeds 40^0C, then theimmature adults of fruitfly could not thrive.
- During rainy season, pests reproduction rate is high, so population dynamics becomes maximum whereas their population decreasesduring dry season. Ifrainfall exceeds 170mm, then the pest population is high and if the rainfall intensity is less than 170mm, then the pest population declines.

6. Mite related diseases:

- Barn itch (*Sarcoptic mange*) occurs in all species of animals, causing a severe itching. Those animals found in poor condition appear to be most susceptible to this disease.
- During cold wet weather, this disease becomes most active but during the summer months, the disease spreads slowly.
- Example- Pigs, camels, sheep, etc.

Effect of climate change on pest's outbreak:

As insects are cold blooded organisms, so they are very sensitive to temperature change.All the insects will be affected to some degrees by changes in temperature and there may be multiple effects upon insect life histories. Their metabolic activity tends to approximately double with an increase of 10^0C. Because they are burning more energy, they consume more, develop faster and larger, suffer less mortality, reproduce faster and lay more eggs. The end result is an increase in populations, and consequently, more crop damage.Increased temperature tends to accelerate insect consumption, growth, development, and movement, which can affect

population dynamics by influencing fecundity, survival, generation time, population size, and geographic range. Species that cannot adapt and evolve to increased temperature conditions generally have a difficult time maintaining their populations, while other species could easily survive and reproduce rapidly. Temperature plays an important role in metabolism, metamorphosis, mobility, and host availability, which determines the possibility of changes in pest population and dynamics.

It has been seen that the population of whitefly increases with high temperature accompanied by high humidity. As ambient temperatures generally increase toward optimal temperatures for growth and development of many insect pest species, potentially reducing thermal constraints on population dynamics, the severity of pest infestations is expected to increase under global warming scenarios.The general consequences of global warming on insect dynamics include: expansion of geographic range, increased survival rates of overwintering populations, increased risk of introduction of invasive insect species, increased incidence of insect-transmitted plant diseases due to range expansion and rapid reproduction of insect vectors, reduced effectiveness of biological control agents such as natural enemies, etc.Winter temperatures increases Stewart's wilt (*Erwinia stewartii*) disease

Increased concentrations of atmospheric carbon dioxidecould affect the distribution, abundance, and performance of crop pests. Due to this, the consumption rates, growth rates, fecundity, and population densities of pests increases to a greater extent. The increased CO_2 levels are likely to affect plant physiology by increasing the crops photosynthetic activity, resulting in better growth, development and productivity of the crop. This in turn could indirectly affect the crop pests by changing both the quantity and quality of plants and vegetation. When plants are grown under elevated CO_2 condition, the chemical composition of leaves changes, that could affect the foliagenutrient quality and palatability to leaf-feeding insects. Such crops often accumulate sugars and starches in their leaves, which reduces palatability by altering the C: N ratio. As nitrogen is the major element in the body of pests, so,elevated CO_2 concentration leads to increased plant consumption rate as discussed earlier. This results inhigher levels of plant damage, as pests must consume more plant tissue to obtain an equivalent level of food. Examples: Foliage feeders such as caterpillars, miners, and chewers consumption are more.

Conclusion:

The Climatic change has been linked to global ecosystem of crop, pests and diseases, insect and animals. Some of the uncertainties that are relevant to insect pests include smallscale

change in weather and climate variability such as increase in temperature, elevated atmospheric CO_2concentration, changing precipitation patterns, relative humidity, light, heavy wind, etc. The effects of weather parameters &climate change on pests are complex factor as it favours some insects whereas inhibits the others, while have a greater impact on their distribution, diversity, abundance, development, growth and phenology. Insects would likely to migrate their geographic distribution (especially migrate towards north). Due to increased overwintering, survival rate and the ability to develop more generations, the abundance of some pests will increase, causing more insect-transmitted diseases in crops.

As human is the center and controller of the global biodiversity. Therefore, sincere efforts should be taken to understand, prevent and manage as well as mitigate the impacts of climate change. These involves reducing emissions of greenhouse gases, reduces pollution of air, land, water as well as to prevent deforestation and undertaking afforestation activities, conservation and the sustainable management of forests, vegetation and crops as well as animals.

References:

1. Prakash, A.; Rao, J.; Mukherjee, A.K.; Berliner, J.; Pokhare, S.S.; Adak, T.; Munda, S.; Shashank, P.R. Climate Change: Impact on Crop Pests; Applied Zoologists Research Association (AZRA), Central Rice Research Institute: Odisha, India, 2014; ISBN 81-900947-2-7.
2. Streck, N.A. Climate change and agroecosystems: The effect of elevated atmospheric CO2 and temperature on crop growth, development, and yield. Ciênc. Rural 2005, 35, 730–740.
3. Luo, Q. Temperature thresholds and crop production: A review. Clim. Chang. 2011, 109, 583–598.
4. Rosenzweig, C.; Hillel, D. Climate Change and the Global Harvest. Potential Impacts of the Greenhouse Effect on Agriculture; Oxford University Press Inc.: New York, NY, USA, 1998; ISBN 0195088891
5. Kocmánková, E.; Trnka, M.; Juroch, J.; Dubrovský, M.; Semerádová, D.; Možný, M.; Žalud, Z.; Pokorný, R.; Lebeda, A. Impact of climate change on the occurrence and activity of harmful organisms. Plant Prot. Sci. 2010, 45, S48–S52.

AN OVERVIEW OF AGRICULTURAL LABOURER: PROBLEMS AND SOLUTION

Ramshankar Varma

Department of Chemistry,

Shri S. K. Somaiya Junior College of Arts Science and Commerce,

Mumbai 400077

Corresponding author E-mail: rsvarma607@gmail.com

Abstract:

Agricultural workers constitute the most neglected class in Indian rural structure. Their income is low and employment is irregular. Since, they possess no skill or training, they have no alternative employment opportunities either. Agricultural labourers constitute an important segment of weaker sections of rural areas. Agricultural labour is provided mostly by economically and socially backward sections. Landless agriculture laboures are also known as invisible farmers; from independence total number of landless laboures is increasing in India. Total number of 55% agriculture workforce labour is landless. The number of landless agricultural workers in India as per Census 2001 was 10.67 crore and as per Census 2011 it was 14.43 crore. There are many problems related to agricultural labourers such as bonded, slavery labour system and exploitation, lower wage, more work, indebtedness, problems of sufficient health facility, lack of healthy food, lack of good housing, lower social status, lack of skill, education etc. To be solve this problems there are important suggestions that Minimum land holding for all rural households, To promote co-operative farming in the rural areas. To introduce social security measures for the agricultural workers and also to introduce compulsory insurance on marginal contribution and also to institute old age pension schemes for the agricultural workers by the government.

Keywords: Agricultural labourers, Weaker section, problems, Cooperative farming.

Introduction:

Agricultural workers constitute the most neglected class in Indian rural structure. Their income is low and employment is irregular. Since, they possess no skill or training, they have no alternative employment opportunities either. In India the agricultural labourers are facing severe unemployment and underemployment as there is no alternative sources of employment.

Agricultural labourers constitute an important segment of weaker sections of rural areas. Agricultural labour is provided mostly by economically and socially backward sections. They are numerically more than any other category of labour in India, more particularly so in the rural sector.

Landless agriculture laboures are also known as invisible farmers; from independence total numbers of landless laboures are increasing in India. Total number of 55% agriculture workforce labour is landless. 100 small farmers are becoming landless farmers every hour in our country. The number of landless agricultural workers in India as per Census 2001 was 10.67 crore and as per Census 2011 it was 14.43 crore," then Union Labour Minister BandaruDattatreya told the Rajya Sabha in a written reply in May 2016. India has forgotten the other part of the agricultural workforce: landless agriculture workers who also double-up as tenant farmers and sharecroppers and are officially recognized as "poorest of the poor". Their contribution to agricultural output is immense given the widespread absentee (farm) landlordism. One estimate suggests that they contribute up to 40% of the total output.

The Indian labourer spends his days in dirt and mud. He produces food grains for us but remains hungry himself. He feeds our cows but never gets anything but water. He fills our stores with food grains but begs his own ration for the whole year. He continuously chops woods and fills water for those who have become rich on behalf of his labor. His condition is heart wrenching and Piteous. *Landlessness is increasingly becoming endemic in India's rural belt, as over 56 percent of the rural population has no landholdings. For decades, there has hardly been any attempt to bring in land reforms in India, even as this critical index affects income, social security, health and education, among other factors that impact households.*

The Socio-Economic and Caste Census of 2011, which acknowledged and counted landlessness as a major indicator of poverty, put the 'households with no land' at 56.41 percent of total rural households or 101 million households. With a mean household size of 4.9 in rural India (as per the 2011 Census), the number of landless comes to 494.9 million (or 49.49 crore).
Landless farm workers are actually doing farm work in their own villages but in addition, they also seek work in nearby mines, quarries, construction and industrial work, often leaving early in the morning and returning in night. Many others are perhaps trying to earn more income now from work as migrant labourers, working in distant farms, mines, brick-kilns and construction sites, leaving for long seasons of work and returning home for shorter periods.

The definition and categories of agricultural labourers:

i. Agricultural labourers are those persons who work on the land of others on wages for the major part of the year and earn a major portion of their income as a payment in the form of wages for works performed on the agricultural farms owned by others.

ii. 2.The second Agricultural Labour Enquiry Committee, 1956-57 accepted a broad view and included all those workers into agricultural labourers who were badly engaged in agriculture and allied activities like animal husbandry, dairy, piggery, poultry farming etc.

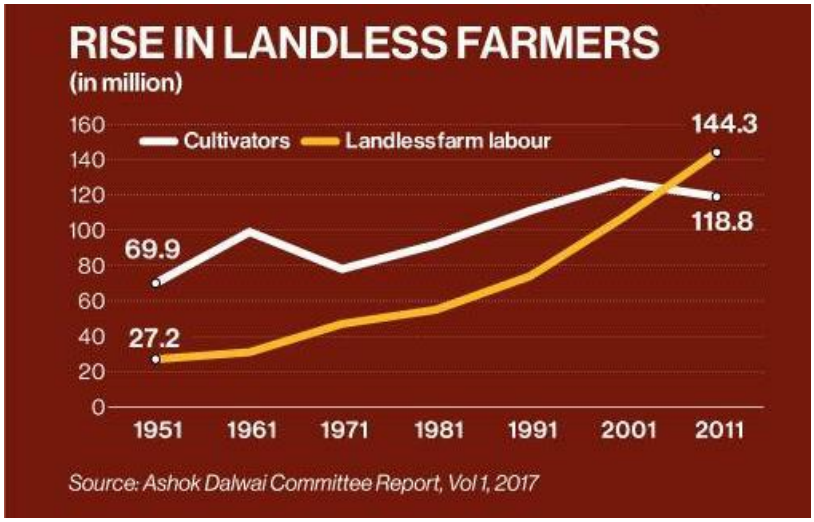
Number of agricultural labourers in India:

Table 1: Number of agricultural workers in India (in Millions)

Sr. No.	State/ UTs	Cultivators		Agricultural Labourers		Total	
		2001	**2011**	**2001**	**2011**	**2001**	**2011**
	All India	127.31	118.81	106.78	144.33	234.09	263.14
1	Jammu & Kashmir	1.59	1.25	0.25	0.55	1.84	1.80
2	Himachal Pradesh	1.95	2.06	0.09	0.18	2.04	2.24
3	Punjab	2.07	1.93	1.49	1.59	3.56	3.52
4	Chandigarh	0.00	0.00	0.00	0.00	0.00	0.00
5	Uttarakhand	1.57	1.58	0.26	0.40	1.83	1.98
6	Haryana	3.02	2.48	1.28	1.53	4.30	4.01
7	Delhi	0.04	0.03	0.02	0.04	0.06	0.07
8	Rajasthan	13.14	13.62	2.52	4.94	15.66	18.56
9	Uttar Pradesh	22.17	19.06	13.40	19.94	35.57	39.00
10	Bihar	8.19	7.20	13.42	18.35	21.61	25.55
11	Sikkim	0.13	0.12	0.02	0.03	0.15	0.15
12	Arunachal Pradesh	0.28	0.30	0.02	0.04	0.30	0.34
13	Nagaland	0.55	0.54	0.03	0.06	0.58	0.60
14	Manipur (Excl. 3 Sub-Divisions)	0.38	0.57	0.11	0.11	0.49	0.69
15	Mizoram	0.26	0.23	0.03	0.04	0.29	0.27
16	Tripura	0.31	0.30	0.28	0.35	0.59	0.65
17	Meghalaya	0.47	0.49	0.17	0.20	0.64	0.69

18	Assam	3.73	4.06	1.26	1.85	4.99	5.91
19	West Bengal	5.65	5.12	7.36	10.19	13.01	15.31
20	Jharkhand	3.89	3.81	2.85	4.44	6.74	8.25
21	Orissa	4.25	4.10	5.00	6.74	9.25	10.84
22	Chhattisgarh	4.31	4.00	3.09	5.09	7.40	9.09
23	Madhya Pradesh	11.04	9.84	7.40	12.19	18.44	22.03
24	Gujarat	5.80	5.45	5.16	6.84	10.96	12.29
25	Daman & Diu	0.00	0.00	0.00	0.00	0.01	0.00
26	Dadra & Nagar Haveli	0.04	0.03	0.01	0.02	0.05	0.05
27	Maharashtra	11.81	12.57	10.82	13.49	22.63	26.06
28	Andhra Pradesh	7.86	6.49	13.83	16.97	21.69	23.46
29	Karnataka	6.88	6.58	6.23	7.16	13.11	13.74
30	Goa	0.05	0.03	0.04	0.03	0.09	0.06
31	Lakshadweep	0.00	0.00	0.00	0.00	0.00	0.00
32	Kerala	0.72	0.67	1.62	1.32	2.34	1.99

Rise in landless farm labour:



The number of landless farmers in India has grown steadily since the 1951 Census to overtake that of farmers (cultivators) by 2011, accounting for 55% of the total agriculture workforce. Their number stood at 144.3 million, as against 118.8 million farmers (cultivators) in 2011 - growing 5.3 times since 1951. In 1951, the 'landless agriculture labour' numbered just 27.3 million which went up to 144.3 million (or 14.4 crore) in 2011.

Scheduled Castes higher share in agricultural labourers:

According to the 2011-12 NSSO statistics, the share of wage labourers among SCs was 63%. This is significantly higher than the values for other social groups. These figures were 44% for Other Backward Classes (OBCs), 42% for upper castes and 46% for the rest. Even among wage labourers, SCs have a much greater share of casual wage workers, whichsignifies higher job insecurity and poor earnings. The share of casual wage labour was 47 percent for SCs compared with one third for OBC/higher caste /rest, and all India average. In fact, of the total casual labourers in the country, about 32 percent are SC, which is double their population share of 16 percent.

Operational land holding:

Percentage share of different social groups in number of operational holdings as per Agriculture Census 2015-16.

Table 2: Operational land holding in percentage Social Groups

Social Groups	Operational land holding (%)
Scheduled Castes	11.84%
Scheduled Tribes	8.65%
Institutional	0.18%
Others	79.33%

Source: Agriculture Census 2015-2016 released in 2019

Womens of agricultural laboures linked to increasing malnutrition in India:

The study, published in the Journal of Feminist Economics, examines the intersections of gender with other forms of social identity and inequality. Indian women's unaccounted contribution in the agriculture sector has a negative impact on the nutrition levels of members of the households, which contributes in increasing the rate of malnutrition among children.

Problems of agriculture labourers:

i. More working hours: The working hours of these laborers are not only irregular but also excessive. They have to work from morning to late at night. His working hours change with harvest, season, and work.

ii. Seasonal Employment: Agricultural labour does not get work for the whole year. According to the Second Agricultural Labor Investigation Society, Seasonal labor gets an average of

197 days of work in a year. Similarly, child labor gets 204 days and women get 141 days of employment. Thus, their average annual income is very lower.

iii. Low Wages: The wage level of agricultural labors very low as compared to that of industrial labor. It has two reasons a)increase in landless laborers b) lack of non-agricultural areas of work in rural areas.

iv. Agricultural Slavery: The majority of agricultural laborers are landless and backward classes. due to their lower social status, they are treated as animals. Big landowners make them work as slaves. They are used as laborers and in return given minimum wages.

v. Indebtedness: Due to lower-income, the indebtedness of agricultural farmers is increasing. They hesitate in negotiating their wages with the landowners in the fear that their services would be terminated. The laborers remain indebted even after working with the landowners for their whole life.

vi. Lack of Unity: The agricultural labourers are spread in millions of villages all over the country they lack unity. Thus, they are unable to negotiate their wages, etc. with the landowners by uniting themselves.

vii. Exploitation of Child and Women Labourers: Due to lower-income, the children and women of agricultural laborers are also forced to work for their livelihood. The child and women laborers are made to work more for livelihood. Thus, exploitation of child labor and woman labor is a major problem in the field of agriculture.

viii. Lower Social Status: Most of the agricultural laborers are of backward classes who have been exploited for centuries. Due to this reason also their social status is lower.

ix. Shortage of Other Jobs: There is a shortage of other jobs in villages.Thus, if the crop is destroyed by floods, famines, etc., it becomes difficult for the agricultural labor to survive.

x. Housing Problem: The landless labourers have no private house. They live in cottages, made on the useless land of the landowners with their permission, and in its return, they have to work without payment, for the landowners. When a number of people live under the same root, the physical, social, moral, and religious problem arises.

xi. Unemployment due to mechanization: At present times, due to an increase in the use of machines, the unemployment rate among the illiterate agricultural farmers is increasing, which is a serious problem for them.

To suggest measures for improving conditions of agricultural labourers:

i. Minimum land holding for all rural households: This may be only a small holding but if supported by water and moisture conservation/minor irrigation and cultivated intensive in

least-cost ways using agro-ecology approach, this can provide a reliable base of food security, good health and firm bonds with the village.

ii. **To implement the Minimum Wage Act** seriously and to revise the minimum wages periodically considering the changing price level.

iii. **To improve their bargaining power:** the agricultural workers should be organised through the formation of unions of farm labourers under the protection and support of the government.

iv. **To abolish serfdom** among the landless agricultural labourers totally.

v. **To rehabilitate the agricultural labourers** on the acquired land declared surplus under ceiling laws and also on the newly reclaimed land.

vi. **To create alternative sources of employment** by developing small scale and cottage industries in the rural areas.

vii. **To improve the conditions of agriculture** by adopting improved intensive methods and multiple cropping for raising the productivity of agricultural labourers.

viii. **To improve the working conditions of agricultural labourers** by enforcing fixed hours of work, banning child labour etc.

ix. **To promote co-operative farming** in the rural areas.

x. **To improve the standard of living** of agricultural labourers by organising special programmes like Minimum Needs Programme.

xi. **To introduce social security** measures for the agricultural workers and also to introduce compulsory insurance on marginal contribution and also to institute old age pension schemes for the agricultural workers by the government.

xii. **Strengthening of Mahathama Gandhi National Rural Employement Guarantee Scheme (MGNREGS)** creating alternative sources of employment, Protection of women and child labourers, Cooperative farming, Proper training for improving the skill of farm labourers.

References:

1. Ashok Gulati, Surbi Jain, Nidhi Satija. (2013). Raising farm wages in India: the pull and push factors. Ministry of Agriculture, Government of India.
2. Anjani Kumar, Sant Kumar, Dhiraj,K, Singh and Shivjee, (2011). Rural employment diversification in India: Trends, determinants and implications on poverty. Agric. Econ. Res. Rev, Conference Issue, pp. 361-372.

3. Brajesh Jha B. (2007). Agricultural wages in India: A state level analysis. The Indian Journal of Labour Economics, vol. 50, no.2, April- June 2007, p.295-301.
4. Deepa, (2002). Agricultural wage in India, Indian Journal of Agricultural Economics, Vol. 52, No.4, pp. 56-57.
5. Kulamani Padhi. (2007). Agricultural labour in India – A close look, Orissa Review, Feb-March 2007, pp.45-48.
6. Angha, A.O, (2003). Effect of rural-urban migration of youths on agricultural labour supply in Umuahia.
7. https://www.newsclick.in/one-hundred-indian-farmers-go-landless
8. https://www.businesstoday.in/opinion/columns/indian-economy
9. https://www.allexamnotes.com/2017/04/agricultural-labor-problems
10. https://www.firstpost.com/india/indias-landless
11. https://thewire.in/agriculture/landless-farmers-rural-workers
12. https://mkuniversity.ac.in/research/SYNOPSIS/P3625s.pdf
13. http://www.ijhssi.org/papers/vol8(1)/Version-1/G0801014549.pdf
14. https://www.business-standard.com/article/news-ani/women-s-agricultural-labour

CROP INSURANCE SCHEMES FOR FARMERS

Yamini Raut[1] and Vikas Bhandari[2]

[1] RKVY-RAFTAAR project,

Shre-e-kashmir, University of Agriculture Sciences & Technology, Jammu (J&K)

[2] Chandigarh University, Punjab

Corresponding author E-mail: [1] yaminiraut1992@gmail.com, [2]vikasbhandari22@gmail.com

1. Background and evoulution of crop insurance:

India is an agriculture-based country wherein more than 50% of the population is still dependent on this sector to make their both ends meet. The situation of the farmers has always been vulnerable due to improper and poor crop yields. This is seen due to various reasons such as natural disasters (draughts, floods), price fluctuations in the market, weather imbalances and many more. The crops are damaged due to pests and diseases, lack of rainfall which leads to revenue loss to the farmers and make this sector a risky enterprise. The revenue loss and vulnerability lead to farmer's suicide practices reaching to 10.281 in 2019 [1] To account for all such issues crop insurance was introduced where benefits were given to the farmers to deal with all such problems.

Crop insurance proposal dates back to the time period of Akbar where Dashuri tax was implemented and many a times the land revenue and other taxes were removed during the crop failure .In the pre independence period many attempts were made by Madras, Baroda and Dewas to introduce schemes for crop insurance but they did not succeed as were expected. Shri J.S Chakravarti in Mysore also came up with an idea of rain insurance scheme to protect the farmers from the destruction caused by draughts in 1915 [2] In 1946, Narainswami Naidu followed a crop insurance scheme based on the outlines of U.S. model to cool down the situation of increasing indebtedness among the farmers of Madras [3] So, attempts have been continuously made to evolve with crop insurance schemes.

This approach was strictly rejected by individual states who rather wanted that individual farmers' data should be collected and then benefits should be distributed so that each farmer will get the benefits according to his own past cropping yields. The Government of India then came upon with the introduction of a Crop Insurance Bill and a Model Scheme of Crop Insurance in 1965 where it was on states if they wanted to include crop insurance in that way or not which lead to the topic been in discussions and debates for many years.

The first ever crop insurance scheme based on individual approach was then implemented in 1972-73. It was introduced by LIC of India, General Insurance Department on H4 cotton [4]. It was based on experimental purposes and was later recognized by an act of Parliament and was implemented on a large-scale including groundnut, potato, gram crops and much more. However, in

the following period it proved to be a failure covering only 3110 farmers and providing only 4.54 lakhs against the claims of 37.88 lakhs. It was based upon area approach and premium up to 150% [5] was approved under this scheme. This proved to be little better than the earlier scheme covering 6.22 lakh farmers and providing Rs.195 lakhs against claims of Rs.155.68 lakhs.

With time, various new crop insurance schemes evolved such as Weather Based Crop Insurance Scheme, Experimental Crop Insurance Scheme (ECIS), Varsha Bima (Rainfall insurance, Pilot scheme), Pradhan Mantri Fasal Bima Yojana (PMFBY), Pilot Coconut Palm Insurance Scheme (CPIS) and many more in the coming years. Advancements and alterations in the crop insurance take place from time to time to include most of the farmers to benefit from these schemes. Some of the prominent crop insurance schemes have been discussed in this paper to study about the basic patterns and trends in these schemes and also to study their effects in the farmers.

2. Crop insurance schemes in modern India:

2.1 Pradhan Mantri Fasal Bima Yojana:

18th February 2016. Pradhan Mantri Fasal Bima Yojana (PMFBY) was launched by Prime Minister Shri Narendra Modi. The main idea behind the PMFBY was to replace the 2 existing agriculture schemes: National Agricultural Insurance Scheme as well as the Modified NAIS. This policy was introduced for the farmers so that they can get a breath of relief during times of natural calamities. The farmers are given a set of rules regarding the premium they have to pay to get their crops insured and the balance premium or subsidy will be paid by the government. A premium of 2% is to be paid on Kharif crops and a premium of 1.5% on Rabi crops. Earlier, there were some set of rules under which only a few farmers were covered and will be able to come under this scheme but after Kharif 2020 it became a voluntary scheme for every farmer. The government used to have a capping on the claim price paid to the farmers but not it has also been removed and the full claim price is paid to the farmers. The main objective behind the scheme is to protect the farmers during times of natural calamities, stabilize the income of the farmers and improve their standard of living, and help the farmers to adopt new modern techniques of farming which are more efficient and will also help in minimum costing.

There are certain types of risks that are included under the scheme and the farmers will get the claim money if they are occurred due to these calamities. Under the post-harvest losses, the insurance claim will be available for only 14 days from the date of Harvest. One of the major reasons for launching the scheme was to double the coverage of crop insurance by 2018 to at least 50% farmers and was expecting it to be 30% by the end of 2017 [6].

Due to the lockdown and continuous adverse impact of Corona affected the agriculture industry to the grounds. Yet due to the successful implementation of PMFBY, 69.70 lakh farmers were benefitted from this scheme during the lockdown phase. Farmers are supposed to submit their losses with particulars to their respective insurance banks and the bank will credit them in the farmer's bank along with a notice regarding all the beneficiaries and the claim list of the farmers on

their notice board. The government has made several agencies to study the details of agriculture at the grass-root level to monitor the season of harvest and report the data to the government regarding the data of harvesting and the damages to the farmers due to natural calamities or any unforeseen incident. The major plus point of the PMFBY scheme is that all the services involved in the process of this scheme are exempted from Service Tax liability, it was introduced to replace the already existing two schemes (NAIS/MNAIS). The state government reviews the scheme every year.

2.2 Restructured Weather Based Crop Insurance Scheme (RWBCIS):

The RWBCIS was implemented on 18th February 2016. Prime Minister Shri Narendra Modi launched this scheme for the benefit of the farmers. Under this scheme farmers will be given compensation under unpredictable financial loss due to adverse weather conditions such as humidity, rainfall, extreme temperature, fast flowing winds, etc.[7]

12 states implemented this scheme under the Kharif 2016, and 9 states implemented this scheme under Rabi 2016-17, the main aim of this scheme is to remove the financial burden of the insured farmers. Farmers often take life taking steps when they don't see any other option to lessen their financial burden; therefore, this scheme was a sense of relief for the farmers. The Government decided to help the farmers during the loss time due to bad weather conditions, when they are not able to harvest properly or their existing harvest gets affected due to the bad conditions. WBCIS uses the weather conditions as a "Proxy" for crop yields in compensating the cultivated loss.

The claim process has certain pre-requisites, the claim process does not start until the Weather Station or Backup Weather Station gives the whole data to the government, then only the government starts the claim process and the claim process is strictly according to the insurance sheet terms, payout conditions and scheme terms. The claim process takes 45 days to process the payment to the farmers and it is monitored by the Ministry of Agriculture. Food crops, oilseeds and Horticultural/Commercials crops are covered under the RWBCIS. The insurance period also referred to as the Risk period, it is basically the period from sowing to the maturity of the crops. Both the Central and State Government is actively involved in the implementation of the Scheme.

Central government looks after the implementation, standardization, making policies, etc. whereas, the State government provides the crop calendar and various practices for the scheme and crops under this scheme, and the weather data needs to updated daily and need to be collected daily from the Weather station. The state government also has to prepare a technical team that will finalize the areas and will evaluate the products and benefits of the farmers. The insurance company has to open separate accounts under this scheme to maintain all the transactions and to be made available any time for the audit by the Government Agency.

The farmers get their crops insured under the crop insurance by submitting certain documents and have to report their insurance bank or authority in less than 72 hours of the calamity. Certain evaluation is done before settling the claim of the Farmer. Crop insurance is only available for those farmers who are growing insured crops and non-Loanee farmers are not allowed under this scheme.

The farmers have to renew their crop insurance either online visiting the official site or offline in the government authority of their area and the farmers are instructed in advance to pay their premium before the due date arrives. The main idea behind Crop Insurance is to lessen the burden of the farmers during losses and give them financial support during their financial losses. Till date the majority of the farmers are benefitted from this scheme and more and more farmers are getting their crops insured every year. The government has been effective in providing financial support to the farmers through its various schemes under crop insurance.

2.3 Coconut Palm Insurance Scheme (CPIS):

Introduction and nature of the Scheme:

India has a vast coastline. Coconuts are one of the leading crop plantations which grow in the coastal areas. The risk of natural calamities, diseases, insects and pest attacks is exceptionally high. The cultivation of Coconut is a perennial crop that occupies nearly 2 million hectares of land and has use of every part of it- coconut oil, coconut water, wood, leaves, shell and kernel, etc. To minimise such enormous loss to the farmers and the economy, a separate insurance scheme was devised to benefit Coconut palm cultivators [8].

The **Coconut Palm Insurance Scheme (CPIS) [9]** was implemented on a pilot basis in some selected areas of Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, Orissa and Tamil Nadu from 2009 to 2011. To formulate and implement such schemes, a statutory body was developed by the Ministry of Agriculture, namely the Coconut Development Board (CDB). In addition, further state-level committees were set up to review the progress and submit their report annually to the Ministry of Agriculture. Therefore, the Ministry of Agriculture, along with the Board, could review progress and implement any suggestions of the committee.

Coverage:

The Department of Agriculture & Cooperation authorised the General Insurance companies to implement CPIS. This scheme covered farmers, planters, growers who had at least five healthy palm bearing trees. Mostly, all varieties of palm were covered under it except unhealthy and senile palms. However, eligibility was dependent upon the age range such as Dwarf and Hybrid within the range of 4 to 60 year were covered and 7 to 60 years for tall variety. Also, the age groups were to be self-declared by the grower/planter.

Types of risk covered and exception:

The insurance scheme covered hazards which resulted in death or total loss or palm becomes unproductive (i.e. impossible for the palm to re-grow/rejuvenate) owing to the Storms, cyclone, tornado, flood, diseases, pest infestation, lightening or accidental fires, earthquake, tsunami, and severe drought. Therefore, all insured palms will be covered from any irreparable damage or total loss resulting from any of the perils mentioned above. The insurance company will pay for the total loss under this policy.

However, the scope of insurance does not cover events such as-

1. Loss occurred due to war, theft, invasion, civil war, rebellion, mutiny, civil war, or power transmission.
2. Radioactive contamination due to nuclear material
3. Wilful Negligence of insured or on his behalf
4. Unhealthy and senile palm
5. Economic loss affecting the irrigation or maintenance of the insured palm
6. Natural death or uprooting of the palm.
7. Damages due to aerial crash/impact.

Insured sum and its premium:

The sum insured per palm was ₹ 900 for the coconut palm aging 4 to 15 years with the premium of ₹9.00 per plant annually, while ₹1750 for palm ranging the age of 16 to 60 years with a premium of ₹14.00 per plant [10].

Subsidies on premium:

A subsidy of 50% was paid by the CDB (i.e. central govt.) and 25% by the participating state government (not compulsory), and the balance of 25% is to be paid by the planter/grower. If some association wants to pay the premium on behalf of farmer/planters, they can do so but should have 'insured interest'. Also, the grower must bear a minimum of 10% of the premium.

Term/period of insurance:

Usually, the insurance policy is taken annual basis. However, planters/growers may take a policy for a maximum term of 3years on which rebate at the premium will be provided @7.5% and 12.5% on two and 3-year policy, respectively [11]. The policy can be taken any time of the year. Any loss or damage to palms within 30 days of insurance isn't payable under the policy. This condition does not apply to the renewal of the policy before any time gap/expiry of the policy.

Issuance and claim of the policy:

Growers/Planters can obtain this policy through Coconut Development Board (CDB), office of Agriculture/Horticulture dept. or any societies registered under Societies Act/CDB. The premium can be paid in cash, cheque or bank draft. The Certificate of Insurance is to be issued by Implementing Agency (IA) within 30 days from the payment of the policy [12].

The death or loss of the palm is to be informed to IA within 15 days from the calamity, along with necessary documents. Palms are not to be moved or shifted until the inspection by loss assessors is done. After assessing the cause for the loss, a Certificate will be issued by CDB, the Agriculture department and SAU within 15 days after being informed by the insured. IA will release the claim Amount within one month after all necessary details are received and certified.

2.4 unified package insurance scheme (upis) as pilot in 45 districts:

Unified Package Insurance Scheme (UPIS) was approved to be implemented on a pilot basis in 45 selected districts from the 2016 Kharif season. This policy provides financial protection to farmers by ensuring assets/activities such as machinery, life, accident, house, crops and student safety etc. [13]

Salient features and benefits:

This package policy was underwritten by General Insurance Companies and authorized by the Department of Agriculture under crop insurance initiative. The policy covers seven sections of insurance. Crop insurance is mandatory, and two other sections need to be chosen to avail of the subsidy. The crop insurance is area-based while other sections on an individual basis—premium for crop insurance ranging 1.5% to 5% based upon the amount payable. Also, the Government will provide subsidies in case of any difference between Actuarial premium and premium paid by the farmer. Also, the premium paid is exempted from service tax.

General Guidelines:

- If any farmer has already taken any insurance policy covering any sections under UPIS, then he/she will be exempted from taking this policy.
- It is mandatory for the farmers to submit a proposal-cum-declaration form and all the relevant documents and details to avail of this policy. Both Loanee and non-Loanee are required to fill up this form.
- After this proposal form is accepted, the banks will issue a unique reference number to acknowledge the proposal form.
- There can be no changes in the proposal form unless specifically agreed upon by the insurance agency [14].

Coverage under unified package insurance scheme:

Section 1: Crop Insurance [Under PMFBY/WBCIS + State Preference]:

This section gives the state government a choice to choose any one or both of the policies for the implementation. Both Pradhan Mantri Fasal Bima Yojna (PMFBY) and Restructured Weather Based Crop Insurance Scheme (RWBCIS) follow the standard guidelines to take care of farmers needs regarding the crops.

Section 2: Personal Accident Insurance [Under Pradhan Mantri Suraksha Bima Yojana]:

It provides a financial blanket to the farmers for one year by offering insurance coverage for accidental death and disability under Pradhan Mantri Suraksha Bima Yojana (PMSBY). It is available to all farmers within the age group of 18 to 70 years. It provides a claim of ₹2 lakh in case of death or total and complete loss of both eyes or both limbs and ₹1 lakh for total and irrecoverable loss of one eye or hand or foot. The premium for such an insurance policy will be ₹12 per annum by the insured [15].

Termination: This cover shall be terminated if any of the given events occur-

- After reaching the age of 70 years
- Insufficient funds to maintain the insurance
- If a member is having more than one policy, then the claim will be restricted to only one policy.

- Risk cover can be suspended at the Insurance Company's discretion if, due to any technical reasons, insurance gets terminated [insufficient balance on the due date for renewal or any administrative concerns.

Section 3: Life Insurance [Under Pradhan Mantri Jeevan Jyoti Bima Yojna]:

Under Pradhan Mantri Jeevan Jyoti Bima Yojna (PMJJBY), Life Insurance policy gives a death cover of ₹2,00,000 lakh per member. Whoever within the age limit of 18 to 50 years has a savings account eligible to avail of this policy under this scheme. The member needs to fill "Consent-cum-Declaration Form" and provide satisfactory evidence of health to the insurance company while applying for the insurance policy. The premium is ₹330 plus service tax which will be deducted from the members saving account annually. If the policy member dies before the termination date, the sum assured will be paid to the beneficiary, provided assurances have not been terminated.

Termination:

Assurances shall be terminated on the renewal date, and no claim will be payable on attaining the age of 55 years or bank account get closed due to insufficient balance on the date of renewal. However, the insurance policy can be revived/reinstated after a grace period on payment of premium and certification of good health.

Section 4: building/contents insurance [fire and allied perils]:

The purpose of this section is to indemnify the losses/damages of the farmers. The insurance company pays the amount whichever is less (sum insured or total loss). It gives protection from any loss or damages which occur due to fire, lightning, explosion, busted pipes or overflowing water tanks, aerial crash, riots, strike, or due to any natural calamities. The farmer provides some basic details of the building and its contents, along with the complete address of the house in the proposal form. Farmers can ensure any building and content for the amount ₹50,000 and ₹20.000, respectively [16].

Exceptions:

- The company shall not be liable in loss/damage which occurs-
- During or because of burglary, theft or housebreak in which the insured himself or any of his family members is a person of interest.
- Any loss of food articles, money, deeds, bonds, certificates, business books, manuscripts, and documents, any kind of Jewellery, Valuable stamps, livestock, vehicle, promissory notes, shares and stock will not be covered under this policy.
- Loss due to terrorism, gross negligence or any willful act of the insured or someone on his behalf.

Section 5: Agriculture Pump-set Insurance [Up to Ten Horsepower Centrifugal Pump Sets]

Under this policy, Centrifugal pump sets that run either on electricity or diesel will be insured. Pumps should not have more than ten horsepower capacity, and they ought to be used only for agricultural purposes. The farmer provides electrical and mechanical specifications of the pump

set, such as make, model, serial number, etc., in the proposal form. The pump can be insured with the sum of ₹25,000, and it should not be more than seven years old.

Exclusion of Agricultural Pump:

· If the condition of the pumps has deteriorated due to normal wear and tear or atmospheric condition, etc.

· Negligence of the insured or due to floods or any natural calamity.

- Faults existed before the insurance policy.
- The manufacturer of the pump is responsible for loss or damage [17].

Section 6: Student Safety Insurance [Accidental death or disability]:

This section covers the accidental death or disability of students/children of the insured. Also, it has a provision where the claim amount is to be converted into FD in the name of a student whose either parent has died. He can avail of the amount after attaining the age of majority. Claim in case of accidental death, permanent disability, loss of any limb/eye is ₹50,000. The person to avail of this policy must be 18-70 years and 5-18 years for parents and student/children, respectively.

Exclusion:

· If the insured party has committed suicide or he/she was under the influence of liquor/drugs at the time of death.

· Death due to Pregnancy or childbirth or any of the venereal disease or owing to insanity.

· If he/she is the party to a crime or responsible for any breach of law with criminal intent.

Section 7: Agricultural Tractors Insurance [As per Motor Insurance Policy]

It covers Agriculture tractors and trailers. This section ensures the Agriculture Tractor against explosion, fire, theft, burglary, terrorist activity and other natural calamities. It also provides coverage to the driver in case any accident occurs while driving the insured tractor. This vehicle is subject to depreciation owing to normal wear and tear. That's why the premium amount is subject to change every year. Therefore, it is necessary for the tractor before getting insured that it must be according to the standard of the Motor Insurance policy.

Policy Exclusions:

- Any loss/damage caused due to the geographical conditions of the area.
- It is owing to wilful negligence and malicious intention.
- Use of tractor for other purposes (i.e. other than agricultural purpose)

3. Financial performance of the crop portfolio – Data & History

India is one the leading exporters of grains, crops and thus various agricultural products. The farmers play an important role in the success of the agricultural industry. But, they're those who are suffering from debt and poverty. It's the unfortunate truth that the Indian farmers attempts to suicide. The rationale is that the less income and deprivation. The agriculture in India depends on the monsoon. Poor monsoon conditions with fewer techniques to tackle the adverse situation affect the crop production. Poverty and the rise in the value of agricultural needs create problems for the

farmers after which they're forced to need loans either from banks or moneylenders. But, because of less production of the crops, or some disasters, they undergo the debt. And once they're unable to return back the cash, they attempt suicide.

Understanding the matter of farmers, the government of India came up with several insurance schemes which are meant to protect the farmers from any damage or loss. The insurance plans for farmers and thus the crops bring stability in their life and agricultural industry

Agriculture in India is definitely one among the country's major occupations. Approximately 52% of Indians depend upon the crops that they yield for their livelihood. Agriculture contributes 16% to the general GDP of the country. Unfortunately, agriculture in India is often a risky business for farmers due to the probabilities of natural disasters (floods, droughts etc.). The fluctuating prices of agricultural products can be a source of worry too. For the sake of farmers within the country, the government has launched crop insurance to lighten the heavy risk related to agriculture.

Agricultural producers (including ranchers, farmers and others) purchase crop insurance so as to guard themselves against the loss of revenue thanks to declines within the prices of agricultural commodities or from the loss of their crops thanks to natural disasters (such as floods, hail, pests, diseases, drought etc.). Crop-revenue insurance and crop-yield insurance are the 2 general categories of crop insurance.

To avail the financial benefits of the crop insurance scheme, the interested farmers have to register themselves with the insurance provider company. The registration of marketing surplus at the sowing of crops is essential for crop insurance. The insurance company offers the appropriate coverage scheme which includes a minimum support price guarantee or market price from the past. Farmers are required to pay the premium for any type of price insurance. In the initial stages, the government shares the burden of premium payment. During harvest, if the notified market price falls below the guaranteed price, then the insurance company pays the compensation. Financial performance of the crop portfolio provides

a) Financial support to farmers going through crop loss due to unpredictable events

b) Stabilizing the income of farmers to make sure their working in farming

c) Encouraging the use of innovative and modern agricultural practices

d) Ensuring flow of credit to the agriculture sector; which may contribute to food security, crop diversification and enhancing growth and competitiveness of the agriculture sector besides protecting farmers from production risks?

Crop Insurance are often availed by the farmers including sharecroppers and tenant farmers provided they're growing the notified crops within the area. Non-Loanee farmers also are eligible to avail benefits under crop insurance upon providing land documents

Two more categories are identified during which the farmers can receive the perks. These also are called Coverage Components and they are:

Compulsory Component: If farmers have applied for Seasonal Agriculture Operations (SAO) credit or loans from the financial organization for the notified crops, they're going to be covered compulsorily

Voluntary Component: Crop Insurance is an option for those farmers who fall into non-Loanee farmers. If they want to, they will register and avail benefits from the government scheme.

Over the years, the list of things that are covered in crop insurance has evolved to profit farmers. Counting on what policies that the farmer opts for, both the private and property need of the farmer could also be covered. Following may notify what is covered and what's not under such policies:

- Losses and damages to the property of the insured farmer
- Damage or loss caused by fire or natural disaster (including storm, flood, tornado, earthquake, cyclone etc.)
- Coverage for private accidents. This includes the insured farmer and therefore the farmer's family members).
- Cover for loss of pump set
- Cover for damage/ loss of tractor
- Coverage for damage/ loss caused by power outage

The fact that the insurance will provide support in the unfortunate event of failure. It will thus be a critical instrument within the development of crop production.

4. Participation of marginal farmers in crop insurance schemes:

Marginal farmer is a farmer who is cultivating the agricultural land which is up to one hectare i.e. up to 2.5 acres. This farmer can be the owner of the land or tenant or can also be a sharecropper [18].

There could be various reasons why these farmers need Crop Insurances. Many small and marginal farmers may not have the access to avail the credit from financial institutions because of the recurring default they might have made due to crop failure. Therefore, commercialization of agriculture seems difficult as a huge amount of credit is needed which is really difficult for small and marginal farmers to accumulate from formal sources. Sometimes money lenders are also afraid to lend money to these poor farmers because of their poor financial situation [19]. Farmers usually prefer informal loans because of their easy availability although they come with extremely high interest rates. Small farmers and marginal farmers face lack of accessibility to formal institutional credits; therefore, they end up using the non-institutional sources for the credit even at the high interest rates. Things are more difficult for the farmers who have land on lease as compared to the farmers who got their own land. Farmers having land on lease are regarded as landless farmers only, so for them, it is really very difficult to get the loans granted or issued from banks and other formal Institutions. Therefore, they end up using non institutional services.

Another reason could be factors related to climate change. Higher the chances of extreme weather, higher are the agrarian distress. Natural calamities such as floods, droughts etc. leaves farmers in a great distress. Since they are not well prepared for these calamities, they are more vulnerable to loss of the harvest. Especially when the money is already paid for required material, for example: seeds, fertilizers etc. Unfortunately, it results in fluctuating incomes and unstable survival and livelihood.

To tackle the above-mentioned issues, these Crop Insurance schemes were formulated, so that, there is no hindrance in the productivity of the agricultural sector. Eventually, it will help to reduce the negative financial impact which is there on the farmers. These schemes not only help in stabilizing the farmer's financial condition but also lead to investment. This investment will basically help the farmers to continue the production even after having a bad agricultural year.

To promote these Crop Insurance schemes among small and marginal farmers 50% of subsidy in premium is allowed which is to be shared equally by the government and State Government of India. Premium Subsidy will be based on the period of 3 to 5 years which is subjected to their financial results review [20].

It can be also seen that insurers face many problems while reaching to the farmers so that they can receive various benefits and the protection they will get from the insurance because of the lack of the rural infrastructure. Without proper information, the farmers are not able to receive adequate benefits from these schemes [21]. There can be some financial issues as well because many state governments have failed; they did not pay the subsidy premium on time. This could also be a major reason why farmers are being hesitant towards these schemes [22].

The participation of these marginal farmers seems to be declining in the central government's Pradhan Mantri Fasal Bima Yojana (PMFBY) in the last 3 years. Their participation for the Crop Insurance schemes in the Kharif season has been reduced almost by 2%, from 18.08% in 2018 to 16.55% in 2020 [23].

5. The pricing process & subsequent pricing challenges:

Pricing Process:

Pricing is the process of determining the worth of a manufacturer's product in exchange for products and services. A product's pricing is impacted by a variety of factors, including manufacturing costs, competition, market circumstances, and product quality. When determining the prices of its products, an organisation must guarantee that the prices cover both the expenses of production and profit margins. If a product's price does not cover its costs, the organization's financial resources will be depleted, and the firm would eventually fail.

Minimum Support Price:

The "Minimum Support Price (MSP)" is basically a government-guaranteed standard amount that functions for farmers as a safety net or insurance when they sell MSP-eligible crops. These crops are acquired by government agencies at a predetermined price that has been agreed upon with

farmers and cannot be changed under any circumstances. The MSP system protects the country's farmers in times where crop prices decline dramatically. The central government determines the MSP for various crops based on the numerous recommendations from the "Commission for Agricultural Costs and Prices (CACP)". The CACP is in charge of setting the MSP, which is based on a formula developed by the Swaminathan Committee, a government-created group tasked with resolving farmer concerns [24].

Subsequent Challenges Faced:

Due to the admission of persons who do not have a licence or registration, farmers will be vulnerable to fraud. In certain locations, the state-run crop produce procurement system is excellent. Farmers are encouraged to focus on taking greater produce by procuring through the Food Corporation of India at promised MSPs, which are announced before each agriculture season. MSPs exist for 23 agricultural crops, however governments typically purchase rice and wheat. Farmers are concerned about the two recent bills because they believe that they would destroy the government procurement mechanism as well as the MSP [25]. Why were the majority of the protestors from Punjab and Haryana? This is due to the fact that they are the primary beneficiaries of the safety net. These are some of the challenges which are being faced by the farmer's whole over the country.

6. Technological Advancements and Crop Insurance:

In India, the assessment of both crop yield and related damages under the area-based schemes, namely, Pradhan Mantri Fasal Bima Yojna, Modified National Agriculture Insurance Scheme, and National Agriculture Insurance Scheme, is done as per the Crop Cutting Experiments. The aforementioned schemes specify the minimum sample size of Crop Cutting Experiments at different levels, viz. district, respective block, and Village Panchayat Level. The matters regarding any technical issues and size of Crop Cutting Experiments, are heard and dealt by a technical advisory committee comprising of members from Ministry of Agriculture & Farmers' Welfare, IASRI, and NSSO. However, practical problems relating to the above-mentioned issues still prevail. These include, firstly, lack of accessibility, availability, and reliability of accurate data on a real-time basis. Secondly, a considerable time gap between the calculation of Crop Cutting Experiments and claim settlements, ultimately leading the framers to suffer both financially and mentally in the process. Lastly, prevalence of local pressure to manipulate the crop yields so as to make the area eligible for insurance claims [26].

To overcome the aforesaid issues, the application of remote sensing technology through remote sensing satellites and drones is crucial. It could not only be able to reduce the time gap between the calculation of Crop Cutting Experiments and claim settlements but also can be a helpful tool for the agronomists for the assessment of the real crop damage.

With respect to the drones, they are light-weighted, low-positioned, manually operated aerial vehicles with high resolution cameras with the ability to videos and pictures on a real-time basis. Drones, nowadays, are finding their widespread applicability in the field of agriculture and crop

management. The concept of precision farming has gained popularity due to the emergence of drones. Precision farming refers to the process of finding problems in specific regions. Their high-resolution pictures and low height positioning effectively help in the evaluation of the crop damage for the enabling of faster settlement of both the insurance claims and the pay-outs. These drones can further be placed at damage prone areas so that as soon as the information on damage in a specific location becomes available, these drones can ensure that the information gathered is reliable, accurate and timely. Agriculture Insurance Company of India (AIC), Skymet, and the Gujarat Government in 2014 ran an experimental operation for the groundnut crop by employing drones. They were able to obtain photographs just a few centimetres away from the agricultural farms, something not possible for the satellites.

The Ministry of Agriculture & Farmers' Welfare, Govt. of India has time and again devised various programmes for the usage of satellite data vis-à-visagricultural applications. These include *inter alia*, FASAL [27], CHAMAN [28], NADAMS [29], and, KISAN [30]. Under FASAL, pre-harvest productions at different levels, namely, district, state, and national is given using remote sensing data. Under CHAMAN, production assessment of major horticulture-based crop is done through various satellite data. Under, NADAMAS, assessment of agricultural droughts at the three aforesaid levels takes place by using several satellites and remote sensing data. Lastly, under the KISAN project, pilot studies are undertaken to look into the efficacy of utilising satellite data to improve yield estimation for crop insurance.

7. Areas for Improvement – Farmers Schemes:

The 4 Crop Insurance Schemes in India are Pradhan Mantri Fasal Bima Yojana, Unified Package Insurance Scheme (UPIS) as pilot in 45 districts, Coconut Palm Insurance Scheme (CPIS) and Weather Based Crop Insurance Scheme (WBCIS). The Pradhan Mantri Fasal Bima Yojana is the latest of the New Schemes.

Schemes – Deliverables and Their Targets at A Glance: Areas for Improvements:

One of its biggest room for improvements has been shifting the premium charged with as restricted per NAIS which is another scheme that was launched initially. Looking at amendments passed under the Farm Laws of 2020, where the Central Acts prohibited the State government to levy APMC a market Fee outside the notified run, we see the State Bills trying to trade outside the markets established.[1] The fees as accordingly decided was to be used for the welfare of small and marginal farmers. This enhancement could be for a good check about marginal farmers as it is a premium based however ensuring the scheme moves in a state-wise run framework be better. Additionally, with the government ensuring private companies such as ICICI Lombard to the forum for insurance-related deals, Statistics showed us that around 323 Lakh Farmers over an area of 450 Lakh Hectares were insured.[2] the need to reach out to this scheme and diversify it more accordingly to certain sectors is important.

The coconut Palm Insurance Scheme was approved for a selected area of Andhra Pradesh, Goa, Karnataka, Kerala, Tamil Nadu, Maharashtra, and other coastal areas where coconut palms were available [2]. With the IS being based on an average cost and a 25 % Premium by the Farmers, There is a big necessity to update these on a yearly and distribution wise framework. With the supply and demand being different in certain regions depending on weather and yearly stock supplies, The Farm Laws of 2020 do ensure that delivery of products can be made at farm gates within agreed time or farmer where the buyer would be the one supposed to prepare for timely acceptance. Disruptions in such chains and this rate of premiums should hence be updated depending on the monthly supplies and according to regions [31].

With an increase in private companies stepping up to provide Insurance to our farmers, the CPIS is being administered by the CDIB [32]. With our GDP ensured for agriculture remains 0.6 Percent of the total, there is a huge need to modify these figures according to the current Demands. The Farm bills of 2020 with its strengths seem to liberalize farming with a very short-term approach to doubling their current average monthly income. However, with the lack of policy-level support for transporting farmer produce, Insured Schemes are not going to benefit them. An additional Model should as well be constitutionalized that enhances transport delivery systems with a check on supply and demand to facilitate Insurance premiums delivered by Farmers on their crops.

With the advent of the PMFBY Scheme launched in 2016, it enhanced greater insurance schemes for farmers. One of its key areas for improvement required is statutory Audit that would be very cost-benefitting and would also help in stabilizing income [3]. As such means, these schemes were set to estimate the value of crops and not on the total quantity, and similarly, all such units were to be small and with a focus given to the rainfall distribution across that area. Even after large pay troughs, there are certain problems faced by Farmers regarding claims settlements. With there being anonymity with states not arriving at a consensus, there is a huge need to divide the digital gap and use the right technology through GPRS for maintaining the exact quantity of crop cutting experiments (CCEs) [33]. Using proper and modified ways can increase the rate for such assessments.

For proper working of such schemes, both sides involved in the deal should be able to understand the terms. With less engagement from the farmers, it limits proper agreement and satisfaction. Using a more channeled network and enhancing more intermediaries would help solve this. Another major room for improvement would be to develop cold-warehouses and storage workrooms to provide proper insurance coverage which in turn could be beneficial to reduce the cost of price Risk.[3] With the PMFBY adding to a greater profit to the insurance companies than sides involved, an important area of improvement would be to allow states more of its control.

Conclusion:

The scheme of crop insurance for farmers:

Various schemes of crop insurance have been launched since 1972, but they failed to meet the needs of farmers. As a result, many farmers are at a risk of committing suicide due to lack of basic standard of livings. Economic planning's first step is to increase the farm production and can be claimed by acquiring crop insurance schemes. The scheme ensures that those farmers whose crops would be damaged by natural calamities; compensation would be given for their losses. It is a crucial step for providing fertilizers for agriculture, increasing the credibility and more power to agricultural productivity. The recent scheme has failed in giving repayment of debt to the loss of crop even not letting them meet their need of consumption. The government is required to solve the matter in the scheme and help them access their financial resources in agricultural department.

It is important to look into the matters that are damaging the system of banks. Bank credit given to agriculture has gone down during the years 2017-18, which was found the main reason by the government for discouragement in lending. Banks are required to apply a fix deposit in agriculture according to the directive given by RBI [34].

National agricultural insurance group has made important declaration to deduct the major crops area of gram panchayat and giving yields, 80 to 90% coverage areas for sowing. NAIS has performed at a good intent in this area. Even though there are various improvement required at organization and functional level [35].

The farmer's bill in the year 2020 has been a hot topic for discussion. States such as Punjab, Haryana were protesting against the bill for the price to be assured and better trade and commerce. Farmers are referred as the backbones for the economy. Being an important element they were protesting for their own issues. Since privatization have come into notice, mandis and the minimal price for support has been discarded. This was one of the demerits for the farmers. Agricultural productivity requires slow and steady progress and the bill will increase markets forces, farmers will not be able to choose their own price for the crops, everything would be handled by the government. 13,000 crore were paid as premium by the kisan and received rs. 60,000 crore as a part of insurance. Four years have been completed by the scheme and has been introduced in27 states including the union territories, the amount that has been insured is almost doubled from rs 22,000 per hectare reached to rs 39,000 per hectare.

The role minimum price for support of farmers is used for steady and helping for adopting modern technologies in the field of farming. The only crop where MSP has procurement is sugarcane. The farmers were worried that the new law of farm bill will affect the minimal price of crops at a high rate, their beneficiation amount would be ceased, and therefore the farmers were worried about the adjustment in the bill. There basic area of income is farming and selling crops, privatization of this sector will create a barrier for the farmers, they will become helpless, and as a result, they will just be an ordinary person with no more support from the government [36].

References:

1. Rahul Tripathi, (2020) NCRB data shows 42,480 farmers and daily wagers committed suicide in 2019 Sep 01, from https://economictimes.indiatimes.com/news/politics-and-nation/ncrb-data-shows-42480-farmers-and-daily-wagers-committed-suicide-in-2019/articleshow/77877613.cms?from=mdr
2. Aayush Chowdhury, (2020) The Historical Background of Crop Insurance - Before and After Independence, krishijagran.com/historical-background-of-crop-insurance-before-and-after-independence
3. Parul Jeybalasingh, Nisha A, (2020) Crop Insurance in India: Evolution, Issues and Way Forward. https://www.researchgate.net/publication/343390925_Crop_Insurance_in_India_Evolution_Issues_and_Way_Forward
4. S. Yoga and Dr. K. Vetrivel (2012). Origin and Progress of Crop Insurance in India - A Historical View, February from https://www.researchgate.net/profile/Krishnan-Vetrivel/publication/334987963_Orgin_and_Progress_of_Crop_Insurance_in_India_-_A_Historical_View/links/5d49174ca6fdcc370a7f9155/Orgin-and-Progress-of-Crop-Insurance-in-India-A-Historical-View.pdf
5. Kumar, Anjani, Saroj, Sunil, Mishra, Ashok K. (2021), Crop insurance and crop productivity: Evidence from rice farmers in Eastern India , 20 January from https://www.google.co.in/books/edition/Crop_insurance_and_crop_productivity_Evi/WHIWEAAAQBAJ?hl=en&gbpv=0
6. Subhankar Mukherjee, Parthapratim Pal. (2017). Impediments to the Spread of Crop Insurance in India. Retrieved June 28,2021, From https://www.epw.in/journal/2017/35/commentary/impediments-spread-crop-insurance-india.html
7. Department of Financial services.2016. Retrieved on June 28, 2021. From https://financialservices.gov.in/insurance-divisions/Government-Sponsored-Socially-Oriented-Insurance-Schemes/Restructured-Weather-Based-Crop-Insurance-Scheme-(RWBCIS)
8. Crop Insurance- Coconut Palm, Retrieved June 28, 2021 from http://www.agritech.tnau.ac.in/ta/crop_insurance/pdf/2014/Coconut_Palm_topic.pdf
9. Coconut Develop Board launches Insurance Schemes, Retrieved June 28, 2021 from https://www.thehindu.com/news/national/kerala/Coconut-Develop-Board-launches-insurance-schemes/article14395076.ece
10. Schemes of Coconut Development Board, Retrieved June 28, 2021 from https://www.coconutboard.gov.in/Scheme.aspx#Insurance

11. Various Agro Schemes, Retrieved June 29, 2021 fromhttps://pmfby.gov.in/pdf/New%20Schemes-english_.pdf
12. General Profile of CPIS, Retrieved June 29, 2021 from https://www.aicofindia.com/AICEng/General_Documents/Product_Profiles/CPIS/CPIS.pdf
13. Agricultural Insurance, Retrieved June 29, 2021 from https://agricoop.nic.in/sites/default/files/AGRICULTUR%20INSURANCE-Credits.pdf
14. Unified Package Insurance Scheme (UPIS), Retrieved June 29, 2021 from https://vikaspedia.in/agriculture/agri-insurance/unified-package-insurance-scheme#:~:text=The%20UPIS%20will%20be%20implemented,renewable%20from%20year%20to%20year.
15. https://www.iffcotokio.co.in/micro-rural-insurance/unified-package-insurance-scheme#t
16. https://eparlib.nic.in/bitstream/123456789/702409/1/53325.pdf
17. https://vikaspedia.in/agriculture/agri-insurance/unified-package-insurance-scheme#:~:text=The%20UPIS%20will%20be%20implemented,renewable%20from%20year%20to%20year.
18. Agricultural Debt Waiver and Debt Relief Scheme, may 23, 2008
19. Anwarul Hoda and Prerna Tewray, "Credit Policy for Agriculture in India", Working Paper 302, Indian Council for Research on International Economic Relations, June 2015, accessed 15 April 2019.
20. National Agricultural Insurance Scheme (NAIS)
21. Report of the Comptroller and Auditor General on Performance Audit of Agriculture Crop Insurance Schemes," 2017, accessed 10 May 2019.
22. Pradhan Mantri Fasal Bima Yojana: An Assessment, Centre for Science and Environment, July 2017.
23. Ministry of Agriculture's PMFBY Data
24. Harish Damodaran, Explained: What is minimum support price (MSP), and how is it fixed?, The Indian Express, Sep 25 2020, https://indianexpress.com/article/explained/what-is-the-basis-of-msp-6609668/
25. Kirti Pandey, What is the Farm Bill and why are farmers protesting against it?, TIMESNOW NEWS, Dec 04 2020, https://www.timesnownews.com/india/article/what-is-the-farm-bill-and-why-are-farmers-protesting-against-it/689215
26. Gulati, A., Terway, P., & Hussain, S. (2018). Crop insurance in India: Key issues and way forward. Retrieved June 27, 2021, from https://www.thinkasia.org/bitstream/handle/11540/8052/Working_Paper_352.pdf?sequence=1
27. Forecasting Agricultural output using Space, Agro-meteorology and Land based observations, read more at: https://www.ncfc.gov.in/fasal.html

28. Coordinated Horticulture Assessment and Management using geo-informatics, read more at: https://www.ncfc.gov.in/po/chaman/srsc/2018-19/mp.pdf
29. National Agricultural Drought Assessment and Monitoring System, read more at: https://farmer.gov.in/nadams.aspx
30. Crop Insurance using Space technology and geo-informatics, read more at: https://www.ncfc.gov.in/kisan.html
31. Comparison of the 2020 Central Farm Laws with the amendments proposed by the States, PRS India. https://www.prsindia.org/theprsblog/comparison-2020-central-farm-laws-amendments-proposed-states
32. Agriculture Insurance Credits: Government of India – Ministry of Agriculture & Farmers Welfare https://agricoop.nic.in/sites/default/files/AGRICULTURE%20INSURANCE-Credits.pdf
33. Hindu Business Line : Improvement of Crop Insurance Coverage – MS Pillai https://www.thehindubusinessline.com/opinion/how-to-improve-crop-insurance-coverage/article30705320.ece
34. Ruchabah rai,Pradhan mantra fasal bima yojana: an assessment of india's crop insurance scheme,ORF, may 28 2019 https://www.orfonline.org/research/pradhan-mantri-fasal-bima-yojana-an-assessment-of-indias-crop-insurance-scheme
35. Shrikrishna s. Mahajan, growth of NAIS: a study of crop insurance in india, researchgate, January 201251370/https://www.researchgate.net/publication/257929206_GROWTH_OF_NAIS_A_STUDY_OF_CROP_INSURANCE_IN_INDIA
36. Shubham Sharma and Tanya Singh, understanding new farm bills,TDG, October 9 2020https://thedailyguardian.com/understanding-new-farm-bills/

STRENGTHEN AGRICULTURE THROUGH SERICULTURE INDUSTRY

Sarika R. Varpe

Department of Zoology,

K. K. W. Arts, Science and Commerce College,

Pimpalgaob B., Dist – Nashik, M.S., India

Corresponding author E-mail: sarikathube@gmail.com

The "Factual development in India can be achieved only through village development programs" said by Mahatma Gandhi Father of the Nation. For reaching goal of Rural development can be sustainable entrepreneurship with employment and income generation for the rural needy poor people is necessary. Scarcity of resources and illiteracy are the barrier to reach rural needy people. Various schemes were planned and executed by different government and non government agencies in rural areas for the sustainable development of agriculture dependents. In rural area lack of "Sustainable livelihood" is due to failure in Eradication of poverty and unemployment. A standard of livelihood comprises the capabilities, assets (stores, resources, claims and accesses) and activities required for a means of living. It is sustainable which can deal with and recovers from stress and shocks maintain and enhance its capabilities and assets and provide sustainable livelihood opportunities for the coming generation and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term. The rural development has been a major factor of sustainable livelihood by using available resources, manpower and technology. For The sustainable development in rural India women and unemployed youths are taken as the driving force. Strong rural urban linkages will not only help farmers stay back in villages pursuing profitable enterprises, it will also improve access to quality produce by urban consumer are the thoughts of late Dr. A.P.J. Abdul Kalam, who has advocated his concept of PURA (Providing Urban facilities in Rural Areas) sustainable development in rural India

In Asian countries 30% of the GDP contributed by single largest sector agriculture. There are certain evidences from various studies that about 70% of the terrible people live in rural vicinity and the reduction of rural poverty is still a number one purpose of the developing nations like in India. Thus far, numerous policies had been pursued to cope with this subject and a few of the most important ones is rural employment introduction. Sericulture is an agro-primarily based small industry in depth enterprise which affords gainful employment to the agricultural and

unemployed young people and enables to uplift the socio-economic status of small and marginal farmers. It's therefore necessary to focus on a broader spectrum of the rural financial system. The status of rural based agriculture corporation like poultry, apiculture , sericulture, out of this especially sericulture, could be very effective in creating new job opportunities and imparting income for his or her livelihood. Being a rural agro-based the Sericulture sector performs a critical position for checking the migration from rural to urban regions. due to it multifarious benefits along with excessive employment potential, rural base, exceptionally low capital requirement, checking migration to urban regions, meeting raw fabric desires of the silk weaving industry and as such advent of sericulture has been tried in several nations however it could be sustained most effective in a few nations. Considering the merits of the sericulture industry for inclusive growth and the sports aligning with the Millennium improvement desires, the authorities of India and the nation Governments have taken up various developmental programes for the development of sericulture and silk industry in India.

Silk is the most stylish fabric at the global level and called the "Queen of Textiles". On the other hand, it stands for livelihood possibility for millions as a result of high employment oriented, low capital in depth and remunerative in nature. The very nature of this industry with its rural based totally on-farm and rancid-farm sports and big employment generation potential has attracted the eye of coverage makers to apprehend the industry as one of the maximum appropriate avenues for socio-financial development of India.

India has a massive potential for sericulture development not like other agro industries when you consider that sericulture is a unique agro-based totally enterprise comprising of numerous additives such as mulberry cultivation, silkworm rearing, silk reeling and different related activities. Every of these additives look like unbiased but closely connected with one another having values of their own. The predominant stage of these components accommodates of mulberry food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for production silk items, subjecting them to the system of degumming, bleaching, dyeing, weaving and printing. Hence sericulture industry offers employment to approximately seventy five million in rural and semi urban regions in India, the economically weaker sections of the society, inclusive of ladies. Further to this, India has the particular credibility of manufacturing all of the recognized business silk viz., mulberry, tasar, eri and muga of which muga with its golden yellow glitter is specific and prerogative of India. Though silk is a luxurious object, its miles produced with the aid of the rural populace and acquired through city wealthy, inflicting cash to glide from city to rural. It also prevents rural people to migrate to city regions. The United country's latest undertaking "Millennium

development desires" has an 8 factor program to make our earth greater wholesome rich and unfastened from inequalities by using 2015. Sericulture being a rural and women pleasant enterprise aligns properly with a lot of those ideas which can be explained in detail in the this chapter.

Importance of sericulture in developing Nations:

The art of silk manufacturing is called sericulture that accommodates cultivation of mulberry, silkworm rearing and publish cocoon activities main to production of silk yarn. Sericulture gives gainful employment, monetary development and improvement within the satisfactory of life to the humans in rural location and consequently it plays an important role in anti poverty program and stops migration of rural humans to urban location looking for employment. Consequently numerous developing countries like China, India, Brazil, Thailand, Vietnam, Indonesia, Egypt, Iran, Sri Lanka, Philippines, Bangladesh, Nepal, Myanmar, Turkey, Papua New Guinea, Mexico, Uzbekistan and a number of the African and Latin American international locations have taken up sericulture to provide employment to the humans in rural vicinity.

Multipurpose use of sericulture:

Aside from silk, there are several other different products from sericulture. The mulberry fruits are rich in minerals and nutrients and from the roots, barks and mulberry leaves numerous ayurvedic and natural drug treatments are organized. A number of the woody mulberry timber offer wood which can be immune to termites and the wooden is used for making sports objects, toys etc. The mulberry branches after silkworm feeding are usually dried and used as gasoline in particular within the villages. The foliage of mulberry is used as a fodder for farm animals. The mulberry timber is also planted inside the embankment vicinity for safety of the soil to prevent soil erosion, and mulberry timber are planted as street bushes. The silkworm pupae are rich in oil content material and pupal oil is utilized in cosmetic enterprise and the ultimate pupal cake is a rich source of protein appropriate for hen and fisheries. In a few tribal populaces, the humans devour eri pupa as a source of protein and nourishment. The silkworm muddle is used for bio fuel production and used as a gasoline for cooking in the rural location. For that reason sericulture not simplest affords silk for stylish clothing's, it additionally provides several very useful bye merchandise to the human society. Therefore, sericulture improvement provides possibilities to enhance the residing requirements of human beings within the rural place in developing countries.

Future demand for silk industry:

The existing international silk manufacturing is fluctuating round 70, 000 to 90, 000 metric tons and the call for silk is yearly growing via 5%. With the increase in population and additionally with the expanded call for stylish apparel objects due to fast changing style designs in advanced international locations, the call for silk is sure to increase even extra. For growing the silk manufacturing we require fantastically effective mulberry types and silkworm races and additionally silkworm races tolerant to damaging climatic conditions and sicknesses that can come specifically from the sericultural germplasm assets and also from the wild family of Bombyx to be had within the natural habitats.

Challenges:

The Indian silk enterprise is an important a part of the Indian fabric industry and is some of the oldest industries in India. Sericulture with its special features performs a widespread function in upgrading the socio economic situations of the agrarian human beings and selected agrarian organization in India. In India, each agriculture and agro-primarily based cottage industries ought to face numerous problems concerning corporation, advertising and marketing, finance, generation, extension and many others. Sericulture, being an agro-primarily based industry, is likewise not free from these troubles. Nobody specific methodological technique suffices to estimate the contributions of the sericulture quarter to monetary and social improvement. The diverse analytical frameworks provide a fixed of complementary techniques which whilst nicely applied, can help to improve knowledge of the contribution of the sericulture quarter to national monetary development and to the livelihoods of the local populations. Recommendations the following measures would be endorsed for adoption to be able to counter the highlighted challenges and enable growth and prosperity of the sericulture enterprise in India:

- The government has to set clear rules and techniques that purpose at promoting the sericulture enterprise in India.
- The Sericulture research and Extension institutes have to create regionally adaptable breeds so that it will enhance silk satisfactory and productivity.
- Farmers have to gradually study and properly geared up with proper fine control measures and equipment for the duration of silkworm rearing.
- Personal buyers inside the enterprise must be relatively recommended and influenced to boost the world.
- Processors ought to manufacture great, fee, flavor, layout, and quantity oriented silk merchandise that could compete in the local and global markets.

- Introduction and promotion of neighborhood and international markets ought to be practiced by using developing systems and groups that sensitizes and streamlines the advertising of silk merchandise.
- As soon as the cocoon yield and exceptional is excessive farmers and processors have to be empowered to practice cost addition which will gain a aggressive edge for their merchandise in the market.
- Develop new bloodless and drought tolerant mulberry sorts.
- Increase silkworm races to undertake for extended temperature coupled with high moisture conditions.
- broaden powerful management machine for silkworm sickness prevention/manipulate as excessive temperature and moisture sell faster boom of pathogens.
- Expand suitable strategies to manipulate excessive humidity and CO2 each at some stage in rearing and cocoon spinning. Developing low-cost conditions the farmers to be interested and capable of make extra capital investments in improving the mulberry cultivation and silkworm rearing centers.

Sericulture plays a vital function in the process of economic improvement of India. Besides presenting distinctive type of food to the kingdom, sericulture releases labour, gives financial savings, contributes to marketplace of business goods and earns forex. But, sericulture turned into the primary business tread contributor to the national sales at the time of independence of India. The sericulture industry is more worthwhile to the economic system directly and not directly. The changes in the area are being induced via elements like new located hobby of the organized sector, new and stepped forward technology, mechanized farming, speedy boom of agreement farming, organic farming etc. Now, India is going through a vital state of affairs with regards to land-use making plans as the various ranges and types of deterioration springing up especially from unsustainable use and mistaken land management practices. Destruction of flowers takes place as a result of deforestation, cutting past the silviculturally right limits, unsustainable fuel timber and fodder extraction, putting off cultivation, intrusion into woodland lands, woodland fires and overgrazing, all of which problem the land to degradation forces. Other crucial causes accountable for huge scale degradation are: non-adoption of suitable soil conservation measures, wrong crop rotation, extensive use of agro-chemical substances along with fertilizers and insecticides, unsuitable design and management of irrigation systems and extraction of groundwater in excess of the recharge potential etc.

References:

1. Chappell MJ, Wittman H, Bacon CM, Ferguson BG, Barrios LG, Barrios RG, Jaffee D, Lima J, Méndez VE, Morales H, Soto-Pinto L, Vandermeer J, Perfecto I (2013) Food sovereignty: an alternative paradigm for poverty reduction and biodiversity conservation in Latin America. F1000Research, 2:235.
2. Fresco LO, Westphal E (1988) A hierarchical classification of farm systems. Expt Agric. 24 :399-419.
3. Himanshu H., Lanjouw P., Murgai R., Stern N., (2013) Nonfarm diversification, poverty, economic mobility, and income inequality: a case study in village India. Agricultural Economics, 44: 461-473.
4. http://www.wbcsd.org/templates/TemplateWBCSD5/layout. asp?MenuID=1 (Accessed 11.05.11).
5. Karthik T, Gopalakrishnan D (2012) Eco-friendly fibres of the future. Asian Text J. 21: 67-71.
6. Karthik T, Gopalakrishnan D (2013) Impact of textiles on environmental issues, Part-II. Asian Dyer 9: 45-51.
7. Madhusudhan L (2015) Agriculture Role on Indian Economy. Bus Eco J, 6: 176
8. Pezzey J (1989) Economic Analysis of Sustainable Growth and Sustainable Development. Washington DC. World Bank, Environment Department Working Paper No 15.
9. Rosenbaum M (1993) Sustainable design strategies. Solar Today
10. WBCSD, World Business Council for Sustainable Development– vision 2050, 2011.

AGRO TOURISM A NEW PROSPECTUS FOR AGRICULTURE DEVELOPMENT

Abhijeet Bajirao Pawar

K.S.K.W. Art's Science and Commerce College Cidco,

Nashik, Maharashtra

Corresponding author E-mail: abhipawar77@rediffmail.com

Agro tourism:

Today, allow us to discuss agriculture tourism in India and the want for agro tourism. Agro tourism is the one this is trending worldwide presently. This makes the city human beings get out of their daily habitual and go back to their rural roots. It might be a very good marketplace for tourists. There may be a thing of training as it includes interplay with individuals. Individuals will start enjoying the processes and additionally studying about the numerous gadgets. Agricultural tourism is turning into a crucial part of the improvement of tourism and brings again the human beings who've absolutely moved to urban areas and misplaced touch with agriculture. Tourism in agriculture is the one that has a hard and fast of social and monetary sports which arise. Their merchandise, reports, and services will get related to journey.

In line with a world travel & tourism council (WTTC) file posted in 2015, the full contribution of tour and tourism region to global GDP was about seven hundred and seventy three billion dollar. It contributed round 9.8% to the global GDP and was higher than other full-size sectors like agriculture (8.5%). The demand within the present state of affairs is for an inclusive and sustainable development and is therefore strongly linked to the increase in agriculture and the rural economic system. It capitalizes at the mixed blessings of improvement in both agriculture and tourism

Agro tourism is the one which makes human beings stay near the functions of the farm that will display the works and all the activities that take area inside the each day commercial enterprise of agriculture. It can be the nice opportunity to get enjoy and also get to recognize about the way of life of the farmers and how it's far special from those who live far away from rural areas. This brings loads of schooling to the humans as they get to view all these farming functions in lovely and peaceful locations.

Activity in farms will include the activities which arise on lands of agriculture, which may insist the people live wide awake overnight, and also few activities of training. This unique category of tourism is one of the sections of a large enterprise referred to as agro-tourism.

Agro tourism is an agency that is set up for an industrial purpose on a functioning farm for the enjoyment of the travelers or traffic which might generate further profits to the proprietor.

Agro tourism is one of the sections of a bigger industry known as rural tourism, to be able to again consist of hotels, markets of the off-website online farmers, agricultural excursions which are performed anticipating no income, enterprise which can be made for the amusement and hospitality of the traffic which come from the nation-state. There are differences between rural tourism and agro tourism.

The corporations of rural tourism will not vicinity at the farm or agricultural plant necessarily. Rural tourism will not offer any sort of extra profits to the proprietors.

According to Veeck et al. **[6]** defining agricultural tourism is something akin to the blind men and the elephant, but there is general agreement that agri-tourism incorporates visits to farms for the purposes of on-site retail purchases, enjoyment, and education (cooking classes, flower classes, and farm history among others **[7]**. Participating farmers hope for significant and steady retail sales, but the components of entertainment and education that are also provided make agri-tourism more than simply a relocation of retail sales to a family farm. Long important in the European Union (EU), agro tourism is gaining popularity throughout the United States. Interest has grown as a result of stagnant staple prices, rising farm costs, and growing international competition. Agro-tourism has not spread much across the states of India and is still concentrated in western belt of Maharashtra. Agro-tourism is still a small scale venture and has low impact on macro economy of India **[1]**. It is slowly growing in some states like Karnataka **[2]**, Punjab **[3]**, Kumar **[4]** and Rajasthan **[5]**. Thus, it can be observed that there is a wide scope for the concept to grow in all agricultural states of India as the market is not at all saturated and is in fact virgin in many of the states like Uttar Pradesh, Bihar and Andhra Pradesh which are prominently agri-driven states of India. As suggested by Veeck et al. **[6]** agriculture has always been an uncertain business. Global trade patterns have changed dramatically in recent decades for all agricultural commodities, including corn, barley, sorghum, rice, wheat, soybeans, cotton, tobacco, fruits, vegetables, essential oils, and other specialty crops such as honey.

The need of Agro tourism in today's era:

Nature is an open opportunity for gaining knowledge of without any closed doors or partitions. If nature is observed carefully, you could discover the treasures which can be hidden in it and get to understand more matters approximately it. As India is a rural area dominant

country that has a majority of the population depending on agriculture, human beings could get to study extra records from it. The population belonging to city regions is growing on a day by day foundation and the youngsters belonging to the urban households are capable of view nature on television. That is due to the fact they are very much confined to closed buildings, video, video games, junk meals, the internet, and all the sports which could smash them physically and mentally. People dwelling in city regions also stopped visiting their family in rural regions as they got habituated to a relaxed life inside the cities. In recent times, agriculture is becoming an enterprise and maximum of the poor humans are not in a role to have enough money it. There is additionally a gradual decrease inside the fertility of the soil and land which is decreasing the yields. There may be a first-rate need for the farmers to begin a business that would aid the farm by using producing profits and additionally make the humans recognize about the importance of agriculture and the life of farmers.

Importance of agro tourism:

Now A days agriculture is being commercialized via completely concentrating on big productions; agro tourism will supply an possibility for the farmers to percentage the works performed on a farm with the individuals. Agro tourism will permit the farmers to sell the greens or every other product grown at the farm to the travelers or traffic. This will once more be a supply of profits for the farmers. The training has completely covered the technology guides to a more quantity and because of this, kids will develop with none sort of expertise regarding the cattle or farm life. Hence, tourism in agriculture will give a possibility to the kids to learn about the farm tradition to a degree at least.

Benefits of agro tourism for the farmers:

There would be a chance for the farmers to extend the operations of farming. There would be a boom within the sales of the farm. There might be development in the customer markets and as an end result, employment increases. The awareness about the rural items which are produced locally will boom. Human beings dwelling in city areas will get to recognize approximately the importance of agricultural land. The dwelling conditions of the farm will growth, which would, in turn, lead to a growth inside the possibilities for farm recreation. The competencies of management and the spirit of entrepreneurship can be progressed. The businesses of the farm will have a possibility to preserve themselves for a long term.

Advantages of agro tourism for the communities:

It generates supplementary profits for the neighborhood corporations as they need to offer offerings for site visitors or tourists. There could be an improvement within the centers of the

groups for the sake of tourists. There could be a development in the protection of the landscapes in the rural regions as it needs to serve the travelers. The traditions which can be observed regionally in phrases of art and craft may be preserved as they may have a possibility to create markets if tourism is developed. This promotes inter-local and intercultural conversation. There could be an increase in recognition approximately the issues associated with agriculture and also the values accompanied. The neighborhood products and services which can be a part of agriculture can be promoted. The rural financial system may be bolstered which could create earnings via jobs.

Blessings of agriculture tourism for tourism operators: there might be a chance to mix the products and services of tourism to site visitors. Tourism might be improved even in rural areas. Tourism markets can have a completely unique location in rural regions the length of the season will boom particularly in the off-top commercial enterprise instances that are historically followed. The foreign money, which is non-local, might be flowing into the companies which are set up inside the rural areas.

Advantages of agro-tourism for the humans residing away from farms:

The farm that's part of agro-tourism will provide urban people to interact with nature. Although they without delay will not take part within the farming activities, they would watch carefully the operations of farming and get to recognize approximately the importance of it. Site visitors can also enjoy the scenic beauty of nature and farming. Farming will create an opportunity for tourists or visitors to find out about how farming operations are carried. It additionally allows teaching visitors approximately a way to integrate tourism and the upkeep of the environment.

Monetary fulfillment of agro tourism:

Agro tourism is developing at an average fee of 20% in line with annum in India. The rural and allied sectors contributed 32.65% to the GDP's of Rajasthan in 2014-15 at cutting-edge costs and witnessed average of 13.5% over 2004-15, indicating the developing significance of this area to economic increase. The agricultural zone contributed round 9.86% to Sikkim's GDP's in 2014-15. Haryana agricultural minister, O. P. Dhankar said on March 16, 2018, that the country government changed into considering starting agro tourism except setting up 340 'Bagawani villages'. Ganpat Parthe, a farmer who is into cultivation of strawberries, mulberries and rasberries from Bilhar, Maharashtra stated, "my profits has gone up by way of 20-30% in the remaining couple of years due to agricultural tourism. It facilitates me cowl losses which might be at instances incurred at some point of farming." Raju Bhandarkavayhekar, who runs an agro tourism centre at Solapur, Maharashtra stated, "we had been walking the centre when you

consider that 2002 and it attracted more than 6000 vacationers ultimate yr. We need to make bigger however do no longer have sufficient monetary assets." Pandurang Taware, director, Baramati agri and rural tourism training, studies and development centre, Maharashtra knowledgeable that if 10% of domestic vacationers in Maharashtra journey to agricultural tourism centers inside the kingdom it can emerge as a rupees 2800 crore industry.

The scope of agriculture tourism:

Agriculture is the spine of the Indian economy. Around 75% of the population is at once or not directly dependent on agriculture and almost 26% of India's GDP comes from agriculture. Then again, tourism is named as tool for employment generation, poverty alleviation and sustainable improvement. So including additional profits generating activities to the existing agricultural area could truly boom the contribution of agriculture to the countrywide GDP.

In agro-tourism, the fees of accommodation, food, and tour might be very low. That is to decorate the tourist population. The modern idea of travel and tourism is simply to urban areas which might be just a section of the population. Hence, the agro-tourism will take journey and tourism to a huge populace so one can decorate the scope of tourism. The urban population, which has their roots in the rural areas, will continually show interest in getting to know approximately the assets of meals, wood, languages, arts, crafts, attire, and many others. Agro-tourism will satisfy the urban population who are curious to find out about farming. Rural areas will supply an opportunity for endeavor at a low price to the kids, center and low-elegance households. The gala's, dresses, games which can be conducted as part of agro-tourism will entertain the complete own family. The human beings living in urban regions have a way of life that consists of strain due to which the common existence span has decreased. The individuals seeking to earn extra to live a at ease life, because of which they work for more hours and miss peace in their lives. Agro-tourism will help these humans to obtain peace as it'd be far from these types of polluted regions. The city populace is attempting to find the way of healthful dwelling and interplay will villagers would assist them to understand approximately their clinical expertise which is indigenous. The ingredients that are cultivated organically have an awful lot demand some of the urban populations due to which they're coming near the villages for the answers. The urban populations who have a busy lifestyle are continually trying to be near nature in their free time. Mountains, crops, rivers, lakes, birds will make the city population neglect about their busy lifestyles and be close to nature. The city population is overcrowded and therefore as they do now not want to disturb each other's peace, they're going beyond the towns for the sake of motels. Good efforts are made to create the village atmosphere inside the name of resorts

wherein farmhouses are built which would be the same as the farms. Agro-tourism in the future could convey a miles urban population to farming with the intention to technically enhance the farming operations. As agro-tourism makes the humans believe inside the magic of nature, this would now not simplest assist the humans commercially but also the agriculture operations boom. Offerings/activities of agriculture tourism Pastime in out of doors areas. Rides on bullock cart. Kabaddi, langadi ,bullock ploughing, Driving on horseback, Buffalo riding looking the animals which are grown at the farm for domestic use. Fishing in rivers or lakes or ponds, Tenting/picnicking (blended) rides in jeep, games inside the rural areas using bikes on the off-street gotya sensible experiences of the schooling. Excursions with colleges excursions to gardens or nurseries, Excursions to wineries, Agro-technical excursions exhibitions of agriculture in records. Tours and visits to chicken farm, Visits to sugar manufacturing unit. Visits to wine or liquor manufacturing unit silk formation can be considered. Entertainment within the shape of festivals of harvest etc. offerings of hospitality encompass live at the farm, courses for the tourists and many others. Sales of the farm products at once.

Principles of agriculture tourism agro tourism should ensure that the under principles are observed: the appeal is within the shape of each visual and bodily: agricultural tourism must make sure that the site visitors or the vacationers are provided with something that's specific to the sight and also the feeling which comes physically. As an example, exact grains or oilseeds are grown in various ranges, medicinal flowers, diverse greens, culmination, plant life, animals; lakes will entice the children and the kids. Crafts, games, art, apparel will create enough hobby and excite many travelers.

Participation and involvement of the travelers: agro-tourism has to be in this sort of way that it gives an opportunity for the visitors or travelers to take part inside the activities of the farm. The farm activities might be like ploughing, harrowing the fields, buffalo driving and cooking, and making crafts so they could experience. Provision of income counter: there ought to be a choice to choose and choose the cultivation that's done by using the farmers of their very own choice. Right here, the travelers will harvest the produce of their very own desire on the idea of fee. Hence the farmers can sell the food grains, seeds, veggies, culmination, and many others.

Primary factors of agriculture tourism:-

There are some predominant factors that make contributions to the achievement of agro tourism. The farmer is the first one within the important elements of agro-tourism. He is the only who isn't educated properly and is likewise harmless. He treats the visitors with the utmost appreciate and with a complete coronary heart. He not handiest entertains the guests but also

entertains himself whilst explaining to the tourists or visitors approximately the farming method. The farmer isn't a businessman which itself makes the touristy atmosphere clean and natural. The village is the only which is very a long way from the cities and has only a few centers which might be provided within the city areas. The funding for agri-tourism is made by means of nature itself in the form of water-our bodies, mountains, plants, and so on. The villagers, while given a responsibility to host people, will deal with the visitors with due respect as they take into account it as a part of their lifestyle. The assets of agriculture which are within the form of land, plants, and water may be unique and will be converting from area to vicinity. Each agricultural discipline is distinctive which pulls travelers in a extraordinary way.

References:

1. Deepika C, Sharayu B. (2012). Socio-economic implications of agri tourism in India. Paper read at International Conference on Innovation, Trade and Economics–ICITE.
2. Hamilpurkar S. (2012). Agri tourism in Karnataka-issues constraints and possibilities. International Journal of Research in Commerce, Economics and Management. 2(7): 106-111.
3. Pinky S, Kaur R. (2014). Prospects and Problems of Agri-Tourism in Punjab State. International Journal of Advanced Research. 2(9): 66-73.
4. Kumar D, Mehta SK, Godara AK, Hudda RS, Sharma S. (2010). Prospects of agritourism in Haryana. Haryana Journal of Agronomy. 26(1-2): 53-54.
5. Mehta P. Farm Tourism in Rajasthan booming. Tourism & Travelogue. 2011.
6. Veeck G, Che D, Veeck A. (2006). America's changing farmscape: A study of agricultural tourism in Michigan. The Professional Geographer. 58(3): 235-248. doi: 10.1111/j.1467-9272.2006.00565.x
7. Small Farm Program. Agritourism(2004). University of California. 2017.

EFFECTIVENESS OF VETIVER GRASS CONSTRUCTED WETLAND TECHNOLOGY FOR THE TREATMENT OF SPRAY PAINTING SPENT WASH FROM AUTOMOBILE SERVICE STATIONS

G. Dhanya*, Vinod Gopal V and D.S. Jaya

Department of Environmental Sciences, University of Kerala

Kariavattom Campus, Thiruvananthapuram.PIN-695581, Kerala, India

Corresponding author E-mail: gdhanyakrish@gmail.com, gopalvinod85@gmail.com, jayvijayds@gmail.com

Abstract:

Untreated wastewater discharge is the main reason forsoil and water pollution. Constructed wetland technology is an emerging and acceptable wastewater treatment methodas. It can effectively remove all most all types of pollutants without harming the environment. The aim of the study was to find out the effectiveness of constructed wetland technology with Vetiver plants for the treatment of Spray Painting spent wash from Automobile Service Stations. The vetiver plants were planted in the constructed wetland. After 90 days of growth, the test group plantsare treated with 250mL of spray painting spent wash on alternate days and are allowed to grow for further 15 days. After the experiment the treated effluent from the tank was collected and finds out the changes in physico- chemical characteristics as well as the concentration of heavy metals. Results show that an average of more than 63% of the total pollution load including heavy metals in the spray painting spent wash was eliminated within 15 days treatment in constructed wetland. So vetiver-constructed wetland technology can be considered as an effective, low cost, eco friendly technology for sewage treatment.

Keywords: Constructed Wetland Technology, Phytoremediation, Spray painting spent wash, Vetiver Grass, Wastewater Treatment.

Introduction:

Pollution, so called the other side of development, is the only threat behind all direct and indirect environmental issues that weare facing today. Almost all developmental actions accompany utilization of natural resources and disposal of a wide variety of waste products, at the greater extent that has irrevocably ruined the sanctity of Mother Nature (Bhatia, 2001). It's the fact that 71% of the total surface area of Earth dominates by water (OECD, 1975). So it is

quite common, water is also extremely susceptible to pollution. Even though industries are significant contributors of the economic prosperity and development of any country, pollution resulted from those activities, dumping of untreated or partially treated industrial waste into nearby land or to water bodiescan very easily pollute people and environment (Dashmishra, 2011).

The rapid urbanization and industrialization in India have doubled the vehicle fleets in the last one decade (CPCB, 2021). As the vehicular population increases, through automobile service centers, there is a sharp hike in wastewater generation from the service stations. Automotive services and repair shops are considered as the largest small quantity generators of hazardous wastes (Abidemi, 2011) and are considered as industrial wastewater and are very difficult to treat or recycle, serve as the major contributor to the environmental problems especially to soil and water as it may contain highly toxic substances including heavy metals and can result in major human health risks as its concentration increases through food chain (Yamuna *et al*., 2004). Treatment of wastewater and its final discharge to water bodies or to land is so important that to regulate any adverse impact on life supporting systems- both biotic and abiotic.

There are several methods for the treatment of wastewater such as activated sludge and biological nutrient removal technologies or otherwise by several chemical methods but which may lead to secondary contamination and all of them are labour intensive, costly and created serious environmental damage (Salt *et al.,* 1998). Vegetative methods (phytoremediation) are thought to be most practical and economical than any other methods. It is the clean-up of contaminated sites (air, water or soil) with the help of photosynthetic hyper-accumulator plants and associated microbes through mechanisms such as phytostabilization, phytoextraction, or rhizofiltration and phytovolatalization, which living plants and associated microbes alter the chemical composition of soil matrix into a harmless form through isolation, uptake, accumulation, degradation, and metabolism of contaminants (Negri *et al*., 1996).

The well accepted constructed wetland technology was first developed by Dr. Käthe Seidel in Germany in 1950s and the first full-scale systems were put into operation during the late 1960s (Vymazal, 2011). There after plethora of studies reported that constructed wetlands are very powerful for treating many types of wastewaters containing heavy metals, petroleum products, pathogens etc. (Cooper *et al*., 1996; Crites *et al*., 2000; Forster, 2003; Brix, 2003).

The present study was carried out in the Department of Environmental sciences, Kariavattom Campus, University of Kerala, Thiruvananthapuram. Thiruvananthapuram, upcoming metro city, is the capital city of Kerala State in South India. Thiruvananthapuram city

ranks second in terms of number of vehicles in Kerala. Vehicular population during last year was 16, 64,565 (12.5 per cent) and the number of accident was 1214 (http://www.kerenvis.nic.in/Database/INFRASTRUCTURE_1419.aspx;https://tvmcity.keralapolice.gov.in/public-information/crime-statistics/road-accident). So there is a sharp increase in the number of servicing centres also reported. The painting and associated works are of great importance in contributing to the pollution of land and inland surface water bodies in urban and rural areas.In view of this, study was attempted to evaluate the physico-chemical characteristics of spray painting spent wash and effectiveness of wastewater treatment in constructed wetland with vetiver grass in order to achieve the effluent discharge quality specified by various agencies before disposal to land/ nearby water bodies.

Materials and Methods:

a. Plant materials

The experimental plants used for the study was Vetiver grass (*Vetiveria zizanioides* L. Nash); in Kerala popular as Ramacham, a common medicinal plant. This high- tolerant hyper accumulator plant belongs to the family 'Graminae' (Poaceae), subfamily 'Panicoide', tribe 'Andropogoneae' with common name 'Khus-Khus' in India (Green field, 1987). Vetiver grass is a perennial fast growing, highly grass, well known by the effectiveness in phytoremediation over the past several years in several countries including India (Dhanya and Jaya, 2013; Badejo *et al*., 2018; Darajeh *et al.*, 2019).

The experimental plants used for the present study was native wild Vetiver plants [*Vetiveria zizanioides (*L.) Nash] are procured from the medicinal garden in Kariavattom Campus, University of Kerala, Thiruvananthapuram (Figure 1). The plants are removed from the propagating soil and surface sterilized with distilled water to remove any adhering soil and dried in air. Then the tops and roots of the vetiver sprouts were pruned to 10 cm and 5 cm respectively, and planted in constructed wetlands for experimental studies.

Figure 1: Vetiver Grass (*Vetiveria zizanioides* L. Nash)

b. Wastewater Sampling station

Thiruvananthapuram district lies in the southern part of Kerala extending between the latitudes 8° 17' 25" to 8° 51' 46" N and longitudes 76° 40' 25" to 77° 17' 6" E. Automobile spray

painting spent wash for the study was collected with the help of painters in a workshop at Kazhakkuttom, where the crude painting wastewater was negligibly drained out to nearby land and wetland area. The homogenous wastewater was collected using a plastic bucket into clean dry plastic containers of 10 L capacity. For the analysis samples were collected in clean poly-ethylene bottles. Temperature and pH of the samples was recorded at the collection point itself. For DO and BOD determination, samples were collected in the labelled BOD bottles and fixed with Winkler's reagent at the site itself. All these samples were brought to the laboratory and analyzed for various physico-chemical characteristics following the standard procedures for wastewater analysis. The wastewater samples for the experimental study were kept in the refrigerator to avoid the changes in physico-chemical characteristics. For the determination of heavy metal analysis samples were preserved by treating with HNO_3 to a pH less than 2.

c. Experimental Design

The wetlands are constructed according to UN-HABITAT (2008) in plastic tanks having 50 litres capacity with drainage facility (tap at the bottom) by filling the base with gravel (20-40mm) up to 8 cm height. The next layer was filled with gravel (5-10mm) to a height of 3 cm. Then the thick sand was used to fill the next layer to a height of 25 cm and again the gravel (5-10mm.) was used to fill the top layer of 3 cm height. The tap water was poured into the tanks so that the water column was 10cm above the soil bed and kept for 1 week for acclimatization. Then drained out all the water from the tanks and six clumps of vetiver grass, (*Vetiveria zizanioides* L. Nash) were planted in each tank and were maintained in the controlled condition for growth. All the plants were watered daily with sufficient amounts of tap water for growth and acclimatization. After one month growth, the tanks were loaded with tap water until the water level was 10cm higher than the soil surface to create a constructed wetland system.

The vetiver plants were allowed to grow under controlled conditions for three months to attain minimum maturity. After 90 days, the water was completely drained out from the crates and 15 L of spray painting spent wash was loaded directly. The experimental plants were allowed to grow for further 15 days. The total experimental period was for 105 days. Duplicates of the experimental groups were also maintained. After the experimental period of 15 days, the treated water in the crates were drained out and collected to find out the changes in the various physico-chemical characteristics by following the standard procedures.

d. Methodology

Water and Wastewater Analysis

Various physico-chemical attributes (Table 1) of tap water and wastewater samples were analysed following the procedures in APHA (2012) and by Trivedi and Goel (1998). Concentration of nutrients (sodium and potassium) was determined using a Flame photometer (ELICO, Model CL 360). The heavy metal analysis of wastewater samples was determined using an Atomic Absorption Spectrophotometer (Perkin Elmer, PinAAcle 900H, USA). All the bio-chemicals and chemicals used for the estimations were of analytical grade. The statistical analysis of the data of the experimental study was done by paired sample t-test using SPSS 17 software.

Results and Discussion:

a. Water and Wastewater characteristics before treatment

The result of the analysis of physico-chemical characteristics and heavy metal contents of spray painting spent wash before and after treatment in the constructed wetland system with vetiver plants are given in Table 1. The study showed that various physico-chemical characteristics of tap water before and after the experimental period in the wetlands are within the permissible limit of Indian Environmental Standards (Raman and Devotte, 2006) and Environment Protection Act (EPA, 2002). But after the experimental period there was a slight variation (increase and decrease) in their values. But the changes are not significant.

The result showed that the spray painting spent wash was highly polluted. Concentration of majority of water quality indicators such as pH, TDS, CO_2, DO, BOD, COD, TN, TP, $(SiO_4)^4$, $(SO_4)^2$, Ca^{2+}, Mg^{2+},K^+, Fe^{2+} and heavy metals such as Pb, Cd, Cr, Zn, Hg and As As in the wastewater was above the standard permissible limits for effluent discharge set by various agencies such as EPA (1996) and Indian Environmental Standards (IES, 2006). Physico-chemical characterisation of the wastewater (spray painting spent wash) showed that it is highly polluted and should be treated properly before its disposal to the land or water bodies.

Changes in the Physical characteristics of spray painting spent wash.

The result showed that a considerable reduction (73.91%) in the intensity of colour of the wastewater after 15 days treatment in constructed wetland with vetiver plants. Colour was reduced to 60 HU after treatment and before it was 230 HU. It was also noted that even after significant reduction, the intensity of colour of the effluent was above the standard permissible limit of discharge (unobjectionable) prescribed by the Indian Environmental Standards (2006). This marked reduction in the intensity of colour shows the efficiency of wastewater treatment. The reduction in the concentration of colour is due to filtration of wastewater by the fibrous roots of vetiver plants and also by the absorption of nutrients by the plants and adsorption by the bed materials of the constructed wetland. Bacterial degradation of organic and inorganic contaminants is also play an important role in the reduction of colour of wastewater (Stottmeister *et al*., 2003; Brix, 2003).

Table 1: Physico-chemical characteristics of water and wastewater after experiment in Constructed wetland

Sl. No.	Parameters	Before Treatment		After Treatment		Percentage Removal (%)	Standard permissible limit	Referred Agency
		Tap water	Waste water	Tap water	Waste water			
1	Colour (HU)	U.O	230	U.O	60	73.91	Unobjectionable	IES (2006)
2	Total Dissolved solids (TDS)	67	4460	61	1025.8	77.00	2100 mg/L	EPA (1996)
3	Total Oil and Grease (TOG)	BDL	137.6	BDL	29.61	78.48	10 mg/L	EPA (1996)
4	pH	6.9	5.61	7.21	7.51	1.49	5.5-9	IES (2006)
5	Electrical Conductivity (EC)	217	4970	211	775.13	84.40	1500 *µS/cm*	EPA (1996)
6	Biochemical Oxygen Demand (BOD)	BDL	14.82	0.98	3.48	76.51	30 mg/L	EPA (1996)
7	Chemical Oxygen Demand (COD)	BDL	963	2.43	251.63	73.87	250 mg/L	EPA (1996)
8	Total Hardness (as $CaCO_3$)	52.0	1160.1	BDL	462.07	60.16	300-400 mg/L	IES (2006)
9	Total Nitrogen (TN)	BDL	16.7	0.44	8.61	48.44	100 mg/L	EPA(1996)
10	Total Phosphorus (TP)	BDL	3.27	0.047	1.02	68.80	<2 mg/L	IES (2006)
11	Sulphate (SO_4)	68.7	72.3	0.31	22.67	68.64	250-400 mg/L	IES (2006)
12	Chloride (Cl^-)	56.6	1235.4	2.08	599.29	51.49	1500 mg/L	IES (2006)
13	Ca (as $CaCO_3$)	36.0	1082.2	1.38	424.59	60.76	75 mg/L	IES (2006)
14	Mg (as $CaCO_3$)	21.4	77.94	1.44	29.56	62.07	75 mg/L	IES (2006)
15	Sodium (Na)	5.9	115.6	9.6	47.61	58.81	<460 mg/L	IES (2006)
16	Potassium (K)	0.7	85.4	3.1	35.77	58.11	<2 mg/L	IES (2006)
17	Iron (Fe)	0.62	1.2	0.98	0.39	67.50	3 mg/L	IES (2006)
18	Lead (Pb)	BDL	1.231	BDL	0.571	87.06	0.1 mg/L	IES (2006)
19	Cadmium (Cd)	BDL	0.792	BDL	0.599	58.17	0.1 mg/L	IES (2006)
20	Chromium (Cr)	BDL	2.132	BDL	1.526	67.05	0.3 mg/L	IES (2006)
21	Zinc (Zn)	BDL	4.542	BDL	1.113	87.33	5.0 mg/L	IES (2006)
22	Mercury (Hg)	BDL	0.453	BDL	0.097	81.05	0.01 mg/L	IES (2006)
23	Arsenic (As)	BDL	0.512	BDL	0.116	78.75	0.2 mg/L	IES (2006)

U.O (Un Objectionable); HU (Hazen units); EC (µS/cm); and all other parameters are in mg/L

Total dissolved solids (TDS) is the various kinds of minerals present in water. TDS of the effluent after treatment was recorded as 1025.8 mg/L and the corresponding reduction in percentage was 77.00 ($p \leq 0.002$) and it is with in the standard permissible limit (Table 1). According to Sundaravadivel and Vigneswaran (2001) and Hoffmann *et al*. (2011), the bed materials in constructed wetlands have a capacity to act as a mechanical and biological filter surface area of the stem and rootsalso traps fine materials. The soluble organic matter in the influent increases the total solid content, is fixed or absorbed by bio-films on stems, roots, sand particles etc. and are degraded due to the action of these attached bacteria. All organic matter will degrade and stabilize by biological processes driven by the activity of microorganisms, mainly aerobic and facultative bacteria and settling of organic matter and other wastes and conversion of some particulate organic matter to soluble BOD etc. are also responsible for the reduction in TDS of wastewater (Koottatep *et al.,* 2010). A paired-samples t-test was conducted to determine the effect of wastewater treatment in constructed wetland with vetiver plants. Result showed that there is significant ($p \leq 0.002$) difference exists between before and after the experiment in constructed wetlands.

The concentration of Total Oil and Grease (TOG) in treated wastewater was recorded as 29.61 mg/L and the percentage reduction was recorded as 78.48. The results show that TOG content of the wastewater also found reduced considerably ($p \leq 0.002$) after the treatment. The bacterial degradation, filtration of water through the bed, the roots etc. The large surface area of the roots, stem, sand and gravel increases the number of micro-organisms and there by breakdown of organic and inorganic oil molecules also increased (Baskar*et al.,* 2009).

b. Changes in chemical characteristics of Spray Painting Spent wash

pH determines whether the water is acidic or alkaline in nature. The pH of the treated wastewater was recorded as 7.51 and it is well within the permissible limit (Table 1). This change in pH may be due to the reducing reactions in the wetlands. According to Hammer and Bastian (1989) wetlands are largely reducing ecosystems and reduction of nitrates and sulphates results in a net production of alkalinity and thereby the acidic pH turned to near neutral ($p \leq 0.002$).

The E.C of the treated effluent was recorded as 775.13 µS/cm and it is well within the standard limit (Table 1). The corresponding changes in reduction was recorded as 83.17%.The filtration by the roots of vetiver plants, bed material, absorption by the plants and degradation by the microbial activity and reduction in the TDS are also responsible for the reduction in the electrical conductivity of the wastewater.

The results showed that concentration of BOD after treatment was noted as 3.48 mg/Land correspondingly the percentage decrease was noted as 76.51 ($p=0.000$). According to the standards (Table 1), BOD of the treated water is within the prescribed limit. According to

Shivhare and Roy (2013), the decrease in BOD on constructed wetland treatment may be due to the action of aerobic bacteria attached to the media and to the plant roots. The high root biomass of the vetiver plants harbours enormous micro-organisms in the rhizosphere and by their action the organic matter in wastewater get degraded and transformed, therefore BOD level would low naturally.

Result showed that concentration of COD after 15 days treatment in constructed wetland was recoded as 251.61 mg/L (p=0.000) and the reduction was observed as 73.87%. Studies by Zirschky (1986) and Vipat *et al.* (2008), reported that BOD and COD are associated with settleable solids in wastewater and is removed by sedimentation. Total Hardness is the sum of concentrations of alkaline earth metal cations present in it (Sawyer *et al*., 1994). Study showed that concentration of total hardness in the effluent after treatment was 462.07 and the reduction was recorded as 60.16% (p=0.000).

Changes in the Nutrient content:

The total nitrogen (TN) concentrations in the effluent after treatment in constructed wetland were recorded as 8.61 mg/L and corresponding reduction was 48.44% (P=0.000). So it was clear that treatment in constructed wetland significantly reduced the TN content and therefore it can be disposed safely (Table 1). According to Vymazal *et al*. (1998) the removal process of nitrogen from CW is regulated by various steps in nitrogen cycle, *i.e.*, volatilization, ammonification, nitrification/denitrification (microbial process), and plant uptake. Organic nitrogen is converted to ammonia in the wetland by the process of decomposition and mineralization. Biological nitrification followed by denitrification is a major pathway for nitrogen removal in wetlands (Li *et al*., 2018).

Total phosphorus (TP) concentration in the treated effluent in constructed wetland was recorded as 1.02 mg/L and the percentage reduction in total phosphorus was noted as 68.80%.Studies by Nicholas (1981) and Watson *et al*. (1989) reported that as in the case of nitrogen, phosphorus removal is also achieved through the processes of plant uptake/ biotic assimilation, sorption, adsorption (retention in the soil), filtration, sedimentation, decomposition and long-term storage occur, phosphorus tends to accumulate in wetlands at a higher rate than does nitrogen. Complexation and precipitation of phosphate minerals can provide a significant sink for P in wetlands with large stores or inputs of iron and aluminium (low pH wetlands) or calcium (high-pH wetlands).

Result showed that concentration of sulphate in the effluent after treatment was 22.67 mg/L and the corresponding reduction was 68.64%. Concentration of chlorides in the treated effluent was recorded as 599.29 mg/L and the percentage reduction was noted as 51.49. As per the standard (Table 1) concentration of both sulphate and chlorides in treated water well within

the permissible limit. Concentration of Ca^{2+} (as $CaCO_3$) ions in the treated effluent was recorded as 424.59 mg/L and the percentage reductionwas 60.76. Concentration of Mg^{2+} (as $CaCO_3$) ions in the treated effluent was 29.56 mg/L and the percentage reduction was observed as 62.07. Concentration of sodium and potassium in the effluent was 47.61 mg/L (within the standard limit) and 35.77 mg/L respectivelyand the corresponding reduction was recorded as 58.81 and 58.11% respectively.

The study showed that concentrations of all the analysed nutrients were reduced significantly (p=0.000) after 15 days treatment in constructed wetland with vetiver plants. This reduction in the concentration of nutrients in the effluent was due to the breakdown of contaminants and filtration through the root-zone of plants. Organic contaminants in the effluents are broken down and utilized by the micro-organisms as well as plants in the wetlands for their metabolism (Baskar *et al.*, 2009). The vetiver grass has thick massive root system and therefore the surface area is also very high. It provides enough space for the microbes to multiply and the wide spreading roots taken up nutrients and other contaminants as a part of their uptake mechanisms and incorporates it in their biomass.

Concentration of iron in the effluent was recorded as 0.39 mg/L and corresponding reduction was 67.50% and it is statistically significant ($p \leq 0.002$). As per the standards, iron content in the sewage was within the standard permissible limits. The reduction in iron content of the wastewater may mainly contributed by bacterial breakdown. According to Ogunfowokan *et al.* (2003), the Fe (II) is oxidised to Fe (III) by abiotic and microbial oxidation and precipitation. Reduction is also due to plants uptake for their growth as iron act as a macro nutrient in plant body.

c. Changes in Heavy metal content

The important heavy metals analysed in the spray painting spent wash include lead (Pb), cadmium (Cd), chromium (Cr), zinc (Zn), mercury (Hg) and arsenic (As). Concentration of heavy metals such as Pb, Cd, Cr, Zn, Hg and As in the treated effluent was recorded as 0.571 mg/L, 0.599 mg/L, 1.526 mg/L,1.113 mg/L, 0.097 mg/L and 0.116 mg/L, respectively. Corresponding reduction in percentage was reported as 87.06, 58.17, 67.05, 87.33, 81.05 and 78.75, respectively. The result showed that concentration of Pb, Cd, Cr and Hg in the treated effluents were exceeded the standard permissible limit while the concentration of Zn and As were within the standard permissible limit (Table 1). Significant reduction (p=0.000) in heavy metal contents in the study again confirms the effectiveness of vetiver wetland technology for wastewater treatment.

There are several mechanisms contributing the removal of heavy metals from wastewater. Studies by Kadlec and Knight (1996) reported that heavy metal removal in constructed wetlands are mainly by four mechanisms, *viz*. binding to soils, sedimentation as particulate matter,

precipitation as insoluble salts, and uptake by bacteria, algae and plants. According to Smith and Kalin (2000) roots of wetland plants act both as bio-films and as filters to entrap fine suspended particles along with heavy metals in the water column. These entrapped particles are subsequently sloughed off the roots as heavier, and settle down more easily at the bottom sediments, where some of them were adsorbed while some others get absorbed. Studies by Watson *et al*. (1989); Cooper *et al.* (1996) and Sundaravadivel and Vigneswaran (2001) reported that sedimentation, filtration, flocculation, adhesion,adsorption, complexation, precipitation, cation exchange, direct uptake by the plants and oxidation by microbial biomass are the main processes responsible for the removal of heavy metals in constructed wetlands.

Removal of contaminants from the wastewater in a constructed wetland is a result of combined activity of plants and micro-organisms. The vetiver plants are very fast growing, high biomass producing plants having very deep, luxurious roots and are highly tolerant to extreme soil, water and climatic conditions. For the fast growth and high biomass production plants taken up nutrients along with toxic chemicals and metals from the wastewater. The thick roots and bed materials acted as a filter and the high surface area of the roots also delivered a good platform for the proliferation and execution for huge numbers of diverse micro-organisms. In the rhizospheric zone the root exudates (soluble organic compounds and low molecular weight acids) and dead plant material may also involve in the microbial co-metabolic degradation of poorly degradable organic compounds such as heavy metals by acting as chelating agents and enhancing the metal complexation (Schwab *et al*., 2008; Le Fevre *et al*., 2013). The rhizodeposition of carbon compounds have important role in elimination, transformation, degradation or immobilization of xenobiotics compounds in the rhizospheric soil. These compounds increase the mobility of nutrients including heavy metals and thereby increasing the solubility and availability and by this mean absorption, transformation and degradation by plants and microbes also increases (Stottmeister *et al*., 2003).

Therefore it is clear that within the 15 days treatment in constructed wetland with vetiver plants reduced an average of 63% of total contaminant load in the spray painting spent wash and an average of more than 76.6% of the heavy metals.

Conclusions:

The study revealed that constructed wetland with vetiver plants is a good choice for the treatment of wastewater contains high concentrations pollutants including various heavy metals, as the vetiver plants can tolerate high levels of toxic pollutants and have an extraordinary capacity to receive nutrients and other pollutants including heavy metals from the treatment medium. There is a remarkable decline (an average of more than 63%) in the concentration of

colour, pH, EC, TDS, BOD, COD, total nitrogen, total phosphorus, sulphates, chlorides, hardness, calcium, magnesium, sodium, potassium, iron and heavy metals present in the spray painting spent wash within a short retention period of 15 days. Therefore the study proved that the constructed wetland technology using vetiver plants (*Vetiveria zizanioides* (L.) Nash) can be considered as good candidates for phytoremediation of spray painting spent wash and is one of the very efficient, low cost, eco-friendly technology for the removal of pollutants especially heavy metals in wastewater.

Acknowledgement:

Authors acknowledge the financial support granted for this work by the Kerala State Council for Science Technology and Environment (KSCSTE), Thiruvananthapuram, Kerala, India.

References:

1. Abidemi, O. O. (2011): Levels of Pb, Fe, Cd and Co in Soils of Automobile Workshop in Osun State, Nigeria. Journal of Applied Science and Environmental Management, 15(2): 279- 282.
2. APHA. (2012): Standard Methods for the Examination of Water and Wastewater, 22nd ed., APHA- AWWA- WEF. Washington, DC.
3. Badejo, A.A., Omole, D.O. and Ndambuki, J.M. (2018): Municipal wastewater management using Vetiveria zizanioides planted in vertical flow constructed wetland. Applied Water Science, 8: 110 https://doi.org/10.1007/s13201-018-0756-0
4. Baskar, G., Deeptha, U. T. and Rahman, A, A. (2009): Root Zone Technology for campus wastewater treatment. Journal of Environmental Research and Development, 3(3):695-705
5. Bernal, B. and Mitsch, J. (2012): Comparing carbon sequestration in temperate freshwater wetland communities. Global Change Biology, 18(5): 1636-1647.
6. Bhatia, S. C. (2001): Environmental Pollution and Control in Chemical Process Industries (2nd Ed.) Khanna Publishers, New Delhi, 1273p.
7. Brix, H. (2003): Plants used in constructed wetlands and their functions. In: Proceedings of the 1st International Seminar on the Use of Aquatic Macrophytes for Wastewater Treatment in Constructed Wetlands, Lisboa, Portugal, 810 p.
8. Chakrapani, G. J. (2005): Major and trace element geochemistry in upper Ganga river in the Himalayas, India. Environmental Geology, 48(2): 189-201.
9. Cooper, P. F., Job, G. D., Green, M. B. and Shutes, R. B. E. (1996): Reed beds and constructed wetlands for wastewater treatment. Swindon, UK: Water Research Centre. 184p.

10. CPCB. (2021): National Inventory of Sewage Treatment Plants. Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi.183p.
11. Crites, R.W., S.C. Reed and R.K. Bastian. (2000): Land Treatment Systems for Municipal and Industrial Wastes. McGraw-Hill, New York. 433 p.
12. Darajeh, N., Truong, P., Rezania, S., Alizadeh, H. and Leung D. W. M. (2019): Effectiveness of Vetiver Grass versus other Plants for Phytoremediation of Contaminated Water. Journal of Environmental Treatment Technology, 7 (3): 485-500.
13. Dashmishra, M. (2011): Political Economy of Development and Environmental Degradation in India. Concept Publishing Company.
14. Dhanya, G. and Jaya, D. S. (2013): Pollutant Removal in Wastewater by Vetiver Grass in Constructed Wetland System. International Journal of Engineering Research & Technology, 2 (12): 1361-1368.
15. Environmental Quality Regulations (1979): Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979. Environmental Quality Act, 1974. Arrangement of Regulations, 121p.
16. EPA (2002): The Environment Protection Act 2002. Standards for Effluent Discharge Regulations. General Notice. No. 44 of 2003
17. Forster, C. (2003): Wastewater Treatment and Technology, Thomas Telford
18. Greenfield, J.C. 1987. Vetiver Grass (Vetiveriazizanioides): A Method of Soil and Moisture Conservation. 1st ed. The World Bank, New Delhi.
19. Hammer, D. A. and Bastian, R. K. (1989): Wetland ecosystems: natural water purifiers. Constructed wetlands for wastewater treatment: municipal, industrial and agricultural, 519p
20. Hanson, R.S. and Hanson, T.E. (1996): Methanotrophic bacteria. Microbiology and Molecular Biology Reviews, 60: 439-471.
21. Hoffmann, H., Platzer, C., Winker, M. and Muench, E. V. (2011): Technology review of constructed wetlands Sub-surface flow constructed wetlands for grey water and domestic wastewater treatment. Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ) GmbH, Germany, pp. 1-36.
22. ITRC. (2003): Technical and regulatory guidance document for constructed treatment wetlands, The Interstate Technology, Regulatory Council Wetlands Team, USA.
23. Kadlec, R. H. and Knight, R. L. (1996): Treatment wetlands. CRC. Baca Raton, FL.
24. Koottatep, T., Polprasert, C and Oanh, N. K. (2010): Design considerations of constructed wetlands for Septage treatment at the ait pilot plant. Asian Institute of Technology Bangkok, Thailand – Urban Env. Engineering &Managament Program

25. LeFevre, G. H., Hozalski, R. M. and Novak, P. J. (2013): Root exudate enhanced contaminant desorption: an abiotic contribution to the rhizosphere effect. Environmental science and technology, 47(20): 11545- 11553.
26. Li, M., Liang, Z.L., Callier, M.D., d'Orbcastel, E.R., Ma, X.N. and Sun, L.L. (2018): Nitrogen and organic matter removal and enzyme activities in constructed wetlands operated under different hydraulic operating regimes. Aquaculture. 496:247–54.
27. Negri, M. C., Hinchman, R. R. and Gatliff, E. G. (1996): Phytoremediation: using green plants to clean up contaminated soil, groundwater and wastewater. In: Proc. International Topical Meeting on Nuclear and Hazardous Waste Management, Spectrum, 96: 1-13.
28. Nichols, D. S. (1981): Nutrient removal from wastewater by wetlands. In Proceedings 6th International Peat Congress, August 17-23, 1980, Duluth, Minnesota. W. A. Fisher Company, Eveleth, Minnesota, pp. 638-642
29. OECD (1975): Annual Report, Paris: OECD.
30. Ogunfowokan, A. O., Okoh, E. K., Adenuga, A. A. and Asubiojo, O. I. (2005): An assessment of the impact of point source pollution from a university sewage treatment oxidation pond on a receiving stream-A preliminary study. Journal of applied sciences, 5(1): 36-43.
31. Raman N.S. and Devotte, S (2006): Hand book of Indian Environmental Standards. National Environmental and Engineering Research Institute, Nagpur.
32. Salt, D. E., Smith, R. D. and Raskin, I. (1998): Phytoremediation. Annual review of plant biology, 49(1): 643- 668.
33. Sawyer, C. N., McCarty, P. L. and Parkin, G. F. (1994): Chemistry for Environmental Engineering. New York, USA, McGraw-Hill:ISBN 0-07-113908-7.
34. Schwab, A. P., Zhu, D. S. and Banks, M. K. (2008): Influence of organic acids on the transport of heavy metals in soil. Chemosphere, 72(6): 986-994.
35. Sharma, B. K. and Kaur, H. (1995): Environmental chemistry. Goel Publishing House, unit of Krishna Prakashan Media (P) Ltd, Meerut, India, 4th Ed. pp. 20-58.
36. Shivhare, N and Roy, M. (2013): Gravel Bed Constructed wetland for treatment of Sewage water. Pollution Research. 32(2): 415-419.
37. Smith, M. P. and Kalin, M. (2000): Floating wetland vegetation covers for suspended solids removal: In Treatment Wetlands for Water Quality Improvement, Proceedings of Quebec 2000 Conference, CH2MHILL, Pries, J. H. (ed.) Pandora press, Kitchener, Ontario, Canada. pp. 73-82.
38. Stottmeister, U., Wießner, A., Kuschk, P., Kappelmeyer, U., Kästner, M., Bederski, O. and Moormann, H. (2003): Effects of plants and microorganisms in constructed wetlands for wastewater treatment. Biotechnology Advances, 22(1): 93-117.

39. Sundaravadivel, M. and Vigneswaran, S. (2001): Constructed wetland for wastewater treatment. Critical Reviews in Environmental Science and Technology, 31: 351-409
40. Trivedi, R. K. and Goel, P. K. (1998): Chemical and Biological Methods for water pollution studies, Enviro media publications, Karad, India. pp. 1-215.
41. UN-HABITAT. (2008): Constructed Wetlands Manual. UN-HABITAT Water for Asian Cities Programme, Nepal, Kathmandu
42. Vipat, V., Singh, U. R. and Billore, S. K. (2008): Efficacy of RootZone Technology for Treatment of Domestic wastewater: Field scale study of a pilot project in Bhopal (MP), India. Proceedings of Taal 2007: The 12th World Lake Conference: 995-1003
43. Vymazal, J. (2011):Constructed Wetlands for Wastewater Treatment: Five Decades of Experience. Environmental Science and Technology, 45(1): 61–69.
44. Vymazal, J., Brix, H., Cooper, P.F., Herberl, R., Perfler, R. and Laber, J. (1998): Removal mechanisms and types of constructed wetlands. In: Constructed wetlands for wastewater treatment in Europe. Vymazal, J., Brix, H., Cooper, P.F., Green, M.B. and Herberl, R. editors. Leiden: Backhuys Publishers: 17–66.
45. Watson, J. T., Reed, S. C., Kadlec, R. H., Knight, R. L. and Whitehouse, A. E. (1989): Performance expectations and loading rates for constructed wetlands. Constructed Wetlands for Wastewater Treatment: Municipal, Industrial and Agricultural. Lewis Publishers, Chelsea Michigan. pp. 319-351.
46. Yamuna, Y., Kabila, V. K. and Geraldine, D. C. (2004): Heavy metals in Indsustrial effluents and their effect on plants. Geo journel, 40: 233-237.
47. Zirschky, J. (1986): Basic Design Rationale for Artificial Wetland, Contract Report 68-01-7108, US EPA, Office of Muncipal Pollution Control.
48. https://tvmcity.keralapolice.gov.in/public-information/crime-statistics/road-accident
49. http://www.kerenvis.nic.in/Database/INFRASTRUCTURE_1419.aspx

A REVIEW ON THE SIGNIFICANCE OF ORGANIC FERTILIZERS

D. J. Vanmare

Vivekanand Arts, Sardar Dalip Singh Commerce and Science College,

Aurangabad 431001

Introduction:

We are losing approximately 1,000 tons of topsoil every Second year after year arable land shrinks through 20,000 hectares (Hazra, 2014). Erosion on my own has made 1000000000 hectares of soil unusable for agriculture. Flora serves as the main supply of feed for livestock. Nutrients required for renovation and manufacturing are furnished through diverse vegetation and plant-derived feeds in conjunction with small quantities from non-plant resources. The primary constituents of vegetation are water, carbohydrates, protein, fats, minerals, and vitamins. Both flowers and animals comprise those nutrients, but the relative proportions vary more in flowers (Prasad, 2009; Roy *et al.,* 2006). These days productiveness has been elevated through a first-rate percentage and the complete credit score goes to fertilizers. Fertilizers are an advanced and advanced approach to promote and enhance productiveness. All the fertilizers had been categorized into numerous types relying on their ingredients, energy, and diverse other capabilities. However, each fertilizer incorporates ok amounts of the wanted chemicals, minerals, and elements to make certain a wholesome and speedy increase. Although fertilizers are vital for all flowers or crops there have additionally damaging consequences (Prasad, 2009; Camargo *et al.,* 2006). The extra chemical fertilizers ruin the soil fertility in addition, to carry back special types of environmental pollutions (Camargo *et al.,* 2006; Hazra *et al.,* 2014). So inside the agricultural and others purposes, there have good enough use of fertilizers which enhance productiveness but don't have any detrimental impact for nature.

What's a fertilizer?

The chemical composition of diverse essential minerals and factors intended for the regular as well as hastened growth and nourishment of all flowers is termed as fertilizer. As these fertilizers were used continuously to promote and beautify the productivity of industrial vegetation, therefore they may be called agricultural fertilizers. Fertilizers enhance the richness of the soil and nourish it with the required vitamins. By using enriching the soil, fertilizers also boom the productiveness of the crops. Fertilizers are the nutrient-stuffed sources that nourish the plant life with vital vitamins and soil acts as a medium between the crops and the fertilizers

(Bokhtiar *et al.,* 2005). A substance (which includes manure or a special chemical) is delivered to the soil to help the growth of vegetation (Merriam-Webster.html, 2016).

Kinds of agricultural fertilizers:

As it has been defined that fertilizers are the composition of one or more diverse chemical substances or nutrients consequently relying on the constituent compounds and vitamins release mechanism, the rural fertilizers were labeled into following categories:

a) Natural agricultural fertilizer organic fertilizers are those fertilizers that are manufactured by the use of natural materials which can be bio-degradable, i.e. organic fertilizers are going on fertilizers and nutrient enhancers of the soil (Bokhtiar *et al.,* 2005). Consequently, each substance that occurs evidently and is without problems bio-degradable is natural and if this natural material complements the richness of the soil, it is termed as a natural fertilizer. Those natural materials are in addition decomposed and broken into smaller and soluble particles by numerous microorganisms. After being become soluble and less complicated compounds, those fertilizers are taken in via the roots. Manure, slurry, worm castings, peat, seaweed, sewage, and guano are going on green manure and compost, blood meal, bone meal, and seaweed extracts, etc. are synthetic natural fertilizers. Vegetation is grown to add vitamins to the soil. Today what each farmer is looking ahead to be the right approach to the agricultural issues without compromising at the yields. It's far a universally acknowledged fact that natural fertilization methods are extra environmentally pleasant and fetch slower however constant consequences. Nowadays when the arena is advancing so fast in each factor, how can the lives helping location can be overlooked? These days the usage of fertilizers is one of the finest innovations of the agricultural revolution.

b) Inorganic agricultural fertilizer: The fertilizers which might be constituted by using inorganic chemical materials are called inorganic agricultural fertilizers, i.e., granular triple superphosphate, potassium chloride, urea, anhydrous ammonia, and so on. These fertilizers are usually non-biodegradable. And these are further divided into diverse categories primarily based on their components and techniques of preparations. These fertilizers are also called artificial or synthesized fertilizers as they may be manufactured in the factories by the use of trendy technologies. The artificial production processes render those fertilizers a rough touch and propel them to be sturdy and fairly consistent with-formative (Liu *et al.,* 2007).

Fertilizer and environment:

Environmental safety is very essential in a business international. Using fertilizers in agriculture can be very beneficial for food manufacturing; however, it can be very risky for the

environment. Consequently, the handiest essential amount of fertilizers can be used to hit plants. It manner that we must use fertilizers, which dissolved it as is a nutrient requirement of plant life. In this case, it isn't a contamination threat tothe environment. The principal factors for a successful plant are ok, Ca, Mg, P, N, Fe, and Zn. Many sorts of fertilizers supply those elements, but the speed of dissolution of fertilizer in agricultural land is greater than the requirement of flowers (Camargo *et al.,* 2007; Kabata-Pendias *et al.,* 1993; WHO, 2006). The most important problem going through using chemical fertilizers is groundwater infection. Nitrogen fertilizers spoil down into nitrates and journey effortlessly via the soil. Because it is water-soluble and might remain in groundwater for decades, the addition of greater nitrogen over the years has an accumulative effect. At the University of Wisconsin, Madison, they determined the consequences of chemical fertilizers are compounded when mixed with a single pesticide. One popular fertilizer, urea, produces ammonia emanation, contributes to acid rain, groundwater infection, and ozone depletion because of the launch of nitrous oxide with the aid of the denitrification process. With its increased use and projections of destiny use, this trouble may additionally growth numerous fold in the coming many years. Groundwater contamination has been linked to gastric cancer, goiter, birth malformations, and high blood pressure; testicular most cancers and stomach most cancers. Excessive air- and water-borne nitrogen from fertilizers may cause breathing ailments, cardiac disorder, and several cancers, in addition to can "inhibit crop boom, increase allergenic pollen manufacturing, and potentially have an effect on the dynamics of numerous vector-borne diseases, such as West Nile virus, malaria, and cholera". In toddlers, it is a substitute known as Blue infant Syndrome. The threat most customarily occurs while infants are given a system reconstituted with nitrate-contaminated water (Alloway *et al.,* 1999; Basta *et al.,* 2001; Raicevic *et al.,* 2005). The situation reasons lower oxygen within the blood and effects in blue-gray skin coloration, causes lethargy and/or irritability, and might lead to coma or demise. I've been unable to find whether the same danger exists for breastfeeding babies whose moms drank contaminated water (Camargo *et al.,* 2006; U.S. Environmental safety corporation ground Water and ingesting Water, 2006). Nitrogen groundwater infection additionally contributes to marine "dead zones". The boom inside the water-soluble nitrates creates an inflow of plantexistence, which eats up oxygen and starves out fish and crustaceans. This has an effect now not only on the aquatic environment but on nearby societies that rely upon meals sourced from those regions. There is the rather questionable use of uncooked sewer sludge as a fertilizer. In a few international locations, uncooked, uncomposted, and untreated human waste is applied without delay to plants and soil, a practice called "night soil" because it's generally carried out at night time. The threat of disorder is apparent and high and this practice

has to in no way be burdened with “humanure”, an extended, particularly worried method of decomposing human waste into a safe resource.

Naturally occurring organic fertilizers:

It includes animal manure, slurry waste, peat, seaweeds, sewage, guano waste, and other bio-degradable wastes. My rock phosphate, sulfate, potash, and limestone also fall underneath the same category.

Manure: The natural waste of animals is called manure whilst it receives decomposed through the continuing process of bacteria and fungi. This decomposed be counted called manure is then utilized in agriculture to beautify and sell productivity of soil and hence revolutionize the yields.

Slurry waste: Scientifically it's far a thick combo of solids in any liquid and when speaking approximately agricultural slurry it must be any house or animal waste cloth properly blended with water to inculcate soil fertility. It is ready thru a long-time system of amassing the waste cloth in a huge field or tanks after which transported to the rural fields within a similar liquid form. It’s far in liquid form; consequently, it receives dissolved without problems and mixes properly with the soil which results in nutrients of the soil.

Bug Castings: it is also known by way of specific names consisting of vermin compost, worm compost, computer virus humus, and many others. it is the quit made of something this has resulted after the break-down of any organic fabric or waste employing the worms, insects, or earthworms. It is miles pretty wealthy in vitamins and proves to be a worth soil conditioner.

Manufactured organic fertilizers:

The fertilizers which might be synthetic by way of decomposition of herbal waste cloth are termed synthetic natural fertilizers. Compost, blood meal, bone meal, and seaweed extracts.

Compost: Additionally referred to as Brown manure, it's far the cease made of the decomposition of the organically waste material. It’s far a technique that is carried on with the aid of numerous bacteria, fungi, and different little organisms. Used in landscaping, horticulture, and to save you soil erosion, compost is a powerful method for soil issues.

Bloodmeal: it's far a nitrogenous fertilizer that's made of dried powdered blood. Distinctly soluble mixture it can without problems be taken in via the soil and its miles a large storehouse of ammonia and other nitrogenous factors. After being combined with water, it can be used as a liquid fertilizer. It can additionally be sprayed on the lawn as an animal and bugs deterrent.

Bone meal: as the name shows, bone meal is a crude aggregate of overwhelmed and powdered.

Bones: it works successfully as a gradual supply of vitamins that keeps on imparting the vital nutrients at equal durations.

Advantages of organic fertilizers:

The organic humus registers a crucial function within the soil nourishment. It mobilizes the prevailing soil nutrients and allows them to attain plant life in equal and balanced quantities. The vitamins are launched at a slower pace which implies that the vegetation isn't suffixed to pressurized growth however their natural functionality is stronger to an extra quantity. This ensures the safety of vegetation and lessened poisonous degrees within the plants. Natural fertilizers hold a blanket like a cowl at the soil accordingly allowing it to recapture the moisture stage and no longer let it out. For this reason, it also facilitates to get better the strain levels of the soil through preserving its moisture content material. Natural fertilizers help to sophisticate the soil structure by using nourishing it, enhancing its productivity, and at the same time shielding it from being eroded. Artificial and inorganic fertilizers have sure disadvantages as they have to be applied over and over. They emerge as a necessity to the soil in any other case the productivity is hampered. They act as a drug for the soils as till the time the soils are fertilized they stay efficient otherwise they die down. Eutrophication, nutrient pollution is induced due to more software of the synthetic fertilizers (Bokhtiar *et al.,* 2005; Kaur *et al.,* 2005). A few benefits of the organic fertilizer

Advanced for the soil: Presents natural count, important for microorganisms. It is one of the constructing blocks for fertile soil rich in humus.

Nutrient release: gradual and constant at a natural rate that plant life can use. No hazard of over-concentration of any element, seeing that microbes should break down the material.

Balance minerals requirement: commonly present in an extensive variety, imparting greater balanced nutrition to the plant.

Safe for soil: safe for all flora and not using a chance of burning because of salt concentration.

Durable: doesn’t leach out because the natural depend binds to the soil debris wherein the roots have got right of entry to it.

More effective for plants and grass: greater resistance to disease and insect attacks (Chen, 2006).

Encourages soil life- Microbes convert the organic remember to the shape of vitamins that plants need. Earthworms feeding on natural materials aerate and unfasten the soil (Young *et al.,* 2003).

Different types of eco-friendly fertilizers biocompost:

It is a form of organic fertilizer, which is prepared from the waste of the sugar industry. The waste has decomposed the use of several human and flora-friendly microorganisms and Fungi. Biocompost consists of nitrogen, phosphate solubilizing bacteria, and plenty of beneficial

fungi just like the decomposing fungi. This biofertilizer allows the farmers to increase soil fertility and thereby boom the yield of the vegetation.

- **Vermicompost:** it's also a natural fertilizer containing nitrogen phosphorus, potassium, sulfur, organic carbon, sulfur, hormones, enzymes, and many others. If used over a time frame, the soil will become extremely fertile and all the misplaced nutrients are restored to the turf and the soil stays fertile.
- **Phospho:** is additionally a form of bio-fertilizer, which releases insoluble phosphorous within the soil, making it greater fertile.
- **Rhizo:** it's far bacterial, which induces nitrogen-solving nodules on the roots of veggies like peas, beans, and many others, thereby, gambling an important position in agriculture.
- **Azotobactor:** Nitrogen plays a critical position in the plant boom. Azotobactor improves the quantity of atmospheric nitrogen in the soil and makes it to be had to the plants. It also shields the roots from other pathogens existing within the soil.
- **Trichoderma:** it is the best fertilizer, which acts as a biocontrol agent and is hyper parasitic towards different pathogens within the subject. Composter: A composter breaks down all-natural substances like farm animals waste, useless leaves, and so forth. The gift inside the soil and thereby increases the productiveness of the soil.
- **Tricho-Card**: It's far a powerful bio-fertilizer that is an effective destroyer of eggs of many rodents, which consume flora and leaves. It’s far effective while used for many plant life particularly sugarcane, cotton, brinjal, corn, jawar, paddy apple, etc.

Advantages of using bio-fertilizers:

Bio-fertilizers have become a rage, thinking about the irreparable harm that the chemical fertilizers are causing to the soil. Some of the advantages related to bio-fertilizers include:

- The primary and the maximum important gain of using bio-fertilizers is that they may be environment pleasant, in contrast to chemical fertilizers that harm the environment.
- They are relatively low on fee inputs and are light in the pockets of the farmers.
- Their use leads to soil enrichment and the satisfaction of the soil improves with time.
- Although they do now not show immediate consequences, however, the results proven through the years are extraordinarily awesome.
- Microorganisms convert complex natural cloth into easy compounds so that the plant can without difficulty soak up the vitamins

- Those fertilizers harness atmospheric nitrogen and make it immediately available to the vegetation.
- They increase the phosphorous content material of the soil through solubilizing and releasing unavailable phosphorous.
- Bio-fertilizers improve root proliferation due to the release of increase selling hormones.
- They assist in growing the crop yield via 10-25%

Disadvantages of commercially available inorganic chemical fertilizers and organic or eco-friendly fertilizers:

Disadvantages of chemical inorganic fertilizers:

- Because water releases the vitamins, it isn't always unusual to lose one-third of the vitamins with the aid of leaching out of the soil before the plant can get entry to them.
- The primary synthetic elements make contributions not anything to decorate soil fertility.
- May lower soil fertility- Chemical nitrogen stimulates the growth of existing microorganisms, which then burn up organic be counted in the soil. Repeating this cycle frequently leaves soil depleted.
- The risk with the wrong application and excess use. Potential of harm from extra, especially lawns getting coverage overlap.
- Synthetic fertilizer is salt. Over utility can bring about terrible results inclusive of leaching, pollutants of water assets, destruction of micro-organisms and pleasant bugs, crop susceptibility to ailment assault, acidification or alkalization of the soil, or reduction in soil fertility—for this reason inflicting irreparable damage to the overall machine (Hazra *et al.,* 2014; Chen, 2006).
- Environmental problems arise with chemical run-off; extra phosphorous can collect within the soil and reason pollution problems.
- Nitrogen is unstable: is lost without difficulty into the ecosystem while fertilizer is left on the floor and not watered into the soil. It’s also lost from luggage in storage, if not sealed nicely.
- Absorbs moisture without problems in storage. These results in caking, or tough fertilizer, that's tough or not possible to apply.
- Eutrophication: Overgrowth of aquatic plant life and degradation of water first-rate because of more nitrogen accumulation.

- Elevated acidity: Many chemical fertilizers are composed of acids like sulphuric acid and hydrochloric acid and those acids decrease the soil's great and heighten the acidity which similarly registers a terrible effect at the plant increase.

Disadvantages of organic fertilizers:

Dependent on microorganisms inside the soil to interrupt down the natural fabric. Soils depleted of those useful microbes, in addition, postpone the results from organics. Organic fertilizers have extra high-priced than chemical fertilizer implemented to equal rectangular footage. The constrained availability of organic fertilizers in some areas limits its use. Can entice bugs in the garage if not covered in sealed packing containers (no longer paper luggage).

Warning: The fertilizers are harmful consequently avoid any physical contact and tie your mouth with a clean cloth and put on gloves in case of applying it with your hands. Inhalation or intake would possibly purpose excessive accidents, allergies, and dying also. However, organic fertilizer might paintings slower however they leave an eternal effect on the soil texture and enhance the water maintaining ability of the soil to regain its fertility and forestalls soil erosion.

Conclusions:

Inorganic fertilizers are immediate to be had in your flowers, however, they're a challenge to leaching, a manner that takes place whilst fertilizers are washed using rain or irrigation water below the extent of plant roots. Heavy programs can burn your plant life and build up to toxic salt concentrations in the soil that can create chemical imbalances. Organic fertilizer may additionally be building up concentrations of some nutrients, however, construct-up of toxicity is not going as long as the natural material is capable of completely decompose. In addition, because organic fertilizers are crafted from natural resources, most effective restricted amounts of fossil fuels are utilized in manufacturing. This indicates greenhouse gas released into the surroundings is the decrease in natural fertilizer production than its miles in inorganic fertilizer production. Nitrification inhibitors can reduce nitrate leaching and boom nitrogen use performance (Hazra, 2014; Hazra *et al.,* 2014). However, measurable agronomic or environmental development will not be seen in all field conditions. The controlled release Fertilizers grant up to 10 weeks of healthy plant growth and coloration so that you could make fewer programs in a season. Organic fertilizers work through the years to create a healthful growing environment, while inorganic fertilizers provide rapid vitamins. In addition to releasing vitamins, as organic fertilizers damage down, they enhance the shape of the soil and boom its capacity to maintain water and vitamins (Bokhtiar *et al.,* 2005). Over time, organic fertilizers

will make your soil—and plant life—healthful and sturdy. determining that's higher in your flowers relies largely on the needs of your plants and your possibilities in phrases of fee and environmental effect as "environmentally pleasant" fertilizers because they allow no longer handiest to lessen the usage of chemicals, but also to re-use agro-industrial wastes and natural residues which gave an "adding cost" to those novel organo-mineral formulates (Biagio *et al.*, 2013; Tzen *et al.*, 2004).

References:

1. Alloway, B. J., and Ayers, D. C. (1999): Chemical basis of environmental pollution.
2. Basta, N. T., Gradwohl, R., Snethen, K. L., and Schroder, J. L. (2001): Chemical immobilization of lead, zinc, and cadmium in smaller-contaminated soils using biosolids and rock phosphate. Journal of Environmental Quality, 30, 1222-1230.
3. Biagio, T., Alessandra, T., Elvira, R., Maria, A., Giancarlo, R., and Francesco I. (2013): Effects of organo-mineral glass-matrix-based fertilizers on citrus Fe chlorosis. Europ. J. Agronomy, 44, 32-37.
4. Bokhtiar, S. M., and Sakurai, K. (2005): Effects of organic manure and chemical fertilizer on soil fertility and productivity of plant and ratoon crops of sugarcane. Archives of Agronomy and Soil Science, 51, 325-334.
5. Camargo, J. A., and Alonso, A. (2006): Ecological and toxicological effects of inorganic nitrogen pollution in aquatic ecosystems: A global assessment. Environment International, 32, 831-849.
6. Chandra, P. K., Ghosh, K., andVaradachari, C. (2009): A new slow-releasing iron fertilizer. Chem. Eng. Journal, 155(1-2), 451-456.
7. Chen, J. H. (2006): The combined use of chemical and organic fertilizers and/or Biofertilizer for crop growth and soil fertility. International Workshop on Sustained Management of the Soil-Rhizosphere System for Efficient Crop Production and Fertilizer Use (pp. 1-11): http://dx.doi.org/10.2134/jeq2001.3041222x
8. Hagin, J., and Mortvedt, J. (Eds.): (n.d.): Technion, Israel Institute of Technology. Haifa. Israel.
9. Hara, Y. (2000): Estimation of nitrogen release from coated urea using the Richard function and investigation of the release parameters using simulation models. Soil Science and Plant Nutrition, 46, 693-701.
10. Hazra, G. (2014): Leaching Study of the some Lead-Iron Phosphate Simulated Nuclear Waste Glasses with Different Modifiers under Soxhlet Condition. IJAREAS, 2(12), 30-47.

11. Kabata-Pendias, A., andPendias, H. (1993): Biochemistry of trace elements. PWN Warsaw, Polish. Kaur, K., Kapoor, K. K., and Gupta, A. P. (2005): Impact of organic manures with and without mineral fertilizers on soil chemical and biological properties under tropical conditions. Journal Plant Nutrition and Soil Science, 168, 117-122.
12. Liu, Y. L., Zhang, B., Cheng-liang, L., Feng, H., and Velde, B. (2007): Long term fertilization influences on clay mineral composition and ammonium adsorption in rice paddy soil. Soil Sci. Soc. Am. J, 72, 1580-1590.
13. Madani, M. J., H., andMobasser, H. R. (2011): Effects of nitrogen fertilization and rice harvest height on agronomic yield indices of ratoon rice-berseem clover intercropping system. Aust. J. Crop Sci, 5(5), 566-574.
14. Merriam-Webster.html. (2016): Retrieved from http://www.merriam-webster.com/dictionary/fertilizer Pansu, M., andGautheyrou, J. (2006): Handbook of Soil Analysis: Mineralogical, Organic and Inorganic Methods.
15. Prasad, R. (2009): Efficient fertilizer use: The key to food security and better environment. Journal of Tropical Agriculture, 47(1-2), 1-17.
16. Raicevic, S., Kaludjerivic-Radoicic, T., andZouboulis, A. I. (2005): In situ stabilization of toxic metals in polluted soils using phosphates: Theoretical prediction and experimental verification. Journal of Hazardous Materials, 117, 41-53. http://dx.doi.org/10.1016/j.jhazmat.2004.07.024
17. Roy, R. N., Finck, A., Blair, G. J., and Tandon, H. L. S. (2006): Plant nutrition for food security: A guide for integrated nutrient management. FAO Fertilizer and Plant Nutrition Bulletin, 16.
18. Sava, B. A., Boroica, L., Savaa, M., Elisab, M., Vasiliub, C. I., Nastasec, F., …Medianu, R. (2011): Potassium phosphate glasses used as agro-fertilizers with controlled solubility. Journal of Optoelectronics and Advanced Materials, 13(11-12), 1534-1541.
19. Shaviv, A. (2005): Controlled Release Fertilizers. IFA International Workshop on Enhanced-Efficiency Fertilizers, Frankfurt. International Fertilizer Industry Association Paris, France.
20. Shoji, S. (2005): Innovative use of controlled availability fertilizers with high performance for intensive agriculture and environmental conservation. Science in China Ser. C. Life Sciences, 48, 912-920.
21. Tachibana, M. (2007, 2008): Chissoasahi Fertilizer Co.. Ltd: Personal report.

22. Trenkel, M. E. (2010): Slow-and Controlled-Release and Stabilized Fertilizers: An Option for Enhancing Nutrient Use Efficiency in Agriculture. International Fertilizer Industry Association (IFA): Paris, France.
23. Trinchera, A., Allegra, M., Rea, E., Roccuzzo, G., Rinaldi, S., Sequi, P., andIntrigliolo, F. (2011): Organo-mineral fertilisers from glass-matrix and organic biomasses: A new way to release nutrients. A novel approach to fertilisation based on plant demand. J Sci Food Agric, 13, 2386-2393.
24. Wacławska, I., andSzumera, M. (2011): Interaction of glassy fertilizers and Cd2+ ions in terms of soil pollution neutralization. Natural Science, 3(8), 689-693.
25. World Health Organization. (2006): International Program on Chemical Safety, Environmental Health Criteria 5: Nitrates, Nitrites, and N-Nitroso Compounds. Retrieved from http://www.inchem.org/documents/pims/chemical/pimg016.htm
26. Young, C. C., Lai, W. A., Shen, F. T., Hung, M. H., Hung, W. S., and Arun, A. B. (2003): Exploring the icrobial potentially to augment soil fertility in Taiwan. In Proceedings of the 6th ESAFS International Conference: Soil Management Technology on Low Productivity and Degraded Soils, pp. 25-27.

ECO-FRIENDLY PREPARED AZO COMPOUND BY N-PHENYL GLUTARIMIDES' SEEDLING GERMINATION (SG) ACTIVITIES ON MUNG BEAN

Ravindra S. Dhivare[1*] and Shankarsing S. Rajput[2]

[1]Department of Chemistry, BSSPM's Arts,

Commerce and Science College, Songir, Dhule, Maharashtra, India

[2]Department of Chemistry, SVS's Dadasaheb Rawal College, Dondicha, Dhule, Maharashtra, India

*Corresponding author E-mail: ravii_1978@rediffmail.com

Abstract:

Environmentally friendly and sophisticated chemical synthesis is a hot topic right now. The novel synthones have been effectively developed in the current context. Instead of using a solvent, the greener method made use of a PbO nanoparticle catalyst that produced a respectable yield. Because of the greener method, an ethanol-based solvent might be replaced. It also aids in the reduction of the consumption of potentially harmful piperidine. Novel classes of synthetic chemicals have increased seedling growth regulator function in Mung seeds in all of their created types. Using the chemicals 5a and 5b, the development of Mung roots and shoots and the weight of the roots and shoots before and after heating 5c were found to be very effective.

Keywords: N-phenyl glutarimide, azo-dipyrans, PbO nanoparticles, Green synthesis, Seedling Germination Activities

Introduction:

Cyclic imides have emerged as an important class of organic substrates for agricultural, biological and chemical applications [1]. Cyclic imides, which are composed of the most abundant heterocyclic components such as nitrogen, oxygen, and sulphur, are important in the pharmacological, medical, chemical, and agricultural areas. The substituted cyclic imides have strong antibacterial and antifungal activity, whereas pthalimide has been shown to block the -amylase enzyme [2]. Certain aromatic succinimide compounds have been shown to promote root development in germinating seeds [3]. After a lag period, seed germination is stimulated by water intake, which is followed by radicle elongation [4]. Following that, reserve energy stored in seeds is dissolved by particular enzymes for seedling development [5]. Aquaporin is a

naturally occurring protein that regulates water transport in a variety of activities, including germination [6] and also developed a method for boosting mung bean seedling development in microgravity, studied growth, gene expression, and enzyme activity under clinorotation, and value to those acquired in normal gravity (control). When clinostat seedlings were compared to control seedlings, they showed a rise in fresh weight, water content, and length [7].Azo (benzopyrans) compounds are a class of chemical scaffolds that are constantly being researched in the scientific community [8-12]. Coloured moieties are common in this situation [13]. The colour of the substance is determined by the structure of the molecule. It might be red, yellow, orange, green, or blue. For the reason that of their colourful character, azo compounds are important not just as dyes but also as pigments [14-18]. It is the goal of this research to investigate the feasibility of producing unique, environmentally friendly azo derivatives from N-phenyl glutarimides [19-23], as well as the certainty of obtaining azo [24-25] compounds with exciting biological and seedling germination activities.

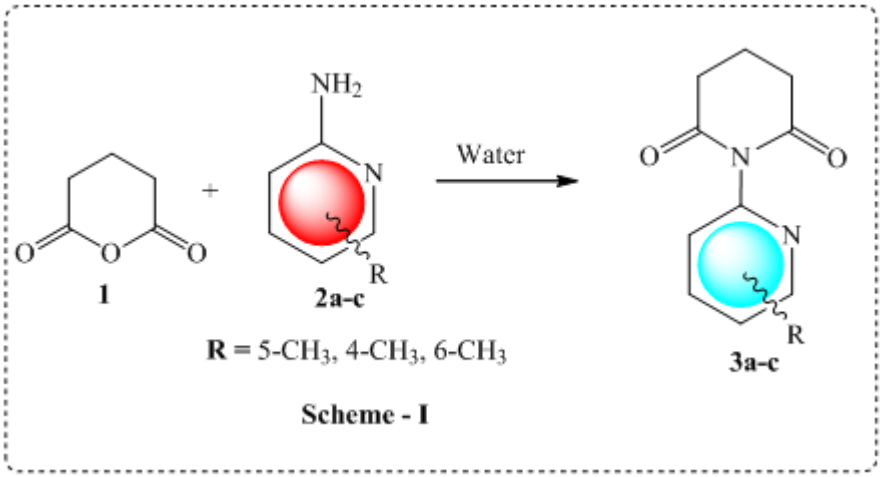
Experimental Section:

Material Methods:

Melting Points were recorded in open glass capillaries and were uncorrected. The chemical structures of the obtained compounds were confirmed by spectral analyses. IR spectra in KBr pallets were recorded on Shimadzu and ATR Brucker alpha FT-IR spectrophotometer. ^{1}H NMR spectra were recorded at 500 MHz by a Brucker spectrophotometer. The chemical shifts were reported as parts per million (ppm) with $(CH_3)_4Si$ (TMS) as an internal standard. Signal multiplicities are represented by: s (singlet), d (doublet), t (triplet), m (multiplet). The purity of the compound was checked by thin layer chromatography, which was performed by using pre-coated silica gel aluminium plates with a mixture of diethyl ether and ethyl acetate in a 7:3 proportion.

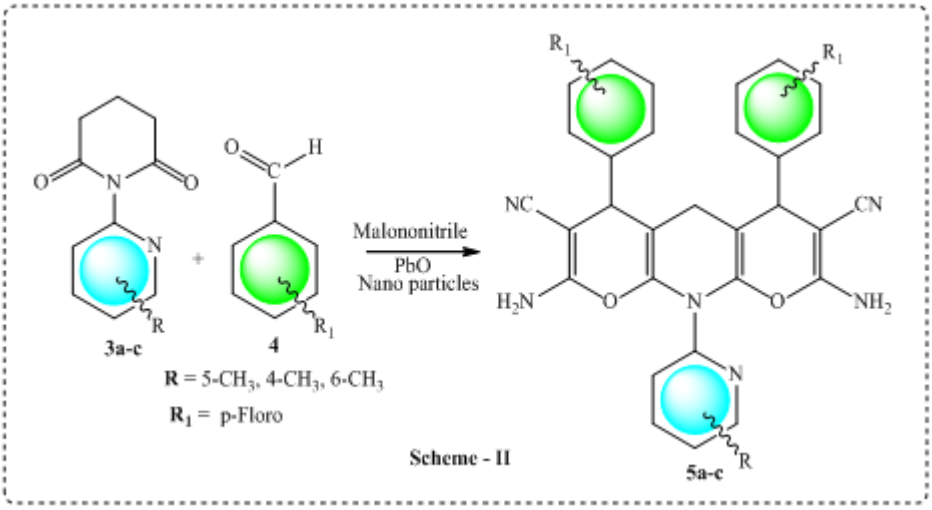
General Procedure for the Synthesis of N-phenyl Glutarimide derivatives (3a-c):

0.01 mole of the appropriately substituted 2- aminopyridine was dissolved in 20 mL of water and 0.01 mole of glutaric anhydride was gradually added. The mixture was heated in an oil bath at 180 ºC and was maintained for 1.5 hr. The crude products **(Scheme–Id)** were recrystallized from isopropanol as per **(Scheme–I)**.



General Procedure for the Synthesis of Azo derivatives (5a-c):

A mixture of N-phenyl glutarimide dervatives (0.1mole), p-fluoro benzaldehyde (0.2 mole), malononitrile (0.2 mole) and 100 mg PbO nanoparticles were ground at a room temperature with a mortar and pestle. The reaction was monitored by thin layer chromatography (TLC). After completion of reaction, the product was washed with distilled water. The novel developed compounds were dried and recrystallized from ethanol to afford pure compounds with high yield as per **(Scheme–II)**



Physico-spectral Analysis of the Prepared Compounds (3a-c and 5a-c):

1-(5-methylpyridin-2-yl)piperidine-2,6-dione (3a): Whitish solid, Yield (71.95%), M.P. 140-142 ^{o}C, M.F. $C_{11}H_{12}O_2N_2$, M.W. 204.22, FTIR (KBr): 1682; 1342; 1310; 3272; 1583; 1455; 1417; 1378; 3083 cm^{-1}. 1H NMR (500.13 MHz, DMSO-d6, δ ppm): 2.35 (s, 3H, CH3-piperidine), 2.16 (t,4H, imide), 1.80 (m, 2H, imide), 7.82-8.47 (m, 2H, piperidine), 8.23 (d, 1H, piperidine).

1-(4-methylpyridin-2-yl)piperidine-2,6-dione (3b): Whitish solid, Yield (68.39%), M.P. 150-152 ºC, M.F. $C_{11}H_{12}O_2N_2$, M.W. 204.22, FTIR (KBr): 1670, 1332; 1295; 3262; 1573; 1445; 1407; 1368; 3073 cm^{-1} ,^{1}HNMR (500.13 MHz, DMSO-d6, δ ppm): 2.40 (s, 3H, CH3-piperidine), 2.16 (t, 4H,imide), 1.80 (m, 2H, imide), 7.19-7.23 (m, 2H, piperidine),8.52 (d, 1H, piperidine).

1-(6-methylpyridin-2-yl)piperidine-2,6-dione (3c): Whitish solid, Yield (69.75%), M.P. 154-156 ºC, M.F.$C_{11}H_{12}O_2N_2$, M.W. 204.22, FTIR (KBr): 1692; 1357; 1305; 2966; 1663; 1636; 1561; 1484; 3025 cm^{-1}. ^{1}H NMR (500.13 MHz,DMSO-d^6, δ ppm): 2.35 (s, 3H, CH3-piperidine), 2.16 (t, 4H,imide), 1.80 (m, 2H, imide), 7.09(d, 1H, piperidine), 7.25 (d,1H, piperidine), 7.77 (t, 1H, piperidine).

2,8-diamino-4,6-bis(4-fluorophenyl)-10-(5-methylpyridin-2-yl)-6,10-dihydro-4H,5H-dipyrano[2,3-b:3',2'-e]pyridine-3,7-dicarbonitrile (5a):Cream coloured solid, Yield (86.97%), M.P. 130-132ºC, M.F. $C_{31}H_{22}F_2O_2N_6$, M.W. 534.51, FTIR (KBr): 1016.44; 2228.74; 3105; 3072; 685; 3040;2941; 1666, 1166; 1112; 1240; 1591; 1504; 1412, 1376; 1446cm^{-1}. ^{1}H NMR (500.13 MHz,DMSO-d^6, δ ppm): 7.11 (m,4H, Ar-H,J=7.40), 7.46 (m,4H,Ar-H,J=7.35), 3.91 (s, 2H, meth.), 3.07 (s, 2H, -CH_2), 6.70 (s, 4H,-NH_2), 7.95 (d, 1H, py.), 6.87 (d, 1H, py.,J=7.25), 7.45 (t, 1H, py., J=7.53), 2.22 (s, 3H, CH_3–py.).

2,8-diamino-4,6-bis(4-fluorophenyl)-10-(4-methylpyridin-2-yl)-6,10-dihydro-4H,5H-dipyrano[2,3-b:3',2'-e]pyridine-3,7-dicarbonitrile (5b):Cream coloured solid, Yield (85.22%), M. P. 138-140 ºC, M.F. $C_{31}H_{22}F_2O_2N_6$, M.W. 534.51, FTIR (KBr): 1017; 2228; 3105; 3072; 685; 3042;2941; 1687, 1166; 1111; 1240; 1592, 1505; 1412, 1378; 1445cm^{-1}. ^{1}H NMR (500.13 MHz, DMSO-d^6, δ ppm): 7.22 (m, 4H, Ar-H, J=7.41), 7.33 (m,4H, Ar-H, J=7.33), 3.97 (s, 2H, meth.), 3.18 (s, 2H, -CH_2), 6.72 (s, 4H,-NH_2), 7.78 (d, 1H, py., J=7.66), 6.97 (t, 1H, py., J=7.54), 6.89 (d, 1H, py.), 2.27 (s, 3H, CH_3–py.).

2,8-diamino-4,6-bis(4-fluorophenyl)-10-(6-methylpyridin-2-yl)-6,10-dihydro-4H,5H-dipyrano[2,3-b:3',2'-e]pyridine-3,7-dicarbonitrile (5c):Whitish solid, Yield (82.86%), M. P. 136-138 ºC, M.F. $C_{31}H_{22}F_2O_2N_6$, M.W. 534.51, FTIR (KBr): 017.51; 2228; 3105; 3072, 685; 3041;2941; 1664; 1166; 1109; 1240; 1592; 1506; 1412, 1377; 1450cm^{-1}. ^{1}H NMR (500.13 MHz, DMSO-d^6, δ ppm): 7.19 (m,4H, Ar-H, J=7.49), 7.39 (m,4H, Ar-H, J=7.36), 3.99 (s, 2H, meth.), 3.12 (s, 2H, -CH_2), 6.75 (s, 4H,-NH_2), 6.65 (t, 1H, py., J=7.57), 7.57 (t, 1H, py., J=7.64), 6.83 (t, 1H, py., J=7.55), 2.50 (s, 3H, CH_3 –py.).

Seedling Germination Activities (SG) of the prepared compounds (3a-c and 5a-c):

Material used: In the material method, the 85 mm Dia. X 15 mm Ht., Petri Dish, Sterile, Disposable: procured from Laxbro Manufacturing Company, W-53, MIDC, Bhosari, Pune-

411026. Seeds: maize (Rajeshwar), moong (PKVM-8802) weremade available from MAHABEEJ: Maharashtra State Seed Corporation Limited, "Mahabeej Bhavan", Gultekdi, Market Yard, Pune -411008 [India]. Whatman Filter Paper No. 1 (Quantitative Circles 125 mm ø). Standard – I: VIM – 95(Humic Acid 95%, Fulvic Acid, K_2O). Standard – II: BIOZYME Crop+ (Seaweed-Ascophyllum Nodosum Extract, Proteins, Carbohydrates, Inorganic Salts, Other inherent nutrients contained in product of vegetable and animal origin: 22% w/w; Associated manufacturing derivatives, preservatives, stabilizers, aqueous diluent: 78% w/w), Standard – III: DMSO.

Concentration of compounds: Stock solution 100 ppm [0.1 gram per liter] of each compound was prepared in DMSO and water. Standard – I solution 100 ppm [0.1 gram per liter] of VIM – 95 was prepared in DMSO and water. Standard – II solution 100 ppm [0.1 gram per liter] of BIOZYME Crop+ was prepared in DMSO and water. Standard – III solution 100 ppm [0.1 gram per liter] was prepared in DMSO and water.

Figure 1: Seed germination activities of the prepared compounds 3a-c (Mung)

SG Protocol: Healthy seeds of maize (Rajeshwar), moong (PKVM-8802) are of equal size were selected. Petri Dish (Sterile, Disposable of size 85 mm Dia. x 15 mm Ht.) were labeled by using appropriate tag. Whatman Filter Paper No. 1 (Quantitative Circles 125 mm ø) was kept inside Petri Dish. Four healthy seeds (each maize and moong) of equal size were in sowed in the Petri Dishes which contain Whatman Filter Paper No. 1. 3 mL of Stock solution of compounds as well as Standard Solution I, II, III were taken in Petri Dishes.

The petri dishes were kept under the incubator at temperature 30°C and observations made after 6 hours in a day. Root length and shoot length were measured after 3, 6 and 9 days later. Weight of root and shoot before and after heating were measured after 9 days later. For heating roots and shoots were kept in Oven at 50°C for an hour.

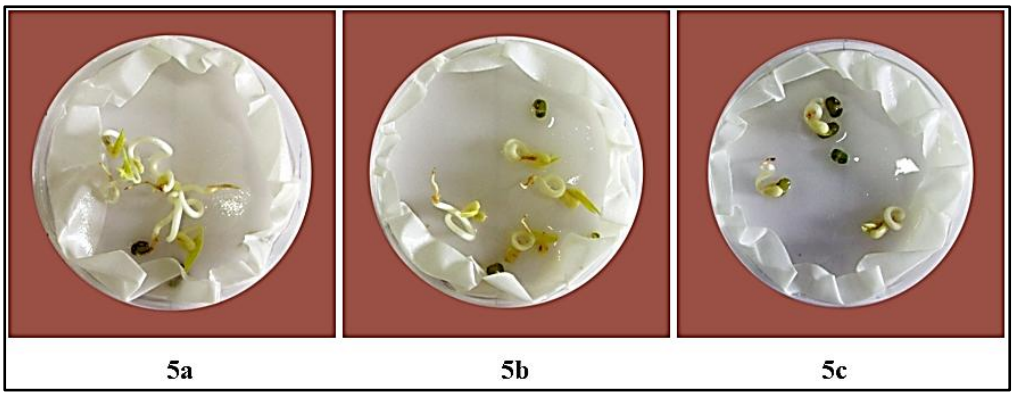
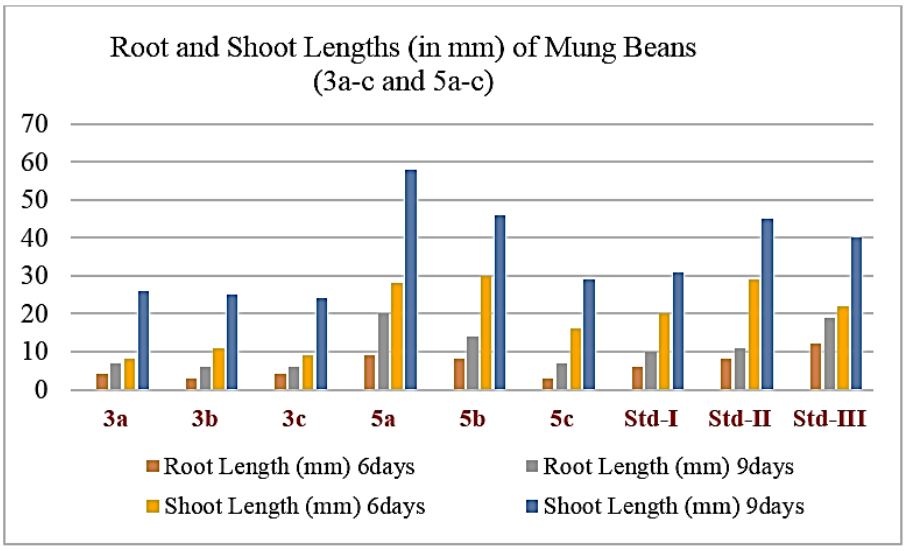


Figure 2: Seed germination activities of the prepared compounds 5a-c (Mung)

Table 1: Root and Shoot Lengths (in mm) of Mung Beans (3a-c and 5a-c)

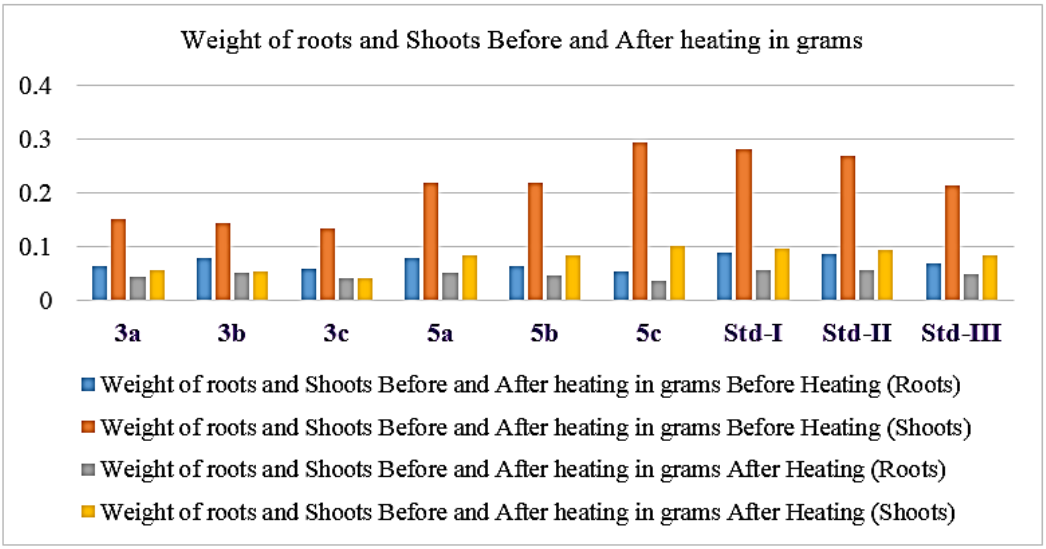
Sample ↓ Days→	Root Length (mm)		Shoot Length (mm)	
	6days	9days	6days	9days
3a	4	7	8	26
3b	3	6	11	25
3c	4	6	9	24
5a	9	20	28	58
5b	8	14	30	46
5c	3	7	16	29
Std-I	6	10	20	31
Std-II	8	11	29	45
Std-III	12	19	22	40



Graph 1: Root/Shoot Length (in mm) of 3a-c and 5a-c

Table 2: Weight of Root and Shoots (in gram) before and after heating after 9 days

Sample	Weight of roots and Shoots Before and After heating in grams			
	Before Heating (Roots)	Before Heating (Shoots)	After Heating (Roots)	After Heating (Shoots)
3a	0.063	0.152	0.044	0.055
3b	0.079	0.143	0.052	0.053
3c	0.058	0.135	0.040	0.041
5a	0.079	0.219	0.052	0.085
5b	0.064	0.220	0.045	0.085
5c	0.053	0.294	0.037	0.101
Std-I	0.089	0.281	0.057	0.097
Std-II	0.087	0.269	0.056	0.095
Std-III	0.068	0.215	0.048	0.084



Graph 2: Weight of Root and Shoots (in gm) before and after heating 9 days later (3a-c/5a-c)

Results and Discussion:

The green approach was used to construct the newly synthesized compounds 3a-c and 5a-c, which were produced by reacting glutaric anhydride with primary aromatic amines and aromatic aldehyde. It has been shown that when using a green route rather than a conventional method, a higher yield is attained. TLC, FTIR, and ^{1}HNMR spectrum analyses were used to demonstrate the synthesis of six-membered cyclic imides and azo derivatives in the reaction. All of the produced compounds 3a-c, 5a-c, and standard I - III, as well as the standard I - III, were tested for seedling growth activity against Mung (PKVM-8802) seeds in DMSO solvent.

All of these compounds were screened for root length, shoot length, and root weight before and after being heated at 50°C to determine their effectiveness. Mahabeej Bhavan, Gultekdi, Market Yard, Pune [India] is where the seeds were obtained. MAHABEEJ is a division of the Maharashtra State Seed Corporation Limited. Some of the compounds demonstrated moderate to excellent activity.

Conclusion:

For the first time under suitable reaction conditions, a new series of Azo (Dipyrano) derivatives from 1-(N-methylpyridin-2-yl) pyrrolidine-2,6-dione substituted aromatic aldehyde and malononitrile. The greener route employed a solvent-free catalyst PbO nanoparticle that generated a reasonable yield. The greener route employed a solvent-free catalyst PbO nanoparticle that generated a reasonable yield. The beauty of greener approach was that it helped to replace the ethanol-based solvent. It also helps to prevent the usage of dangerous piperidine. All of the novel classes of synthesized compounds have showed improved seedling growth regulator activity in Mung seeds. The compounds 5a and 5b have shown to be quite effective in the growth of Mung roots and shoots as well as weight of root and shoots before and after heating 5c showed higher weight.

Acknowledgement:

We are presenting this study in honour of Late, a researcher who was a part of our team. **Dr. Prashant Prakash Chaudhari** was an Assistant Professor of Chemistry at the Dr. D Y Patil School of Engineering's Department of Engineering Science in Lohegaon, Pune. He has co-inventor of eighteen patents with our team and has published several research publications in international journals. He served on the editorial boards of various scientific journals, served as a reviewer for a number of reputable publications, and organised several international conferences in Europe and Asia. The whole world celebrates the removal of a great talent and significant figure from our squad; tragically, God took him from us during the present COVID-19 outbreak. In his honour, we entrust it to him to complete his unpublished scientific work.

References

1. Lee Y. et al., (1995), Korea Polymer Journal, 3(2): 76-81.
2. KmetaniT. et al.,(1986),Tetrahedron Letters,27(8):919-922.
3. MederskiW. W. K. R. et al.,(2003),TetrahedronLetters,44(10):2133-2136.
4. Bewley, J. D., (1997), Seed germination and dormancy,Plant Cell.9, 1055–1066
5. Vander Willigen, C. et al., (2006),Plant Cell Physiol.47, 1241–1250 (2006)

6. Maurel, C. et al., (2007),FEBS Lett.581, 2227–2236 (2007)
7. Nakajima, S. and Nagata, M.,(2021), NPJ Microgravity7, 26
8. Katritzky A. R., and Rees C. W., (1984),Comprehensive Heterocyclic Chemistry, Pergamon Press Oxford,3: 51
9. Kirkan B., and Gupta R., (2008),Turk. J. Chem.,32: 9-17
10. Carey E.A., (2003),Organic Chemistry, New York, Prentice-Hall Inc., 462-465
11. Seferoglu Z., (2009),ARKIVOC,viii: 42- 57.
12. Paula Y. B., (1995),Organic Chemistry, Prentice Haul Inc., New York, 658-659
13. James A. M. et al., (1982),Experimental Methods in Organic Chemistry, New York, Saunders Publications, 313-326
14. Giles C. H., (1974),A Laboratory Course in Dyeing, Brad Ford Soc, Dyers and Colourists (SDC), 93-101
15. David R. W., and Geoffery H., (1994),The Chemistry and Application of Dyes, New York and London, Plenum Press, 115-231
16. Burkinshaw S. M. et al., (1994),The Chemistry and Application of Dyes, Plenum Press, New York and London, 326-331
17. Ellis P. G., and TaylorE.C.,(1987),The Chemistry of Heterocyclic Dyes, Wiley Inter Science, Chi Chester, 47: 1-120.
18. Robert T. M. et al., (2011), Organic Chemistry. 6thedition, New Delhi. Pearson Prentice Hall, 1096-1097
19. Dhivare R. S. and Rajput S. S., (2016), International Journal of ChemTech Research, 9(3), 325-331
20. Dhivare R. S. and Rajput S. S., (2016), International Letters of Chemistry, Physics and Astronomy, 65, 53-63
21. Chauchari P.P. and Rajput S. S. (2016),International Journal of Current Research, 8(11), 41647-41651
22. Dhivare R. S. and Rajput S. S., (2016), Heterocyclic Letters,6(3), 543-551
23. Dhivare R. S. and Rajput S. S., (2016), Iranian Journal of Organic Chemistry, 8(4), 1909-1918
24. Chauchari P.P. and Rajput S. S. (2018), World Journal of Pharmaceutical Research7(7), 1640-1656
25. Chaudhari P.P., Dhivare R. S. and Rajput S.S., (2019), Synthesis of Novel Azo-Dipyrano, Dicarbonitrile Acts as Plant Growth Regulators and Antimicrobial Agents, IN201721032007 A.

ORGANIC FARMING: AN OVERVIEW

Suman Kantwa[1] and Kamal Mahala[2]

[1]Department of Agronomy,

[2]Department of Horticulture,

Sri Karan Narendra Agriculture University,Jobner- Jaipur, Rajasthan (303329)

*Corresponding author E-mail: kantwasuman@gmail.com

Abstract:

After the independence period, the most important emerging challenge has been to produce sufficient food for the growing population of India. In view of rising population and demand for food production, conventional farming systems cannot be abandoned but organic farming should be certified where it already exists and promoted to the newer areas to the extent possible because it seems safer yet for sustainable agriculture at a time when advanced technologies are still costly and have to be proved safe for long-term development. Organic farming is considered as an ecologically, socially and economically viable agricultural production system. Organic farming is one of the several approaches found to meet the objective of sustainable agriculture. In organic farming, negative effects of chemical farming are avoided. It is also key approach to solve the problems being faced by agriculture in India today.

Keywords: Organic farming, conventional farming, population, sustainable agriculture and chemical farming.

Introduction:

Organic farming based on “Nature can provide for everyone's need but not for greed” (Mahatma Gandhi). Organic farming currently covers only a small area in developing countries but its extent is continuously growing as demand for organic products is increasing. Current agriculture today is leading driver of environmental degradation and a major force driving the Earth system beyond the ‘safe operating space for humanity. In developing countries as currently still one in six people are undernourished due to in-sufficient access to nutritious and quality food. At presently, the increasing population pressure has forced many countries to use in-organic fertilizers to increase the crop productivity for fulfilling their ever-increasing food requirements. The prolonged and indiscriminate usages of chemicals are resulted in human and soil health hazards along with environmental pollution. Farmers in the developed countries are being encouraged to convert their existing farms into organic farm. From an agricultural perspective point of view, we need to produce more food in the proper locations at affordable

prices, ensuring livelihoods to farmers. The more considerable challenge ahead of us is that to assess the potential contribution of different types of farming systems to sustainable food security. Organic farming as a alternative' farming systems try to mimic ecological processes while minimizing external inputs are often suggested as more sustainable forms of food production. Organic movement in India owes its origin primarily to the work of Sir Albert Howard, who formulated and conceptualized most of the views which were later accepted by those people who became active in this movement. Sir Albert Howard was a key founder of the post-industrial-revolution organic movement. To meet objectives of organic farming farmers need to implement a wider range of practices that optimize nutrient and energy flows and reduce risk of crop rotations and enhanced diversity of crop; various combinations of livestock and plants; symbiotic nitrogen fixation with legumes; use of organic manure; and biological pest control.

As per the definition of the USDA study team on organic farming "organic farming as a production system which avoids or largely excludes the use of synthetic in-organic inputs (such as fertilizers, pesticides, hormones, livestock feed additives etc.) and to the largely rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection".

Concept of Organic Farming:

Organic farming includes the concept that the soil, plant, animals, and humans are linked. Concept of organic farming is based on some below mentioned principles:

- Nature is considered as a best role model for farming, since it does not use any inputs nor demand unreasonable quantities of water.
- Organic farming system does not believe in mining of the soil of its nutrients and protect the long term fertility of soil.
- The soil in this system is considered as living entity.
- On sustained basis living population of microbes and other organisms in soil's are significant contributors to its fertility.
- Development of biological diversity and the maintenance and replenishment of soil productivity is the major concern of organic farming systems.
- Importance given on crop rotation, natural predators, biological pest, disease and weed management, resistance varieties instead of chemical control.

The main pillars of organic farming:

- Organic threshold standards.
- Reliable mechanisms regarding certification and regulatory affairs.

- Technology packages.
- Efficient and feasible market network.

The Principles of Organic Agriculture:

To understand the motivation for organic farming, it is important to understand the guiding principles of organic agriculture. These principles encompass the fundamental goals and caveats that are considered important for producing high quality food, fiber and other goods in an environmentally sustainable way. Organic agriculture is based on dynamic interaction between the soil, plant, animals, humans, ecosystem and the environment.

The principle aims of organic production and processing:

- To produce food of high quality in sufficient quantities,
- Operation within natural cycles and closed systems as far as possible, drawing upon local resources,
- To maintain long term fertility and sustainability of soils,
- The creation of a harmonious balance between crop production and animal husbandry,
- The securing of high levels of animal welfare,
- The fostering of local and regional production and supply chains, and
- To utilize biodegradable, recyclable and recycled packaging materials;
- To support the establishment of an entire production, processing and distribution chain which is both socially and ecologically responsible;
- To recognize the importance of, and protect and learn from, indigenous knowledge and traditional farming systems.
- To consider the wider social and ecological impact of the organic production and processing system. (23%).

The four IFOAM main principles of organic production:

- **The Principle of Health –** Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.
- **The Principle of Ecology –** Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.
- **The Principle of Fairness –** Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.
- **The Principle of Care –** Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

The Important Goals of Organic Farming are:

- A sufficiently high level of productivity
- Compatibility of cultivation with the natural cycles of the production system as a whole
- Maintaining and increasing the long-term fertility and biological activity of the soil.
- Maintaining and increasing natural diversity and agrobiodiversity
- Maximum possible use of renewable resources
- To create an integrated, environmentally sound, safe and economically sustainable agriculture production system.
- Protection of, and learning from, indigenous knowledge and traditional management systems.

Components of Organic Farming: Different components of organic farming are as follows:

Crop and soil management: Organic farming encourages the use of crop rotations and use of organic manure including green manure for increasing soil organic matter. Carefully management of soil offers some advantages with respect to the increase water holding capacity, ion exchange and reduces soil erosion. Green manuring and inter-cropping of legumes is another important aspect for organic farming systems. It is not only helps in controlling weeds but also in improving its chemical and physical properties by reducing the leaching of nutrients and reducing soil erosion. For success of sustainable agriculture a mixed cropping with pasture and livestock system is desirable or even essential.

Compost: Conventional compost is prepared from aerobically decomposed products of organic waste left over in the field such as, animal dung, plant debris, crop and fodder residues, weeds left in the field and on the field borders or bunds raw manure, decaying and rotting vegetables whereas vermicompost is a metabolic product of earthworms. Decomposition is quicker when Trichoderma or “Panchagavya” is added to organic matter and this process results in compost of greater nutritive value.

On-farm Waste Recycling: Increase in price of chemical fertilizers has enabled organic wastes to regain an important role in the fertilizer practices on the farm. Composting of all organic wastes and Farm Yard Manure (FYM) or feedlot manure is important in organic farming.

Crop diversification: Yearly crop rotations, inter-/mix cropping and cover crops are routinely followed. Border rows of the main or subordinate crops prevent drift of the chemical sprays or pollens of GM crops from surrounding fields. Trap crops attract and trap insect pests. These crop patterns reduce the incidence of pests and diseases, maintain soil fertility (when used with pulse crops) and optimize the balance of plant nutrients.

Soil solarization: Mulching with polyethylene during the period of intense solar radiation, and spreading of dried weeds or crop residues around plant base reduces water evaporation resulting in retention of soil moisture.

Non-chemical Weed Management: Weed management is one of the main concerns in organic agriculture. The some important practices that consider in preventing weed problems are tillage, crop rotation, and manure management, use of cover crops, mulches and green manuring.

Domestic and Industrial Waste Recycling: Among the industrial by products, molasses and press mud from sugar industry have good manurial value. It is important to use only well decomposed press mud at 10 tones/ha. Addition of press mud improves the soil fertility and enhances the activity of microbes. Coir waste can be used as manure after proper decomposition. Use of sewage and sludge for crop production can form an important component of organic farming if treatment and application methods are improved further.

Bio-manures: Farm yard manure (FYM) containing dung, urine, straw and farm waste; concentrated organic manures made from non-edible oil cake, edible oil cake, fish meal bones, poultry, sheep/goat manure etc. are a rich source of nutrients and organic matter besides serving as a soil conserving material. Green manuring in situwith plants such as, dhaincha, berseem, Sunnhemp, cowpea, green gram, glyricidia or sesbania increases green plant mas into the soil which improves its physical and chemical properties and fertility level. Green manuring with leguminous crops can substitute FYM to some extent.

Botanical pesticides: Application of naturally available indigenous plant materials and their products such as, neem- seed kernel extract, water extract of leaves of neem, nirgunc bulb of garlic and onion, chillies, medicinal plants etc. have been recommended for several crops. Use of these pesticides being saferto environment, facilitates the survival, conservation and augmentation of natural enemies of pests (predators, parasitoids, and parasite: nematodes, disease pathogens).

Biofertilizers and microbial inoculants: Nitrogen fixers (Azotobacter, Azolla, Rhizobium, Azospirillum, blue-green algae, phosphate solubilizing bacteria and fungi, phosphate mobilizers (vesicular arbuscular mycorrhizae) and other micro-organisms help reduce the dose of other fertilizers.

Biofertilizers: It has been observed that there is decline in crop yield due to continuous apply of inorganic fertilizers. Therefore, increasing need is being felt to integrate nutrient supply with organic sources to restore the health of soil. Bio-fertilizers are the biological active product called microbial inoculates which containing active strain of selective micro-organisms like bacteria, fungi, algae or in combination.

India has other comparative advantages for organic production:

- India is strong in high quality production of certain crops like tea, some spices, rice specialties, Ayurveda herbs etc.
- India has a rich heritage of agricultural traditions that are suitable for designing organic production systems. Sophisticated crop rotation or mixed cropping patterns, for example the famous agro-forestry systems of the Western Ghats, facilitate the management of pests, diseases and nutrient recycling. Botanical preparations, some of which originate from the ancient Veda scripts, provide a rich source for locally adapted pest and disease management techniques. The widespread cultivation of legume crops facilitates the supply of biologically fixed nitrogen.
- In several regions of India agriculture is not very intensive as regards the use of agro-chemicals. Especially in mountain areas and tribal areas, use of agro-chemicals is rather low, which facilitates conversion to organic production. On these marginal soils, organic production techniques have proved to achieve comparable or in some cases (especially in the humid tropics) even higher yields than conventional farming.
- Compared to input costs, labour is relatively cheap in India, thus favouring the conversion to less inputdependent, but more labour- intensive production systems, provided they achieve sufficient yields.
- The NGO sector in India is very strong and has established close linkages to a large numbers of marginal farmers. Many NGOs are engaged in promotion of organic farming and provide training, extension services information and marketing services to farming communities.

Organic farming as a Food security: Organic agriculture supports and enhances ecologically sound systems of food production that can achieve food security by

- Increasing and stabilizing yields in low input areas.
- Increasing resistance to pests and diseases.
- Reducing erosion and improving water uptake and retention.
- Battling poverty through reducing debt and increasing returns on labor invested.
- Maintaining genetic diversity of crop, this helps cope with climate change.
- Maintaining and improving environmental services.
- Providing diversified, healthy and nutritious food for farming families and communities.
- Being sustainable in long term.

Constraints:

The major challenges include quality and certification credibility, food safety, myth to change from conventional farming and GM crops contamination. Of course, there is awareness

in consumers in cities and towns who accept to pay higher premiums for organically produced farm commodities, but rural population cannot afford to do so. Also, it is not sufficient to incentivize production but there is also a need to create market demand. Crop yields are rather low in the beginning. Skilled labour is needed and high wages are to be paid. Organic manures are costly and not easily available. Cost of certification is not affordable for small farmers. It is difficult to obtain non-treated seeds because general cultivation is done with seeds treated with synthetic insecticides and fungicides. In some states this treatment is mandatory for sale of seeds. With increasing use of GM crops in conventional agriculture and due to gene transmission through pollen, separating fields with organic crops is necessary but poses problems as surrounding areas are mostly under GM crops or chemically-grown crops making it uncertain to ensure that organic products are entirely GM free in nature. Transparency in the supply chain is required. Therefore, farmers need to be organized in a group/ association for crop cultivation such as, Organic Farming Association of India, Institute of Natural Organic Agriculture.

Perspectives:

- Although organic farming is labour intensive, it provides an opportunity for rural employment and for achieving long term improvement in natural resources. For example, integration of animal husbandry into organic farming provides ready manure and organic materials. Organic fabric is being appreciated and organic farming proved to be beneficial for sericulture. This concept may be extended to other allied industrial products.
- Adoption of organic farming may be gradual and can be supported by a sound research an development network that would result in sustainable agriculture which seems to be appropriate to Indian farming conditions in order to make the country self-sufficient in food production. Therefore, policy makers should promote organic farming for good quality of life, restoration of soil health, generation of national economy and creation of better environment. Subsidy may be given to encourage farmers. The premium fixed .or organic products is not attractive to farmers to go for it. For this purpose, contract farming can be an appropriate solution. By this way, farmers will be encouraged to implement organic practices and use green inputs in agriculture.
- In areas where water pollution is on increase, conversion to organic farming should be highly encouraged as a restorative measure.
- There is scanty information on organic technology for all crops. Systematic research on development of suitable varieties/hybrids, plant nutrition and IPM techniques may lead to the increasing demand of organic produce both in retail marketing and export.

- Under “Bhudan Movement”, waste and fallow lands have been distributed by the government. These areas can probably be brought under organic crops for increasing area and production of food crops. Thus, seed production by public agencies like National Seed Corporation, local agricultural universities and private seed companies could be initiated. Subsequently, authentic and reliable data should be made available for promotion of organic farming though locationspecific processes need standardization. Also, there is urgent need to introduce labelling for organic produce as it has been mooted for GM crops.
- Separate minimum support price for organic produce would encourage and motivate farmers for more crop production. For this purpose, organic zones may be separated from other areas to a maintain distance for isolation especially for seed production.
- Indian standards are to be revised from time to time in accordance with changes in global standards so that organic produce from India will not be rejected by importing countries. Till date, 58,408 tonnes of farm produce have been exported to Europe (70% of production) followed by USA (20%) and South-East Asia (5%). India exported 135 organic products in 15 categories during 2009 valued at $112 million; cotton being at the top followed by basmati rice and honey.
- Farmers can take help and advantage of farmer-centric certification system known as “Participatory Guarantee System". With this scheme, organic farming in India has grown 25-fold in the past seven years because of combined efforts of farmers, NGos, government interventions and push from other market forces. Further development would certainly create awareness about organic farming which would transform it with future market potential.

References:

1. APEDA. Agricultural and Processed food product Export Development Authority, Ministry of Commerce and Industries, GOI, www.apeda.gov.in, 2014.
2. Asokan R, Murugan D. 2018. Sustainable agriculture through organic farming in India. *Multidisciplinary global journal of academic research*; 5(3):27-34.
3. Brook, Bhagat G. Organic by default: The irony of organic farming in India, available at: http://www.ecoworld.org/Home/ Articles2.cfm? TID=349, 2004.
4. Clark MS, Horwath WR, Shennan C, KM. 1998. Scow Changes in soil chemical properties resulting from organic and low-input farming practices,” *Agronomy Journal*; 90(5):662-671.

5. Davari MR, Sharma SN. 2010. Effect of different combinations of organic materials and biofertilizers on productivity, grain quality and economics in organic farming of basmati rice. *Indian Journal of Agronomy*; 55(4):290-294.
6. FAO. Codex Alimentations – Organically Produced Foods, FAO, Rome. Fertilizer statistics 2003-04, The Fertilizer Association of India, New Delhi, 2001, 77p.
7. FAO. The State of Food Insecurity in the World. Addressing food insecurity in protracted crises. Rome, Food and Agriculture Organization, 2010.
8. Grolink. Development of Organic Agriculture, 2001.
9. Gahukar, R.T. 2007. Contract farming for organic crop production in India. *Current Science*. 93(12): 1661 -1663.
10. Gahukar, R.T. 2011. Food security in India: The challenges of food production and distribution. Journal of Agricultural and Food Information.13 (3) in press.
11. Howard A. Agricultural testaments. The Oxford University Press, 1940, 233p.
12. IFOAM. IFOAM Norms – IFOAM Basic Standards – IFOAM Accreditation Criteria. IFOAM, TholeyTheley, Germany, 2002.
13. IFOAM. The IFOAM Norms for organic production and processing including IFOAM Basic Standards and IFOAM Accreditation Criteria. Version 2005. IFOAM, Bonn, Germany, 2005.
14. Kasturi, Das 2007. Towards a smoother Transitition to organic Farming, Economic and Potyential Weekly.
15. Musa M, Bokhtiar SM, Gurung TR. (Eds) Status and future prospect of organic agriculture for safe food security in SAARC countries, 2015.
16. Pandey, Jitender, Singh Ashima . 2012. Opportunities and constraints in organic farming. An Indian perspective. *Journal of Scientific Research*; 56:47 -72.
17. National Project on Organic Farming (NPOF), Estimates Committee , 2015 -16. Loksabha 9th report.
18. Roychowdhury R, Gawwad MRA, Banerjee U, Bishnu S, Tah J . 2013. Status, Trends and Prospects of Organic Farming in India: A Review. *Journal of Plant Biology Research*; 2(2): 3 8 -48.
19. Sinha, R.K. 2008. Organic farming: An economic solution for food safety and environmental security. *Green Farming*. 1(10-11): 42-49.

Agricultural Science: Research and Reviews (Volume I)

ISBN: 978-81-953600-2-4

About Editors

Dr. Rajendra Vishnu Salunkhe is currently working as Associate Professor at Department of Zoology and Head of the Department of Microbology at Arts, Science and Commerce College, Indapur, Dist. Pune. He has teaching experience of 31 years at graduate and post graduate level at Savitribai Phule Pune University, Pune. He has published research papers in leading national and international journals. He is working as a member of examination committee at Punyashlok Ahilyadevi Holkar Solapur University. He has received a 'Best research paper presentation award' at national conference. His biography has been published as 'Herpetologist and Educationist' in Asia-Pacific Who's Who by Rifacimento International, Delhi. He is a life member of Indian Science Congress Association. He has worked on snake research project and submitted to Pune University in 2014. He has massive contribution in the snake rescuing. He rescued 2750 snakes from Indapur tehsil and doing work since 30 years. He is good in bird watching and has collection of 245 bird species identification data from tehsil area.He conducted the certificate courses and demonstrated the college students that how to rescue the venomous snakes at an ease. In his youtube channel 'Dr. Rajendra Salunkhe' many videos are famous for snake rescuing and releasing activities. He is a good trekker climbed many difficult forts.

Dr. Shrikant D Kalyankar working as an Assistant Professor (Dairy Technology), College of Dairy Technology under Maharashtra Animal and Fishery Sciences University, Nagpur since 2008. He has completed his M.Sc. (Agri) from VN Marathwada Agriculture University, Parbhani in year 2001 and Ph.D. in Dairy Science in the year 2006. He has 13 years of experience in the field of Teaching, Research and Extension. He was invited as Lead speaker in International conference organized by International Dairy Federation (IDF) at Ireland. He is the recipient of ISCA-Young Scientist Award in the year 2007. Dr. Kalyankar is also the recipient of various awards like Best Poster Award from IDA-DIC, Best Teacher Award, Best Extension Award (Agrocare), Best Presentation Award and Krushi Gaurav Puraskar. More than 70 research/technical/extension publications are to his credit. He has delivered Television and All India Radio Talks on various topics. He is the life member of Indian Dairy Association, New Delhi and act as a reviewer for many publications.

Dr. Laxmikant N. Borkar, (M.Sc., M.Phil., Ph.D.) is working as an Assistant Professor and Head in Department of Botany, S. S. Jaiswal College Arjuni Morgaon Dist- Gondia, Maharashtra, India. He has 12 years of teaching experience. He has published 28 research papers in Reputed National and International Journals. He has attended more than 30 National and International conference / Workshops /seminar/ symposia and presented Paper. His area of interest is Cyto-genetics, mycology and Melittopalynology. He is a life member of the Indian Science congress Association, Indian association for Angiosperm Taxonomy.

Dr. Parashurama T. R (M.Sc., PGDMP., Ph.D) is Founder Secretary of Panchavati Research Academy for Nature (PRANA), Kalamaji, Central Western Ghats, Shimoga and Former Principal of Kumadvathi First Grade College, Shikaripura. He received Bachelor science (2003), Master of Science in Botany (2005) and Ph.D(2014) on Medicinal plant Pathology from Kuvempu University. His research interest includes medicinal plants, Ethno-botany, Pteridology, Phyto-chemistry and Plant Biodiversity. He was awarded JRF and SRF under DST, New Delhi sponsoring Project. He has published 34 research papers in National and International Journals and two book chapters in national edited volumes. He has participated (36) in many National and international Seminars, Conferences and workshops with presented 11 papers. He contributed many significant new reports on medicinal plant diseases. He has excellent work experience in teaching, Administrative and research with various academic institutions and Universities.

Bhumi Publishing

ISBN 978-81-953600-2-4
9 788195 360024