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EDITORIAL

The Agriculture Sector is primary source of income and employment for rural population of India. In the last two decades, Indian Agriculture has witnessed a lot of changes and advancement in the diverse cultivating techniques as well as in extension approach for wider outreach to the masses. New and advanced technologies of agriculture based information dissemination has enabled the agriculture sector in transforming towards improved methods of cultivation, nutrient management, plant protection, harvesting, post harvest management and marketing of agricultural produce.

In this era of digitalization, Information and Communication Technologies (ICT) such as computers and mobile phones have revolutionized the access to knowledge and information for skill enhancement and better services. The use of ICT in agriculture (e-agriculture) has accelerated the process of agricultural information dissemination in rural areas. It has helped in addressing the challenges associated with the extension of agriculture based information also. With the help of ICT, information is disseminated in no time through text messages, social media messages, mobile apps, web portals etc. and the same is accessed by large number of stakeholders in their mobile phones and computers.

The government has implemented use of ICT in agriculture sector and stepping forward for Digital Agriculture. The milestones in this direction are: providing extension services in local languages through Kisan Call Centres, dissemination of information through Knowledge Management Portals, AGMARKNET for updated information on various market activities, Mobile Apps for information on advanced cultivation practices, weather, crop insurance; digitization of agri markets (Mandis), online registration of beneficiary to avail benefit of schemes, Direct Benefit Transfer etc.

However, there are some challenges in digitialization of agriculture sector such as minimal digital skill of farmers, limited access to e-services, weak technological infrastructure and high cost of technology. Unequivocally, Indian Agriculture will excel in digitalization and achieve milestones by addressing the existing challenges.

Dr Sanjay Kumar Joshi

CONTENT

Organic Crop Production

S. K. Yadav, Assistant Professor, D. K. Singh, Professor and Kirti Sharma, Research Fellow

Organic farming is a production man-agement system, excluding all syn-thetic off-farm inputs but rely upon on-farm agronomic, biological and mechanical methods like crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives, biological system of nutrient mobilization and plant protection etc which promotes and enhances biodiversity, biological cycles and agro-ecosystem health.

Organic production systems are based on management practices that promote and enhance farm biodiversity, biological cycles, and soil biological activity. Organic agriculture strives to minimize use of off-farm inputs and relies on management practices that restore, maintain and enhance soil ecology and farm landscape. Growers considering organic grain crops need to recognize that success will depend on developing a diversified crop management system, including an appropriate rotation plan.

Present Status in India

More than 60 % of India's arable land is under traditional agriculture, where no synthetic inputs are being used. Although, the products grown under such systems have so far not been defined as organic products but by all mean they are genuine organic products. Most of the agriculture in backward and tribal areas especially in the hills of northern, eastern and northeastern region could be safely classified as organic. We must take advantage of this opportunity by arranging a market for these products both for domestic and export market.

Total Production	585970 M.T.
Total quantity exported	19456 M.T.
Value of total export	Rs. 30124 Lakhs
Total area under certified organic cultivation	339113 ha
Number of Farmers	141904
Percentage of export	04

Benefits of Organic Crop Production

- ★ Reduced exposure to pesticides and chemicals.
- ★ Organic farming builds healthy soil.
- ★ Combatting erosion
- ★ Fighting the effects of global warming
- ★ Organic farming supports water conservation and water health.
- ★ Discouraging algal blooms.
- ★ Supporting animal health and welfare.
- ★ Organic farming encourages biodiversity
- ★ Better taste and more nutrition
- ★ Consumes less energy

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Components of Organic Crop Production Systems

Organic crop production is the application of a set of cultural, biological and mechanical practices that support cycling of on-farm resources, promote ecological balance and conserve biodiversity. These include maintaining or enhancing soil and water quality, conserving wetlands, woodlands and wildlife, avoiding use of synthetic fertilizers, sewage sludge, irradiation and genetic engineering. The list of tools and practices is not intended to be comprehensive, though the primary organic crop production practices are addressed as follows:

★ **Crop diversity:** Organic crop production encourages Crop diversity. The science of agro ecology has revealed the benefits of polyculture (multiple crops in the same space), which is often employed in organic farming. Planting a variety of vegetable crops supports a wider range of beneficial insects, soil microorganisms and other factors that add up to overall farm health.

★ **Crop Rotation:** In organic farming, the use of crop cycle principles is very effective to make available the crop nutrients mainly nitrogen and increase fertility status of soil. For this, cultivation of cereal crops should be followed by pulses and pulses followed by cereal crops. The use of pulses in crop cycle increases the environmental nitrogen fixation which will be available for the next crop and also reduce the consumption of organic manures. In the initial years of organic farming, rice-wheat cropping system should not be included in crop cycle because it reduces the productivity of wheat. Therefore, after rice, pulses like lentil, chickpea, vegetable pea etc. should be cultivated.

★ **Soil management:** Organic farming relies more heavily on the natural breakdown of organic matter than the average conventional farm by using techniques like green manure and composting to replace nutrients taken from the soil by previous crops. This biological process, driven by microorganisms such as mycorrhiza and earthworms, releases nutrients available to plants throughout the growing season. Farmers use a variety of methods to improve soil fertility, including crop rotation, cover cropping, reduced tillage and application of compost.

★ **Intercropping and Companion Planting:** Intercropping is the growing of two or more crops in close proximity to promote beneficial interactions. Companion planting refers to the establishment of two or more species in close proximity so that some cultural benefit, such as pest control or increased yield may be achieved between them.

★ **Agronomic practices:** Various crop activities can also be a process of management of extremely effective low-cost and environmentally safe pest management practices. Agronomic practices change the environment of crop and also change the stage of crop and behavior of disease and pests and lastly reduce its attack. These processes breakup the relationship between pest- diseases and plants, thus making the life cycle of insects- disease different.

★ **Selection of appropriate seed and variety:** The main basis of good crop is healthy seed, farmers always take risks in the selection of seeds and often use non-certified seeds. Most of the diseases are seed borne or soil borne. If the variety of particular crop is selected according to the local environmental condition then the risk of crop damage is very low.

Nutrient Management under Organic Farming

Plant root system is always in close association with multitude of microorganisms and other nutrients. The microbes in root zone are maintained due to a variety of secretions from the roots and constitute what is often described as 'rhizosphere'. These microbes supply nutrients to the soil system through their heterotrophic activity. Therefore, maintenance of these microbes in the rhizosphere is also necessary for soil health. Crop productivity and nutrient cycles, however, are integral parts of the exploitation of soil health and have led to soil degradation through nutrient depletion and erosion, hence long term strategies are needed to

avoid the use of chemical fertilizers without adversely affecting crop productivity. The use of organic manures, composts, Biofertilizers has received increased attention in our cropping systems. Following are the components in Nutrient management system.

Green manures

Green manuring can be defined as a practice of ploughing or turning into the soil un-decomposed green plant tissues for improving physical structure as well as soil fertility. Green manuring, wherever feasible, is the principal supplementary means of adding organic matter to the soil. The green-manure crop supplies organic matter as well as additional nitrogen, particularly if it is a legume crop, due to its ability to fix nitrogen from the air with the help of its root nodule bacteria.

Composting

Composting is the natural process of 'rotting' or 'decomposition' of organic matter by microorganisms under controlled conditions. Raw organic materials such as crop residues, animal wastes, food garbage, some municipal waste and suitable industrial waste, enhance their suitability for application to the soil as a fertilizing resource, after having undergone composting. Compost is a rich source of organic matter. Soil organic matter plays an important role in sustaining soil fertility and in sustainable agricultural production. In addition to being a source of plant nutrient, it improves the physico-chemical and biological properties of the soil. The following farm waste material is used for different type of composting:

i) Crop Residue Composting

Crop residues are the non-economic plant parts that are left in the field after harvest. The harvest refuses include straws, stubble, stover and haulms of different crops. Crop remains are also from thrashing sheds or that are discarded during crop processing.

ii) Sugarcane Trash Composting

Sugarcane produces about 10 to 12 tonnes of dry leaves per hectare per crop. The detaching is done on 5th and 7th month during its growth period. This trash contains 28.6% organic carbon, 0.35 to 0.42% nitrogen, 0.04 to 0.15% phosphorus, 0.50 to 0.42% potassium. The sugarcane trash incorporation in the soil improves physical, chemical and biological properties of the soil.

iii) Value addition of Poultry Waste through Composting technology

Poultry industry is one of the largest and fastest growing livestock production systems in the world. The localized nature of poultry production also means that it can represent a large percentage of the agricultural economy in many states or regions.

Vermicompost

Vermicompost is the product of decomposition process using various species of worms, usually red wigglers, white worms and other earthworms to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast. This process is called Vermicomposting, while the rearing of worms for this purpose is called vermiculture. Vermicast (also called worm castings, worm humus, worm manure or worm feces) is the end-product of breakdown of organic matter by earthworms. Vermicompost

contains water-soluble nutrients and is an excellent, nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small scale sustainable organic farming.

Bacterial and fungal biofertilizers

Contribution of biological fixation of nitrogen on surface of earth is the highest (67.3%) among all the sources of N fixation. Following bacterial and fungal biofertilizers can be used as a component of organic farming in different crops :

★ ***Rhizobium :*** The effectiveness of symbiotic N_2 fixing bacteria viz. Rhizobia for legume crops eg. *Rhizobium, Bradyrhizobium, Sinorhizobium, Azorhizobium, and Mesorhizobium* etc have been well recognized. These bacteria infecting legumes have a global distribution.

★ ***Azotobacter:*** N_2 fixing free-living bacteria can fix atmospheric nitrogen in cereal crops without any symbiosis. Such free living bacteria are: *Azotobacter sp.* for different cereal crops; *Acetobacter diazotrophicus* and *Herbaspirillum spp.* for sugarcane, sorghum and maize crop.

★ ***Azospirillum:*** The genus *Azospirillum* colonizes in a variety of annual and perennial plants. Studies indicate that *Azospirillum* can increase the growth of crops like sunflower, carrot, oak, sugarbeet, tomato, pepper, cotton, wheat and rice.

★ **Plant growth promoting rhizobacteria :** Various bacteria that promote plant growth are collectively called plant growth promoting rhizobacteria (PGPR). PGPR are thought to improve plant growth by colonizing the root system and pre empting the establishment of suppressing deleterious rhizosphere microorganisms on the roots.

★ **Phosphorus-solubilizing bacteria (PSB):** Phosphorus is the vital nutrient next to nitrogen for plants and microorganisms. This element is necessary for the nodulation by Rhizobium and even to nitrogen fixers, Azolla and BGA.

★ **Mycorrhizal fungi:** Root-colonizing mycorrhizal fungi increase tolerance of heavy metal contamination and drought. Mycorrhizal fungi improve soil quality by having a direct influence on soil aggregation and therefore enhance aeration and water dynamics.

★ **Blue green algae (BGA):** BGA are the pioneer colonizers both in hydrosphere and xerosphere. These organisms have been found to synthesize 0.8 x 1011 tonnes of organic matter, constituting about 40 percent of the total organic matter synthesized annually on this planet.

★ **Azolla:** A floating water fern 'Azolla' hosts nitrogen fixing BGA *Anabaena azollae*. Azolla contains 3.4% nitrogen (on dry wt. basis) and add organic matter in soil. This biofertilizer is used for rice cultivation. There are six species of Azolla viz. *A. caroliniana, A. nilotica, A. mexicana, A.filiculoides.*

Weed management

Organic weed management promotes weed suppression, rather than weed elimination, by enhancing crop competition and phototoxic effects on weeds. Organic farmers integrate cultural, biological, mechanical, physical and chemical tactics to manage weeds without synthetic herbicides. Organic standards require rotation of annual crops, meaning that a single crop cannot be grown in the same location without a different, intervening crop.

Mechanical and physical weed control practices used on organic farms can be broadly grouped as:

★ Tillage - Turning the soil between crops to incorporate crop residues and soil amendments; remove existing weed growth and prepare a seedbed for planting; turning soil after seeding to kill weeds, including cultivation of row crops.

★ Mowing and cutting - Removing top growth of weeds.

★ Flame weeding and thermal weeding - Using heat to kill weeds.

★ Mulching - Blocking weed emergence with organic materials, plastic films or landscape fabric.

Biological Pest Control: Biological pest control is the use of one or more beneficial organisms, usually called natural enemies to reduce the numbers of another type of organism, the pest.

Sanitation: Sanitation can take on many forms including removal, burning, or deep plowing of crop residues that could carry plant disease or insect pest agents, destruction of nearby weedy habitats that shelter pests, cleaning accumulated weed seeds from farm equipment before entering a new field and sterilizing pruning tools.

Tillage: Merely maintaining soil organic matter levels are difficult if soil is intensively tilled (such as with annual use of a moldboard plow). Reducing tillage means leaving more residues, so tilling less often and less intensively than conventional tillage is required.

Mulching: Organic mulches, such as straw or spoiled hay can reduce the need for cultivation, protect soil from erosion and crusting, and replenish organic matter.

Supplemental Fertilization: Organic farming management relies on developing biological diversity in the field to disrupt habitat for pest organisms and for purposeful maintenance and replenishment of soil fertility.

Biorational Pesticides: This term refers to synthetic, organic or inorganic pesticides that are both low toxicity and exhibit a very low impact on the environment. "Biorationals" also have minimal impact on species for which they are not intended (called non-target species).

Buffers and Barriers: In the context of organically managed systems, buffer and barriers are required under NOP rules if there is a risk of contamination of substances not allowed under organic regulations.

Components of Sustainable Organic Crop Production

- ★ Economic Profitability.
- ★ Environmental Stewardship.
- ★ Social Responsibility.
- ★ Upholding Animal Welfare.

Organic Certification: Key stages of Organic certification

Application by the Producer to the certification agency on the prescribed format.

⇩

Reviewing the application form received by the certification agency and seeking other information if required.

⇩

On receipt of full information, registering the producer, estimating the duty and determining the date / time of inspection.

⇩

To supervise / audit all production processes by the inspectors as per the standards and submit the inspection report to the agency office.

⇩

Evaluation of inspection data by the agency and submission of certification decision (buggy / unqualified) to the production agent.

⇩

Issuance of certificate by certification agency only after compliance with standards.

References

Santhosh kumar, M., Reddy G.C. and Sangwan P.S., A Review on Organic Farming - Sustainable Agriculture Development, Int. J. Pure App. Biosci. 5(4): 1277-1282 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5649.

Elayaraja M. and Vijai C. Organic farming in India: Benefits and Challenges. European Journal of Molecular and Clinical Medicine. ISSN 2515-8260 11(7) 2020.

Mahimairaja,S., P.Dooraisamy, A.Lakshmanan, G.Rajannan, C.Udayasoorian and S.Natarajan.2008.Composting technology and organic waste utilization in Agriculture.A.E.Publications, P.N.Pudur, Coimbatore-641 041.

Singh V. Y. and Dabas J.P.S. Organic Farming. Kurukshetra journal.

TNAU Agriculture Portal.

QR Code Based Digital Agricultural Information Board (DAIB) for Agricultural Technology Transfer

Dr. L. R. Tambade

Social Media and communication is becoming more & more dynamic every day.The Quick Response codes or in brief QR code, are two dimensional (2D) matrix barcodes that is scanned using exploitation sensible and web capable smart mobile phones having Camera and access the information. QR code is an emerging technology that is applicable in many fields and replaces traditional way of reading, agricultural extension and education etc. QR code have now become part of various content of the print medium for providing information, audio video content, entertainment etc. QR codes are made of black and white pixels arranged in a squared matrix (sahu & Gonnade, 2013). QR code possesses a high capacity of storing information. A QR code is capable of storing various type of data like numeric, alphabetic, characters, audio / video content, hiragona, binary, symbols and control codes. A QR code can store 7089 characters in one symbol (Ji Qianyu, 2014) which is much more than conventional barcodes (20 digits storage only).

The Author of this article conceptualized and developed QR code based Digital Agricultural Information Board (DAIB) with improved agricultural production, protection &

processing technological knowledge of 14 different aspects including animal husbandry during 2020-21 and promoted it as innovative tool of extension in more than 55 villages of 3 tahsils of Solapur district of Maharashtra. Initially demonstrations were given to farmers about use of QR code based DAIB's and also displayed DAIB's in more than 55 villages and offices (TAO and DSAO Solapur) of Department of Agriculture of Solapur district.

The studies were focused on use of QR code based Digital Agricultural Information Board (DAIB), especially by the young & educated farmers for transfer of improved agricultural technologies seamlessly with least cost thereby enhancing adoption of improved agricultural technologies.

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Methodology

Present study is an online exploratory study assessing the use and impact of QR code based Digital Agricultural Information Board (DAIB), conceptualized and developed by the author during 2020. The QR code based Digital Agricultural Information Board (DAIB) is having 14 QR codes with images of the crops like Capsicum, Onion, Drumstick, Gram, Sugarcane, Red gram, Watermelon production technologies, Protection technologies of vegetables & Maize. Processing & value addition technologies in Soybean & Sorghum. The topics related to animal husbandry i.e. feed management & Goat farming were also included. The QR Code of crops / enterprises with respective image were designed & developed at 3 X 2 feet size of digital foam sheet flex during 2020 and displayed in more than 55 villages including KVK focal villages, 3 TAOs and DSAO offices. First DAIB Board was fixed in KVK corridor during January, 2021. At village level the DAIB boards were displayed at most busy place / Gram Panchayat Corridor with responsibility to 2 young farmers. Initially demonstrations were given to farmers about how to access the needful information through QR code based DAIB.

The Google Questionnaire were developed, pre-tested and finally online data regarding personal characters, utility and impact were studied during August, 2021. 80 Farmers data from 8 Villages (Pimpri, Dhorale, Dahitne & Sakat from Barshi Tahsil and Boramani, Musti, Darganhalli & Doddi from South Solapur Tahsil) in two tahsils of Solapur district were collected through Google form (Questionnaire), where QR code based Digital Agricultural Information Board (DAIB) was displayed during last year. The data were analyzed through percentage and drawn inferences.

Result and Discussion

The results along with relevant discussion have been presented in prime heads as personal characters like age, education, sex, caste etc and source of information, ease in operation (comfort), ranking of usefulness, technology preference, knowledge preference, impact on increasing production / income, experience of use etc.

The personal characters which were assumed to influence the use of QR code based Digital Agriculture Information Board have been included and presented in Table 1.

Data presented in Table 1 depict that, majority (69.30%) of the respondents who are using QR code based DAIB are young (25 to 34 years age group) , whereas, 26.70 per cent respondents are of middle (35 to 44 years) age group and remaining just 4.0 per cent farmers belongs to old (45 & above) group. The result of the study is near about similar to the results of Athma, B. Nath & Titto Varghese (2020). It was also observed from the data of table 1 that, majority (68.80%) of users belong to male category, whereas 31.30 per cent users are females which is encouraging. The sizable female users are because of involve-

Table 1: Details of the Personal Characters of the QR code DAIB users (n=80)

Variables	Category	Percentage
Age	Young (25 to 34 yerars)	69.30
	Middle (35 to 44 years)	26.70
	Old (45& above)	04.00
Gender	Male	68.80
	Female	31.30
Education	Primary (1-4 Std.)	15.00
	Secondary (5-10 Std.)	32.50
	Higher Secondary (12th Std.)	22.50
	Graduate	20.00
	Post Graduate	8.80
Caste	Open	86.30
	OBC	12.50
	SC/ST	1.20

ment of female FPC in promotion of QR code based DAIB.

The data from Table 1 also shows that, majority DAIB users (32.50%) are educated up to secondary level, followed by 22.50 & 20.00 per cent by Higher Secondary & Graduate level of education respectively. In nut shell all the QR code based DAIB users are quite educated & Young. Also majority (86.30%) of farmers using QR code based DAIB are Open category followed by 12.50 percent OBC and 1.2 per cent belong to SC/ST category.

The Krishi Vigyan Kendra's plays vital role in transfer of agricultural technologies to rural masses. Data pertaining to source of information about use of QR code based Digital Agricultural Information Board in Table 2 reveals that, the KVK scientists acts as key informant for majority

Table 2: Details of source of information about QR code based DAIB board (N=80)

Sr. No.	Particulars	Percentage
1.	KVK Scientist	87.50
2.	News Paper / Social Media	1.20
3.	Friends	6.30
4.	Village leaders	2.50
5.	Agril. Officers / Assistants	2.50
6.	Others	1.20

(87.50%) of farmers as this technology is developed and spread by KVK Scientist.

The data depicted in Table 3 indicate that, majority of farmers (72.50%) feel highly Comfortable for accessing information from DAIB through mobile phone, whereas 25.00 Per cent feel Comfortable in use. Only 2.50 percent expressed that they are somewhat comfortable in accessing the information from Board. It was also observed that, nobody expressed negative remarks about use of QR code based DAIB.

Also the data from Table 4 reveals that, the majority of (75.00%) farmers expressed that the QR code DAIB are very useful and 20.00 per cent farmers ranked it as useful. Only 3.80 per cent farmers expressed that QR code DAIB are

Table 3: Details of Comfortableness about use of QR code based DAIB (N=80).

Sr. No.	Particulars	Percentage
1.	Highly comfortable	72.50
2.	Comfortable	25.00
3.	Somewhat Comfortable	2.50
4.	Not comfortable	00.00

Table 4: Details of ranking of usefulness of QR code based DAIB by the respondents (N=80)

Sr. No.	Particulars	Percentage
1.	Very Useful	75.00
2.	Useful	20.00
3.	Less Useful	3.80
4.	Not Useful	1.20

less useful. This is once again confirmed that application of ICT tools to a great extent depend on the access & availability of media and facility structures to explore the benefit of the innovative ICT tools. This might have reflected in the results.

Efforts were made to know the experience of the users about use of QR code based DAIB. According to Table 5 its seen that, majority (66.30%) QR code based Digital Agril. Information Board users feel Excellent and 25.00 per cent feel Good while accessing the information seamlessly & 24 x 7 at their own places. But very negligible (1.20%) get poor experiences while getting the information.

As seen in the Figure-1, 81.30 per cent users prefer the Onion production technology information followed by Gram technology (72.50%

Table 5: Details of farmers experiences about use of QR code DAIB. (N=80)

Sr. No.	Particulars	Percentage
1.	Excellent	66.30
2.	Good	25.00
3.	Fair	5.00
4.	Neutral	2.50
5.	Poor	1.20

Figure-1: The details of the technologies preferred by the Farmers in DAIB

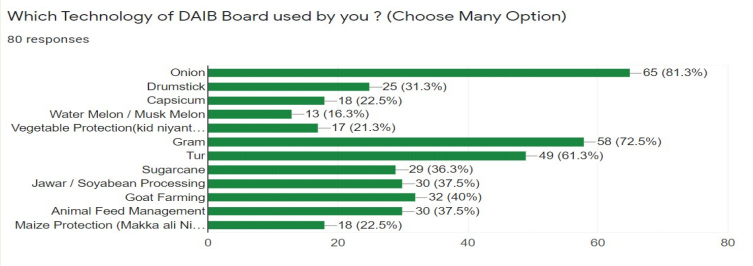
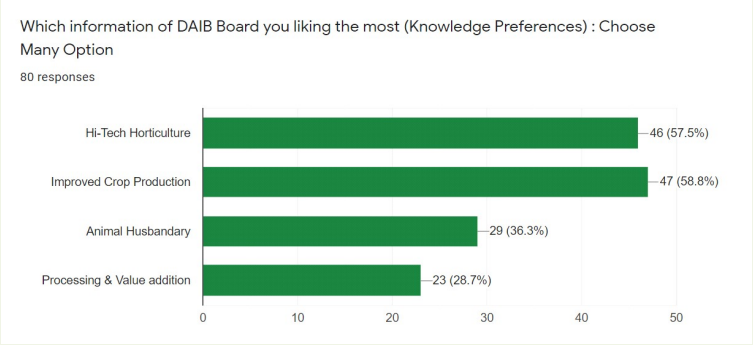


Figure-2: The details of the information liked by the users in DAIB.



Users) and Red gram technology (61.30% users) respectively. It was also observed that all displayed technologies were preferred by the users, it shows that the QR code based Digital Agril Information Boards are Prepared on Need based technological topics.

Further it was noted from Figure-2 that majority (58.80%) users are interested in improved crop production technological information, whereas, 57.50 per cent users are interested in Hi-tech Horticulture information. Also 36.30 per cent users are interested in technologies related to animal husbandry and 28.70% interested in processing & value addition respectively. This was due to the fact that the farmers are interested in market led production and development of Agro based entrepreneurship. It was further inferred that there is tremendous scope for transfer of need based improved agricultural technologies through innovative extension tools. The results are found parallel with the findings of Gurhan Durak and E. Emre Ozkeskin (2016).

During the study, special attention was given to know the impact of the use of QR code based Digital Agricultural Information Board for getting improved agricultural information in time & seamlessly. Also, to get an overview of the increase of production / income after getting needful information through QR code based DAIB. Majority (73.80%) of users expressed that there is sizable increase of their production / income, due to timely availability of improved agricultural information at their village. Whereas 23.80 per cent users expressed that there is increase in production / income due to its use. This was due to the fact that technology plays vital role in increasing production / income of farmers.

Conclusion

The results concluded that majority of the QR code based Digital Agril. Information Board (DAIB) users were young farmers having better education level. Some farmers were observed to be in the high level of education and higher level of use of ICT applications. The majority (32.50%) of users were educated up to secondary level, followed by 22.50 and 20.00 Per cent by higher secondary & graduate level of education. It was observed that 72.50 per cent users feel comfortable about use of DAIB Board. Also 75.00 per cent users ranked it as very useful whereas 20.00 per cent ranked it as Useful tool for getting improved

Table 6: Details of response of farmers after use of QR code based DAIB in respect of increase in Production / Income (N=80)

Sr. No.	Particulars	Percentage
1.	Major Increase	73.80
2.	Increase	23.80
3.	No change	2.50

Agril. Information. It was also observed that out of 14 different technologies displayed through QR codes on DAIB, 81.30 per cent Farmers chose Onion Technologies followed by 72.50 per cent for Gram technologies respectively. Also 58.80 per cent farmers preferred improved crop production technologies followed by 57.50 % and 36.30 % Hi-tech Horticulture and animal husbandry technologies respectively. It is inferred that QR code based DAIB are helpful to improve their production due to timely & seamless availability of needful information with respect to improved agricultural technologies. It is cost effective and easy to use model of extension for transfer of agricultural technologies especially for Young farmers and it has wide scope in futuristic Extension.

References

Athma B. Nath, Titto Varghese (2020). Factors influencing the effective usage of QR code: A Study among readers of Trivandrum city, IJRAR 2020, Volume 7 (1), 822-825.

Iranna M. Shettar (2016). Quick Response (QR) Codes in Libraries: Case Study on the use of QR code in the Central Library, NITK, National Conference on Future Librarianship. pp 129-134.

Nain, M.S. Rashmi, S and Mishtra, J.R. (2019). Social Networking of Innovative Farmers through WhatsApp Manager for Learning Exchange: A Study of Content Sharing. Indian Journal of Agricultural Sciences. 89(3), 556-558.

Noor Agha, Ghanghas, B.S. and Chahal, P. K.. (2018). Use of Information and Communication Technologies by Extension Personnel to disseminate agricultural information. International Journal of Current Microbiology & Applied Science. 7(4), 1369-1376.

L. R. Tambade, P. A. Gonjari and Lakhan Singh (2019). Analysis of YouTube use pattern among the farmers for Agro-Advisory. Indian Journal of Extension Education, Vol.55(1), 53-55.

Koran, J. (2011). 5 steps to a successful QR code Marketing Campaign. Social Media Examiner. Accessed 11/8/11.

Irfan Bashir, J. Rama Krishna Naik and C. Madharaiah (2012). Potential Business Applications of Quick Response (QR) Codes. Prajan Vol. XLI. No.4.

Gurhan DURAK, E. Emre OZKESKIN and Murat ATAIZI (2016). QR Codes in Education and Communication. Turkish Online Journal of Distance Education-TOJDE.Vol.17(2). 42-45.

Jeewan Ram Jat, N. K. Punjabi and Rashmi Bhinda (2021). Use of ICTs by Tribal Farmers for obtaining Agricultural Information in Southern Rajasthan. Indian J. of Extn. Edu. Vol.57(3), 16-19.

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Lac Cultivation- A Measure for Poverty Alleviation

S. Ghosal

Shri Chandan Binha is an ordinary farmer belonging to lower middle class family from Sogad village, Jamchua Jaarey, Ranchi. Like Crores of farmers, he also used to do traditional cultivation. Normal cultivation operation was restricted to rice, wheat, *sarguja*, pulses, millets, vegetables etc. Like many other farmers, he was not habituated to diversify his thinking beyond the traditional agriculture. Generation after generation, there had been no breakthrough in the thinking process. As a result he used to follow traditional methodology of cultivation. Therefore, poverty used to be companion in his daily life and his life was full of constraints. To explain the scenario he expressed that farmers normally grow vegetables as cash crop but all lands are not suitable for vegetable cultivation. Out of several acres of land under his disposal, only one acre is suitable for vegetable cultivation equipped with irrigation facility and fencing. Coming to the profitability from vegetable cultivation, he added that cost of cultivation for one acre of land could be Rs 1000/-. Profitability from this cultivation could be 2-5 times. Crops other than vegetables are used for home consumption only. Poor performance of agriculture crop made him think about probable solution. *Ber* and *kusum* trees are abundant in Jharkhand (Pal *et al*, 2013) and it is a boon to uplift economic condition if used for lac cultivation.

Scientific intervention

New exposure of thoughts with practical experiences of any individual bring permanent change in life. In actual sense, change takes place in the mind. At some point of time such an event took place with Shri Chandan Binha, when Scientists from ICAR-IINRG visited his village and asked him to do *kusmi* lac cultivation in winter season with scientific intervention in particular reference to fertilizer application. In the year of demonstration, inputs like fertilizer (2 kg lime, 300 g urea, 300 g DAP and 800 g MOP per *ber* tree) and pesticide was supplied to him.

He was associated with lac cultivation since 2014 and started the venture with 1.5 kg broodlac, purchased from *Taimara* market. High rate of broodlac in that year (Rs 500/kg) attracted him

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towards lac cultivation. His journey was not easy in the initial phase of cultivation. Crop production fluctuated very much in different years till he could understand the principles of lac cultivation through demonstration in his field in 2017. He asserted that afterwords no crop failure was recorded and the same stock of broodlac is being multiplied year after year.

Several interventions, as recommended by this Institute has been adopted by him. *Kusmi* lac cultivation on *kusum* and *ber* is very much profitable (Jaiswal and Singh, 2014). He prunes the *kusum* and *ber* trees in recommended time and gives suitable rest period to hosts i.e. 18 months for *kusum* and 6 months for *ber*. He has understood that spraying of insecticide and fungicide in crucial time on lac crop is a key to success in lac cultivation. He has adopted both the interventions meticulously. Soil fertility condition of Jharkhand is very poor (Ghosal et al, 2016). He is aware of the fact that host trees get exhausted when lac cultivation is done year after year, without application of fertilizers. Therefore, he applies fertilizers as per recommendations. He got an idea that some nutrients like nitrogen and phosphorus are useful only for trees but lime and potassium are important for both, trees and the lac insect. Further, he could perceive very well that one requires to do lac cultivation on both the seasons *i.e.* summer and winter crop for fulfilling high ambition. Therefore, he follows the recommendation of the Institute *i.e.* utilizes *kusum* trees for summer crop and *ber* tree in winter season. Therefore, total number of *kusum* trees under his disposal *i.e.* 82 have been divided into two coupes and does cultivation in different years giving suitable rest to each.

Success

By following these novel interventions, he successfully grows lac every year. He is able to produce 7 quintals of broodlac in the summer crop of 2021. Out of this total broodlac he has inoculated 4 quintals on *ber* trees for winter season *kusmi* lac which is to be harvested in Feb 2022. Rest amount of the broodlac *i.e.* 3 quintal was sold in local market @ Rs 400/kg. He is satisfied with this achievement and thankful to the Institute for extending need based help. While doing cost/benefit analysis, he added that for pruning, 7 quintals of broodlac (worth Rs 2,80,000/-) in one season, he had to spend Rs 24000/- only. Majority of this amount was spent to meet up labour requirement and other inputs (except broodlac, since he is self sufficient in producing broodlac). With the use of several novel technologies, he could produce around 35 kg broodlac/kusum tree against a farmers' field average of 6-10 kg. He normally receives around 8 kg broodlac from *ber* trees against 1.5-6 kg at normal course.

By generating profit from lac cultivation, he is able to purchase two insurance policies worth Rs. 5500/- annually. Besides, 3 acres of land kept under mortgage has been freed. He was fully satisfied with his achievement.

Conclusion

Shri Chandan Binha has set an example

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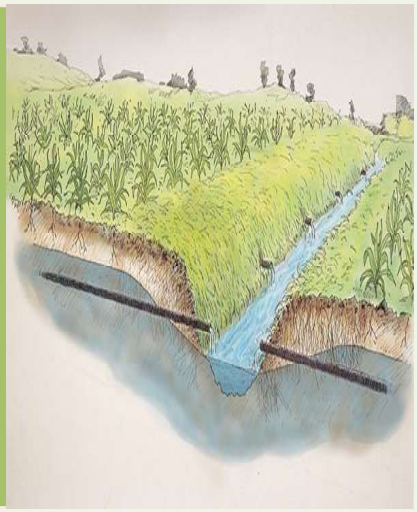
Agricultural Drainage Technologies for Enhancing Productivity of Temporary Water Logged Vertisols



Ramadhar Singh, K.V. Ramana Rao, K.P. Singh, and Satish Kumar Singh

Agricultural land drainage has all along been an essential but neglected activity in Indian agriculture. Expansion of irrigated agriculture in India has resulted in twin problems of waterlogging and soil salinity adversely affecting crop production and productivity. Vertisols/clay soils offer good prospects of production when adequately drained since they suffer from flooding, surface ponding and/or waterlogging due to poor soil physical properties. In India, severely waterlogged saline soils occur in about 2 mha area in alluvial regions and more than 1 mha each in coastal and black cotton heavy soil (Vertisols) regions. In India, about 23 million ha is suffering from salinity/alkalinity/acidification and 14 million ha from water-logging/flooding (Kumar and Sharma, 2020). In India, during the monsoon season of four months, major rains occur usually with high rainfall intensity. This results in high surface runoff volume within a short time, thus surface drainage is the first requirement. In Bhopal region, high intensity erratic rainfall during *Kharif* season combined with poor physical properties of vertisols leads to rise in temporary water table (0.2 – 0.4 m) in crop root zone affecting their growth. This situation prevails for about a month saturating the entire root zone. Artificial land drainage to reclaim waterlogged and saline soils is urgent need to sustain the productivity levels. Soybean is a popular *Kharif* crop in Madhya Pradesh which has moderate tolerance for short periods.

The sub surface drainage (SSD) technology has enhanced crop intensity, crop yield and farmers income by 40-50%, 50-120% and 200-300% respectively (Bhattacharya and Michael, 2010). Mole drains are unlined circular soil channels, which function like pipe drains. Mole drainage also known as pipe less SSD is an inexpensive and effective method of drainage which is widely used in the clay soils having clay content greater than 30 per cent. The life of mole drainage is 5 to 10 years. Mole drains are formed with a mole plough which comprises a cylindrical foot attached to a narrow leg, followed by a slightly larger diameter cylindrical expander. Mole drains are installed at depths between 0.5 and 0.7 m. The mole drain spacing ranges between 2 to 6 m. Common length of mole drains varies from 30 m to 100 m long depending on the grade. Mole drains are installed using a mole plough, pulled by a powerful tractor (drawbar pull 40-60 KN) (Rao. at al., 2009). The ICAR-CSSRI, Karnal has compiled research information and field experiences at national level, to prepare guidelines for large scale installation of SSD systems in waterlogged and saline soils (Bundela, et al. 2017). The broad bed and furrow (BBF) farming system has been mainly developed at the International Crops Research Institute for

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the Semi-arid Tropics (ICRISAT) in India (Krantz 1981, Pathak et al. 1985). The BBF farming system is developed for conservation of water in case of dry land zone and to overcome water logging and improve soil structure on cropping soils in case of high rainfall zone.

Materials and Methods

The Study Area and Field Experiment

The study area falls under Agro-Ecological Region VII of India *"Semiarid Lava Plateau and Central Highlands"* and is bounded by latitude 230 18' to 230 20' N and longitude 770 24' to 770 25' E at an altitude of 490 m (msl).. The study region receives about 1070 mm average annual rainfall with 56 rainy days every year. The soil of study area is having sub angular blocky structure with predominant montmorillonite clay minerals. The soils of Bhopal region is heavy clay (Vertisols) with 47.3 – 54.7 per cent clay content. The present study was carried out at ICAR-Central Institute of Agricultural Engineering (CIAE) farm during the years 2016 to 2019. Field experiment treatment details are given in Table-1. Field experiments for wheat (*Variety: HI 8498*) and soybean (*Variety: JS 9560)* on surface drainage (BBF) and sub-surface drainage (mole drainage) with eight treatments having three replications of each following block randomized design were carried out during consecutive Kharif and Rabi seasons. The area under each treatment is 0.104 ha. Mole drains of 85 mm diameter at 4.0 m spacing and 500 mm depth with 65 m lateral length were installed in experimental field of Institute using tractor drawn mole plough developed at CIAE, Bhopal. Mole drains were installed at a longitudinal gradient of 0.20 per cent, using 75 hp wheel tractor. A drainage sump well was constructed for automatic drained water pumping and measurement. BBFs of 65 m length and varying depths (150 - 250 mm) were formed.The sowing of experimental crop and construction of BBFs were done simultaneously in a single pass using BBF cum Seeder machine developed at CIAE, Bhopal (Fig. 1). Crop growth parameters and yield attributed were recorded at regular interval (Fig. 2).

Result and Discussion

The monsoonal rainfall of the year 2016 was normal rainfall with nearly uniform rainfall distribution pattern. During the monsoon season of the year 2016, 1263.6 mm rainfall occurred in 56 rainy days resulted in 432.4 m^3 (equivalent 117.3 mm depth) subsurface flow which is 9.3 % of the rainfall amount. During the monsoon season of the above normal rainfall year 2019, 1757.2 mm rainfall resulted in 711.6 m^3 (equivalent 193.1 mm depth) subsurface flow which is 11 % of the rainfall amount.

Variations in Soybean and Wheat Grain Yield

The variation in grain yields of soybean and wheat under different treatments are given in Table 2. During kharif-2016 and 2019 , the grain yields of soybean were found to be significantly higher in treatments comprising BBFs and mole drainage as compared to the control (T_1). Increase in soybean grain yields un-

Table 1 Treatment Details and Layout of Field Experiments

Symbol	Experimental Layout
T1 (Control)	Conventional cultivation practice
T2	BBF (Furrow depth 150 mm, Top width 300 mm)
T3	BBF (Furrow depth 200 mm, Top width 400 mm)
T4	BBF (Furrow depth 250 mm, Top width 500 mm)
T5	Mole drain+ BBF (Furrow depth 150 mm, Top width 300 mm)
T6	Mole drain+ BBF (Furrow depth 200 mm, Top width 400 mm)
T7	Mole drain+ BBF (Furrow depth 250 mm, Top width 500 mm)
T8	Mole drain

Fig. 1 Construction of Mole drains with sump well and BBFs

Fig. 2 Field experiments on BBFs with mole drains in soybean and wheat crops

der treatments comprising BBFs over the control (0.78 t/ha) varied from 32.2 to 39.9 % and 27.3 to 30.2 % in Kharif-2016 and Kharif-2019 respectively. The increase in soybean grain yields under treatments comprising BBFs and mole drains over the controls (0.82 t/ha and 0.78 t/ha) varied from 67.4 to 80.1 % and 48.3 to 70.4 per cent in Kharif-2016 and Kharif-2019 respectively. The increase in subsequent wheat grain yields under treatments comprising BBFs and mole drainage over the control varied from 11.3 to 13.8 per cent and 11.0 to 13.7 per cent during Rabi 2016-17 and Rabi 2019-20 respectively. The rainfall occurred during monsoon season of the year 2016 and 2019 was normal and above normal. This is because of effect of sub-surface (mole) drainage on sequential Rabi season crop due to improvement of soil health.

Economics of BBFs and Mole Drainage

The economics of cultivating water sensitive crops (i.e. soybean) with and without drainage (conventional) systems in temporary waterlogged Vertisols was worked out. For economic analysis, CIAE farm data on crop yields and cost of cultivation for the year 2019-20 under varying cultivation practices were used. The costs of mole drainage system for 1 ha field of rectangular and square shape with gravity and pumped outlet were worked out using commodity/materials prices for the base year 2019-20. For economic analysis,

Table 2 Grain Yield Variations of Soybean and Wheat under Different Treatments

Treatment	Soybean yield Increase (%)		Wheat yield Increase (%)	
	2016	2019	2016-17	2019-20
T_1(Control)	0	0	0	0
T_2	32.2	27.3	5.2	2
T_3	36.1	29.5	6.7	4.1
T_4	39.9	30.2	7.0	5.1
T_5	70.5	61.3	12.1	13.0
T_6	78.7	67.2	12.3	13.5
T_7	80.1	70.4	13.8	13.7
T_8	67.4	48.3	11.3	11.0

the life of 7 years for mole drains is considered. The life of BBF is considered 1 year. The cost details for different layouts of mole drainage and B/C ratio are given in Table 3. The cost of mole drainage for1 ha field varies from Rs. 20040 to Rs. 24800 for gravity outlet and Rs. 30540 to Rs. 35300 for pumped outlet depending upon the shape of field and site conditions. The cost of Mole with BBF Pumped outlet for 1 ha rectangular shape field is found to be Rs. 40,000/-. The B/C ratio of BBFs, BBF cum mole drainage and conventional method (without drainage systems) are found to be 1.65, 2.03 and 0.98 respectively. The surface drainage (BBF) and mole drainage technologies are techno-economical feasible for soybean crop cultivation in temporarily waterlogged vertisols of Bhopal region. The payback period of mole drainage technology in temporary waterlogged vertisols is 1-2 years.

Conclusion

Field studies on BBF coupled with mole drainage with eight treatments and three replications were carried out for soybean and wheat cropping system for the years (2016 and 2019) using standard recommended cultivation practices in Vertisols. The BBF system of 65 m length with varying depths (150 to 250 mm) and 1.50 m spacing increased 27-32% soybean crop yield over the control. Economic analysis revealed that BBF and control systems resulted in benefit-cost ratio of 1.65 and 0.98 respectively. Mole drainage comprising mole drains of 85 mm size formed at 4 m drain spacing and at a depth of 500 mm with 65 m lateral length resulted in 48 to 67% increase in soybean grain yield over the control. The soybean grain yield increased by 60 to70% under treatment comprising BBF coupled with mole drainage over the control. The B/C ratio of BBFs, BBF cum mole drainage and conventional method (without drainage systems) are found to be 1.65, 2.03 and 0.98 respectively. The payback period of mole drainage technology is less than 2 years. The SSD effect study on subsequent wheat crop revealed 11-14%

Table-3: Cost economics of Mole drainage & BBF system for rectangular shape (150m x 67m) field (1ha) (*Based on commodity/materials prices-base year 2019-20)*

S. No.	Drainage systems Layout	Total cost (Rs.)	Annual cost (Rs.)	Annual income (Rs.)	Annual B:C ratio
1	Mole drainage system for rectangular shape with gravity outlet	24800	25913	54100	2.09
2	Mole drainage system for rectangular shape with pumped outlet	35300	27223		1.99
3	Mole with BBF (Pumped Outlet)	40000	29200	59400	2.03
4	BBFs for Rectangular shape field	24200	24200	40100	1.65
5	Conventional practices	19500	19500	19250	0.98

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Seed treatment for managing insect pests and diseases of Rabi crops

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Seed is a basic and vital input for sustained growth in agricultural productivity and production since ninety percent of the food crops are grown from seed. Seed treatments with insecticides and fungicides have helped to improve the yield of crops by providing the protection from pre and post-emergent insects and diseases and insurance of a uniform stand across a wide variety of soil types, cultural practices and environmental conditions. Seed treatments provide an economical crop input which is easy to apply, cost effective and environment friendly. Presently, issues related to ill effects of pesticides are emerging. Excessive spray applications are posing danger to our ecosystem services. Seed treatments are on the other hand safer to natural enemies and pollinators than direct spray applications. The recommended insecticides and fungicides in Rabi crops for the management of insects and diseases through seed treatment are discussed below in the article.

Wheat

1.Termite - Wheat is the main Rabi crop occupying a maximum area in Punjab state and it suffers tremendous damage from termite attack especially where there are light sandy soils. Termites are present in the soil and can damage the crop at the seedling stage and even the fully mature crop. The plants damaged by termites dry up completely and can be easily pulled by hand. The plants damaged at maturity stage give rise to white ears.

Control: Seed treatment of wheat seed with 1 g Cruiser 70 WS (thiamethoxam) or 2 ml Neonix 20 FS (imidacloprid+hexaconazole) or 4 ml Dursban/Ruban/Durmet 20 EC (chlorpyriphos) per kg seed can help to reduce the incidence of termite attack. This is mandatory for light sandy soils as they are common habitat for termites. For sowing an acre of wheat crop, dilute 40 g of Cruiser or 160 ml of Dursban/Ruban/Durmet or 80 ml of Neonix in one litre of water and spray any one of these on seed (40kg). Neonix treated seed also helps to manage smuts of wheat. Also,

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insecticide treated seed is less preferred by birds.

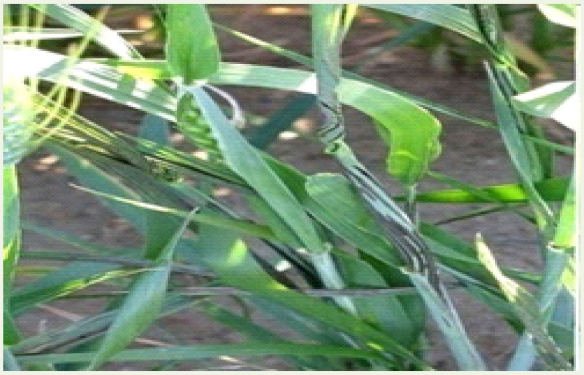
After sowing of crop if its infestation occurs, then apply 7 kg Mortal 0.3 G (Fipronil) in 20 kg sand/soil per acre before first irrigation.

2. Loose smut- This fungal disease is mainly seed borne and it survives as a dormant mycelium in the embryo of the seed. The identification of this disease can be done from the earheads which are transformed into black powdery mass of smut spores and there is no proper grain formation. Generally, all florets are converted into loose black powdery mass but sometimes part of earhead may

produce grain and part of it is infected and turns into black powdery mass. The black powder present in the earheads is ultimately shifted to new plants with the wind and thus the spores fallen on the developing earheads germinate and penetrate inside the wheat grain. The pathogen then becomes dormant inside the grain and is a source of infection in the next season. Thus, this disease is an internally seed borne disease. When such seed is sown in the next season the pathogen on getting favourable conditions, turns into an active stage and start producing symptoms.

Control: For managing this, an easy and cheap method of solar heat treatment in May/June is recommended. In this, wheat seed is soaked for about four hours in water on bright sunny day during the hot summer months. After that, spread out the moist seed in the sun in a thin layer on pucca floor on a tarpaulin sheets and let it dry completely. The seed should then be stored in a dry place and used in the next season for sowing. Alternately, seed can be treated in a seed treating drum with 13 ml Raxil Easy/Orius 6 FS (tebuconazole) by dissolving in 400 ml water or 120 g Vitavax Power 75 WS (carboxin+tetramethyl thiurum disulphide) or 80 g Vitavax 75 WP (carboxin) or 40 g Tebuseed/ Seedex/Exzole 2 DS (tebuconazole) per 40 kg seed.

3. Flag Smut- It is a seed as well as soil borne fungal disease of wheat. In this disease, narrow elongated greyish or blackish streaks or stripes form on the leaves, sheaths and stems, which are initially covered by thin silvery membrane, that on rupturing releases black powdery mass of spores. These spores contaminate the soil and seed at the time of harvesting and threshing. When the crop is sown in the next season, the seed borne or soil borne inoculum (spores) attacks the young seedlings, systemically grows inside the plant and produce symptoms after about one month. Integrated disease management practices can be followed for



managing this disease. In areas with previous infection prefer shallow sowing so that the seedlings could escape from the infection.

Control: Seed should be treated in a seed treating drum with 13 ml Raxil Easy/Orius 6 FS (tebuconazole) by dissolving in 400 ml water or 120 g Vitavax Power 75 WS (carboxin+tetramethyl thiurum disulphide) or 80 g Vitavax 75 WP (carboxin) or 40 g Tebuseed/ Seedex/Exzole 2 DS (tebuconazole) per 40 kg seed. The affected shoots should be rogued out and destroyed by burning.

4. Karnal Bunt- It is both seed and soil borne fungal disease of wheat. The infected part

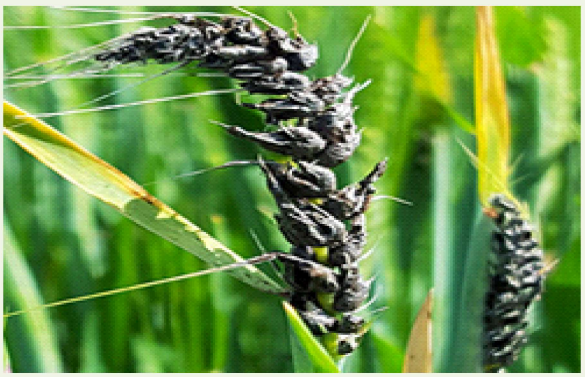
of the grain turns black and is covered with black mass of thick walled spores which are not loosely held as in the case of loose smut. Generally, few grains in the earhead show symptoms. Only, some earheads show the symptom. So, it is also called as partial bunt. The affected grains emit a foul stinking smell. The spores fallen on the ground or on the seed while harvesting remain viable for upto five years.

Control: To obtain a disease free seed, spray the crop at boot stage with Tilt 25 EC or Folicur 25 EC @ 200 ml in 200 litres of water per acre.

Barley

1.Loose smut- It is an internally seed borne disease. The grains in the earhead turn into black smut sori that are loosely held in a fragile membrane which can rupture, releasing the black dusty spore mass. These spores are further disseminated by wind, leaving the naked rachis behind.

Control: For managing this disease, solar heat treatment as recommended for wheat can be done or seed can be treated in a seed treating drum with Vitavax 75 WP (carboxin) @ 1.5 g per kg of seed.



2.Covered Smut- It is also a seed borne disease. The visible symptoms of the disease are produced at the earing stage, although infection can occur while in the seedling stage. At maturity, smutted ears are produced which remain covered under a silvery membrane.

Control: The disease can be easily managed by late sowing of crop. Also practice shallow sowing where possible. Treating the seed with Vitavax (carboxin) @ 1.5 g/kg seed can help in controlling the disease.

Spring Maize

1.Maize shoot fly- It is the most serious insect pest of spring maize. It attacks very young (3-7 days old) seedlings. The attack of this insect leads to deformed, twisted and dead hearted plants.

Control: Seed treatment with 6 ml Gaucho 600 FS (imidacloprid) per kg of seed. If seed treatment is not done, then apply 5 kg Furadan 3 G (carbofuran) per acre in the furrows at the time of sowing.

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increase in yield over the control. Field study revealed that BBF, mole drainage and BBF coupled with mole drainage systems are technically feasible and economically viable for effective drainage of Vertisols.

Acknowledgements

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References

Bhattacharya A.K. and Michael A.M. 2010. Land Drainage: Principles, Methods and Applications; Vikas Publishing House: New Delhi, India,

Bundela, DS, Kaledhonkar MJ, Gupta SK, Kamra SK, Sharma DK, Sharma PC and Chaudhari SK. 2017.Guidelines for Sub-Surface Drainage for Reclamation of Waterlogged Saline Lands. ICAR-Central Soil Salinity Research Institute, Karnal, India,

Krantz B. A.1981. Water conservation, management, and utilization in semi-arid lands. In: Advances in Food Producing System for arid and semi-arid Lands, Part A, pp 339-378. University of Californiya, Davis.

Pathak P., Miranda S. M.and El-Swafy S. A. 1985. Improved rainfed farming for semi-arid tropics- implications for soil and water conservation. In: Soil Erosion and Conservation, pp 338-354. El-Swaify, Moldenhauer and Lo (eds). Cons. Soc. Am.

Rao, Ramana KV, Kishore R, and Singh R. 2009. Mole drainage to enhance soybean production in waterlogged Vertisols. J Agric Eng 46(4):54–58.

Diversification of Summer Paddy Through Sunflower Crop Value Chain

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Sunflower is an efficient oilseed crop with wider adaptability to soils and seasons providing high quality edible oil within a short duration of 90-105 days. In India, it is grown over an area of 2.24 lakh ha with a production of 2.29 lakh tones (Fourth Advance Estimates, DACnet). Around 48% of total sunflower area is under rabi sunflower cultivation. Area under sunflower has been declining in the country and in the state of Telangana due to its low productivity and profitability. In Telangana, the crop was grown during *rabi* season with an average productivity of 1667 kg/ha during 2016 and increased to 2714 kg/ha during 2020-21. The low productivity is due to traditional practice of cultivation without adoption of key agronomic practices, promising hybrid, seed treatment, thinning, balanced nutrition and biological IPM. Coupled with this, high cost of cultivation and low market rates for scattered and low volume of production are major reasons for decline in area under sunflower production.

Nizamabad district in Telangana State is better endowed with fertile soil and water resources for intensive agriculture resulting in dominance of mono-cropping of rice. Maize, chickpea and sunflower are the competing crops during rabi/summer in the district. Farmers are showing less interest in cultivation of maize due to the incidence of fall army worm and chickpea due to very low yields. Sunflower crop is the most successful alternate crop due to its high productivity potential, if grown under best management practices (BMPs).

Demonstration of Best Management Practices (BMPs)

Identifying the potential of sunflower in the region, ICAR – Indian Institute of Oilseeds Research, Hyderabad (IIOR) along with KVK and State Department of Agriculture had demonstrated the BMPs through frontline demonstrations (FLDs) employing cluster approach in Hegdoli village of Nizamabad district during rabi seasons . Other existing schemes of soil health cards and skill development training were converged. Based on the assessment of soil fertility, it was found that the nutrient requirement of sunflower succeeding intensively cultivated rice was low except for sulphur. The available residual fertility and moisture was effectively integrated under zero or minimal tillage cultivation of sunflower with reduced seed rate (5 kg vs traditional 10-12kg/ha) and maintaining optimum plant population through thinning. It paved the way for timely sowing of sunflower and significant reduction in cost of cultivation. Supplying the needed phosphorous through SSP and directed spray of boron @ 0.2% at ray floret

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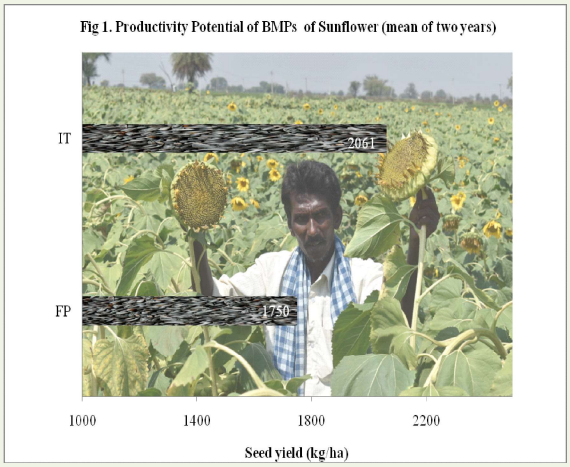
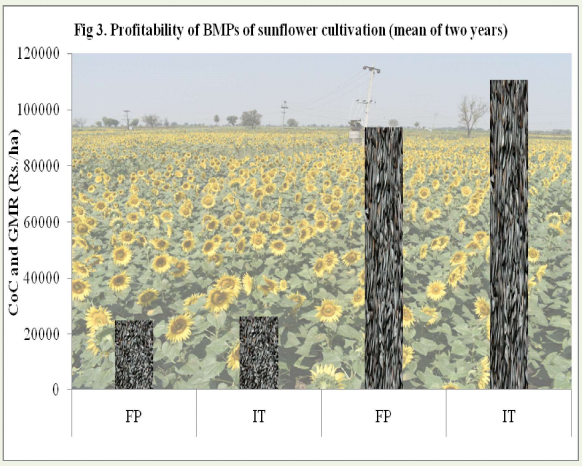




IT = Improved technologies; FP = Farmers' practice; BMPs = Best management practices

opening stage, irrigation at critical stages (2 to 3 vs 6 to 8 for maize), and minimal or need based plant protection resulted in realizing higher seed yield of 2500 to 3000 kg/ha, which is 16-24% improvement over farmers' practices (Figure 1).

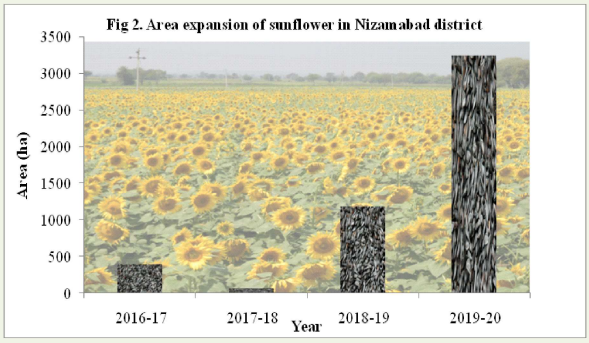
Crop Area Expansion

As per the farmers' opinion, this practice of sunflower cultivation had also contributed for realizing higher rice yield in the succeeding season, possibly due to effect of sulphur and balanced nutrition. Thus, the area under sunflower expanded from about 400 ha during 2016 to more than 3200 ha in 2019-20 in the district (Figure 2). Consequently, the demand for quality seed also increased.

With this growth of sunflower area in Nizamabad district, better marketing was established and Government of Telangana through NAFED further supported to procure the crop at minimum support price, thereby with the high productivity and remunerative prices, the profitability from sunflower was highest at Rs.45,000 to 60,000/acre (Figure 3) in 100 to 105 days. The irrigation water was also saved including expenditure on electricity.

Initiation of bee keeping

It is well documented that low population of pollinators will adversely affect the sunflower yields. In order to increase the sunflower yield and realize complete value chain by strengthening supply chain through co-cultivation of honey bees, bee keepers association was persuaded to introduce apiary in Hegdoli village during 2020-21. About 400 ha area of sunflower crop was under cultivation contiguously and more than 3000 ha was spread across the vicinity of villages. Observing the potential of the area, the bee keeper association started apiary with 800 bee hive boxes set up during flowering period for three weeks (Figure 4).



CoC= Cost of cultivation; GMR = Gross Monetary Returns; Net Monetary Returns

Fig 4. Honey bee boxes at one of the sunflower crop cluster in Hegdoli village

Fig. 5 Pure honey marketed as Honey Natural' in PET bottles

Honey was extracted after three weeks and the bee hives were shifted to adjacent area, where the sunflower crop was at flowering stage and together harvested 5200 kg of pure sunflower honey. Entire honey was sold out on the spot with word of mouth popularity and spread supported by ICAR-IIOR. The golden yellow, bright, pure and nutritious honey extracted on-site was sold at a modest price of Rs. 300/kg. This honey was branded as 'Honey Natural' in PET bottles of 0.50 kg and 1.0 kg capacity (Figure 5). The gross income realized was Rs. 15.6 lakhs with in a period of two months, besides realizing a net income of Rs. 5.6 lakh and Rs. 6222/day for a period of three months (Table 1).

Generally, two bee boxes are recommended per acre area of the crop, in this case, the boxes were placed based on the cluster approach in view of the foraging distance of bees, which is around 2.0 km. This resulted in savings on transportation, installation, maintenance and labour costs.

Fixed cost of each box is Rs.7500/-, which includes the wooden box, comb, queen bee, worker bees, extractor and other required items. Depreciation of 10% (Rs.750/- per year) assuming the life of the box is 10 years and maintenance cost of Rs.500/- towards transportation, installation, honey extraction and three-stage physical filtration.

Apiary is a win-win situation for sunflower farmers and the village level entrepreneurs, whereby farmers perceived that the yield of sunflower increased by 20% due to honey bee activity and provided a sustainable livelihood to the local entrepreneur with additional valuable honey. This model can be replicated in rice- fallow areas of Andhra Pradesh, Assam, Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Tamil Nadu, Uttar Pradesh, West Bengal and other traditional sunflower growing areas of Karnataka to increase the productivity of sunflower crop and income of farmers. This practice will also encourage agri-entrepreneurship through honey bee keeping and honey production.

In order to successfully upscale the model, timely access to quality seed for the farmers has to be ensured through collaborative efforts of the state seed production agencies, private seed companies/producers and ICAR-IIOR. Capacity building of the bee keepers, farmers, rural youth, staff of agricultural department and AICRP scientists on bee keeping is proposed to be taken up by ICAR-IIOR in collaboration with NIRD, Hyderabad.

Conclusion

Adoption of best management practices in sunflower under minimum tillage or zero tillage conditions will improve the crop yield and economics to farmers. Apart from adoption of BMPs, co-cultivation of honey bees will further provide a win-win situation of increasing the sunflower crop yield by around 20% and gainful employment to the rural youth. Further, the study clearly indicated that pure, nutritious and healthy honey can be available locally at a modest price, which is beneficial to the rural communities. Therefore, this model can be replicated in rice-fallows and rice-rice cropping systems for sustainable crop diversification.

Table 1. Economics of apiary in Hegdoli village, Nizamabad

Item	Value in Rs./ Quantity in kg
Operational expenditure/box (Rs.)	1250=00
Total expenditure (Rs.) for 800 boxes	10,00,000=00
Honey yield/box (kg)	6 to 7
Total honey yield (kg)	5200
Sale price of honey/kg	300=00
Gross returns (Rs.)	15,60,000=00
Net income (Rs.)	5,60,000=00
Net income/day (Rs.)	6222=00

Oyster Mushroom Cultivation: A Profitable Enterprise

Mousumi Gohain Das and M. Mokidul Islam

The Ri-Bhoi district of Meghalaya lies between 25° 40' N to 25° 21' N lon gitude and 90° 55' E to 91°16' E latitude with an elevation of 100 m to 1350 m above sea level. Mushroom cultivation in the district is a new venture and there is a rise in demand of mushroom in the market in the last few years. In comparison to other districts of Meghalaya, the production of mushroom is quite low and mostly procured by collecting from the nearby forest areas which is limited to specific period in a year. Climate of the district is very congenial for cultivation of various species of oyster mushroom (summer variety: *Pleurotus sajor caju, winter variety: Pleurotus florida*, PL-14-02 etc) round the year. The district has loamy to fine loamy soil and receives an average annual rainfall of 1636.46 mm. The maximum rainfall is in the month of June and July. Temperature ranges between 2°C and 36° C. Since most of the farmers are small, marginal or landless agricultural labourers (18.8%) and cultivators (52.4%) among total workers in the district (Census 2011), their income level is quite low for a sustainable livelihood. In order to raise their family income, mushroom cultivation was considered to be an alternative and additional source of income by individual as well as women SHG members for improvement of their livelihood.

Umden Mission, a medium size village in Umsning block (now Bhoirymbong block) of Ri-Bhoi district, Meghalaya is situated at a distance of 13 Kms from KVK Ri-Bhoi. The village resided a total of 114 families with population of 600; of which 289 are males while 311 are females. Umden Mission village has higher literacy rate compared to Meghalaya. In 2011, literacy rate of Umden Mission village was 80.71 % compared to 74.43 % of Meghalaya. In Umden Mission Male literacy stands at 81.40 % while female literacy rate was 80.00 %. Among them 95% populations are Schedule Tribe (ST) with 38% female landless workers in the village. As per constitution of India and Panchyati Raaj Act, Umden Mission village is administrated by Sarpanch (Head of Village) who is elected representative of village. Hence, the interested farm women were encouraged to form SHGs and grow Oyster mushroom to supplement their family income.

KVK Intervention

Initially a training programme and method demonstration on cultivation of oyster mushroom was organized by KVK to make the farmers better understand the technology and its advantage. The technology involved in mushroom cultivation is very simple and can be acquired by any person after a short training. The demonstration units were monitored on a regular basis and suggestions were provided to the

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Details of Technology: Raw material requirement:

(i) Paddy straw
(ii) Polythene bags
(iii) Spawn

Soaking:

Cutting of straw into 2 to 2.5'' size

↓

Soaking in clean cold water for 12-16 hrs

↓

Draining excess water

↓

Pasteurization of the straw pieces in boiled water at temp. 60-65^0 C for 1hr.

↓

Draining of excess water & dry in shade to get 65% moisture.

Laying of bed & spawning:

Filling in the polythene bag (65cm x 35cm) with sterilized straw bits (6" height)

↓

Sprinkling of ¼ part of spawn over it at the periphery only.

↓

Again covering with sterilized straw pieces to another 6'' height.

↓

Repeat spreading of straw pieces and spawn for 4th time.

↓

Covering the top layer with thin layer of straw & tie the polythene bag at the top & making 20 to 25 holes for exchange of gas & keeping it in dark room.

Spawn running :

Removing the polythene cover after 16th day. Arranging the beds on the rope/rack, leaving a space of 6'' between the beds.

↓

Sprinkling of water twice a day as per the weather to keep the bed moist.

Harvesting :

Harvesting fresh mushrooms after 7 days by twisting carefully when the edges start upward curling.

1st flush – 1 kg

After 7 days: 2nd flush – 250 gm.

↓

After 7 days: 3rd flush – 250 gm

↓

Marketing of fresh mushroom (local & nearby market).

farmers as per requirement. The mushroom spawns were purchased from Division of Plant Protection, ICAR RC for NEH Region, Umiam. KVK Ri-Bhoi had taken initiative to grow mushroom out of agriculture waste in a better and profitable eco-friendly way of waste disposal. Mushroom growing as a cottage industry is quite valid for the women SHG due to its low capital investment and high yields obtained even under controlled rural condition. Mushrooms are good supplement for protein lacking diet and can be easily cultivated indoors and marketed profitably. Keeping in view the above fact, training, on-farm testing (OFT) of new strains and demonstrations (FLD) on oyster mushroom cultivation were undertaken in the village Umden Mission forming women Shg (*Iaikyntiewlang And Tyllinginieng)* covering 30 women farmers.

Innovative Extension Approach

KVK, Ri-Bhoi demonstrated on oyster mushroom cultivation in the village Umden Mission through 3-4 beds hanging rope system through FLD. Similarly, training programme on oyster mushroom cultivation was organized for SHG members. Necessary technical literature was provided to the farmers, field day was arranged to create awareness and interest among the farmers for mushroom cultivation. KVK is instrumental in imparting skill training to the farmers, rural youth and farm women. Hanging rope practise of mushroom cultivation with three to four beds per rope was found to be very effective with more yield in which the entire bag could be utilized. However, in rack system the bottom part of the mushroom bag could not be utilized resulting in less output of the economic part. The cost was reduced in rope hanging system than rack system of mushroom cultivation due to fewer requirements of bamboos which makes the practise very compatible among the small and marginal farmers with high relative advantage, saving inputs with eco-friendly disposal of agricultural waste (paddy straw).

Adoption of the technology and benefit to the women farmer

The extension interventions made by KVK Ri-Bhoi in the Umden Mission village and inspired by the easy method of cultivation, good yield and economy of production, other SHG's like *SYNROP LANG* (20 members), *SNOHKTI LANG* (20 members) from other villages started practicing oyster mushroom cultivation in small scale under the guidance of scientists of KVK Ri-Bhoi. As a result, the beneficiaries of SHG group could harvest 115 kg mushroom from 100 beds and generate net profit of about Rs.7250/- within a month by selling mushroom in the nearby market at the rate of Rs.150-200/- per kg. The success of mushroom production not only encouraged other two SHGs of the adopted villages but also women of neighbouring and other villages like Umeit, Kyrdem, Thadnongiaw, Sumer, Umsning , Paramhinai etc to grow mushroom successfully and profitably.

Farmers' reaction and feedback

The farm women of the village Umden Mission were surprised with the success of mushroom cultivation. They could not just believe such a good amount of net profit in less than a month period. Now, they are interested to take up mushroom cultivation as a major income generating activity throughout the year due to its heavy demand in Ri-Bhoi district as well as in Shillong, either fresh or dry mushroom. The farmers were able to buy good quality seeds for vegetable cultivation after the harvest of

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Journey from Daily Wage Labourer to an Entrepreneur

Dr. Banwari Lal, Mohd. Anas and Sheetal

The arid zone of India covers around 15.8% of the geographical area cov ering about 31,900 million sq. Km. of hot desert, of which Rajasthan accounts for 61%. Desert of Rajasthan is located between the foothills of Aravalli ranges in the north and international border with Pakistan in the west. The Climate vegetation scenario of the arid zones indicate a very high temperature, very low precipitation, scarcity of water, low content of organic matter and presence of soluble salt in the soil leading to very low productivity of agricultural crops. The poor availability of natural resources in the area is badly affecting the livelihood of the people. The district like Jaisalmer, Barmer, Bikaner and Jodhpur comes in this category.

There districts are predominantly characterized by sandy, rocky and rough terrain as well as regular periodic drought. Hillocks, salty marshland, gravel, shifting of dunes, fragments of rocks, scrub vegetation and rare oasis are scattered over the vast sandy expanse. Jodhpur district covers a total geographical area of 22850 sq.km and occupies largest area in Rajasthan. Extreme temperatures are recorded in summer and in winter and it may vary from 49 degree in summer to 1 degree in winter. Limited precipitation (rainfall) of 120-240 mm per year leads to poor- development of area. Besides, poor availability of natural resources

in the area is badly affecting livelihood of the people. It is hard for people to practice farming due to these conditions. It is too difficult to produce crops in such conditions. The depleted natural resources, land degradation accompanied by acute shortage of water, perpetual drought and famine like situation lead to livelihood insecurity and poverty that forces people to migrate to other areas for survival.

In these climatic conditions it is hard for a farmer to earn livelihood and raise a family. But firm determination is key to fulfil one's needs and achieve success. This is story of a hard working farmer, Shri Gobar Ram who lives 20 km away from Jodhpur district, Village Keru in Mahadev Nagar. He was supporting his family by doing daily wage labour and rain based farming in his infertile land. Due to the lack of suitable resources for crop production and daily wage labour, he wished

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that his son could get higher education but the situations were not in favour. In 2018, Shri Gobar Ram got information about the training program being conducted in the Agriculture University, Jodhpur under the Scheduled Castes Sub- Plan organised by Indian Council of Agriculture Research, New Delhi. He participated in the program and learned that earning of meaningful income is possible by integration of different components of agriculture even with limited resources. Under this integrated farming model, necessary support was provided to Shri Gobar Ram for setting up of nursery unit, goat rearing unit and vermicompost unit. He was provided with all the necessary tools, water tank and seed for establishing the nursery unit.

10 goats and 1 buck of Sirohi breed was provided for goat unit and vermi bed along with earthworms was provided for organic compost unit. Dung obtained from goats was used for making manure in organic compost unit. The manure was used for raising the nursery and production of fodder. Thus, the output of one unit was used as supplement to another unit. Mr. Gobar Ram sold the saplings of vegetables and received an income of about 40 thousand rupees. The number of goats was increased to 30 in a year, which provide milk and manure. He also received an income of Rs. 1 lakh 80 thousand from goat unit.

In addition to getting annual income of 30 thousand rupees by organic compost, Shri Gobar Ram also practiced organic farming in one bigha of land and produce organic vegetables by which he got an extra income of about 50 thousand rupees.

The resources provided under this scheme helped Shri Gobar Ram to establish his own business and improve the livelihood of his family. From the income received by this business, he admitted his son in coaching centre for the preparation of competitive examinations. At present, Shri Gobar Ram is earning three lakh rupees annually from the model established by SC project. Other members of the family who were unemployed earlier are also involved in this model. Mr. Gober Ram says that SC-SP project saved him from wandering and thanks the Agricultural University and Agricultural Scientists for their support. With the help of their suggestions and support from the government he has become an entrepreneur from a daily wage labourer with significant improvement in his livelihood.

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that how one can enhance his livelihood by adopting scientific methods of lac cultivation. There are a number of farmers in this country who have succeeded in this line. Not only they have improved their own way of life, but also could stand beside the society or the poor people. There are many ways to improve further by adopting *rangeeni* lac cultivation. This aspect is very much ignored because farmers face occasional *rangeeni* lac crop mortality but young, enthusiastic farmers can adopt *rangeeni* lac cultivation more fruitfully by adopting newly evolved technologies from the Institute.

References

Ghosal S, Meena SC, Ghosh J and Thamilarashi K (2016) Strategy for application of macro-, micronutrients and liming in acid lateritic soils of Jharkhand for sustainable growth of Flemingia semialata. Indian Journal of Agricultural Sciences 86 (2): 202–207

Jaiswal A K and Singh J P 2014. Schleicheraoleosa and lac cultivation. Indian Institute of Natural Resins and Gums, Ranchi (Jharkhand). Extension Bulletin No .06 (2015)1-38 pp.

Pal Govind, Prasad N., Ghosal S., Pandey S.K. and Kumar M. (2013). Socio-economic Profile of lac growers in Ranchi and Khunti District of Jharkhand. The Journal of Rural and Agricultural Research 13 (2): 1-5.

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paddy with the extra income from mushroom which increased the cropping intensity and diversity.

Impact and horizontal diffusion of the newly adopted technology

The net profit and employment generation to rural women in mushroom cultivation has attracted the other two SHG (SYNROP LANG, SNOHKTI LANG) for practicing the mushroom cultivation in small scale. People of neighbouring villages are now enthusiastic in producing mushroom in large scale. Different NGO's like RRTC, SACH, Bethany Society , Mumbai based AFC India Ltd etc decided to replicate this successful programme in different blocks of the district through the Skill Development programmes under Meghalaya State Skill Development Society, Government of Meghalaya. KVK is instrumental in imparting

technical support in this regard.

Up-scaling of technology

KVK, Ri-Bhoi has documented the innovative mushroom technology bulletin and skill development training plan to promote this technology. Apart from this KVK has printed literature, produced documentary film & video in YouTube and media coverage of the technology has been organized for wider dissemination of the technology. The success of the technology in the farmers' field has generated tremendous interest and curiosity among the villagers towards mushroom cultivation.

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