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IN THIS ISSUE

The Soil Conservation Society of India, New Delhi is going to celebrate its **Foundation Day** on September 24, 2019 at its HQ in New Delhi and All State Chapters should also celebrate the occasion.

FROM THE PRESIDENT'S DESK

The task of providing food security to our country's burgeoning population is becoming increasingly difficult. This challenge must and needs to be met in the face of the changing consumption patterns, impacts of the climate change and degradation of the finite land and water resources. Management of land resources, in general, and potentially culturable lands in particular, encompasses, crop production methods that will keep pace with country's food needs, sustaining environment, blunting impacts of climate change, preserving and enhancing natural resources, and supporting livelihood of farmers and rural population in the country. Thus, there is a pressing need for enlarging area under arable lands, by the way of reclaiming degraded lands for sustainable intensification of agriculture, in which crop yields can be increased without compromising and yielding to adverse environmental impacts and without reducing area under forests.

Per capita availability of inelastic land resource is rapidly declining in relation to annual population growth of 1.4% in the country. Increasing GDP growth is expanding urbanization and industrialization and, therefore, more and more of agricultural lands are being utilized for non-agricultural purposes. The complex interplay of natural and anthropogenic processes compounds problems of land-use planning further. Maintaining and enhancing productive potential of our land resources is vital for progressive introduction of sustainable technologies, and thereby resilience in crop production.

Soil and water conservation technologies have been the major driving force for increasing agriculture productivity and development in India. Recent trends in rainfall pattern, its distribution and changes have shown complication in efficient planning and management of soil and water resources. In this context of climate change scenario, the soil & water conservation technologies play major role for mitigating climate change impact on yield of various crops and overall ecosystem security. In the past, the choice of technologies and their adoption was to reduce the soil erosion, rehabilitating degraded lands and enhancing productivity and production the crop management and agriculture practices suited to land exposed to different abiotic stresses at present demand a specific orientation for meeting challenges of the food and nutritional security. In addition to the type and the extent of degradation the lands have undergone or are undergoing, appropriate management strategies need to be developed and implemented in a time frame to bring these land to 'productive Health'.

Dr. Suraj Bhan
President, Soil Conservation Society of India

PHYTOREMEDIATION TECHNIQUE TO MANAGE HEAVY METALS POLLUTED SOIL OF COAL MINE AREA OF JAINTIA HILLS

Euwanrida Adleen Shylla Lyngdoh and Sanjay-Swami

Due to extensive coal mining, large areas of Jaintia Hills of Meghalaya has been turned into degraded land, creating unfavourable condition for plant growth. In the last 12 years, coal mining area has increased by 1.2% and agricultural land has decreased by 1.5% in Meghalaya due to the deposition of coal particles. Owing mostly to acidity-related fertility stress, average crop productivity in acid soil regions like Meghalaya is very low, coupled with increasing concentration of heavy metals, productivity has further dropped. Continued decline in plant growth reduces yield which eventually leads to food insecurity. Various methods of remediating metal polluted soils exist; these range from physical and chemical methods to biological methods. Most physical and chemical methods such as encapsulation, solidification, stabilization, electrokinetics, vitrification, vapour extraction, and soil washing and flushing are expensive and do not make the soil suitable for plant growth. Biological approach (bioremediation), on the other hand encourages the establishment/reestablishment of plants on polluted soils. It is an environmentally friendly approach as it is achieved via natural processes. Bioremediation is also an economical remediation technique compared with other remediation techniques.

Bioremediation of heavy metal polluted soils

Bioremediation is the use of organisms (micro-organisms and/or plants) for the treatment of polluted soils. It is a widely accepted method of soil remediation because it is perceived to occur via natural processes. It is equally a cost effective method of soil remediation. Although bioremediation is a no disruptive method of soil remediation, it is usually time consuming. Further, heavy metals cannot be degraded during bioremediation but can only be transformed from one organic complex or oxidation state to another. Due to a change in their oxidation state, heavy metals can be transformed to become either less toxic, easily volatilized, more water soluble (and thus can be removed through leaching), less water soluble (which allows them to precipitate and become easily removed from the environment) or less bio-available. Bioremediation of heavy metals can be achieved via the use of micro-organisms, plants, or the combination of both organisms.

Phytoremediation is an aspect of bioremediation that uses plants for the treatment of polluted soils. It is suitable when the pollutants cover a wide area and when they are within the root zone of the plant. Phytoremediation of heavy metal polluted soils can be achieved via different mechanisms. These mechanisms include phytoextraction, phytostabilization, and phytovolatilization.

Phytoremediation of heavy metals pollutes soil of coal mine area of Jaintia Hills

In order to assess the phytoremediation effect on the heavy metals polluted soil of coal mine area of Jaintia Hills, a bulk surface soil sample (0-15 cm) was collected, processed and analysed. The physico-chemical analysis of soil sample exhibited pH 3.93, O.C. 0.83%, available N, P and K 259.87, 9.18 and 166.00 kg ha^{-1}, respectively. The heavy metals content of the soil with respect to Cr, Cd, Pb, Ni and Co was recorded as 95.39, 25.94, 17.41, 51.13 6.46 mg kg^{-1}, respectively. A pot culture trail was conducted at School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Umiam, Meghalaya using processed soil with two phytoremediating crops *viz.* Asparagus cv. UPC-287 (PC_2) and Sunflower cv. EC-68913 (PC_3) and along with control with no phytoremediating crop (PC_1). To find out the variability in the phytoremediation potential of both the crops on the heavy metals, 33 pots for each phytoremediating crop including no crop treatment was considered as 33 replications and the significant means was separated by following one way ANOVA. The crop plants were harvested at 60 DAS. The result revealed that dry matter yield of Asparagus (11.79 g pot^{-1}) was higher than the Sunflower crop (5.08 g pot^{-1}). However, the Sunflower was found to be superior phytoremediating crop in comparison to Asparagus as it accumulated more heavy metals *viz.* Cr, Cd, Pb, Ni and Co as 51.83, 15.05, 10.40, 30.88, and 5.68 μg pot^{-1}, respectively while Asparagus accumulated 42.98, 14.30, 9.20, 21.43 and 4.06 μg pot^{-1}, respectively. The analysis of heavy metals in the soil after harvest of phytoremediating crops indicated that the content of heavy metals reduced significantly in soil phytoremediated by Asparagus (S_2) and Sunflower (S_3) compared to non-phytoremediated soil (S_1) as presented in Table 1. However, the soil phytoremediated by Sunflower recorded least heavy metals content in soil indicating its superiority over Asparagus.

Heavy metals content (mg kg^{-1}) in soil after harvest of phytoremediating crops grown in heavy metals polluted soil of coal mine area of Jaintia Hills of Meghalaya

Non-phytoremediated soil (S_1)					Asparagus remediated soil (S_2)					Sunflower remediated soil (S_3)				
Cr	Cd	Pb	Ni	Co	Cr	Cd	Pb	Ni	Co	Cr	Cd	Pb	Ni	Co
95.05	25.20	17.07	50.59	6.65	51.70	11.25	8.80	30.30	2.44	41.63	9.32	7.10	20.02	0.79


Asparagus at 30 days after sowing


Sunflower at 30 days after sowing

On the basis of present investigation, the farmers of coal mine areas of Jaintia Hills of Meghalaya are advised to phytoremediate their soil with Sunflower crop before planting the main crop to reduce the adverse effects of heavy metals.

CROP DIVERSIFICATION FOR ENHANCING INCOME- SUCCESS STORY FROM J&K

Prof. (Dr) R.D. Gupta

As most of the arable land of Jammu and Kashmir State is hilly terrain, so farming system of State's peasants is quite different than that of plains. The farmers pose with a number of problems like small size of land holdings, undulating and dip slope, erratic monsoonal rainfall and lack of infrastructural facilities. Out of over 1.3 million land holdings, about 52% of the farmers just hold one or less than one kanal of land (one-twentieth of hectare), 26% less than 1 ha and 14% in the range of 1-2 ha. Remaining only 8% farmers hold greater than 2 ha. Owing to the small land holdings, the farmers of the state are, by and large, economically poor.

Economists, planers, policy makers and developmental analysts often argue that marginal and small farmers are not economically viable under the existing technological and socio-economical environment. It is because they cannot provide an adequate income to an average family necessary for reasonable standard of living. However, such farmers can stabilize their income at higher level by adopting "Crop Diversification".

Crop Diversification?

Although the concept of diversified farming i.e., raising of cereals alongwith Vegetables, fruits and livestock enterprise

is very old yet still it has to be realized from scientific angles in the Stat e of Jammu and Kashmir.

Diversification has several connotations. "It may mean that apart from growing of adequate staple food crops (rice, wheat), there is now dire need to grow pulses, oilseed crops, fruits, vegetables, flowers and medicinal plants." Growing of such crops will not only bring higher revenue for the farmers but also serve as cushion against crop failure and gives more balanced nutrition.

Success Story of Crop Diversification

The rationale behind diversified farming is to derive maximum benefits from more than one source of enterprise i.e., adoption of agro-vocations like mushroom cultivation, apiculture alongwith crops, vegetables and fruits cultivation as well as to render the soil more fertile. In this direction, efforts made by KVK, Jammu could be cited as an example where, in its farm, continuous growing of rice and wheat for the last about four decades (1960-1997) showed declining trend in their yields. Hence inclusion of berseem in some of the plots instead of wheat, was made from 1998 and onwards. This not only improved the soil fertility and also brought an income by selling green fodder at the rate of Rs. 64000 acre. The yield of wheat crop too enhanced in the subsequent years, where berseem had been grown previously. Similarly, lot of income was also generated by growing mushroom and vegetables after their sale among the staff members of SKUAST Jammu at nominal rates.

Berseem cultivated in the KVK farm soils showed higher moisture retention than the conventionally cultivate soils under rice and wheat. Fertility status of the berseem cultivated soils was also improved. The soils where berseem had grown contained 'higher organic carbon and total N but narrow C:N ratio. Available N,P and K contents and exchangeable Ca and Mg status were also found to increase, where rice-berseem cropping sequence had been followed.

Crop diversification is intended to give a wider choice in production of variety of crops in a given area so as to expand production relation activities on various crops and also to lessen the risk due to failure of monsoon rainfall.

For higher returns, diversification not only is necessary in respect of its cropping pattern but is also important with regard to the pattern of diversification. As for instance, cultivation of flowers, fruits and vegetables pays more dividend to the peasants. This was proved by one of the farmer, named Kirpu Ram.

Kirpu Ram, a marginal farmer (land holding of about 1.5 acre), an inhabitant of Benagarh (tehsil RS Pura, District Jammu, State Jammu & Kashmir) was hitherto cultivating only rice and wheat. But after coming in contact with the scientists of KVK of Jammu, he shifted towards diversified farming. He was probably the first peasant in RS Pura, who started to grow marigold flower during 1989. Now he grows this flower in an area of 2 kanal. After picking flowers and preparing garlands, he sold them at the nearby temples twice a week. This brought an income of Rs. 18000 per season.

Kirpu Ram is also growing seasonal vegetables in an area of 1.5 kanal, 0.25 kanal of land remains under vegetable nursery and 0.5 kanal under fruit nursery, and earned an annual income of Rs. 10,000-12,000 through sale of vegetables and fruit plant scrolling. On the rest of the land, he cultivates the field crops using the latest agricultural technology as has been generated by SKUASTs Jammu scientists. All this made him self-sufficient in food-grain requirement of all his family members.

He was the first man in RS Pura, who after planting popular (*Populus* spp.) used its wood for preparing furniture in the year 1989. It is place to mention that Kirpur Ram planted popular on the bunds of his farm. Kirpu Ram has now become a respected opinion leader of the village. After seeing success of his efforts, many farmers of nearby villages have now started growing flowers, vegetables and established fruit and vegetable nurseries besides their traditional farming i.e. growing rice and wheat / berseem.

INSTITUTIONAL ROLE IN PROMOTING INDIGENOUS TECHNICAL KNOWLEDGE IN AGRICULTURE

Suraj Bhan[1] and V.K. Bharti[2]

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Indigenous Technical Knowledge (ITKs) are treasure troves of ancient wisdom, beliefs and traditional knowledge passed on from generation to generation for preservation, effective utilization and conservation of natural resources, soil, plant and other organisms. It is a well-known fact that India has a charitable and glorious heritage of past, both in richness and variety in performing agricultural and allied practices. ITKs are based on experience, often tested over a long period of use, adapted to local culture and environment, dynamic and changing, and lay emphasis on minimizing the risks rather than maximizing the profits. It has the element of use of natural products to solve the problems pertaining to agriculture and allied activities. But, despite these, the ITK at the farmer's level receive less recognition by the organizations. Also the propriety rights on ITK have often been ignored. It is so, because of the key actors are not working closely with each other. Hence, there is an urgent need to have institutional reforms especially for better coordination, convergence and efficiency in action in recognizing and encouraging the scientific talents behind such grass root level ITKs and widely sharing benefits accrued from such ITKs across the country. The objective of this paper is mainly to get thorough understanding of the role of institutions in promotion and commercialization of ITKs and suggesting effective strategies in up scaling and out scaling of ITKs.

Indian farmers, over centuries, have learnt to grow food and to survive in difficult environments, where the rich tradition of Indigenous Technical Knowledge (ITK) has been interwoven with the agricultural practices followed by them. Local or indigenous knowledge refers. In order to manage their farms successfully, small farmers require information and knowledge on a variety of technical and market matters. The information helps the farmers make correct decisions in the world of available choices. This includes the crop, the variety, various other inputs, and how much, when, and how to use them. With development, as the number of options expand and become more and more complex, this decision-making becomes increasingly difficult. Growing variation in the market and agro-climatic environment with globalization and climate change makes this more risky and crucial. Systems to provide good information and knowledge to the small farmers are thus, becoming increasingly important for their viability, well-being and productivity. to the cumulative and complex bodies of knowledge, know-how, practices and representations that are maintained and developed by local communities, who have long histories of interaction with the natural environment. It is the basis for decision-making of communities in food security, human and animal health, education and natural resource management.

There are different classes of ITK in agriculture i.e. climatology, local soil and taxonomy, soil fertility, primitive cultivars, intercropping, agronomic practices, irrigation and water management, plant protection, post-harvest technology and methods. As the indigenous practices are inexpensive, easily accessible, locally appropriate and tested in actual farm situation, they are, more rapidly accepted by other farmers than the results of formal research imposed on them. The enhancement of the quality of life of the Indians who in great majority live in and depend on agricultural production systems would be impossible by keeping this rich tradition of ITK aside. Institutions like ICAR, National Innovation Foundation, PPV and FRA (Protection of Plant Varieties and Farmer's Rights) etc has realized the importance of ITK in Agriculture.

The increasing attention that indigenous knowledge is receiving by researchers and policy makers has not yet led to a unanimous perception of the concept of indigenous technical knowledge (ITK). ITK is the locally available indigenous technical knowledge (ITK) is the information based on long time experiences which facilitates proper timely communication and accurate decision-making. The village people have good knowledge of many aspects of their area and can adopt them based on needs to solve regional problems in good agricultural practice and related activities. ITK helps the farmers to properly diagnose the particular disease in their field crops, vegetables, and orchards as well as its economically viable and socially accepted management through their resources as proved by their ancestors. This is mainly based on their assumption, reliable evidences, economic viability, social consent, traditional sound experience and knowledge, and proven result. Farmers in India are more sensitive to adopt ITK practices as they are far away modernize Agricultural researches as well as social and economic issues. They easily follow this traditionally available knowledge that they have learnt from their families. A number of ITK practices are also frequently used by the villagers of Indian farmers. Some very popular ITK practices are used in agriculture in present days also.

Institutions are playing major role in identification, collection, documentation and preservation, validation, up scaling and out scaling of the ITKs, and giving the acknowledgement to the knowledge generated local system or person.

Indian Council of Agricultural Research

ICAR launched a nationwide Mission Mode project on collection, documentation and validation of indigenous technical knowledge under National Agricultural Technology Project (NATP). Information on ITK will be collected from the primary sources through the voluntary disclosure. The major task is to collect and compile the practices on ITK from the available literature, books, journals, theses etc. and publish into documents. ICAR is maintaining CD of Inventory of Indigenous Technical Knowledge (ITK) in Agriculture.

It is a major initiative undertaken by ICAR to document and validate the ITKs practiced by the farmers in the country. Through this initiative, a total of 4880 ITKs in 28 thematic areas were collected, validated and published in seven volumes. Further the seven ITK e books and a resource book for training on ITK was also published. The inventory of all ITK documents have been classified under different subject matter areas viz. rain water management, soil and water erosion, tillage and interculture management, crops and cropping systems, pest and disease management, soil fertility management, farm implements, post-harvest technology, grain/seed storage, horticultural crops, veterinary science and animal husbandry, fisheries, ethno-botany and agro-biodiversity, weather forecasting, food product development, agro-animal based yarns/ natural dyes, and low cost housing materials.

Further the Intellectual Property and Technology Management Unit (IP&TM) in ICAR oversees all matters related to intellectual properties and technology transfer/ commercialization. ICAR recognizes that a systematic management of its technology products and services while bringing commercial ethos in their transfer and realization at the user end would result in much-needed dividends for the nation. Therefore, the Council is slowly and steadily but comprehensively moving towards intellectual property management and technology transfer in an organized manner.

Protection of Plant Varieties and Farmers Rights Authority (PPVFRA)

In order to provide for the establishment of an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants Plant Varieties and Farmers' Rights Act, 2001 has been enacted in India. It recognizes and protects the rights of the farmers in respect of their contribution made at any time in conserving, improving and making available plant genetic resources for the development of the new plant varieties. Moreover to accelerate agricultural development, it is necessary to protect plants breeders' rights to stimulate investment for research and development for the development of new plant varieties. Such protection is likely to facilitate the growth of the seed industry which will ensure the availability of high quality seeds and planting material to the farmers. India having ratified the Agreement on Trade Related Aspects of the Intellectual Property Rights has to make provision for giving effect to Agreement.

National Research Development Corporation (NRDC)

NRDC was established in 1953 by the Government of India, with the primary objective to promote, develop and commercialize the technologies / know-how / inventions / patents / processes emanating from various national R&D institutions / Universities and is presently working under the administrative control of the Department of Scientific and Industrial Research, Ministry of Science and Technology. During the past six decade of its existence and in pursuance of its corporate goals.NRDC has forged strong links with the scientific and industrial community in India and abroad and developed a wide network of research institutions, academia and industry and made formal arrangements with them for the commercialization of know-how developed in their laboratories and is now recognized as a large repository of wide range of technologies spread over almost all areas of industries, viz. Agriculture and Agro-processing, Chemicals including Pesticides, Drugs and Pharmaceuticals, Bio Technology, Metallurgy, Electronics and Instrumentation, Building Materials, Mechanical, Electrical and Electronics etc. It has licensed the indigenous technology to more than 4800 entrepreneurs and helped to establish a large number of small and medium scale industries.

Technology Information, Forecasting and Assessment Council (TIFAC)

TIFAC is an autonomous organization set up in 1988 under the Department of Science and Technology to look ahead in technologies, assess the technology trajectories, and support technology innovation by network actions in select technology areas of national importance. TIFAC continues to strive for technology development of the country by leveraging technology innovation through sustained and concerted programmes in close association with academia and industry. The main objectives of TIFAC include generation of Technology Forecasting/Technology Assessment/ Techno Market Survey documents, developing on-line nationally accessible information system, promotion of technologies and evolving suitable mechanism for testing of technology and enabling technology transfer as well as commercialization. TIFAC embarked upon the "Umbrella Scheme on Technology Vision 2020 Projects in Mission Mode" in the year 2000 in which agriculture was taken up as one of the important sectors for commercialization of technologies.

Empowering farmers for validation and promotion of ITK

Indigenous knowledge system has been key to survival strategies for civilizations across the globe. Rural communities used local resources for meeting the demands of food, feed, fuel and fiber. The local wisdom and skill did play a crucial role in decision-making and efficient farm management by the farmers but in the process of modernization they began to lose their significance. However, attainment of plateau in productivity as well as unsustainability and deleterious consequences of frontier technologies have necessitated rigorous search for appropriate, sustainable, eco-friendly and resource conserving technologies. In this endeavor, indigenous technical knowledge with sound sustainability and ecological principles, time tested merits and proven rationality has become an important subject of deliberation and investigation among the researchers and academicians in the recent past. The time-tested principles and practices of indigenous technical knowledge (ITK) have amply demonstrated that much of the problems related to natural resource management and ecology degrading agricultural practices could be effectively managed by their utilization either in their present form or improvisation and even blending with modern technology.

Indian agricultural research perspective began with study of traditional veterinary medicines used by nomads in Himalayan ranges during mid-sixties. Later studies conducted on documentation of traditional knowledge and technologies, testing of their scientific rationality, their validation and comparative analysis with modern technologies were galore. However, all these studies and projects in this area remained focused upon the indigenous technology per se, while the critical issues related to revival and rejuvenation of indigenous technical knowledge base like experimentation and adaptation capability of farmers, their capacity building for understanding and laying hands upon experimentation and grassroots innovations, augmentation of participatory research process, etc. are yet to get adequate attention in technology development and dissemination system.

To provide continuity to grassroots experimentation and evolution of indigenous technologies it is imperative to transfer science among the farmers and also develop their experimentation capabilities. Endeavour in this direction was made through farmer participatory validation of indigenous technologies under NATP Mission mode project of ICAR on documentation and validation of indigenous technology.

Since, information on ITK are seldom documented, it often happens that such information are lost, if not passed on from generation to generation or protected and practiced by the local people. Hence, in today's concept of IPR regime, it is all the more imperative to document and protect our valuable ITK for posterity. In the context of agricultural sustainability, ITK is also required to be properly documented for the benefit of researchers, planners and development officials Validation of ITK is a logical step to qualify and quantity effectiveness of the practices. Suitable modifications of the local practices, through research and development will help to develop appropriate and acceptable technologies that are more suited to our farming situations. ITK which is treasure of our agriculture, without this agriculture cannot sustain and will not fulfill the requirement of future.

ENHANCING FARMERS INCOME THROUGH ADOPTION OF RESOURCE CONSERVING TECHNOLOGIES

A.K. Mauriya, Vinod Kumar and Anshuman Kohli

Mr Ranjan Kumar Suman has demonstrated the potential of technology to transform the economic and attitudinal response of a traditional cultivator. Constrained by the typical socio-economic setting of rural Bihar, the farmer was finding hard to make his ends meet through farming, despite having sufficient cultivated area. His success story is the documentation of how a farmer can benefit by learning from the extension activities and progressive attitude to transform his fate. He adopted the appropriate technologies in the right spirit to eradicate his dependence on sharecroppers and transform himself towards self-sustenance and service provider. He is an inspiration to the farmers of the region.

Success Story: Sri Ranjan Kumar Suman is a humble farmer from village Barahari, block Goradih, district Bhagalpur, Bihar. The village Barhari is situated at a latitude of 25°14´32´´ N and a longitude of 86°58´21´´ E. Till about a few years ago, he was a farmer with medium size land holding (undulated and devoid of irrigation) and ordained to feed a family of six through his traditional agricultural practices on the farm. With about 8.0 hectares of land for cultivation, he was finding it hard to fulfil the growing needs of his family in this age of consumerism and urbanized markets. He was solely dependent on agriculture and had never thought of an alternate source of income, occupation or profession. Belonging to a conservative family, the ladies of the family were also apprehensive of working outside the household. Thus any alternate sources to supplement the family income were beyond imagination. His transformation to a millionaire farmer is a story of how an appropriate technology adopted and adapted with the local ecology and socio economic context can do wonders. Not only has this transformed his family's economic condition, but also given them a sense of pride in following a profession as a farmer; simultaneously becoming a role model for the community. Close relatives, both on his and his wife's side, who have migrated to the city, till a few years ago used to call them to migrate and work as domestic helps and assistants, are even thinking of following his footsteps and return to the rural ecological setting for a healthy life style.

Transition from Dependence to Self Sustenance to Service Provider

Primarily he used to cultivate only 1.0 -1.5 ha land for rice with traditional system. Traditionally, transplanted rice (TPR) that involves intensive inputs in transplanting, weeding, irrigation, harvesting and threshing. The remaining 6.5 – 7.0 hectares of land was cultivated by other farmers as sharecroppers or on lease basis. In 2011-12 he became seriously ill. At that time there was no one else in the family to shoulder the responsibility of agriculture as other immediate family members were either children, women or too old. The sharecroppers connived to occupy the whole cultivated land without any agreement. This was the stage that turned his mind and he conceived the idea to cultivate his land on his own. After improvement in his health, a transformation happened in his life when he attended a farmers' training programme on "Advanced technology of rice cultivation including direct seeded rice" at Krishi Vigyan Kendra Sabour, Bhagalpur. He interacted with the specialists of various disciplines and conceptualised on using the technological options being recommended by the KVK. Luckily, he also got an opportunity to follow very closely a front-line demonstration on Direct Seeded Rice (DSR) in rice and Zero tillage (ZT) in wheat with improved varieties as the said demonstration was conducted on his field during 2013 - 14. Mr Ranjan Kumar Suman was impressed to see the overall growth, yield and quality

Mechanized farming towards enhancing farm income of produce under the field demonstration. This impressive performance inspired him to cultivate direct seeded rice on 8.0 ha area followed by cultivation of the entire *rabi* crops without any tillage. During the *rabi* season, he cultivated zero tilled wheat, chickpea and lentil. The adoption of direct seeded rice followed by zero tillage technology in post rice crops not only reduced his dependence on hired labourers, but also substantially reduced his investments on inputs. With far lower requirement of external labourers, he could successfully cultivate all his land on his own and do away with the sharecroppers and tenants. After successfully reducing the expenditure on tillage and planting, he contemplated further mechanization of his farm by using a combine harvester for harvesting and threshing of his crops. Adoption of large scale prophylactic measures demanded adoption of mechanized sprayers for pest control. As he was determined to make a successful transition to professional farming reducing the excessive use of manpower as well as other inputs, he made use of the promotional avenues offered by the state government for purchase of machinery that has reduced drudgery on his farm.

Challenges in Adoption of what was Thought

After purchasing these farm equipments, the real challenge was to be able to use them at the opportune time. He realised that the undulating topography of his terrain offered severe restrictions in realising the full benefits of farm mechanization. Having also attended an orientation about the Laser Land Leveller at the Bihar Agricultural University, Sabour, he contemplated if it could help him overcome these constraints. Following a technical discussion with his mentors at KVK, Sabour, he decided to include a laser land leveller in his fleet. However, the seasonal use of the farm machinery and their upkeep and maintenance was still a challenge. The preying eyes of neighbouring farmers provided him an opportunity to use his farm machinery on custom hiring basis for the benefit of other villagers, simultaneously generating valuable cash income during the spare time. Thus was accomplished a total transition from a labour hirer to self sustenance to a service provider.

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