

Magazine on Low External Input Sustainable Agriculture



LEIS INDIA A



Agroecological innovations



December 2018 Volume 20 no. 4

LEISA India is published quarterly by AME Foundation
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PRINTING

Nagaraj & Co. Pvt. Ltd., Chennai

COVER PHOTO

Small farmers in remote villages in West Bengal, even today use cloth enclosures known as "Hatching Hapas" to fertilise fish eggs.

(Photo: Pratap Mukhopadhyay, Retired Principal Scientist, ICAR-CIFA)

The AgriCultures Network

LEISA India is a member of the global Agriculures Network. Seven organisations that provide information on small-scale, sustainable agriculture worldwide, and that publish:

Farming Matters (*in English*)

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The editors have taken every care to ensure that the contents of this magazine are as accurate as possible. The authors have ultimate responsibility, however, for the content of individual articles.

The editors encourage readers to photocopy and circulate magazine articles.

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Dear Readers

Small holder agriculture is increasingly becoming vulnerable to many changes happening in the external environment. While we cannot stop the changes that are happening, we can adapt to the changing situations. Innovative farmers have shown various ways and means to tide over the crisis in agriculture.

Small farmers facing a myriad of problems in farming, seek practical solutions emerging out of their experience. Their solutions are simple and are born out of nature. The resourcefulness and innovativeness of these small-scale farmers has been an important asset for solving many kinds of problems in agriculture. Integrating them in the formal research process will result in the development of relevant, accessible and affordable solutions, for wider benefit. Hope you find this issue inspiring and useful.

We are glad to inform you that LEISA India has completed **two decades of knowledge sharing on ecological alternatives**. LEISA India owes its continuity primarily to enthusiastic contributors committed to strengthening agroecological knowledge sharing and exchange. We are extremely grateful to all those who have supported this movement. We earnestly seek your continued support, in large numbers, through voluntary contributions.

Wishing all our readers a very Happy New Year!

The Editors

LEISA is about Low-External-Input and Sustainable Agriculture. It is about the technical and social options open to farmers who seek to improve productivity and income in an ecologically sound way. LEISA is about the optimal use of local resources and natural processes and, if necessary, the safe and efficient use of external inputs. It is about the empowerment of male and female farmers and the communities who seek to build their future on the bases of their own knowledge, skills, values, culture and institutions. LEISA is also about participatory methodologies to strengthen the capacity of farmers and other actors, to improve agriculture and adapt it to changing needs and conditions. LEISA seeks to combine indigenous and scientific knowledge and to influence policy formulation to create a conducive environment for its further development. LEISA is a concept, an approach and a political message.

AMEF is a member of AgriCultures Network, which is involved in co-creation and sharing of knowledge on family farming and agro ecology. The network is **locally rooted and globally connected**. Besides magazines, the network is involved in multi stake holders' engagement and policy advocacy for promotion of small holder family farming and agroecology. The network consists of members from Brazil, Ethiopia, India, Netherlands, Peru and Senegal. The secretariat of the network is located in IED Afrique, Dakar, Senegal.

MISEREOR founded in 1958 is the German Catholic Bishops' Organisation for Development Cooperation. For over 50 years MISEREOR has been committed to fighting poverty in Africa, Asia and Latin America. MISEREOR's support is available to any human being in need – regardless of their religion, ethnicity or gender. MISEREOR believes in supporting initiatives driven and owned by the poor and the disadvantaged. It prefers to work in partnership with its local partners. Together with the beneficiaries, the partners involved help shape local development processes and implement the projects. This is how MISEREOR, together with its partners, responds to constantly changing challenges. (www.misereor.de; www.misereor.org)

AME Foundation promotes sustainable livelihoods through combining indigenous knowledge and innovative technologies for Low-External-Input natural resource management. Towards this objective, AME Foundation works with small and marginal farmers in the Deccan Plateau region by generating farming alternatives, enriching the knowledge base, training, linking development agencies and sharing experience.

AMEF is working closely with interested groups of farmers in clusters of villages, to enable them to generate and adopt alternative farming practices. These locations with enhanced visibility are utilised as learning situations for practitioners and promoters of eco-farming systems, which includes NGOs and NGO networks. www.amefound.org

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Key for ecological sustainability

S Kalavathi, A Abdul Haris, Jeena Mathew and V Krishnakumar

Success in farming mainly depends on the understanding of the specificity of farming systems and their dynamic interaction with local agroecological factors. Small scale farmers from time immemorial evolved a lot of techniques to defend the adversities in farming. Farmers' wisdom, their adaptive skills and innovative spirit play a key role in agroecosystem management. Such adaptations based on the local wisdom are crucial in attaining ecological sustainability.



10 Five Square Model

An innovative practice to reduce soil salinity

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An innovative irrigation method

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Farmers traditional practice with a little adaptation has resulted in enhancing the quality and quantity of apple production in Jumla district in Nepal. This low-cost technology has been most helpful for those farming communities with lesser water resources. Valuing the significance, this innovation has been institutionalized by the Government of Nepal to support apple farmers.



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Bankey Bihari, Lakhan Singh, Rajesh Bishnoi and Suresh Kumar

In remote hilly regions of the country, small land holders are still not able to make a remunerative living out of farming owing to poor access to markets. Farmers in the remote hilly region of Chakrata area in Dehradun district of Uttarakhand have evolved a unique type of localized marketing mechanism, which is successful and sustainable.

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Agroecological innovations

Farmer faces challenges of climate on one side and markets on the other. Resilience is not just a desirable trait but an essential approach to deal with these growing uncertainties. Agroecological approaches are now firmly recognised as the way forward to deal with issues like food security, improving farm livelihoods and climate aberrations. In short, it is being recognised as a means to achieve SDGs.

Small holder family farmers are the ones who have continued to keep agroecological approaches alive and popular. In spite of having limited access to resources and extension support from the government, and subjected to piecemeal approaches of development, these farmers are surviving owing to their ingenuity and innovative capacity. Fundamental to small holder's survival is resilience and resilience is innovation based. In fact, Innovation nourishes resilience. It is necessary to examine whose resilience and innovation we are talking about. While most other stakeholders are caught in the trap of 'more of the same', farmers have been in fact practising resilience through innovation and showing simple ways of doing things. As agroecological approaches are rooted in local ecosystems, local resilience and adaptation, small scale farmers have been able to evolve a lot of techniques to defend the adversities in farming.

It is widely acknowledged that the contribution of family farmers to global food security is much more compared to the market driven commercial farmers. The declaration of 2019-2028 as the '**Decade of family farming**' by the UN General Assembly, in its 72 session, finally gives the much needed recognition to family farmers across the globe.

Adaptations/Innovations

Farmers' wisdom, their adaptive skills and innovative spirit plays a key role in agroecosystem management. Most of the farm level innovations of small holders are based on low cost intensive options. This issue highlights some of these approaches and experiences.

Water availability is a critical limiting factor, whether it is crop management or fisheries. Coastal farmers of South Kerala have been addressing this critical issue of salinity and water logging through appropriate crops and intercrops, suitable varieties, crop combinations, agronomic innovations, resilient planting time etc. For instance, among intercrops, pineapple was found to be the most ideal crop to withstand water logging. (Kalavathi et al., p. 6).

Another interesting example of dealing with water logging has been water harvesting structure named as 5 square model which involves a water harvesting structure and appropriate land shaping to minimise water logging and salinity. The water body created and the field bunds created support diverse production systems like pisciculture, seasonal crops and vegetables. (Sutapa De et al., p.10). A series of simple and local indigenous devices developed and used by aquaculture farmers in West Bengal highlight the simplicity and effectiveness of these in dealing with a challenging production system. Some of them include bamboo based local devices and eco-friendly options to deal with predators. (Pratap Mukhopadhyay, p.22).

In yet another simple but effective innovation, apple farmers in Nepal focused on collecting snowfall, and

irrigating apple trees. By slightly refining their traditional snow harvesting system through scientific methods, they could support critical irrigation of the crop, resulting in better quantity and quality of production. (Dhan Bahadur Kathayat et al., p.14)

Innovations are not limited to crop production systems. Farmers in remote hilly region of Chakrata area in Dehradun district of Uttarakhand have evolved a collective marketing and transporting mechanism with transparent mechanisms of pricing and cash payments. (Bankey Bihari et al., p.18).

Enabling environment

Ingenuity of farmers' innovations and improvements successfully tested over time should be given due recognition, lest such innovative ideas and spirit get lost for ever. (Pratap Mukhopadhyay, p.22). Innovation is dependent on an enabling environment -an environment where the innovator is motivated and supported.

There is a need for creating an enabling environment and local innovations could be incubated and scaled up. Though the approaches are fragmented, there are some interesting examples of convergence and need based collaboration. NGO Prasari joined hands with Panchayat and Rural Development Department to address salinity through 5 square model, leveraging NREGA scheme with community involvement. While the NGO supervised the model implementation, the Agriculture Department scaled up the technology ((Sutapa De et al., p.10).Also in Nepal, the Government institutionalised the innovation on snow harvesting, by supporting apple farmers. (Dhan Bahadur Kathayat et al., p.14).

There are instances where research played a very supportive role. CPCRI carried out effective demonstrations introducing low cost alternatives for diversified production systems. (Kalavathi, et al., p.6).These models do give us encouragement on what is possible.

Documenting farmer innovations is also one way of recognising their knowledge systems. Farmer innovations seldom enter the public domain knowledge systems. They remain localised and inaccessible. Strongly believing that innovation is intrinsic to agriculture, Small Farmers' Agribusiness Consortium (SFAC), documented a

compendium of innovations by farmers. Around 100 profiles of innovative farmers was compiled with a focus on individual farmers and entrepreneurs and simple, cost-effective yet imaginative solutions to common problems faced by the farming community. Some of them include dairy shed design; mixed cropping of banana and papaya; introduction of wild karela species; preparation of bio pesticide from leaves; homemade dal etc. (p.28).

While most concede that there is an urgent need to radically transform our food systems through innovations, the proposed innovations for more sustainable food systems are drastically different. The suggested technological innovations reinforce the concentration of political and economic power in the hands of a small number of corporations. A number of questions need to be answered. Who controls the global governance of innovation? Would the farmer innovation be incubated and supported or would it be replaced by a dominant industrial paradigm patenting technologies? We need to be careful in choosing those that will have long-lasting effects on human society and the planet. Deliberative and inclusive processes such as citizen's juries, people's assemblies, and community led participatory approaches are urgently needed to decide priorities for food and agricultural innovations. (Pimbert and Anderson, p.33). Only then the decade of family farming will serve its purpose.



Farmer adaptations

Key for ecological sustainability

**S Kalavathi, A Abdul Haris, Jeena Mathew
and V Krishnakumar**

Success in farming mainly depends on the understanding of the specificity of farming systems and their dynamic interaction with local agroecological factors. Small scale farmers from time immemorial evolved a lot of techniques to defend the adversities in farming. Farmers' wisdom, their adaptive skills and innovative spirit play a key role in agroecosystem management. Such adaptations based on the local wisdom are crucial in attaining ecological sustainability.

Modified husk burial method resulted in uniform bearing in pineapple



Coastal conditions of Kerala are favourable for growing coconut, yet the productivity remains low due to poor physico-chemical properties of the soil. Apart from the poor fertility status of the soil, water logging due to precipitation variation and salt water inundation were observed as major impediments to successful cultivation of coconut in the southern coastal tracts of Kerala. This peculiar situation in the tract made it difficult for the farmers to take up cultivation of many of the intercrops and adopt year-round cultivation.

Several farm level *climate-smart* practices were evolved by the farmers to increase productivity and build resilience in the coastal tracts with climatic vagaries. These practices were further tested and refined incorporating scientific inputs from ICAR-CPCRI team in a participatory mode.

The initiative

CPCRI has been demonstrating a number of practices and technologies on management of coastal sandy soils in Alappad Panchayat of Kollam district and Arattupuzha Panchayat of Alappuzha district in Kerala. While demonstrating, the local wisdom and rich experience of a farmer couple, Shri. Devadas, and Smt. Sathyavathi, from Alappad Panchayat and another farmer Shri Babu Muthiraparambil, from Arattupuzha Panchayat paved a way in successfully refining the technologies to suit the requirements of coastal farmers. The demonstrations were undertaken in an area of 0.6 ha each in both the places during 2012 - 2015.

The soils in both the locations were found to be non-saline, having pH ranging from 4.5 to 6.3 with low levels of organic carbon, Potassium, Calcium and Magnesium and higher levels of Phosphorus, Manganese, Iron and Zinc. Adoption of management strategies, especially, crop residue recycling, resulted in the improvement in organic carbon status to the tune of 74 per cent in the main crop and 32 per cent in the intercropped area. Application of

need based amendments and fertilizers resulted in the improvement in the content of potassium, magnesium and calcium. A reduction in the content of iron and phosphorus was also observed. The trend in the soil fertility change was similar in both coconut as well as in the intercrop. Agro-techniques like husk burial, balanced nutrition, integrated management and micro irrigation were adopted for enhancing productivity.

To overcome the problems of water logging and salt water inundation, different intercrops like pineapple, banana (4 varieties), tuber crops, vegetables including cool season vegetables, fodder grass, ginger and turmeric were tested for their adaptability. Pineapple was found to be the most ideal crop to withstand water logging, followed by Nendran variety of banana, fodder grass and colocasia, among different intercrops. Various intercrops were planted using various adaptation measures like husk burial in the planting pits and application of coir pith compost under coastal sandy conditions and their performance was evaluated.

Farmer adaptations and their impact

Farmers made some adaptations to the practices and technologies recommended by CPCRI in each of the intercrop and reaped good results.

a. Pineapple

Pineapple was found to be the most ideal crop to withstand water logging, yielding fruits on an average 1.0-1.75 kg. While planting, husks were placed at the bottom of the trenches with concave surface facing up as recommended. Even though the pineapple plants with husk burial had more growth and vigour compared to control plants during the initial period, growth slowly declined after rainy season due to water logging inside the husks. A modified method of sideways placement of husk around the plant, as suggested by the farmer showed better performance under water logged conditions. This has resulted in better growth, early bearing and higher fruit weight for pineapple (average 1.75 kg) compared to normal planted ones (average 1.00 kg). Majority of the plants (80%) planted with sideways placement of husk flowered during 50-60 weeks (average 57 weeks) without flower induction. Plants in control plots were treated with Ethrel for flower induction during 57th week and flowering was completed within 6-8 weeks.

Among intercrops, pineapple was found to be the most ideal crop to withstand water logging.

b. Banana

Among different banana varieties, Nendran performed well, yielding bunches weighing an average of 7 kg/plant. Compared to Red banana, Njalipoovan and Robusta varieties, Nendran variety could survive from water logging due to short duration nature. In case of the variety Njalipoovan, even though found susceptible to water logging, farmers preferred to grow it due to the higher yield potential, demand, marketability and price of product. Planting of the same variety during normal planting time with and without husk burial resulted in lodging of majority (73%) of the plants and moderate reduction in yield levels due to poor finger formation. Farm level adaptations included advancement of planting time, planting of 4-5 months old suckers and earthing up with silt, green manure, coir pith compost, potash and modified husk burial for banana which helped to tide over the situation. All the plants were saved from lodging and the yield enhanced by 80%. Average yield of 13.5 kg/bunch for Njalipoovan and 22.5 kg/bunch for Robusta variety were obtained after following adaptive measures.

c. Fodder crops

Generally fodder grass showed a decline in growth during rainy season in low lying areas due to water logging as manuring was practically ineffective. Farmers on the other hand tried applying biogas slurry in a channel parallel to the row of planting. By this, there was no water logging at the base of clumps and aeration was maintained, resulting in good growth and yield of fodder.

d. Tuber crops

Tuber crops except Taro planted during normal planting time resulted in severe crop loss due to water logging. Farmers tried several adaptations. They planted short duration varieties of tapioca like *Vellayani Hraswa*, *Sree Jaya*, and *Sree Vijaya*. Planting time of Tapioca was advanced from February to October-November. By adopting short duration varieties and advancing planting time of Tapioca, the farmers could get a reasonable yield (average 3.2 kg/plant). In case of elephant foot yam and dioscorea, the farmers retained the previous year's crop in the field and obtained average yields of 6.3 kg/



Burying husk in banana pits helped the plants from lodging

plant from dioscorea, 5.2 kg/plant from *Gajendra* variety and 13.5 kg/plant from *Peerumedu*, a local variety of elephant foot yam. Retaining previous year's lost crop (elephant foot yam and dioscorea) in the field resulted in higher yield during off-season, enabling to obtain higher price thereby compensating the yield loss during previous year. In case of Tania, tuber formation was reduced due to prolonged and heavy monsoon, for which the farmers applied 1 Kg *Trichoderma*- enriched coir pith compost along with 50g of Muriate of Potash while earthing up, which resulted in doubling of yield.

e. Vegetables

In case of vegetables, the better practice of planting coir pith compost enriched with *Trichoderma sp.* along with other organics was found to ensure better growth and 20-30% improvement in yield. Among the vegetables, amaranthus, bitter gourd, cow pea, tomato, cauliflower and cabbage performed well. Cauliflower weighing up to 2 kg and cabbage up to 2.50 kg could be harvested. The farmers could get single plant yield up to 18 kg from bitter gourd and 4 kg from cow pea.

Economic viability of farmer adaptations

The yield of coconut showed improvement up to 59% and 55% respectively at Arattupuzha and Alappad locations during 2014, over that of 2012. Due to the time lag in income realization from intercrops like



Healthy plants with healthy fruits in Robusta banana

pineapple and banana and partial crop loss due to water logging, the net profit from coconut based farming system (CBFS) during 2012-13 was only moderate. However, Benefit-Cost Ratios of 1.95 and 1.59 revealed feasibility of the CBFS under coastal conditions, which prompted the farmers to undertake and validate adaptation measures against climatic vagaries. Through intensive crop diversification and cost effective adaptation measures, profitability of the system could be considerably enhanced. The net income from the coconut based cropping system varied from Rs.1.35 – 1.89 lakh during

2013-14 depending on the intensity of intercrops cultivated, which is around three fold to that realized during 2012-13.

Conclusion

As farmers closely and regularly observe the effects of temperature, water, wind, and humidity on the processes of production, it is farmers' wisdom that plays a key role in evolving climate resilient adaptations. Moreover, such farm level innovations are dependent on locally available resources, making them low cost intensive options to be adopted. Such farmer innovations, if encouraged and supported can lead to replicable models of small scale sustainable farming systems.



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Five Square Model

An innovative practice to reduce soil salinity

Sutapa De, Saikat Pal and Purnabha Dasgupta

Aquaculture is recognized as a very efficient form of animal production system. Improvement in fish yield while sustaining the natural resources, depends to a great extent on the appropriate husbandry practices adopted.

The five square model on the ground



The Sundarbans is the largest single block of tidal halophytic mangrove forest in the world. The area receives good annual rainfall which is much higher than the annual average rainfall of India. Sundarbans receive rainfall, to the tune of 1800 mm to 2000 mm in a year. Almost 70% of the rainfall takes place in the month of July, August and September of the year. This high rainfall in three months results in huge water logging, as the terrain is flat.

Agriculture is the major source of livelihoods. Paddy is grown during the monsoon season. The agriculture land suffers from severe water logging in rainy season and soil salinity in the winter and summer. There is also very minimum rainfall in the winter and summer months (November to April) of the year. The salinity in the soil and the shallow ground water increases in these dry months which again does not allow the second crop to grow. Salts become active in the winter and salinity reaches maximum values in the summer. In the summer, no crop can be grown as there are no sources of sweet water supply for irrigation.

The Initiative

In 2009, the entire Gosaba block of South 24 Parganas district was destroyed by Aila cyclone. Entire land got converted from sweet to saline soil owing to excessive water logging. It was impossible to grow crops. With sea water inundation, growing a single rice crop was also at stake. However, the heavy rainfall during 2010-12 helped in reducing salinity to a certain extent. At this point of time, PRASARI, an NGO working in the area tried to find out ways to address the problem of soil salinity and help farmers build their livelihoods.

In order to reduce salinity and improve incomes, PRASARI organised a sharing workshop with Gram Panchayat and the community. Problems were identified which highlighted issues like salinity, stagnant water and low incomes. Solutions were also identified through community participation.

Land shaping was found to be an ideal solution to begin with. Following discussions, a technological model was designed. It included creating rain water harvesting structures, shaping/raising the land bed and strengthening field bunds with the excavated soil thus ensuring easy drainage to counter waterlogged situation. It also included

Box 1: What does the land treatment do?

- It provides a gentle slope to facilitate runoff: avoiding water logging.
- Raised land bed facilitates leaching and surface wash of salinity thus reducing it to a great extent.
- High field bunds protect the plots from flooding.
- Harvested rain water ensure staple and cash crops from beds and bunds.
- Fish is an assured source of income from Water harvesting structure.
- Almost a bigha of land has the potential to generate annual income of Rs. 50,000, sufficient to prevent migration.

ways of optimising utilization of land-water-human resource to ensure a quantum jump in the family's annual income to prevent distressed migration. For example, integration of kharif rice (through SRI-system of rice Intensification) and residual mainland moisture use through mustard as second crop (using SRI principles); growing two vegetables in a year on the strengthened field bunds; improved carp and prawn culture in the water harvesting tank, ensured additional incomes. This is a bottom up trend for area or patch treatment, which helps in making that particular area free from water stagnation and salinity.

"Five-Square" Model

Such water harvesting structure (WHS) is named as "five-square" model, designed for a bigha (1/3 rd of an acre of land) and would provide good water supply for the treated plots, based on the water availability and crop water requirements. The dimension of the structure (55 ftX55ft; five square depicts 55 ft.) for one third of an acre of the land may vary with the plot dimension. If calculated, the structure requires 20% of the plot size (i.e. one fifth of the plot). For any plot with length-L and width-B, the structure's length-L1=L/2.5 and width B1=B/2. So the WHS area will be $L1 \times B1 = (L/2.5) \times (B/2) = (L \times B) / (2.5 \times 2) = \text{Plot area} / 5$. The size of the structure has been decided based on the discussion and preferences of the farmers. There are three different layers each of 3 ft. depth.

Community level workshops were organised inviting Geotechnical engineers, Agricultural scientists and soil scientists, where in "Five Square Model" was discussed and advantages recognised.

Trying on the ground

In the year 2012-13, PRASARI shared the idea of “five square” model with local Gram Panchayat (GP) at Kochukhali, Gosaba Block. Panchayat agreed to invest through MGNREGA on a single structure to examine the efficacy of the ‘solution’. ‘Phanida’ a marginal farmer from Kochukhali agreed to take the ‘risk’. In the month of May-2012, the Panchayat Engineer agreed to provide the ‘field lay out’ after a lot of technical debate, especially on the ‘soil stability’.

Workshop with the GP representatives was organised with a special focus on beneficiary selection and technical monitoring. Beneficiary selection through community meeting was done through water flow mapping, patch marking of revenue villages and fixing minimum criteria for beneficiary selection.

Technical training was provided to the labour for developing structure which included, cutting process and design, bund design, process of land shaping along the slopes, channels and outlets.

Once the excavation and land shaping were over, the challenge was to grow crops on the shaped land and bunds. The soils were expected to have huge salinity as

the soil from deeper layers was excavated and uniformly deposited on beds and bunds. The field was separated from the adjacent plots and ponding of water allowed for a while. Draining out water later carried away maximum possible salts from the field.

Thereafter, three types of production systems were initiated - SRI on main land, egg-plant, cucurbits and peas on the field bund and a few carp fingerlings (just to test whether they can survive in the very first year) in the tank. Sowing of SRI paddy was taken up a little late to allow the rain water to drain. SRI which takes 10-15 days less for crop maturity, had compensated for the cropping time loss. In the very first year, the bund has been tried with cucurbits, solanaceae species and peas to track the response of different species. Also, we agreed not to go for prawn culture in the very first year as prawn seeds are little expensive.

Apart from crop coverage, special focus was given to track the changes in the very first year. Data on water logging, soil and pond water qualities and salinity levels were tracked. pH paper strips and Portable Diffractionmeter were used to determine the salinity percentage.

The government scaled up the water harvesting structures through MGNREGA programme



Five Square Model Data (2018-19)						
Name of the farmer: Phanindranath Mondal, Kachukhali, Gosaba						
Soil parameters						
Date	Bund		Field		Outside	
	Salinity (%)	PH Level	Salinity (%)	PH Level	Salinity (%)	PH Level
July	3	5	5.5	4.9	7.5	6.3
August	2.5	5.1	5	5.2	7	6.2
September	2	5.2	4.5	5.4	6.5	5.5
October	1.5	5.4	3	4.8	4.5	5.8
November	0	5.4	1.5	5	4	5.8

Five Square Model Data (2018-19)		
Name of the farmer: Phanindranath Mondal, Kachukhali, Gosaba		
Tank Water Quality		
Date	Salinity (%)	PH Level
July	5	3
August	6	3.5
September	6	4
October	3.5	4
November	2	4.3

Impact and spread

Pisciculture and agriculture were the two main activities taken up at these five square models, which improved incomes. Presently, a variety of vegetables are grown on these models such as creepers and Solanaceae species (bitter gourd, tomato, spinach, brinjal, green chillies, beans etc). Among the beneficiaries, Biswajit Mahato of Pathankhali GP, Gosaba Block deserves special mention, He has earned a considerable amount of income from his five square model. Biswajit has invested Rs 21,790 in the last financial year for vegetable cultivation (ladies' finger, bitter gourd and brinjal), from which he has earned Rs 59,720. He has also succeeded in fish farming which he has mostly used for home consumption.

Inspired by the results of five-square model, the Panchayat and Block took initiative to construct such models in their locality. A number of such models have been constructed.

Panchayat and Rural Development Department has also taken up this technology to build water harvesting in all

the 19 Blocks in Coastal Sundarbans. The programme is being implemented through MGNREGA programme.

Creation of water harvesting structures and its replication has been taken up by Block Agriculture Department, especially in Sandeshkhali II Block, North 24 Parganas district. This has been implemented through PMKSY project at block level, wherein 41 such water harvesting structures (five square models) have been created, under the supervision of PRASARI.

Land shaping technology if adopted on a larger scale, would result in an entire delta region free from salinity and water stagnation. Better income generation would further result in poverty reduction and reduced migration.

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Snow harvesting

An innovative irrigation method

**Dhan Bahadur Kathayat, Mahananda Joshi
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Farmers traditional practice with a little adaptation has resulted in enhancing the quality and quantity of apple production in Jumla district in Nepal. This low-cost technology has been most helpful for those farming communities with lesser water resources. Valuing the significance, this innovation has been institutionalized by the Government of Nepal to support apple farmers.

Rolling of snow ball



Agriculture, the backbone of the Nepalese economy provides employment to 66% of the total population and contributes 33% to the GDP. Jumla district ranks top in terms of area and production of apple. There is a steady increase in the area as well as production of apple. Apple is produced under rainfed conditions dependent upon the winter snowfall and summer rainfall. Lack of irrigation is considered as one of the prime reasons for the poor quality of apples in this region.

Farmers have been collecting snowfall during the winter season and irrigating apple trees by piling it around the base of the apple trees. However, the practice has resulted in disease incidence. In order to improve this traditional, innovative practice, an action research was conducted to explore if the snowfall could be collected in a plastic pond. Thus, an action research was conducted to improve the farmer's traditional practice of snowfall collection around the apple tree in an improved way in the year 2014-15 through the Climate Smart Agriculture Project (CSA), supported by SNV, Nepal. The action research study was conducted jointly in Jumla district of Nepal in collaboration with District Agriculture Development Office (DADO) and local organization, Surya Samajik Sewa Sang (4S).

Action research

In 2014, the District Agriculture Development Office (DADO), conducted focused group discussion with about 600 farmers to prepare the Agriculture Development Plan of Jumla district. This was done in collaboration with different organizations like Forest Action, LI-BIRD, World Vision and Italian Foundation. The idea was to find whether the snowfall during the winter season (Dec-Feb) could be collected in Silpolin plastic pond and water be generated after melting.

The snow harvested in each pond was enough to irrigate approximately 120-130 plants in the orchard.

Table 1: Cost of constructing plastic pond (3x1.1x1.2 m size)

S.No	Cost items	Rate	Total amount
1	Materials		
	Silpolin plastic (150 GSM)- 1 number	12,500	13,500
	Digging materials (shovel)-2 set	1,000	2,000
2	Labor cost		
	Digging pond (3x1.1x1.2 m size)	4 man-days @600/day	2,400
	Total cost		17,900

The study was conducted in two villages, namely, Mahat and Kartikswami in Jumla district. Three farmers namely Hansha Mahat, Narbir Kami and Amrita Chaulagain were selected to conduct action research on snow harvest plastic pond irrigation. The farmers were selected to see whether this new idea of collecting snow during winter months could be successful or not. These farmers had a minimum of 25 apple trees with no irrigation source. They provided their time and willingness to share cost in the research. The selected farmers were provided training on the stepwise process of snow harvest collection and the orchard management practices.

The digging of the pond was done during the month of August, just after the completion of the monsoon season. This made the digging easy. Although the idea was to dig a pond of 3x1x1 meter volume size, the final volume of the pond after farmers dug was 3x1.1x1.2m. After digging the pond, the silpolin plastic of 150 GSM was laid inside the pond. The laying of plastic in the pond is a crucial action. The pond was made free from roots, stones or rocks in order to prevent the damage of the plastic. The average cost of the pond came to be around Nepalese rupee 17,900. The detail of the cost items is listed in Table 1.

During the study period, the snowfall occurred several times in a span of 3 months (December-February). Each time after the snowfall, it was collected in the plastic pond. The collection of snow was done for 4 times. In the study, the snowballs were rolled over the ground and moved slowly into the pond to avoid damage to plastic sheets.

Each time the pond was filled up with the snowball, it started to melt with rise in temperature. The measurement was done every time after the snowball was added to it.



Snow balls rolled over and harvested in the pits

The final measurement of the three ponds was done after the snowballs had completely melt, during the end of April. The melted water was measured. To reduce the evaporation losses, the pond was covered with mulch material from tree trunks and pine leaves.

All three farmers were trained to select 5 trees for control (no irrigation) and 5 five trees for irrigation. Melted snow was applied at the rate of 5 liters/plant with plant age being 10 years. Each plant was irrigated five times coinciding with the five critical stages of apple production. The five critical stages at which the snowmelt water was applied were: fertilizer application stage - end of January; bud sprouting period – end of February; flowering time- 2nd week of March; fruit setting stage - end of April and marble size fruit stage -2nd week of May.

The apple trees receiving snowmelt water were mulched with pine leaves to minimize evaporation loss. Some qualitative parameters like fruit size, number of fruits per kilogram weight and Total Soluble Solid (TSS) content was recorded. In order to measure the Brix percentage, a refractometer was used.

Results

The amount of water collected in all plastic ponds of 3 farmers orchards from 4 consecutive collections of snow was 3710, 4110, and 4310 liters respectively. The average water that was harvested from the snowfall was 4044

liters/pond. Since the water collected in the pond was applied at the rate of 5 litres/plant in 5 critical stages, the total water applied for one single tree was 25 litres. Based on this application, the average water harvested (i.e. 4044 litres) in each pond was enough to irrigate, approximately, 120-130 plants in the orchard. Although the amount of water applied to the apple tree was very less compared to the general water requirement of 250 - 400 mm, the scarce snow-melt water was applied near the root zone. The feeder roots of the apple trees lie in the top 1-20 cm of soil profile. Mulching was done to mitigate the evaporation loss. Pine leaves of about 10 cm thickness were applied around the base of the tree. Earlier, research has shown that the trees with mulching have a higher percentage of roots in this topsoil profile, which was anticipated as water applied could be taken by the roots effectively. Mulching helped in maintaining moisture, especially in the water stress region. Although the water requirement of the apple trees might depend upon the variety, soil type, and orchard management practices adopted by the farmers, this innovation has helped in managing water for apple farming.

The farmers using snow collected water and better management practices reported higher yield with good quality harvest compared to non-irrigated ones. Similarly, the number of fruits per kilogram in irrigated apple trees ranged from 6-8 as compared to 9-12 fruits/kg in non-irrigated trees. The grading of fruits was done as A (> 75mm), B (65-74mm) and C (< 64 mm) based on diameter. Greater number of A-grade fruits were observed in irrigated trees than in non-irrigated trees. The Brix percentage of fruits in all irrigated plants ranged from 11-14 as compared to 10-12 in non-irrigated plants.

Upscaling the innovation

The innovative practice in three farmer's orchards was a key success, revealing that snow-melt water could be preserved in the plastic pond and used during critical stages of apple production. The use of water at the critical stages resulted in improved fruit size with more TSS percentage, thereby enhancing the quality of the fruit. As a validation to the innovation, 150 farmers from different villages were selected in the year 2016 and the same process of snow harvest was repeated. In the year 2016, about 130 farmers were able to collect snow in the plastic pond. The success of the innovation was



Water harvested in each pond was sufficient to irrigate around 125 trees in the orchard

broadcasted from the local and national FM radio station and television. A Joint Secretary led team from Ministry of Agriculture Development visited the farmer's orchard. Since the Directorate of Extension under Department of Agriculture has been supporting small irrigation schemes like rainwater harvest, plastic pond irrigation, small and medium canal irrigation (construction and maintenance) in Nepal, the Ministry later re-amended the Plastic Pond Irrigation Directive 2065 (2008) and added provision to support snow-harvest pond irrigation in the directive. The innovation has now been institutionalized in the

government program to support the apple farmers in Himalayan districts of Nepal.

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Call for Articles

Sustainable Aquaculture

Vol. 21 No. 1, March 2019

Farmers and fisher folk in India have practiced aquaculture since time immemorial. With the advent of blue revolution, aquaculture moved into commercial lines. In the last four decades, aquaculture in India evolved as a commercial farming practice from the level of traditional backyard activity. This also meant that an environmentally sound and traditional industry transformed into an intensive production system leading to a number of environmental problems, like increased soil salinity, reduction in agricultural production, decrease in livestock production and destruction of mangrove forests. Shrimp cultivation has also negative impacts on biodiversity. In addition to the environmental effects, health and social issues have also been raised as major concerns.

We also find many farmers who adopt integrated or sustainable fish farming practices. What are the practices that farmers adopt that help in increased production while keeping their impacts on the environment low? How are these farmers managing to adopt these practices in the changing external environment? Are there any community level initiatives towards safe fish farming? Are there any supportive mechanisms or incentives for adopting sustainable aquaculture? What are the challenges in following sustainable practices in fish farming? In this issue of LEISA India, we would like to include experiences that address these issues, both at the local as well as at the national level.

Articles for the March 2019 issue of LEISA India should be sent to the editors. Email: leisaindia@yahoo.co.in before 31 January 2019.

Innovative market mechanism

**Bankey Bihari, Lakhan Singh, Rajesh Bishnoi
and Suresh Kumar**

In remote hilly regions of the country, small land holders are still not able to make a remunerative living out of farming owing to poor access to markets. Farmers in the remote hilly region of Chakrata area in Dehradun district of Uttarakhand have evolved a unique type of localized marketing mechanism, which is successful and sustainable.

Utility vehicle used for marketing vegetables



In Uttarakhand hills, about more than 80% farming community possess marginal and small land holdings. Of the total geographical area, only 12% of the land is under cultivation and more than half of the land is under rainfed conditions. Untimely rains and its uneven distribution is a big threat for hill farming. Situation in the winter and summer becomes more serious where water is available only through small springs with poor discharge. Water available through these small sources is used for domestic purpose as well as for irrigating field crops.

As the climatic conditions are favourable throughout the year, farmers even with their limited resources, cultivate off-season vegetables. They often produce in small quantities ranging from 5-20 kg in case of green vegetables like tomato, shimla chilli, green chilli, ladies finger & leafy vegetables and 20-100 kg in case of other vegetables like potato, ginger, colocasia, green pea, bottle guards, pumpkins, radish and carrot. As transporting from the hilly area to a nearby mandi is also expensive, farmers tend to sell the produce locally, receiving low prices. Sometimes, in remote hilly areas, even local markets are also not available. In such situations, farmers cannot even think to go for commercial cultivation.

Utility vehicle drivers are the catalysts for the innovative market mechanism



Poor access to markets has been restricting farmers in hilly regions in moving towards commercial cultivation of vegetables.

Since generations, affluent farmers in the Jaunsar region in Dehradun district, Uttarakhand and adjoining areas in Sirmour in Himanchal Pradesh, have their family members or village as whole sale agents in the nearest mandi. Being well known to them, farmers relied on these agents for sale of farm produce, purchase of inputs and, if required, also for lending money in the time of crisis. Earlier, farmers were transporting the farm produce from village to mandi using donkeys, as the condition of village roads was very bad. Village communities walked long distances to reach the market, even to meet out their petty needs. Sale of farm produce was a distant dream for the small and marginal farmers.

Since last 20-25 years, with improved road connectivity, every village in the area got connected through 2-3 utility vehicles plying to and from the village, daily. On an average, daily, about 160-170 utility vehicles come to mandi at Sahiya, Vikasnagar, Dehradun (Uttarakhand) and Nahan (Himanchal Pradesh). It comes from the village in the forenoon and returns to the village in the afternoon. Owing to these vehicles, mobility of farmers and their exposure to the market improved, significantly.

Innovative market mechanism

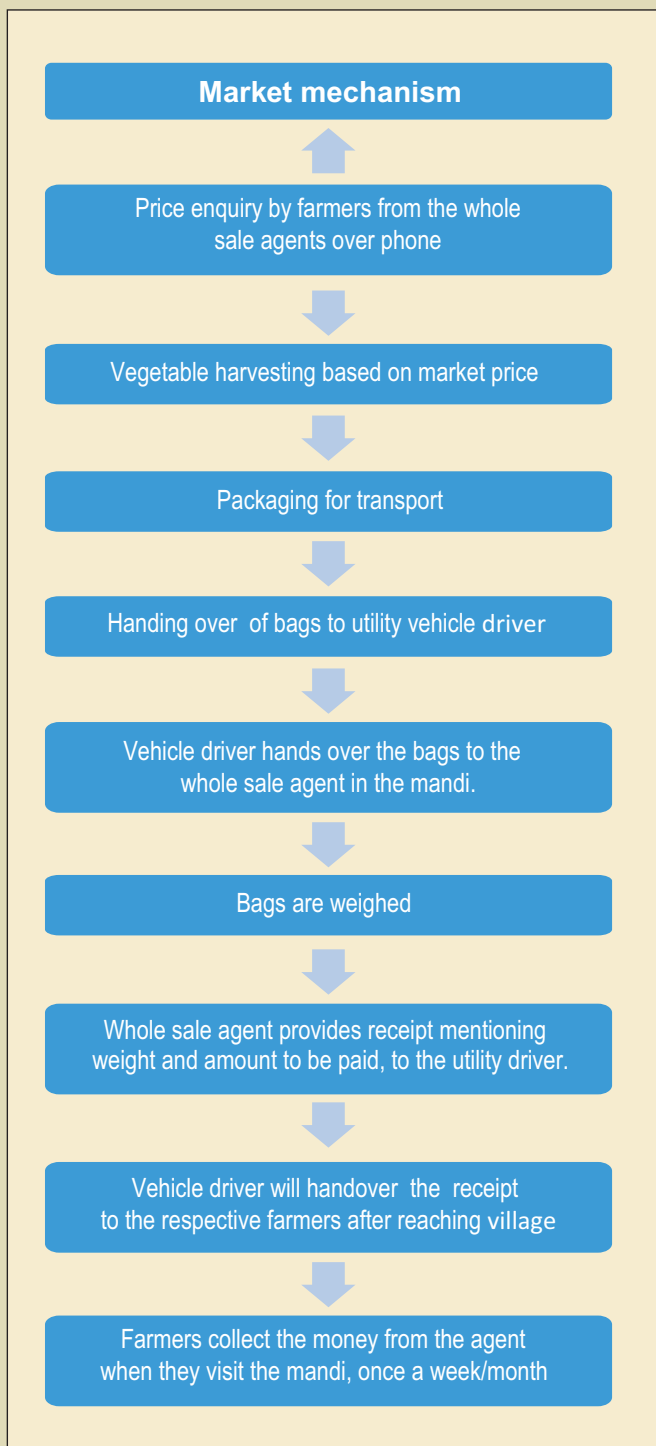
With improved connectivity, farmers explored the idea of using the utility vehicles for marketing their vegetables in the mandi. The process they follow is as follows. Farmers first get to



Wholesale agents in the market weigh the produce and provide receipts

know the prevailing price of different vegetables in the mandi, by calling the wholesale agents over phone. Based on the market price, they decide which vegetables to sell and harvest accordingly. After harvesting they pack vegetables into different sized bags, not exceeding one quintal. Each bag is labelled with name of the farmer and also name of whole sale agent to whom it is to be given. Farmers who have more number of bags, travel to the mandi with their produce in the utility vehicle. Those who have less, handover the bags to the utility vehicle driver.

After reaching the mandi, the driver will hand over the bags to the whole sale agent. After weighing the bags/packets, the whole sale agent will provide a receipt mentioning weight and amount to be paid, to the utility driver. This receipt is handed over by the driver to the



concerned farmer in his village. He also collects some charge from the farmer, for transporting the bags. For lesser produce (<20 kgs), no carrying charges are collected by the driver.

Farmers keep all their receipts and once in a week or a month, they visit mandi and collect all the dues from the whole sale agent.



Utility vehicles improved the mobility of farmers and enhanced their exposure to markets

If required, utility divers also purchase and bring other household items from market for the farmers. For small things, farmers need not pay anything but for big/heavy items, they have to pay the carrying charges. Really, this innovation is a boon to the farmers in the remote hilly areas. They get the things done without travelling to the mandi/market so frequently, saving their time and expenses.

Conclusion

The innovative market mechanism has come as a boon to the farmers in hilly areas. This mechanism has been working well saving farmers from visiting mandis often, thus saving on travel costs too. Uniqueness of the mechanism lies in the fact that along with big farmers, it also supports small and marginal resource poor farmers with small produce. With no great technology, the mechanism has been successful solely owing to the faith that farmers, drivers and wholesale agents have on each other. Its time to look for such simple innovative practices that make farmers lives easy and remunerative.

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Simple innovations by small farmers deserve attention

Pratap Mukhopadhyay

Aquaculture is recognized as a very efficient form of animal production system. Improvement in fish yield while sustaining the natural resources, depends to a great extent on the appropriate husbandry practices adopted.

Fish feed is prepared using local devices



Aquaculture is a highly diverse production system. The diversity of aquaculture production is reflected in terms of *holding units* (ponds, tanks, raceways, cages, pens etc); *management levels* (extensive, semi-intensive, intensive, super-intensive); *nature of rearing* (monoculture, poly-culture); *salinity levels* (freshwater, brackish and marine); *climate* (cold water aquaculture, warm water aquaculture) and *state of motion of water* (static systems and flow-through systems). Earthen pond aquaculture however, is the most common, but other efficient production systems such as tank culture, cage culture, raceway culture, integrated culture, and pen culture among others are also widely used worldwide.

Freshwater aquaculture is a viable rural activity in India. Its contribution towards food provision of very high biological value and livelihood improvements hardly needs any emphasis. Mass production at reduced cost of operation will make aquaculture more remunerative for the farmers. This will have economic as well as ecological significance. The country's fish production, which is second in the world, is greatly contributed by small and marginal farmers.

The key factors influencing the production are (a) appropriate pond management (b) a good breed of stocking material of right size and proportions (c) farm-made feeds using locally available agro-based ingredients and appropriate feeding strategies. Sustainable yield increase especially in small scale aquaculture is expected primarily from optimization of inputs used. This can be achieved through adoption of simple scientific principles and management measures wherever possible. Earlier, in the absence of a precise knowledge on the control of reproduction and breeding, farmers resorted to collection

of larvae and juveniles from rivers for stocking in the culture ponds. Practices like 'Bundh breeding' where a sudden gush of rain water is forced into the spawning ground were and are even today used to induce natural spawning. Subsequently, with the advent of induced spawning technique to breed the fishes in a consistent manner, simple improvements in hatchery technology for mass breeding followed by genetic selection procedures accelerated the development of carp aquaculture in particular, through availability of stockable seed almost throughout the year.

Farmer innovative practices

Use of simple tools and implements accompanied by continuous farmers' creative ideas in the fish husbandry process and skill of problem solving proved to be quite successful and stood the test of time. Farmers in some of the districts in West Bengal like Bankura, north 24 Parganas; south 24 Parganas, south Dinajpur, east Burdwan; Hooghly, Malda and east Medinipur, have been practicing fish production using traditional wisdom and simple indigenous innovative devices. Some of the

Simple methods are used for feeding fish



Ingenuity of farmers' innovations and improvements successfully tested over time should be given due recognition, lest such innovative ideas and spirit get lost for ever.

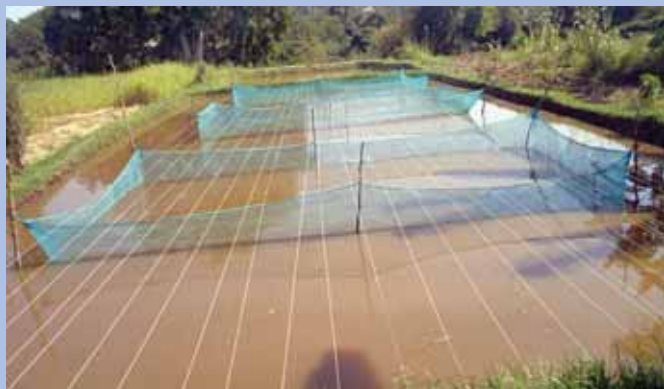
Box 1: Other innovative practices

- i) Creating a shade on the pond with the help of palm leaves during summer months when heat becomes unbearable.
- ii) Measurement of water quality parameter -like turbidity using fabricated secchi disc.
- iii) Fortnightly application of medicated feed containing herbal extracts like neem leaves, turmeric, basil leaves, garlic mixed with pinch of common salt, to prevent disease infestations.
- iv) Periodic removal of generated gases from the pond bottom using rakers followed by lime application to maintain water quality parameters within recommended levels.

innovative practices of fish farmers are listed in Box 1 and some of them are described below.

- i) Depletion of dissolved oxygen (DO) content in pond /tank water is a recurring problem in aquaculture. In case DO level dips down to 3.0 mg/litre, water becomes stressful for the fish to live in. Large fishes, particularly carps, come to the water surface desperately to breathe. This generally happens early in the morning and that too during the days when normal bright sunshine is not there or when cloudy weather conditions prevail. Such problem can be fatal and the farmer may lose the entire crop of fish, unless emergency oxygen is supplied. Since farmers do not have crop insurance, they cannot afford to buy expensive mechanical aerators. A simple device using bamboo baskets put in a cascade pattern is tied with 3 bamboo poles and affixed in the pond with 0.5 HP pump connection attached to hosepipe. This device is used to make good oxygen deficiency in water in a short time. This saves money and the cultured fish also.

Farmers use threads to ward off birds preying on fish



- ii) Many resource poor farmers in West Bengal villages prefer growing advanced fingerlings from fry stage. The culture period is of 3 months duration. When fish is harvested, the pond is restocked the very next day, enabling farmers to grow 3 crops a year. With continuous demand, farmers also get their returns quickly. However, the predator birds like kingfisher, cormorants, herons pose threats for fish survival. To overcome this, farmers use simple threads, spreading over the culture ponds. This has been found to be very effective and environmentalists also do not object to this process of preventing bird predation as it does not harm the birds too.
- iii) Although carp or the Indian major carp species -*catla*, *rohu*, *mrigal* are the main cyprinids cultured throughout India in the freshwater sector, small indigenous fish species like air-breathing catfishes - *magur* and *singhi*, murrels like *Channa* spp., perch like *koi*, feather-back like *folui* eels like *pakal*, small local fishes like *mola*, *tangra*, *pabda*, *khoira*, *vacha* are in very high consumer demand. Hence, farmers prefer crop diversification. Installing bamboo cages in ponds enables farmers to go in for multiple species culture without facing problems in feeding or harvesting.
- iv) Since feed is the most expensive input in any aquaculture system, small farmers who have no option than to go in for low external input culture system, prefer growing fish based on natural food organisms like natural zooplankton, periphyton and the like. Using organic manure prepared *in situ* and sometimes stuffed in hollow bamboo poles or bamboo sticks wrapped with discarded sugarcane bagasse affixed at several locations of the pond is found quite useful for the fabulous growth of periphyton- the preferred natural food for rohu. These form part of organic aquaculture also which is a currently growing trend.
- v) Small farmers of most West Bengal villages with small and medium sized ponds, use simple feeding devices. One of them is the use of perforated nylon bags hung with the help of bamboo poles in ponds. This is widely used feeding practice in semi-intensive carp polyculture.



Indigenous way of tackling deficiency of deprived oxygen in the pond

- vi) Fish feed, in the form of chowmein /spaghetti, is prepared using locally available agro-based by-products. These are prepared using locally made devices and sun dried and stored in gunny bags. Tribal youth and small farmers are adept in preparing such local feed, both for their own enterprise as well as a business option too.
- vii) Farmers generally remove the aquatic macrophytes, physically from the pond and do not use weedicides.

Of late, farmers are encouraging the growth of plants like Ipomea which is considered delicious. Growing azolla and duckweeds have served as feed for fish and also as a biofertilizer. All such practices have helped the farmers to grow human food of very high biological value at a relatively low production cost making the entire state a model for inexpensive low external input aquaculture development.

While there is no denying that application of scientific principles is important in the scaling up of the production performance of cultured fishes, ingenuity of farmers' innovations and improvements successfully tested over time should not be overlooked and given due recognition, lest such innovative ideas and spirit get lost for ever.

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Bamboo baskets are installed to rear multiple species





Climate Change and Agricultural Development Improving Resilience through Climate Smart Agriculture, Agroecology and Conservation, 1st Edition

Udaya Sekhar Nagothu (Ed.), 2018, *Routledge*, 322 p., £36.99; ISBN: Paperback: 9781138364080

Two of the greatest current challenges are climate change (and variability) and food security. Feeding nine billion people by 2050 will require major efforts aimed at climate change adaptation and mitigation. One approach to agriculture has recently been captured by the widely adopted term of “Climate Smart Agriculture” (CSA). This book not only explains what this entails, but also presents practical on-the-ground studies of practices and innovations in agriculture across a broader spectrum, including agroecology and conservation agriculture, in less developed countries.

It is shown that CSA is not a completely new science and a number of its recommended technologies have been used for some time by local farmers all over the world. What is relevant and new is ‘the approach’ to exploit their adaptation and mitigation potential. However, a major limitation is the lack of evidence-based knowledge that is necessary for policy makers to prepare strategies for adaptation and mitigation. This book assembles knowledge of CSA, agroecology and conservation agriculture, and perspectives from different regions of the world, to build resilient food systems.

Mainstreaming Agrobiodiversity in Sustainable Food Systems: Scientific Foundations for an Agrobiodiversity Index.

Bioversity International, 2017; *Bioversity International, Rome, Italy*; ISBN: 978-92-9255-070-7

Mainstreaming biodiversity in sustainable food systems is vital if we are to achieve Sustainable Development Goals by 2030. Using biodiversity for sustainable farming systems that produce diverse, nutritious foods will contribute to the conservation of these precious resources; conserving biodiversity resources will make them available for future climate scenarios and today’s nutrient needs.

For this reason, the creation of an Agrobiodiversity Index, which can help bring production and consumption together for sustainable biodiversity-based solutions could go a long way to raise awareness about the multiple links between biodiversity, healthy nutrition and sustainable food production and, thereby, help promote the multiple aspects of sustainable food systems.



Farming, Food and Nature Respecting Animals, People and the Environment, 1st Edition

Joyce D’Silva, Carol McKenna, 2018, *Routledge*, 280 p., £25.89; ISBN: 9781138541443

Livestock production and its use of finite resources is devastating biodiversity and pushing wildlife to the brink of extinction. This powerful book examines the massive global impact caused by intensive livestock production and then explores solutions, ranging from moving to agroecological farming to reducing consumption of animal products, including examples of best practice and innovation, both on land and within the investment and food industries.

Leading international contributors call for an urgent move to a flourishing food system for the sake of animals, the planet and us. Some offer examples of global good practice in farming or the power of the investment community to drive change, and others highlight food business innovation and exciting developments in protein diversification. Providing a highly accessible overview of key issues, this book creates a timely resource for all concerned about the environmental, social and ethical issues facing food, farming and nature. It will be an invaluable resource and provide inspiration for students, professionals, non-governmental organisations (NGOs) and the general reader.





Community Innovations in Sustainable Land Management Lessons from the field in Africa, 1st Edition

Edited by Maxwell Mudhara, Saa Dittoh, Mohamed Sessay, William Critchley, Sabina Di Prima (Eds.), 2018, Routledge, 223 p., £25.89, ISBN: 9780367029708

It is increasingly recognized that land can be managed most sustainably through involving local communities. This book highlights the potential of a new methodology of uncovering and stimulating community initiatives in sustainable land management in Africa.

Analyses of four contrasting African countries (Ghana, Morocco, South Africa and Uganda) show that as communities directly face the challenges of land degradation, they are likely to develop initiatives themselves in terms of sustainable land management. These initiatives (or 'innovations') may be more appropriate and sustainable than those emanating from research stations located far from the communities. The book describes the rationale of the approach used, the set of steps followed, how the project managed to engage the communities to understand the importance of the activities they were undertaking, and how they were stimulated to improve and extend their initiatives and innovativeness.

Innovation Platforms for Agricultural Development Evaluating the mature innovation platforms landscape, 1st Edition

Iddo Dror, Jean-Joseph Cadilhon, Marc Schut, Michael Misiko, Shreya Maheshwari (Eds.), 2018, Routledge, £25.89, ISBN: 9781138588905

Innovation Platforms (IPs) form the core of many Agricultural Research for Development programmes, stimulating multi-stakeholder collaboration and action towards the realization of agricultural development outcomes. This book enhances the body of knowledge of IPs by focusing on mature IPs in agricultural systems research, including the crop and livestock sectors, and innovations in farmer cooperatives and agricultural extension services.

Resulting from an international IP case study competition, the examples reported will help the many actors involved with agricultural IPs worldwide reflect on their actions and achievements (or failures), and find tools to share their experience. Chapters feature case studies from Central Africa, Ethiopia, India, Kenya, Nicaragua and Uganda. Authors reflect critically on the impact of IPs and showcase their progress, providing an important sourcebook and inspiration for students, researchers and professionals.

Innovation Africa Enriching Farmers' Livelihoods, 1st Edition

Pascal Sanginga, Ann Waters-Bayer, Susan Kaaria, Jemimah Njuki, Chesha Wettasinha (eds.), 2008, £25.89, ISBN: 9781844076727

Agricultural research, extension and education can contribute greatly to enhancing agricultural production in a sustainable way and to reducing poverty in the developing world, but achievements have generally fallen short of expectations in Africa. In recent years, growing economic and demographic pressures - coupled with the entry of new market forces and actors - have created a need and an opportunity for more interactive approaches to development. Understanding the existing innovation processes, recognizing the potential for catalysing them and learning how to support joint innovation by different groups will be the key to success.

This book covers new conceptual and methodological developments in agricultural innovation systems, and showcases recent on-the-ground experiences in different contexts in Africa. The contributions show how innovation is the outcome of social learning through interaction of individuals and organizations in both creating and applying knowledge. In 25 broad-ranging chapters the book reflects cutting-edge thinking and practice in support of innovation processes in agriculture and management of natural resources.



Innovations on the ground

Strongly believing that innovation is intrinsic to agriculture, Small Farmers' Agribusiness Consortium (SFAC), documented a compendium of innovations by farmers. Around 100 profiles of innovative farmers was compiled with a focus on individual farmers and entrepreneurs and simple, cost-effective yet imaginative solutions to common problems faced by the farming community. Here, we present profiles of a selected few farmer innovator.

Dairy shed design and management

Mr. Kailas Jadhav has 40 buffaloes on his farm near Pune in Maharashtra. He has designed a hygienic and naturally cooled dairy shed which provides good air circulation. The air circulates from top as well as from the sides. It also protects from sunlight and rain. GI sheets have been used for the roof-top. This model design helps in keeping the temperature low during summers. The model is cost effective and has a convenient design.

Around five acre of land is used for producing fodder. Different types of grasses are used as fodder to increase the nutrients in the milk. Also, Ayurvedic medicines are used for buffaloes in case of any health problems.

The model has resulted in better health of the animals and costs on medicine has reduced by 50 to 60 percent. There is a 20 to 30% increase in milk production as compared to conventionally managed dairy farms. Each buffalo gives around 9 to 11 litres of milk everyday. Milk is sold in Pune through their own outlet, at the rate of Rs. 50 per litre. Selling in own outlet also results in better incomes. Many farmers and entrepreneurs from all over India visit their farm.

This innovative farmer can be contacted at Raviraj Hitech Farm, AP Nere, Mulsh taluk, Pune district.

Mobile: 09822258378

Jhaar Karela - A selection of wild bitter gourd

Jhaar Karela is found on bushes on sandy area and considered as weed in south-western districts of Punjab. Shri Dalip Singh travelled wide, even to Rajasthan, for collecting the seeds of this wild variety of bitter gourd. He made the selection and developed a variety of his own. It has been 5 years since he is growing '*Jhaar Karela*' on an area of 0.5–1.5 hectares annually. *Jhaar Karela* is a trailing crop and requires staking for successful cultivation. Dalip Singh has also developed a system of bamboo staking on concrete foundation to trail the vines.

The average yield produced is 75 quintals per hectare. Shri Dalip Singh has made a packing size of *Jhaar Karela* of 1, 2 and 5 kg. The *Jhaar Karela* is priced up to Rs. 50–60 per kg. The innovator gets orders from Ludhiana and Batinda. The farmer has earned a net return of about Rs. 2,00,000 per hectare. The plant has a medicinal value and is good for diabetic patients.

This innovative farmer can be contacted at Kothe Ramsar village, Post Dhilwan Kalan, Kotkapoora, District Faridkot, Punjab, Mobile: 09417929149

Mixed Cropping of Banana and Papaya

Traditionally only one crop is being cultivated in Kamrej taluk in Gujarat. Mehulbhai Bhogilal introduced the concept of multiple cropping in horticulture crops. He planted 650 plants of Papaya and 1100 plants of Banana alternatively in one acre of land. The crops ripen at different points of time and it makes it easy to manage the cultivation process for both the crops.

Production increased more than 50% compared to regular crop. By raising multiple crops on same field, there was reduction in cost and increase in net returns. Cultivation of multiple crops on the same field also resulted in improvement in the quality of soil.

Mehulbhai sells produce in the local market. He has not taken any loan assistance from the government, and has made his investment by directly purchasing banana and papaya tissue plants from market.

This innovative farmer can be contacted at Dungra Post, Kamrej taluka, Surat district, Gujarat.

Leaves decoction as Bio-pesticide

Shri Anand Singh Thakur has developed a bio-pesticide from easily available materials in farm like leaves and cow urine. The decoction is prepared using 5 different types' leaves and other bio-materials. Five different types of leaves used are of Neem, Pongamiya, Custard apple, Ipomia, and Calotropis gigantia (Commonly known as Madar). One kg of each type of leaf is mixed with 250 gm garlic, water and cow urine. This mixture is then boiled till it reduces to half the quantity and then filtered.

Shri Anand Singh is making this bio-pesticide for his use in the land where he grows potato, wheat and other crops. Due to the use of this pesticide the yield of wheat increased from 10 quintals to 11 quintals. It also enhances weight and gives shine to the grains.

This decoction is very simple to prepare and use. All the components are easily available at village level free of cost, therefore reducing the cost of cultivation. This bio-pesticide is very effective for controlling the insect-pest (sucking pest, leaf feeders, etc.) of soybean and other crops. The use of this bio-pesticide does not harm beneficial insects. Also, by using this bio-pesticide, around 20% water can be saved. Shri Anand Singh also demonstrates this innovation to other farmers. Many farmers visit his farm and he provides consulting to them.

This innovative farmer can be contacted at Village Umariya Khurd, Post Doodhia, Tehsil & District Indore, Madhya Pradesh, Mobile: 09301301901

Value addition of Bengal gram

Mr. Nagesh Swami owns 3 acres of land. His family is dependent on farming. So for increasing the income he started to add value to his organic farm produce. Chana dal is the major product that he produces from chickpea. It is made by processing on hand driven rollers. He designed these rollers by redesigning its input space, in such a way that rollers produce the chana dal smoothly. As the rollers are hand driven he saves the electricity for driving rollers as well as for dryers. The innovation has also created employment for women in the area, who drive the rollers.

Homemade dal has decent demand from the traditional cultured customers. Customers pay more money and purchase it in bulk. He sells dal at the cost of Rs. 50 to 55 per kg. He sells his products from his home. He maintains the records of customer orders, based on which he decides his scale of production.

Mr. Nagesh Swami is not too profit oriented. He produces all the farm inputs organically so that he incurs minimum costs on external inputs. His wife also helps him in all the operations. She was awarded as 'Progressive female farmer' in 2011.

Mr. Nagesh Swami also provides consulting on this technique to many other farmers without any cost. Many farmers visited him and got inspired. This is best example of self reliance for small farmer.

*This innovative farmer can be contacted at Shewade (Umbraj) Taluka Karad, District Solapur - 415109
Mobile: 09822848432, 09423341861*

Source: Small Farmers' Agribusiness Consortium (SFAC), **Krishi Sutra-Profiles of agricultural innovations in India, 2012, New Delhi.**



Pit method of vegetable production - An innovative practice

Murugesan aged 40, lives in Gotlumarampatti village of Pennagaram taluk in Tamil Nadu. Eight years ago he bought 4 acres of land. Of this, only one-fifth of the area has access to irrigation through open well.

Murugesan grows diversified crops on his land – groundnut on one acre and ragi and samai on half an acre each. He has divided the remaining 2 acres into four parts and grows vegetables like ridge gourd (0.5acre), snake gourd (0.5acre), bitter gourd (0.5acre) and a mix of black gram and green gram.



He cultivates these vegetables in broad bed and furrow system maintaining 8 feet width of beds and dibbling the gourd seeds at 4 feet distance over ridges. This system requires frequent irrigation to wet the soil profile. Providing irrigation being a challenge, he had to manage vegetable crops with prolonged moisture stress. He could not go in for drip and sprinkler irrigation systems, owing to its high cost. Prolonged moisture stress resulted in delayed and stunted growth leading to weak stems, low flowering and weak fruits. He also spent high in fertilizer application to these vegetable as he followed generally the broadcasting method which is the customary practice of other vegetable farmers too.

Murugesan had an opportunity of participating in a Farmer Field School organized by AME Foundation during 2015. During one of the sessions, he understood the importance of applying enriched FYM with bio inputs such as Trichoderma, Azospirillum, Rhyzobium, Phosphobacteria to the root zone of groundnut in improving water retention capacity of soil particles. This triggered an innovative idea. Murugesan wanted to try pit method of cultivation, using enriched FYM.

Instead of dibbling seeds, which was the usual practice, Murugesan made pits of 1'x1'x1' in 1.5 acres, at a distance on 4 feet in a row. The spacing between ridges was reduced from 8 feet to 5 feet. Meanwhile he prepared enriched FYM using the bioinputs. For 300 kgs of FYM he added one kilogram each of Rhyzobium, Azospirillum and Phosphobacteria and half kilogram of Trichoderma. The heap was mixed well, water was sprinkled and covered with moist gunny sacks and kept for aerobic decomposition for about 20-25 days. This decomposed mixture was used to fill the pits upto 3/4th level from the bottom and the top was filled with excavated soil. Around 1-2 seeds of gourds were sown in each pit. He also created one foot mini irrigational channel in already existing channels, at a distance of one feet, which enabled water to reach the pits directly, avoiding unnecessary wetting of other area. He applied vermicompost once in 15 days and totally avoided chemical fertilisers.

With this method, Murugesan reaped very good results. The use of EFYM helped in retaining moisture better, almost storing 5 times more than the normal soil. This way he got a phenomenal growth and establishment of vegetable crops from each pit. He also observed that the crop had vigorous growth, stems had more girth, rooting was better with high root mass, flowering was more and the plants bore bigger fruits. More importantly, there was extended flowering and crop life cycle. There was good saving on water as he could reduce the irrigation frequency from alternate days to once or twice a week.

By adopting this method, Murugesan could get better yields. Also the harvested crop was of good quality. The vegetables had a fresh and healthy appearance which fetched him better price in the market. More importantly his vegetables created high demand from various merchants with better price.

Mr. Murugesan can be contacted at Door no. 2/300, Gotlumarampatti, Bikampatti post, Pennagaram taluk, Dharmapuri-636 813.

The writeup has been developed by Mr. J Krishnan, AMEF. He can be contacted at krish72oxigen@gmail.com

Women of India Organic Festival 2018

The 5th edition of the 10-day “Women of India National Organic Festival 2018” organised by the Ministry of Women & Child Development culminated on the night of Sunday, 4th November, at the expansive grounds of Indira Gandhi National Centre for the Arts, Janpath Road. Over the 10 days, women farmers and entrepreneurs from across the country, participated with vast variety of organic products ranging from food and fabrics to wellness and personal care participated in this festival, which is an annual affair.

This year, the total sales by the women farmers and entrepreneurs who came from 26 States, was a record of over Rs. 2.75 crore, up from Rs. 1.84 crore in last year’s edition that was organised at Dilli Haat, INA, New Delhi. The festival is expected to have had footfalls of nearly 12 lakh. The success of the Organic Festival has added



to the joy of the women farmers from diverse as well as far off corners of the country, such as Majuli, Kangra, Leh, Palakkad, Chikkmagalur, Yavatmal, Dimapur and Almora, among others. This year saw the grand debut of the Food Court and Vegan Food, which were very well received by all visitors.

The Festival, which was held from 26th October to 4th November, saw a regular stream of people from diverse walks of life on all days, giving immense encouragement to the earnest efforts of all the participants. The main objective of the Festival has always been to support and encourage women and women-led groups that promote organic farming, thus supporting their local community’s economy, creating jobs and keeping farmers thriving, in addition to spreading proper awareness about the benefits of organic products.

The participants of Women of India National Organic Festival 2018 also had the opportunity to enroll themselves in Mahila-E-Haat, which is an online marketing portal set up by the Ministry of Women & Child Development, to meet the aspirations and needs of women entrepreneurs. This unique e-platform exponentially strengthens the socio-economic empowerment of women beyond the Festival. The Women of India National Organic Festival is an annual affair and serves as a platform to celebrate and promote women farmers and entrepreneurs from different corners of India.

For more information go to <http://pib.nic.in/newsite/PrintRelease.aspx?relid=184613>

Simple test to detect adulteration in milk devised

IIT-H researchers use the power of a smartphone to help identify adulteration.

IIT-H researchers have developed a nano-sized paper that gives an accurate reading of the acidity in milk by changing colour. The simple test is a big step in the quest to develop smartphone based sensors to detect adulteration in milk, say the team from the Indian Institute of Technology, Hyderabad (IIT-H).

The nano-sized (as thin as human hair) indicator paper is a chip based detector system. It is made of fibres of nylon loaded with a combination of three types of dyes. Called halochromatic, it is designed to change colour with the acidity of milk. Supplementing this, the team also developed algorithms that can be incorporated on to a mobile phone to accurately detect and interpret the colour change.

The research has been done by a team led by Shiv Govind Singh, Department of Electrical Engineering, with Soumya Jana and Siva Rama Krishna Vanjari and others. It has been published in the November 2018 issue of Food Analytical Methods journal.

Adulteration of milk is a serious problem in India. A recent report by the Animal Welfare Board shows that 68.7 per cent of milk and milk by-products in the country are adulterated with products such as detergent, glucose, urea, caustic soda, white paint and oil. Chemicals such as formalin, hydrogen peroxide, boric acid and antibiotics could also be added to milk to increase shelf life.

In the long run, Govind Singh's research group seeks to detect contamination by sensing changes in the biophysical properties of milk. Some common biophysical properties that change because of adulterants are acidity, electrical conductivity and refractive index (passage of light through material).

For more information, go to <https://www.thehindubusinessline.com/economy/agri-business/simple-test-to-detect-adulteration-in-milk-devised/article25555598.ece>

Sikkim wins UN award for becoming world's first Organic State

Sikkim beat 51 nominated policies from 25 different countries of the world to win the Future Policy Award 2018, which is also known as the “Oscar for best policies”.

When it comes to sustainable food practices in India, Sikkim has been leading the way in the subcontinent, for years now. Finally, the United Nations has taken cognisance of the state's efforts towards making sustainable practices mainstream. The northeast Indian state just received an award from the Food and Agriculture Organisation, for the world's best policies promoting “agroecological and sustainable food systems”. Sikkim beat 51 nominated policies from 25 different countries of the world to win the Future Policy Award 2018. The Chief Minister of Sikkim Pawan Kumar Chamling received the award from the Deputy Director of UN's FAO Maria Helena Semedo in Rome.

The award is nicknamed the “Oscar for best policies” and is co-organised with the FAO by The World Future Council (WFC) and IFOAM - Organics International. Semedo was all praise for Sikkim during the award presentation on Monday and said, “Sikkim is an outstanding example on how to successfully transform the food system and ensure respect for people and planet”. The award recognised the state's leadership and political will to lead by example. She added that Sikkim's transition to a fully organic state “has benefited over 66,000 family farmers, reaching beyond just organic production to include socioeconomic aspects such as consumption and



market expansion, rural development and sustainable tourism with its comprehensive and inclusive approach”.

The award is in recognition of the policies adopted by the state government, starting with a political commitment to organic farming, way back in 2003. The state then devised the 2010 Sikkim Organic Mission and a strong commitment of the government, led to the state becoming fully organic in 2016. Several other Indian states, including Kerala and others in the northeast of India are trying to follow in the example of Sikkim.

For more information, go to <https://www.ndtv.com/food/sikkim-wins-un-award-for-becoming-worlds-first-organic-state-1932862>

Buttermilk-based bioformulation helps in cotton disease control

Scientists at Coimbatore-based Tamil Nadu Agricultural University (TNAU) have found that a plant growth promoting rhizo bacteria called *Bacillus amyloliquefaciens* can be used to fight Tobacco Streak Virus (TSV) in cotton crop.

The formulation, prepared in buttermilk, was tested against the plant virus and found effective. Many milk proteins are known to have shown antiviral activity, by inhibiting reverse transcriptase enzyme of viruses. In the new study too, buttermilk base alone could reduce virus concentration but was more effective when used in combination with *Bacillus* formulations.

TSV causes cotton necrosis disease and is a major problem for cotton farmers. Farmers are generally unaware of the symptoms and end up applying insecticides indiscriminately to control the vector. Scientists have, therefore, been looking for an eco-friendly management method.

A few studies have reported the possibility of antiviral activity of bacteria against cotton leaf curl, cucumber mosaic virus and tobacco mosaic virus. Taking the cue, researchers collected rhizospheric and endophytic bacteria from both healthy as well as infected cotton plants. They cultured the bacteria and assessed their antiviral efficiency. They found that a rhizobacterium called *Bacillus amyloliquefaciens* was showing promising results.

Experiments were conducted during 2015 and 2016 in two different locations in Tamil Nadu to assess the efficacy of *Bacillus* species and phyto-antiviral principles against TSV infecting cotton. A high yielding hybrid, RCH659 was selected for the study. Buttermilk was used as a carrier base for application of bacterial inoculation. It was found to effectively colonize rhizosphere and phylloplane of cotton plant and produce anti-microbial peptides and fatty acids, which curbed the virus.

For more information go to: <https://www.downtoearth.org.in/news/science-technology/buttermilk-based-bioformulation-helps-in-cotton-disease-control-62258>

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The battle for the future of farming

What you need to know

Michel Pimbert and Colin Anderson

It is widely agreed that today's global agriculture system is a social and environmental failure. Business as usual is no longer an option: biodiversity loss and nitrogen pollution are exceeding planetary limits, and catastrophic risks of climate change demand immediate action.

Most concede that there is an urgent need to radically transform our food systems. But the proposed innovations for more sustainable food systems are drastically different. Which we choose will have long-lasting effects on human society and the planet.

Suggested innovations in food systems can be broadly understood as either seeking to conform with – or to transform – the status quo.

A technological future

Some want to keep the agriculture industry as close to existing practices as possible. This is true of the increasing number of corporate and financial actors who seek to solve the food crisis by developing new technologies. These technologies are envisaged as being part of what is being called the “fourth industrial revolution” (4IR).

Growing multiple crops at once

Photo: AMEF



The “answer” here is thought to lie in a fusion of technologies that blurs the lines between physical, digital and biological domains.

For example, the World Economic Forum is currently supporting agricultural transitions in 21 countries through its “New Vision for Agriculture” initiative. This initiative supports “innovation ecosystems” to re-engineer food systems based on “12 transforming technologies”. In this imagined future, next generation biotechnologies will re-engineer plants and animals. Precision farming will optimise use of water and pesticides. Global food systems will rely on smart robots, blockchain and the internet of things to manufacture synthetic foods for personalised nutrition.

Like previous green revolution technologies in agriculture, this effort is designed by and for powerful agricultural giants. These technological innovations reinforce the concentration of political and economic power in the hands of a small number of corporations. Indeed, the latter have a growing monopoly control over the “12 transforming technologies” protected by patents.

Most notably, the spread of these technologies will expand the technosphere at the expense of the biosphere. Flying robots will pollinate crops instead of living bees. Automated machines will replace farmers’ work on soil preparation, seeding, weeding, fertility, pest control and harvesting of crops.

These hi-tech innovations radically depart from most farming practices. They are moving us towards an

increasingly people-less food system. Yet they show a remarkable continuity with the logic of capitalist accumulation – hence their staying power despite their significant risks.

The spread of automated, de-localised and digitalised production and commercialisation of food is part of the “financialisation” of the global food system. Financial markets play an increasing role in controlling food systems from a distance. This generates huge social and human risks. For example, the significant growth in the sale and purchase of financial products linked to food commodities was one of the determining factors in the 2008 world food crisis.

Another option

But there is an alternative to this future. Agroecology involves the application of ecological principles for the design and management of sustainable agroecosystems. Our research on agroecology focuses on how it can contribute to food sovereignty, which emphasises the democratisation of food systems. Agroecology’s contribution to the Sustainable Development Goals is now recognised.

In contrast to the technological vision described above, agroecological innovations promote circular systems that involve recycling, reuse and combining resources to reduce dependency on external inputs, in particular fossil fuels. They mimic natural cycles and the functional diversity of natural ecosystems.



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Farming systems are designed in a way that is based on beneficial interactions between plants, animals and environments. Trees and shrubs might be planted amongst or around crops, say. Or two or more crops might be grown in proximity. Agroecology reduces the dependence of food producers on expensive external inputs, distant commodity markets and patented technologies. This is achieved by relying on appropriate biodiversity to ward off pests and increase farm yields.



Photo: Food Sovereignty Alliance

At broader scales, agroecology involves circular systems that combine food and energy production with water and waste management. Pollution is minimised and synergies achieved by carefully clustering industries into functional wholes. The re-localisation of production and consumption within territories enhances local economic regeneration and sustainability.

Agroecological innovations in transitions to sustainable food systems are being driven largely from the bottom up by civil society, social movements and allied researchers. In this context, priorities for innovations are ones that increase citizen control for food sovereignty and decentralise power. This is in direct contrast to the monopoly control enabled by 4IR technologies.

A democratic debate

Government, civil society and private sector representatives will soon meet in Rome at the United Nations Food and Agriculture Organization to discuss the future of farming. Who controls the global governance of innovation will be a hotly debated topic.

But given these highly contested views on innovations for food and agriculture, it is vital that everyone is able to exercise their right to have a say on the future of their food supply. Deliberative and inclusive processes such as citizens' juries, peoples' assemblies and community-led participatory processes are urgently needed to decide

Agroecology can contribute to food sovereignty, which emphasises the democratisation of food systems

priorities for food and agricultural innovations. This is all the more important in today's context of rapid global change and uncertainty.

So. Do you want to live in a world in which artificial food is produced by intelligent robots and corporations that put profits before people? Or one where agroecological innovations ensure we can nourish ourselves and our communities in a fair, ecologically regenerative, and culturally rich way?

Note: The article was originally published at <https://theconversation.com/the-battle-for-the-future-of-farming-what-you-need-to-know-106805>

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