Organic Growth: Tracking the Seed Saver

Pesticides: Pesticides Matter; But Farmers?

FARMERS' FORUM

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Issues and Ideas for Indian Agriculture

FARMER 2018

GOOD SCIENCE; BAD PESTS
GOOD ORGANIC; SAD POLLUTION

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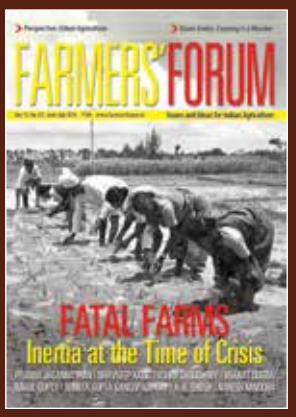

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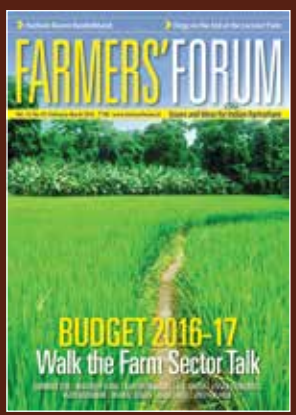

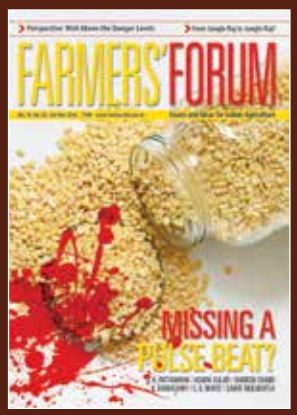

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Glorified Farming; Unglorified Farmer

"Until lions have their own historians, tales of the hunt shall always glorify the hunter"

An old African proverb tells the tale of India's beleaguered farmers. Given the morbid circumstances that they find themselves in, it is in order for farmers to be likened to the hunted lions that need their side of the story – their sacrifices, agony, courage and fears – to be narrated. The hunters may well be likened to today's media houses, academicians, businesses and the government officials who seek career advancement and power, extracting glory out of the farmers' misery. It is thus in the fitness of things that the farmers should present their perspective effectively, frequently and loudly.

The story is most unedifying for both sides. For farmers, for having failed to produce leaders though they have brought to power leaders who have quietly forsaken them. For policy-makers, policy influencers and the press, it demonstrates folly on the one hand and cussedness on the other for having cornered the farmer into such desperate straits, even though it is the farmer who will deliver food security for India, the most fundamental of the securities that the country needs. All this is happening in a veritable "tamasha" where the actors on the stage are singing paeans of praise for the farming class and seemingly legislating for its well being.

POLICY-MAKERS, POLICY INFLUENCERS AND THE PRESS DEMONSTRATE FOLLY ON THE ONE HAND AND CUSSEDNESS ON THE OTHER FOR HAVING CORNERED THE FARMER INTO SUCH DESPERATE STRAITS

New ideas could create both winners and losers and the programmes planned for the farmer could have the potential for delivering good outcomes. There is the rub though because never in the recent past has one seen any policy being formulated in consultation with stakeholders. Even though there is the entire charade of stakeholder consultation, what is discussed is often tweaked in the most senseless manner with consequences that are most adverse for the farm sector. Much of this happens at the behest of organizations representing business and importer interests that are well informed and funded to influence the government's farm policy.

To be generous to Indian policymakers one could say that they are probably too naive to understand the circuitous ways in which these vested interests manipulate even well-meaning ideas. Not to be generous to them would lead to the most unfortunate conclusion that they have wilfully defenestrated the interest of the masses. Whatever be the motivation

Photo: Pixabay

FOR THE FARMER, THE HEARTBREAK IS ALL THE MORE PATHETIC BECAUSE PARLIAMENTS SEEMS TO HAVE ABDICATED ITS RESPONSIBILITY TO THE FARMING COMMUNITIES

or reason, the point remains that the winners as a result of almost all these new decisions to help the farmers have been a small band of businesses and the vast majority of losers are always the hapless farmers. It is time to challenge this grim reality and seek solutions to the real structural problems tormenting farmer livelihoods.

For decades, India has pursued a 'Food Policy' and Budget 2018 is an opportunity to shift to a 'Farmers' Policy'. The general consensus is that pre-budget consultations are limited to the budget allocations but the Bharat Krishak Samaj has gone beyond the simple business of placing demands and referred to issues concerning centre-state relationships that impinge on the farm sector and matters of international trade and the Indian farmer. The BKS' suggestions, 'Time to shift focus from Food Policy to Farmer Policy' (*Page 20*), are open to critical analysis and reader reactions would enrich them.

It is accepted that the global value of production increases with trade and innovations but there is no magic formula whereby the generated value will be shared fairly amongst all stakeholders. As these lines get written, negotiations for regional comprehensive economic partnership (RCEP) are being held and the Indian farming community has its fingers crossed. All the hue and cry about safeguarding interests of the small farmer in developing nations is like caressing the animal before a sacrificial halal.

The cover title of the last issue of Farmers' Forum, "Who is In-charge of the Farm Economy?", generated considerable heart burn amongst the farming community and there was a very interesting blame game going on as readers and other stakeholders discussed who has actually been responsible for the messed-up farmer livelihoods. The answer is clear; everyone is but the central government is much more so than the state governments. For the farmer, the heartbreak is all the more pathetic because parliamentarians seem to have abdicated their responsibility to the farming communities.

To put it in layman's lingo, they do not care two hoots about the farmer. It is not like a thin line as between 'tax avoidance' and 'tax evasion', there is no scope for doubt. It is a thick red line, which demarcates the bad from the beaten; the winners from the losers. The distinction between the two is doubly stark and glaring because, as a consequence, so many in the losing camp are considering suicide as a better option. ●

Ajay Vir Jakhar
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To the Editor

Between intentions and reality

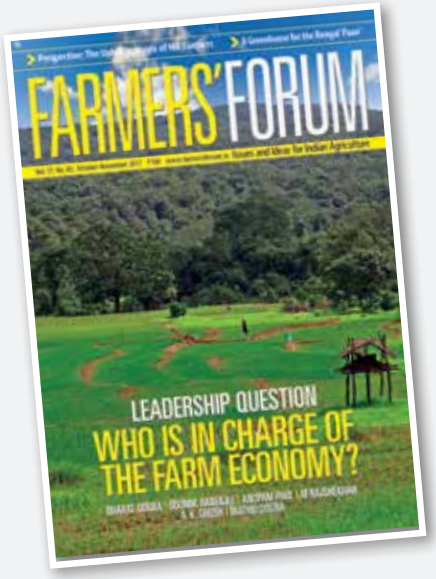
Sir,- Apropos of your excellent editorial "When Farm Policy is Designed to Fail" (*Farmers' Forum,* October-November 2017), you hit the nail on the head when you point out that the Pradhan Mantri Fasal Bima Yojna is a living demonstration of how the best intentions of the policy-makers can get muddled in the policy fine-print. If this is to be the state of affairs, there is no question of 'acchhe din' ever coming; not at least for the farmer. There are very real structural issues plaguing the Indian farmer and his circumstances and, as you say, these can only be ignored at India's peril.

Sandeep Soni
New Delhi

Bharat darshan

It is wonderful that you are giving us a veritable farming Bharat Darshan by taking *Farmers' Forum,* across the country, especially to the little known north east and painting such lovely pen-portraits of developments there. The organic Apatanis:Arunachal's wonder rice-growers by Anupam Paul (*Farmers' Forum,* October-November 2017) is such a detailed and picturesque description of this enterprising tribe and its intelligent farming practices. Continue to provide such insights by experts and you will have served the cause of the Indian farmer across its various agro-climatic zones well.

Vipul Rohatgi
Raipur, Chhattisgarh



Organic glory!

Your Case Study on 'Odisha's mustard-rapeseed story: Time for a yellow revolution' by Soumik Banerjee (*Farmers' Forum,* October-November 2017) is an excellent example of the organic movement in India and we can almost feel the joy of Felicita Topno as she invites people to see her farm that has seen no use of chemical fertilizers. The technical details were most appreciated as well. One hopes that Krishi Vigyan Kendras across the country are reading *Farmers' Forum* and learning about these developments.

Pramod Bhaskar
Patna, Bihar

***Farmers' Forum* website www.farmersforum.in is now up and running. Log in to check out all the earlier issues.**

Wither the women farmer?

Bharat Dogra's "Farmer Movements as Harbingers of Change" (*Farmers' Forum,* October-November 2017) is an eye-opener. It was shocking to know that "only 13 per cent of women in the country own the land they work on and the farms are never in their names, women are never referred to as farmers. To make matters worse 60 to 80 per cent of all farming work is done by women. It is a huge discrimination against women farmers and this 'degenderization' of women who are virtually dumped in the 'farm worker' category should be protested and remedies sought.

Vikas Sharma
Mandsaur, Madhya Pradesh

Love the paan

The Green Fingers "A Greenhouse for the Bengal 'Paan'' by Aditi Roy Ghatak (*Farmers' Forum,* October-November 2017) is as interesting as it is informative. Imagine a person managing to make a living on a three decimal plot on which a betel farm can be set up! It is equally interesting to know that a farm of 10-15 decimals can provide enough net profit for a family of five and that too for 10-30 years. It is important that these paan plantations be cherished with state support and organic manures so that they can provide financial well being for the very poor farmer.

Amit Singh
Ajmer, Rajasthan

WHEN LOWLY FUNGI TAKES ON Genetic Modification

A Farmers' Forum Report

If the Sikar agitation showed the plight of Rajasthan farmer; a Symbiogenics experiment showed that hope is nigh in a world in which climate change threatens farming existence. Rajasthan with its punishing climate and susceptibility to droughts may be well served if it follows up on research on plant-fungal relationships that could help feed the earth even as the world heats up.

Indeed, crops can be protected from global warming and experiments by microbiologist Rusty Rodriguez in India over five crops, including wheat, has shown an average of 29 per cent increase in yields across those crops. Applied to India's entire wheat crop, a 29 per cent increase would mean additional grain to feed 75 million people each year without any increase in land, fertilizer, labour or water!

"The images (published in this article) from India were taken when we were treating seeds and training women to be seed treaters as part of our female empowerment programme" (*Page 08*), Rusty Rodriguez told Farmers' Forum. The experiment included "farmers getting seeds treated". Rusty Rodriguez talks of finding the secrets of plants that thrive in the most punishing climates thanks to a superpower-conferring fungus.

Crops that they sprayed with fungi before they were subjected to stressed conditions in their lab continued to grow. Drought-tolerant crops are supposed to provide critical solutions to the food insecurity question. In essence, Rodriguez and his colleagues have developed a non-GMO, organic strategy for generating plants of virtually any crop or native species that can tolerate

drought, high salinity, extreme temperature or toxic chemical stress.

There are fungi that empower drought/heat affected plants from panicking, as it were. It is known that the metabolism of a water depleted plant is affected and it is uses up all its energy to survive. Yet there are plants that can weather the stress. Regina Redman and Rusty Rodriguez who are still researching the power behind this stress resistance, believe that aiding them are some fungi!

Rodriguez has studied symbiotic interactions between plants and microorganisms for more than 25 years. He worked in India in a programme funded by the US-India Endowment Fund (*http://www.usistef.org/fourth-call-awardees.aspx*) and USAID's Securing Water for Food, to develop novel biological seed treatments to confer abiotic stress tolerance in crops along with SFPL Crop Life Sciences Private Limited[1].

The Problem

Only nine per cent of the planet landmass is conducive for crop production, while 91 per cent is under abiotic and biotic stresses (drought, salinity, temperature), which are further likely to increase due to land degradation, urbanization and climate change. The global population is continuously expected to increase and agricultural production must increase to ensure food security.

The Solution

The team intends to commercialize a proprietary novel seed treatment called BioEnsure (a BioStimulant) which is developed by harnessing natural symbiotic microorganisms designed to improve the tolerance of plants to abiotic stresses such as drought, salinity and temperature is envisaged for commercialization. "The images alongside feature AST scientists analyzing plants for chlorophyl and biomass lab/greenhouse as a result of BioEnsure treatments", says Rust Rodrigues.

Nine per cent of the planet landmass is conducive for crop production; 91 per cent is under abiotic & biotic stresses. These will increase due to land degradation, urbanization & climate change

BioEnsure enables a broad-spectrum of agricultural crops to flourish under areas of drought, extreme temperatures and saline soils. The team intends to test and deploy this product in India besides also isolating native strains that would optimize the efficiency of final product.

His company, Adaptive Symbiotic Technologies (*http://www.adaptivesymbiotictechnologies.com/*) is a "socially conscious biotechnology company" that is addressing the greatest limitations to agricultural

1 Endowment Fund jointly established by the Governments of United States of America & India and administered through the bi-national Indo-US Science and Technology Forum

09

Basic Symbiosis Research

In 2012, Rusty Rodriguez formed the non-profit company, Symbiogenics, to pursue basic symbiosis research developing solutions for a sustainable future in the face of global declines in agricultural and natural habitats. He also expanded the company Adaptive Symbiotic Technologies to apply symbiotic technologies to real world problems by developing a series of seed and plant treatment product lines to confer symbiotic benefits to crop plants. Rusty is CEO of both Symbiogenics and Adaptive Symbiotic Technologies and has served as President of the International Symbiosis Society.

— http://www.adsymtech.com/

and natural ecosystems globally; drought, salinity, and temperature stresses. Basing its approach on more than 150 years of research on symbiotic interactions between plants and micro-organisms, the company has discovered that certain types of symbiotic fungi, known as endophytes, are capable of conferring several benefits to plants, including tolerance to drought, salt and temperature stress. With this knowledge, the scientists have developed a series of microbial seed and plant treatments to confer stress tolerances to crop plants.

"Most plants under stress also produce more oxidative chemicals, which are lethal to them in high doses "Some fungi help plants handle stressors with greater equanimity. Although their metabolism, slows down with them, it does so in a more coordinated way, and their production of

oxidative chemicals does not spike. "The result is steadier growth despite extreme conditions", says Lauren Schenkman, explaining the outstanding work of the couple. (The surprising plant-fungi relationship that could help feed us, even as the world heats up; August 9, 2017)[2]. Ted Talk features Rodriguez in an programme where he talks of the Indian experience, amongst other things.

Extending the research to Rajasthan, where drought-driven failing harvests has been plaguing farmers, Rodriguez hopes that symbiotic products could have cascading effects in a positive direction: farmers should have more crops to sell, so there will be less seed to buy and more money to spend on other things. Having spent years exploring the plant-fungi relationship, Rodriguez believes that one could apply the results to critical problems around food security in these times of climate change.

His company seeks to improve agricultural sustainability and farmers' profitability by developing novel technologies to mitigate the impacts of climate variability. "To achieve this goal, we continually undertake research to understand the role of fungal endophytes in plant bio-geography and adaptation. This research encompasses many plant and fungal species in habitats encompassing temperate, subtropical and desert ecosystems on several continents around the world. Our intent is to make this technology available to small and large-scale farmers in the first world, emerging and developing nations. We believe that increasing agricultural sustainability and crop yields will decrease human hardship and lead to more social and political stability around the globe", the company says.

Rodriquez and Redman have created a mix of three to six fungi (depending on the crop) in a water-based solution that is sprayed on seeds before planting; as the plant grows, the fungi grow between the plant's cells. Just as one fungal strain allowed sagebrush to survive in the desert, a different one enabled panic grass to grow in super-hot soil, the mixture relies on a combination of fungi imparting resistance to an array of stressors. Because the fungi do not grow in the part of the plant that will be harvested and consumed, humans will not end up eating it. (However, the company has fed symbiotic plants to rats and the fungi appear to pass safely through their digestive systems.) To avoid the prospect of

2 https://ideas.ted.com/the-surprising-plant-fungi-relationship-that-could-help-feed-us-even-as-the-world-heats-up/

The Fungal Inquisition

The mission of Symbiogenics is based on two fundamental observations:

1. All plants in natural ecosystems are thought to be symbiotic with microscopic fungi (known as fungal endophytes) that live inside plant tissues.
2. Contrary to contemporary views, we have found that in natural ecosystems it is the fungal endophytes that adapt plants to environmental stresses rather than the plants themselves. Based on these observations, we have developed a non-GMO strategy for generating plants of virtually any crop or native species that can tolerate drought, high salinity, extreme temperature or toxic chemical stress.

Although we have made great advances in symbiogenic technology, there is still much to be discovered about symbiosis and sustaining plant life on earth. Many questions need to be addressed such as:

1. What are the limits of fungal endophyte-conferred stress tolerance?
2. Are there extreme environments where plants do not associate with fungal endophytes?
3. What are the molecular, genetic and biochemical bases of the symbiotic interaction responsible for stress tolerance?
4. How do environmental gradients affect the relationship between plants and fungal endophytes?
5. What is the communication between plants, fungal endophytes and other soil micro-organisms?
6. How does habitat degradation influence the abundance and diversity of fungal endophytes and other soil microor-ganisms?
7. How will climate change affect symbiotic relationships and soil microbial communities?

Based on these questions and others, we are focusing on the research areas below to address global issues concerning agriculture and the natural environment. The goal of these projects is to ensure sustainability in agricultural and natural systems, and reduce human suffering in the 21st century.

— http://www.symbiogenics.org/research-areas.html

Mt. Everest – Nepal/Tibet

Working in conjunction with Adventurers and Scientists for Conservation (ASC), we have obtained samples of the plants growing at the highest elevations on earth. There is a moss species that grows in granite slabs at an elevation of 21,000 ft (6,420 meters) on Mt. Everest. Working with expedition leaders and ASC, samples were collected using proper scientific methods and analyzed for the presence of symbiotic fungal endophytes living inside plant tissues. We have isolated several species of fungal endophytes and are working to determine the ecological significance of the symbiosis and potential applicability in agriculture.

— http://www.symbiogenics.org/projects.html

contamination, the fungi strains die if they spread into the soil. Rather than being genetically modified, the fungi have been selectively bred for certain qualities (e.g., not growing in the "fruit" part of the plant), explains Lauren Schenkman.

The spray has led to promising crop increases in a test case in India. The pair recently worked with growers from a village in the Indian state of Rajasthan. There, farmers coax pearl millet and mung beans from their hot, dry soils, watered by torrential monsoon rains. In the spring of 2016, 96 farmers sprayed 1,300 kilograms of seed. That fall, the average yield difference between sprayed and unsprayed pearl millet was 29 per cent; for mung beans, it was 59 per cent. "In the US, a significant increase in yield is considered two per cent", says Rodriguez. "And these increases happened without requiring any additional land, fertilizer, labour or water."

Redman, Rodriguez and colleagues have been to India for their second trip to India in mid 2017, where they have treated 6,000 kilograms of seed for more than 300 farmers. Testing is now underway in the US, Argentina, Brazil, Peru, Uruguay, Australia and Mauritius on crops including corn, soy, wheat, rice, cotton, beans, peas, lentils and sorghum. These experiments will not only assess the efficacy of the cocktail with a variety of crops in a variety of climates but also generate the data that is needed to receive regulatory approval in these countries.

"During the last century, changes in agricultural practices resulted in the inadvertent loss of symbiotic micro-organisms. The loss of symbiotic benefits was partially compensated by the use of synthetic fertilizers and pesticides. It is becoming increasingly clear that such current large-scale practices are not sustainable. "It is time we put symbiotic microbes back into agricultural crops and develop farming practices that combine symbiosis with some of the great agricultural advancements of the 20th century", they say. •

Reference

https://www.youtube.com/watch?v=jJslxcgo-Gg
https://ideas.ted.com/the-surprising-plant-fungi-relationship-that-could-help-feed-us-even-as-the-world-heats-up/
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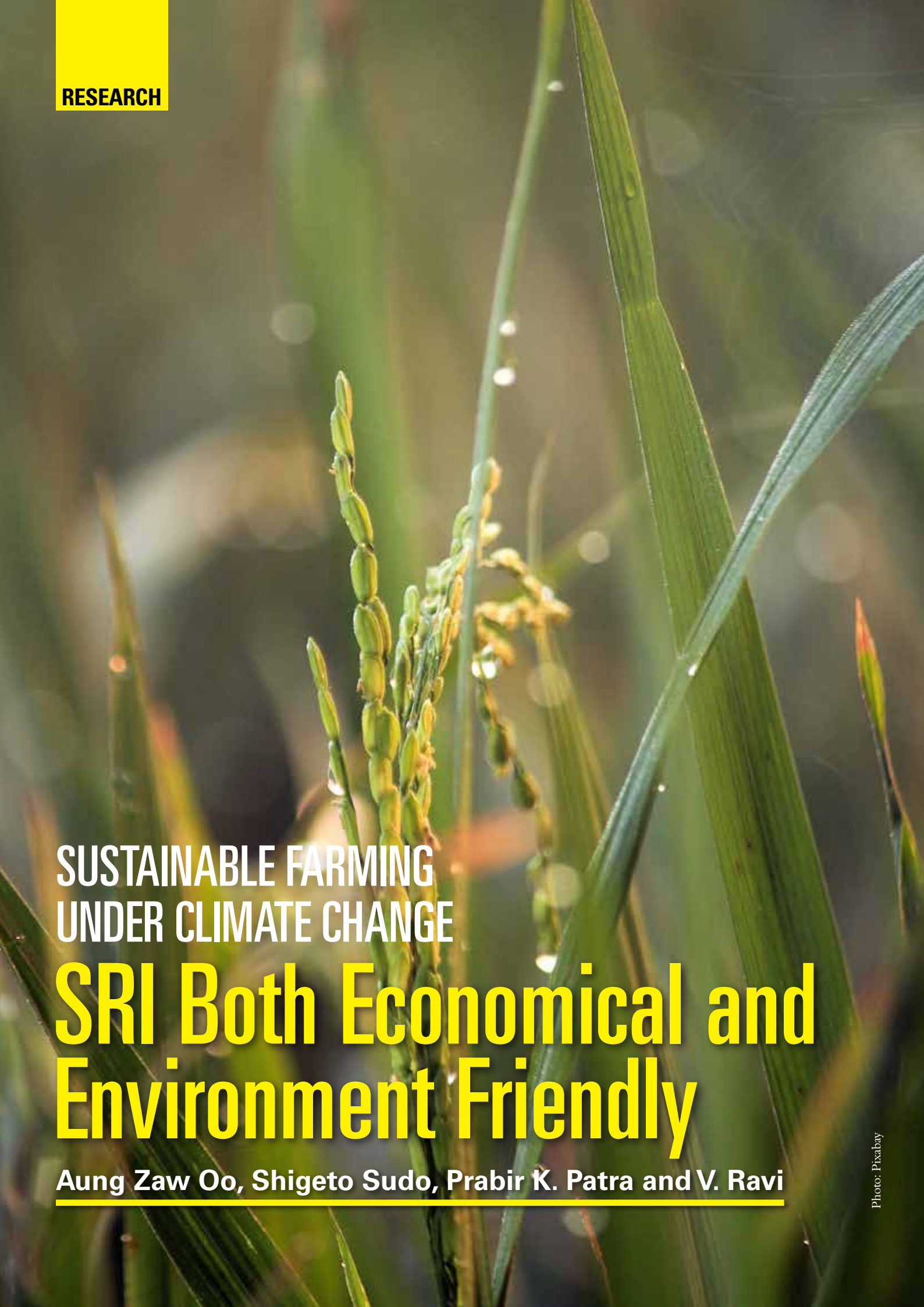
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0014823

RESEARCH



SUSTAINABLE FARMING UNDER CLIMATE CHANGE

SRI Both Economical and Environment Friendly

Aung Zaw Oo, Shigeto Sudo, Prabir K. Patra and V. Ravi

Photo: Pixabay

Rice (Oryza sativa L.), the staple food for many Asian countries like China, India and Japan for thousands of years, has faced major production challenges in recent years. They include water scarcity for irrigation, environment pollution and the on-going climate change. Given the methane (CH_4) emissions by rice paddies, rice cultivation itself feeds back into environmental pollution through production of ozone (O_3) in the troposphere. Ozone, being toxic, often causes reduction in rice yields by affecting soft paddy-plant tissues as the stomata opens during photosynthesis[1].

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Methane has made the second largest contribution, after carbon dioxide (CO_2), to global warming among the man-made greenhouse gases during the past century. Thus, CH_4 is considered as one of the important short-lived climate pollutants (SLCPs) targeted for immediate mitigation by the Climate and Clean Air Coalition under the United Nations Framework Convention on Climate Change[2].

In a research project to assess the emission reduction potential of Indian rice fields, "Atmospheric Methane and Agriculture in South Asia (AMASA)" that was supported by the Environment Research and Technology Development Fund (A2-1502) of the Ministry of the Environment, Japan with the Tamil Nadu Agricultural University providing support for conducting the experiments, the authors launched a field observation.

Modifying current cropping techniques is considered to be a possible way for increasing yield, saving water and mitigating greenhouse gas emission. Figure 1a shows that about 14 per cent of total anthropogenic CH_4 emissions are released from rice cultivation in 2003-2012, as estimated by the Emissions Database for Global Atmospheric Research (EDGAR), release EDGAR v4.3.2 (EDGAR, 2016)[3]. The enteric fermentation in ruminants is identified as the single largest (51 per cent) sector of anthropogenic CH_4 emissions, followed by the waste water management (18 per cent).

India has the largest rice crop area harvested and is second only to China in terms of CH_4 emissions in 2014 (*Figure 1 b,c, page 14*), as per the statistics of the Food and Agriculture Organization of the United Nations[4]. In India, paddy cultivation occupies about 43 million ha (mha), the largest rice producing area in Asia and accounting for 20 per cent of all world rice production.

India's rice production has increased to 157 million tonnes (mt) in 2014 from 53 (area = 35 mha) and 112 (area = 43 mha) Mt in 1961 and 1991 respectively. This is likely to increase to meet the growing demand in the future[5]. Thus, an evaluation of trade-offs between rice yield increase while controlling CH_4 emissions is urgently needed by cropping technique innovation.

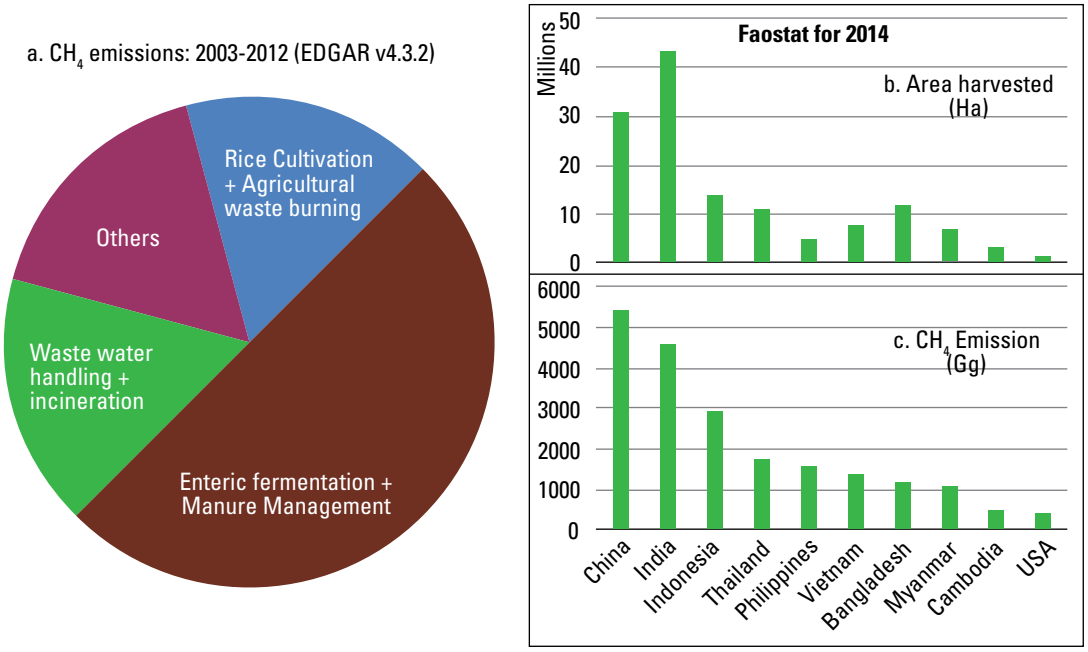
The system of rice intensification (SRI) has been pioneered as a strategy for more efficient, resource saving and productive way to practice rice farming in Madagascar[6]. In contrast to the conventional transplanting (CT), SRI involves reduced water application and transplanting young single plant per hill with wide spacing (*Table 1*) and leads to

Table 1: Three Most Popular Rice Growing Methods

Conventional Transplanting **(CT)**	**ON-CF** **O**ld seedlings, **N**arrow spacing, **C**ontinuous Flooding
System of Rice Intensification **(SRI)**	**YW-AWD** **Y**oung seedlings with one seedlings per hill, **W**ide spacing, **A**lternate **W**etting and **D**rying
Modified System of Rice Intensification **(MSRI)**	**IB-AWD** **I**ntermediate **B**etween them **A**lternate **W**etting and **D**rying

1 Sawada and Kohno, 2009
2 http://newsroom.unfccc.int/lpaa/short-term-pollutants/
3 EDGAR, 2016; Janssens-Maenhout et al., 2017
4 FAOSTAT, 2016; www.fao.org/faostat/en/#data/GR
5 Carrijo et al., 2017; Hadi et al., 2010; Das and Baruah, 2008
6 De Laulanié, 2011

Figure 1: (a) Emissions from agricultural sectors of enteric fermentation (14910 Gg) and manure management, rice cultivation and agricultural waste burning (4135 Gg) as estimated for the period of 2003-2012 by the EDGAR (2016). (b, c) The area of rice crop harvest and CH_4 emissions for top-10 emission countries in 2014 as per the FAOSTAT (2016).



In modified system of rice intensification, 2-3 seedlings are planted per hill with the same plant spacing of the SRI method to increase the initial transplanting population

a reduction in CH_4 emission though there are reports of little gain in yield and even negative results[7]. This is likely due to the sparse initial population arising from single-seedling per hill at transplanting.

Therefore, a modified pattern of system of rice intensification (MSRI) is introduced, in which 2-3 seedlings can be planted per hill to increase initial population at transplanting with the same plant spacing of the SRI method. Both the SRI and MSRI methods require fewer seeds. The other unique SRI feature is the water management practice of alternate wetting and drying (AWD) cycle.

AWD irrigation can save irrigation water without any loss of rice grain yield while reducing CH_4 emission from rice soil. Despite the advantages of using AWD irrigation practice, it is not easy for farmers to decide the best time to irrigate their crop. The International Rice Research Institute (IRRI) and Institute for Agro-Environmental Science (NIAES) developed a set of simplified guidelines for AWD irrigation system using a field water tube to monitor the water level below the soil surface[8]. A perforated field water tube is used so that the water table is easily visible. Irrigation is advised when the perched water table falls to a threshold level of 15 cm below the soil surface without harming the rice paddies.

Figure 2 shows the field experimental site at the Tamil Nadu Rice Research Institute (TRRI), Aduthurai, Thanjavur District, Tamil Nadu, India (11°0'N, 79°30'E, 19.4 m MSL). Measurements were carried out from May 2016 till January 2017, covering the two rice growing seasons; the hot and dry summer season (Kuruvai: May to September) and the wet and cool monsoon season (Thaladi: September to January). The agro-ecological conditions in the area was a tropical wet and dry/ savanna climate, with a pronounced dry season in the high-sun months and wet season in the low-sun months with annual precipitation of 1292 mm in 2015 (*Figure 2*).

7 Chapagain et al., 2011

8 Minamikawa et al., 2015

Figure 2: Time series of daily minimum and maximum temperature, and rainfall as observed at the experimental site at the Tamil Nadu Rice Research Institute, Aduthurai, Thanjavur district, Tamil Nadu, India (11°0'N, 79°30'E,19.4m MSL).

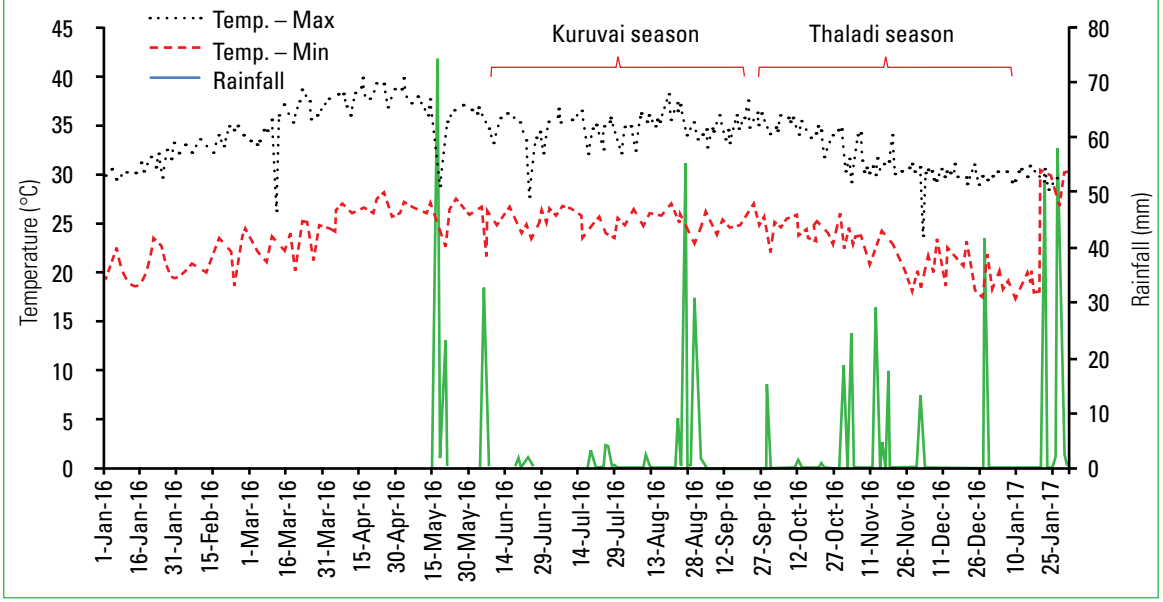


Table 2: Details Rice Plantation and Water/Fertilizer Treatments in the Three Experimental Plots

	Conventional (CT) (ON-CF)	SRI (YW-AWD)	Modified SRI (IB-AWD)
Seedling (days old)	25	8-12	16
Seeding per hill	2-3	1	2-3
Spacing (cm)	10 × 15	25 × 25	25 × 25
Hills per m^2	66	16	16
Irrigation	Continuous flooding	AWD	AWD
Fertilizer	NPK 150:50:50 kg ha^{-1}+ $ZnSO_4$-25 $kgha^{-1}$+ Gypsum (500 $kgha^{-1}$)		

The soil was classified as alluvial clay comprising total nitrogen (N) 1.1 g kg^{-1}, total carbon (C) 19.6 g kg^{-1}, pH 7.5 (1:5 H_2O) and EC 11.6 mSm^{-1}, 13.6 per cent sand, 61.2 per cent silt and 25.3 per cent clay. The experiment was laid out in a split plot design with three isolated replications of size 7×5 m^2. Two sets of factors included in the experiment were:

- Different planting methods (CT, SRI and MSRI)
- Commonly grown rice varieties (ADT 43 and CO 51 in Kuruvai season and ADT 46 and TKM 13 during Thaladi). *Table 2* provides further details of the experimental design of rice plantation, irrigation and fertilizer[9].

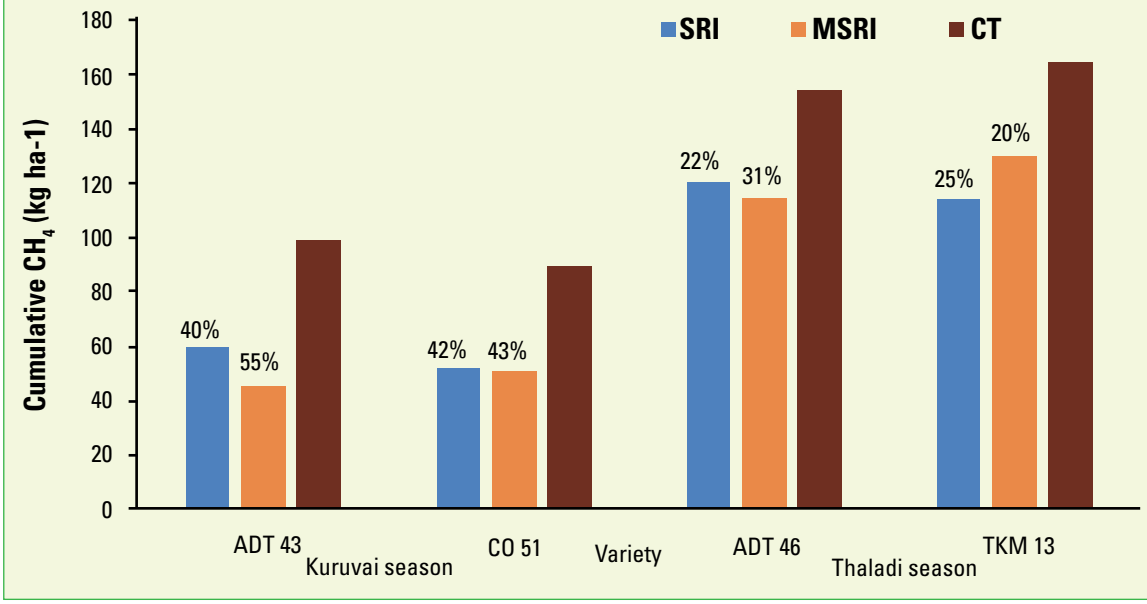
The air samples to measure CH_4 concentrations, used for rice field to atmosphere flux calculation, were taken by using the closed chamber method[10]. The gas samples from all the plots were collected 20 and 22 times during the growing period in Kuruvai and Thaladi season, respectively, under a well-mixed condition (*Figure 3,* page 26). The temperature inside the chamber was recorded at the time of sampling by using a micro-temperature thermometer (PC-9125, AS ONE Co., Tokyo, Japan).

The concentrations of CH_4 were analyzed with a gas chromatograph (GC 2014, Shimadzu Corporation, Kyoto, Japan) equipped with a flame ionization detector (FID) (and for N_2O using an electron capture detector)[11]. The CH_4 fluxes were calculated by examining the linear increases of CH_4 concentrations in the headspace of the chambers over time. The seasonal total CH_4 emissions from all plots were calculated directly from the fluxes.

9 Refer. Oo et al., 2018
10 Minamikawa et al., 2015
11 See Oo et al., 2018 for further details

Figure 3: Sampling of air from the flux chamber (seen as white tombs) headspaces through a three-way stop cock using an airtight syringe of 50 ml volume (a; left). Samples were collected at 0, 15 and 30 min after closure of the chambers. The air samples were then transferred to 15 ml vacuum glass vials with rubber stoppers and kept cool and dark till analysis at NIAES, Tsukuba, Japan (b; right).

Figure 4: Cumulative CH_4 emissions as estimated using the flux chamber method at the TRRI experimental site for the 3 rice cultivation practices (CT, SRI and MSRI) and two rice varieties during the two cropping seasons of summer Kuruvai (dry) and Thaladi (wet). The reductions in CH_4 emissions in SRI and MSRI compared to the CT method are given in percentage at the top of the SRI and MSRI bars.



Seasonal changes in CH_4 flux throughout the growing seasons differed among the planting methods. In the Kuruvai season, CH_4 flux increased during early growing period and then gradually decreased to the end of the growing period. The CH_4 flux from CT showed two emission peaks both occurred during vegetative growing period. In SRI and MSRI, high emission peak was observed with the commencement of AWD irrigation.

In the Thaladi season, CH_4 fluxes increased from the beginning and peaked for the first time within two weeks, followed by decreased emission in both rice varieties. Thereafter, CH_4 fluxes from SRI and MSRI increased, peaked for a second time at middle of the growing period and then gradually decreased toward the low emission value on account of AWD irrigation. The CH_4 fluxes from CT also showed high emission peak for the second time and tended to remain high during middle and later growing period. In all planting methods, CH_4 fluxes increased again, peaked for the third time at final stage of growing period and then decreased to lowest value at harvest time due to dry condition.

During Kuruvai, the highest cumulative CH_4 emission was observed in CT (*Figure 4*). The SRI and MSRI reduced cumulative CH_4 emissions by

40 per cent and 55 per cent, respectively, compared to CT. During Thaladi, cumulative CH_4 emissions from SRI and MSRI were significantly ($P<0.05$) lower compared to CT. The reduction in CH_4 emissions by SRI and MSRI were 22 per cent and 31 per cent in ADT 46, and 25 per cent and 20 per cent in TKM 13, respectively, compared to CT.

Cumulative emission between SRI and MSRI was statistically on par and no varietal differences were observed in both crop seasons. Between the Kuruvai and Thaladi seasons, the rate and cumulative CH_4 emissions were higher in the Thaladi season (*Figure 4*). Kuruvai season accounted for 33 per cent and the Thaladi season for 67 per cent of the total emission from double-cropping paddy rice averaged over planting method and rice variety.

Although the date of seedlings transplanted varied with the planting methods, there was no effect on water requirement in either crop season. Water use was mainly influenced by different irrigation management practices among the planting methods. Under AWD irrigation, total water saving from SRI and MSRI was 47.5 per cent and 49.3 per cent in Kuruvai and 79.4 per cent and 79.8 per cent during Thaladi season, respectively, compared to CT (*Table 3*). High water saving in Thaladi was due to high frequent rainfall occurrences that coincided with irrigation time for the SRI and MSRI methods.

A meta-analysis suggested that if AWD is practiced during the wet season, a 25.7 per cent reduction in total water use, which translates into

an even greater reduction in irrigation water use[12].

Table 3 also shows the CH_4 emissions as estimated for the different planting methods. The equivalent CO_2 (CO_2-eq) emission as a measure of the greenhouse gas intensity is calculated using the equation: $CO_2\text{-eq} = TCH_4 \times 34$; where TCH_4 is the total amount of CH_4 emission (kg ha^{-1}) and 34 is the global warming potential for CH_4 relative to CO_2 over a 100-year time horizon (as in IPCC, 2013). The results clearly suggest an environmental benefit of SRI (and MSRI) cultivation method through reduction of CH_4 emissions as well as large savings in irrigation water use. These cost reductions are achievable without compromising on crop yield.

Table 3: Impact of SRI on seed and water savings and CH_4 emissions in Tamil Nadu, India. Scaled up values for 1 mha are also given for showing the advantage of SRI over the CT rice cultivation practice. Total rice cultivation area in India is 43 mha and 2 mha in Tamil Nadu alone.

	Conventional	SRI	Estimate for 1 M ha		Advantage due to SRI
			Conventional	SRI	
Seed used	30 kg ha^{-1}	7.5 kg ha^{-1}	30000 t	7500 t	22500 t
Irrigation water used					
Kuruvai	930 mm	526 mm	3.1 M ft	1.7 M ft	1.4 M ft
Thaladi	488 mm	108 mm	1.6 M ft	0.35 M ft	1.2 M ft
Cumulative CH_4 emission					
Kuruvai	94 kg ha^{-1}	56 kg ha^{-1}	94000 t	56000 t	38000 t
Thaladi	159 kg ha^{-1}	117 kg ha^{-1}	159000 t	117000 t	42000 t
CO_2-eq emission (CH_4 emission × 34)					
Kuruvai	3196 kg ha^{-1}	1904 kg ha^{-1}	3196000 t	1904000 t	1.29 M t
Thaladi	5406 kg ha^{-1}	3978 kg ha^{-1}	5406000 t	3978000 t	1.43 M t

12 Carrijo et al., 2017

Empowering the Farmer with Knowledge

Farmers in Tamil Nadu, where this experiment was conducted, as elsewhere in India, are simple, industrious, sincere and honest. Hard work is a given for, apart from the sowing, watering, nurturing and harvesting of crops, they have to prepare the field and get it ready to plant for two to three crops per season. Depending on availability of irrigation water resources, they grow two rice crops followed by pulses within a year. This is clear even without having to interact much with the farmers directly for this project.

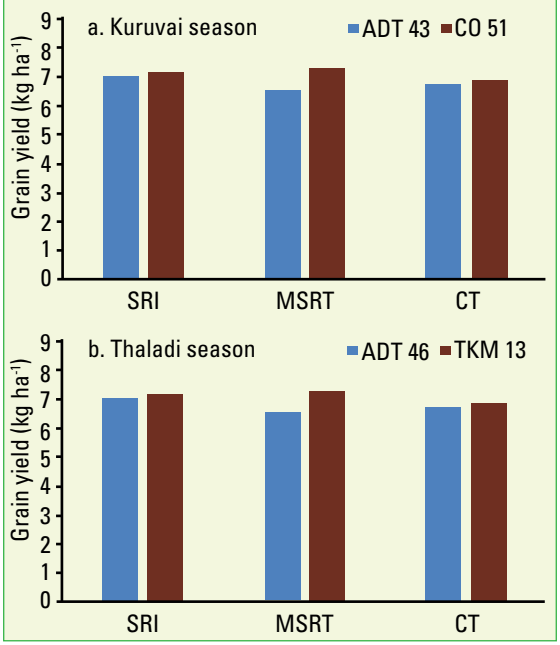
For many good reasons, farmers stick to their traditional methods of farming and are reluctant to change to new approaches for sustainable crop production. The situation becomes complex due to lack of facilities and support to make the transition. Farmers could easily adapt to the water management practice of alternate wetting and drying (AWD) provided there is guaranteed water supply.

In our understanding, they flood the paddy fields by collecting monsoon rain for securing water sufficiency till the time of harvesting. Rice paddies, unlike the wheat or pulses, are tolerant to continuous flooding. Under on-going climate change, scarcity of water for irrigation might affect the farmer's method of rice farming and their livelihood.

In this situation, it is necessary to educate farmers by sharing information like climate-smart agriculture methods. Our research findings might offer a possible solution through practicing System of Rice Intensification (SRI) or modifying this system to local/regional differences in infrastructure such as optimal water saving by the alternate wetting and drying irrigation, depending on rainfall events.

For scientists, it is extremely rewarding when research results are of direct relevance to the society and the global environment and enhance convenience of the farmers (savings in terms of cost of seeds and irrigation for example). In addition, engaging in field work is a pleasant experience for those who spend long hours in the laboratory. The experience is made richer by the warm welcome and kind hospitality of the host institutions who, at TRRI, are also dealing with farmers' well being by producing high-yield grain cultivars and other knowhow.

Figure 5: Rice grain yield observed for the different cultivation methods (CT, SRI, MSRI) and rice cultivars (ADT 43, CO 51, ADT 46, TKM 13) during Kuruvai (dry; a) and Thaladi (wet; b) seasons.



This study observed no significant differences in grain yields in the two crop seasons, grain yield of SRI and MSRI with AWD irrigation was comparable with yield of CT (*Figure 5*). Other studies have showed high grain yield in SRI compared to conventional transplanting for the 'Pusa Basmati 1401' variety[13]. Although such modification of the SRI method as transplanting 16-day old seedlings with 2-3 seedlings per hill was introduced to increase grain yields in both crop seasons, an increase in rice productivity under MSRI depended largely on rice variety (high yield was observed only with CO 51 and TKM 13 varieties under the MSRI method in Kuruvai and Thaladi seasons respectively).

The yield-scaled metric is increasingly used to provide a measure of agronomic efficiency that begins to address both climate change and future food supply concerns. Results from this study clearly showed that the yield-scaled CO_2-eq emission, which integrates the mitigation of GHG emissions while achieving food security, was highest in CT because emissions were higher and there was no significant difference in grain yield compared to SRI and MSRI in either crop season.

13 Suryavanshi et al., 2013

Yield scaled CO_2-eq emission from SRI and MSRI was lower due to low CH_4 emission. Therefore, it is strongly recommended that SRI and MSRI methods be adopted for efficient reduction of CO_2-eq emission without reducing grain yield, in comparison with the CT method regardless of the crop seasons/variety.

The seasonal variation in CH_4 emission was influenced by soil environmental factors such as soil redox potential (Eh), water depth and soil temperature in both crop seasons. Negative correlations between CH_4 emissions and soil Eh existed in both crop seasons. Positive correlation between soil temperature and CH_4 emission was observed only in the Kuruvai season, although the temperature range in both crop seasons was higher than the range 15-20°C for triggering CH_4 formation in anaerobic zones of rice soils. Thus, the farmers may also be advised to track their field conditions for maintaining soil quality for sustainable farming under the global change conditions. ●

References

De Laulanié, H., Intensive rice farming in Madagascar, *Tropicultura*, 29, 183-187, 2011.

Carrijo, D.R., Lundy, M.E., Linquist, B.A., 2017. Rice yields and water use under alternate wetting and drying irrigation: A meta-analysis, *Field Crops Res., 203,* 173-180.

Chapagain, T., A. Riseman, E. Yamaji, Assessment of System of Rice Intensification (SRI) and Conventional Practices under Organic and Inorganic Management in Japan, *Rice Sci., 18*(4), 311-320, 2011.

Das, K., K. K. Baruah, Methane emission associated with anatomical and morphophysiological characteristics of rice (*Oryza sativa*) plant, *Physiol. Plant., 134*, 303-312, 2008.

Hadi, A., K. Inubushi, K. Yagi, Effect of water management on greenhouse gas emissions and microbial properties of paddy soils in Japan and Indonesia, *Paddy Water Environ., 8,* 319-324, 2010.

IPCC (Intergovernmental Panel on Climate Change), 2013. The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report [Stocker, T.F., et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Janssens-Maenhout, G., et al., Global Atlas of the three major Greenhouse Gas Emissions for the period 1970-2012, Earth System Science Data, in review, 2017.

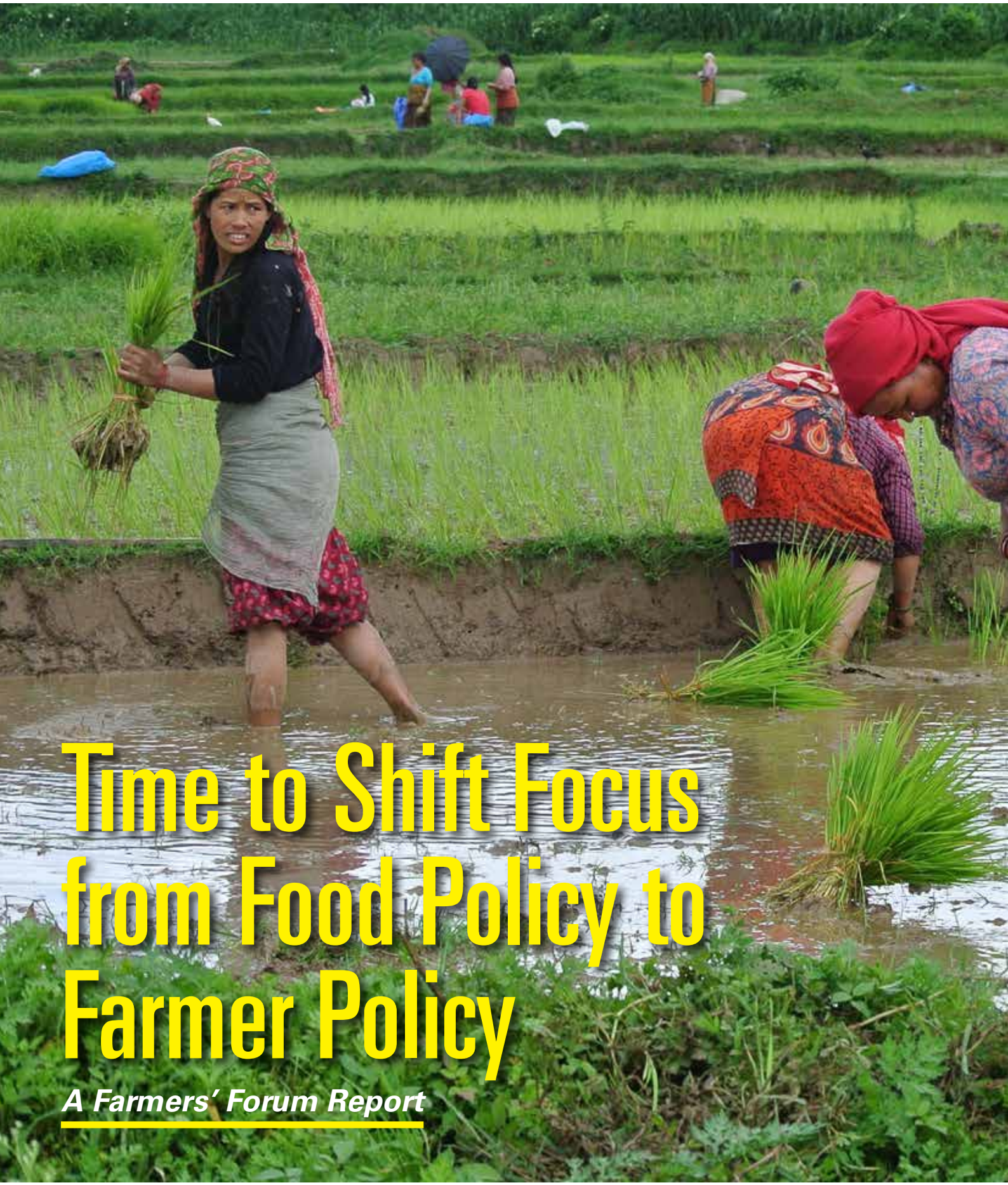
Minamikawa, K., T. Tokida, S. Sudo, A. Padre, K. Yagi, Guidelines for measuring CH_4 and N_2O emissions from rice paddies by a manually operated closed chamber method, National Institute for Agro-Environmental Science, Tsukuba, Japan, 2015.

Oo, A. Z., S. Sudo, K. Inubushi, M. Mano, A. Yamamoto, K. Ono, T. Osawa, S. Hayashida, P. K. Patra, Y. Terao, P. Elayakumar, K. Vanitha, C. Umamageswari, P. Jothimani, and V. Ravi, Methane and nitrous oxide emissions from conventional and modified rice cultivation systems in South India, Agri. Ecosys. Environ., 252, 148-158, 2018.

Sawada, S, and Y. Kohno, Differential ozone sensitivity of rice cultivars as indicated by visible injury and grain yield, Plant Biology, 11, 70-75, 2009.

Suryavanshi, P., Y. V. Singh, R. Prasanna, A. Bhatia, and Y. S. Shivey, Pattern of methane emission and water productivity under different methods of rice crop establishment, Paddy Water Environ., 11, 321–329, 2013.

BUDGET



Time to Shift Focus from Food Policy to Farmer Policy

A Farmers' Forum Report

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The Bharat Krishak Samaj (BKS) has proposed that the government shift its approach to policy-making in the food production space from its traditional focus on a Food Policy to one on a Farmers' Policy. It urges the government to bring about this shift in its forthcoming Budget 2018-19. The BKS, publishers of Farmers' Forum, a non-partisan association of farmers advocating the crucial need for India to work towards farmer prosperity, made this suggestion at the pre-budget consultation with the government.

There are some overarching changes that the BKS suggests:

- Creation of **off-farm jobs** to reduce pressure on land.
- **Enhancement of education quality** in villages to make it comparable to what obtains in cities. Children from the villages are at a disadvantage with those educated in English medium urban schools. This requires specific interventions. The government should exclusively fund states to make short videos on each chapter for all class in vernacular and in English languages with sub titles, for instance.
- **Physical and mental health care** are critical issues and stressed agriculture labour and small cultivators are committing suicides. The BKS urges that allocations be made for health care costs that are otherwise crippling. It wants free health tests and generic medication to be a basic right and for the government to pay the health insurance premium for families of landless labour and for arming all farmland stakeholders farmers.
- Access to quality data through **centrally funded data banks** for different states with a blockchain process for government working along with big data analytics that will usher in improved governance and transparency. The BKS suggests increasing funding manifold for the purpose of arming all farmland stackholders with a **'nationally consistent database'** that would be available to all at a nominal cost.
- **Focus on research and development** with a target of two per cent of agriculture GDP targeted for expenditure on agriculture R&D over the next few years. **Revitalizing faltering agro-economic research** centres/units instead of discontinuing funding and ensuring delivery by establishing a measurement matrix.
- **More funds for the Indian Meteorologi-**

cal Department for improving medium-term weather forecasts.

- **Devaluation of the Rupee** that will be beneficial for the Make in India programme and the rural sector.
- **Merger** of the Ministry of Food Processing with Ministry of Agriculture & Farmer Welfare to create the elusive synergy.
- **Implementation** of the Ramesh Chand committee report on MSP and ensure procurement of crops at MSP.

As far as **farmer income** adequacy is concerned, the BKS points out that, after the 7th Pay Commission, incomes and perks of the employees in the organized sector increased significantly, whereas the real incomes of farmers have continued to decline. It, therefore, urges budgetary allocations to set up a "Farmers' Income Commission" for securing **'income security'**. The BKS also refers to the parameters whereby the 15th Finance Commission will offer fiscal incentives to states and says that they must include aspects of rural economy like farmer incomes and farm productivity. Besides, the BKS wants an equitable distribution of resources to all, irrespective of land holding size to be calculated for two-hectare farms, where total fiscal incentives per state do not drop with direct payment to bank accounts of women members of the farmer family.

The collapse of farm extension, which should have been the key to any transformative change in farms, necessitates urgent redressal, the BKS suggests

A major concern is the **rise in cost of agriculture inputs** post GST because the subsidy component on such inputs has been neutralized by the higher taxation. Therefore, the subsidy component be increased to equalize the impact of GST for items like drip irrigation, the BKS has suggested.

Given the government's primary agenda to keep prices in check, the BKS has sought allocations that would **offset the impact of central government interventions** to mitigate inflation because many of them hit the farmer's earnings and these interventions take place across several areas of farm operations:

- In the event of a central government intervention for purposes of keeping prices of crops such as tomatoes, onions and potatoes in check, the BKS asks for a minimum price with the central government **meeting the shortfall between market and minimum price**. This will spare farmers and states from being penalized for fallout of policy not sanctioned by them and from having to share the cost of such policy.
- The collapse of farm extension, which should have been the key to any transformative change in farms, necessitates urgent action, the BKS suggests. It urges amendments to the Agricultural Technology Management Agency (ATMA) that mandates sharing of resources in the 60:40 ratio, with the centre's contribution at 60 per cent. **Reviving farm extension** will mean changing the ratio to 90:10, with the centre taking on 90 per cent, the BKS has told the finance minister.
- Funding for programmes such as Pradhan Mantri Krishi Sinchayee Yojana, National Food Security Mission, Mission for Integrated Development for Horticulture and Sub-mission on Agricultural Mechanization also needs to be doubled and the **funding ratio** changed from 60:40 to 90:10, where centre's contribution should increase to 90 per cent to help prepare Indian farmers for global assimilation.
- The Rashtriya Krishi Vikas Yojana has seen a ₹25,000 crore fund allocation over three years with the centre and states sharing the contribution in the 60:40 ratio. This ratio too needs to be changed to 90:10 with the centre bearing 90 per cent. Subsequently, the government contribution will increase from ₹15,000 crore to ₹22,500 crore. The BKS further urges that **states**, which have different priorities, **be allowed the leeway to utilize 100 per cent funding for infrastructure** creation.
- Suggesting changes in the Mahatma Gandhi National Rural Employment Guarantee Act (**MGNREGA**) that allows the payment of wages for working on one's own farm where ownership is limited to two hectares for plantation crops, the BKS recommends that this benefit be passed on for growing vegetable to **promote diversification** and improve farmer livelihoods.
- The BKS suggests changes in the Pradhan

Photo: Pixabay

Mantri Fasal Bima Yojana, where the centre currently pays part of the premium subject to the states adhering to certain conditions. Given that the scheme has failed to catch on, the BKS recommends that **states be allowed to design their own centrally funded crop insurance scheme.** Continued eligibility for the centre's share of the premium will inject life into this scheme, the BKS suggests.

- It urges that a **long-term agriculture import-export policy** be brought to play and arbitrary decision-making be brought to an end.
- In the spirit of a federal structure, the **centre should not negotiate international trade treaties for agriculture produce without the consent of states**.
- The BKS also urges the centre to **fund capacity-building for negotiating trade treaties** in farmer organizations and bureaucrats and incentivize university courses on international farm policies. It also wants facilitation of real time data collation and analysis vis-a-vis international markets.

Farm sector credit has been an area of critical concern given that many states are declaring selective farm loan waiver in response to the crises on the farms. The BKS wants the centre to:

- Declare an Agricultural Debt Relief package for the entire country, with matching contributions from the state governments. At least 25 per cent of the package should be used to provide debt relief from non-institutional loans to tenant farmers, sharecroppers, adivasi farmers and women farmers who do not have access to institutional loans.
- Scrutinize data from public and private sector banks because they reveal that they have indiscriminately given loans to farmers based on their asset value rather than economic viability.
- Banks have been guided by the need to meet their own priority sector lending targets and

loans were given beyond each farmer's scale of finance or actual value of crop sold each year. In-house study by the Financial Inclusion and Development Department of RBI establishes such loans could not be repaid. The BKS urges the centre to rectify such recklessness and seek compensation for impacted farmers.

- Have forensic audit of agriculture credit lending portfolio of all banks.
- Double the number of farmers receiving loans of up to ₹2 lakh at one per cent interest with an Aadhar linkage to such loan accounts to avoid duplication.
- Ensure that tenant farmers or lessee farmers get access to bank loans on a high priority basis.
- In view of the Bhoomiheen Kisan Credit scheme and NITI Aayog report, the BKS proposes that a credit guarantee fund be set up to increase the bankers' confidence in lending to non-land owning "licensed" cultivators, both as individual farmers and in Joint Liability Groups.
- Increase credit limit for animal husbandry other than dairy and poultry. The BKS urges Nabard to increase funding 10-fold for small ruminants. Also the centre must provide subsidized loans to landless and small farmers, it suggests.

Grassroots entrepreneurship is an agenda that the BKS wishes the government would foster and it recommends that:

- Agro-processing incentives be restricted to small entrepreneurs with preference to FPOs.
- Funding for Pradhan Mantri Kisan Sampada Yojana should not come with restrictive conditions to such as mandatory setting up of units in food parks because they are counterproductive. The 'Mega Food Park' policy has failed, says the BKS and it suggests a re-structuring of fiscal incentives based on value of food produced in India, which is processed in 'Mega Food Parks'.
- Further, the BKS wants all the incentives being provided under Startup India mission to be extended to Farmer Producer Organizations (FPOs), including tax exemptions, provision of capital and infrastructure.
- It asks for more incentives for bio gas units without restricting incentives for electricity generation.
- The BKS wants more emphasis on "Agro Forestry" for income generation.
- It also urges greater focus on the animal husbandry sector. Tripling funding for small ruminants

Photo: Pixabay

The BKS wants all the incentives being provided under Startup India to be extended to Farmer Producer Organizations, including tax exemptions, provision of capital and infrastructure

like piggery, goat, sheep and buffalo meat along with backyard poultry, fishery and beekeeping. At present, this forms a small part of the total farm sector funding. Animal health is a major driver for human disease and provisions must be made for animal disease prevention and the government should pay 100 per cent insurance premium for small ruminants for landless and small farmers.

The BKS suggests that targeting a **10 per cent annual reduction in use of chemicals** on farms should be a primary objective and, accordingly, the centre should engage in:

- Funding laboratories to test for sub-standard and spurious inputs.
- Funding laboratories to check fresh and processed food imports.
- Placing the 'Pesticide management Bill 2018' in the forthcoming Parliament session.
- Funding Internet of Things (IOT) to enforce supply chain tracking and traceability of each agricultural sale from factory floor to farmer.
- Making specific allocations for microbiome technologies to improve crop yields, for improved crop protection and reduced use of water.
- Increasing allocations for Paramparagat Krishi Vikas Yojana manifold and, within this, having a specific component to revive traditional crop diversity in all farms.
- Redesigning National Skill Development Council programmes on skill development in agriculture in collaboration with farmer organizations because the current schemes have not yielded desired results.

Irrigation is a major area of concern and the BKS suggests:

- Funding of one million water storage reservoirs.
- Providing drainage for existing irrigated areas

without funding new flood irrigation projects.
- Increasing outlay for optimum water utilization with special focus on rain-fed areas.
- Funding distribution of soil moisture measuring sensors to all farmers.

Making markets work in the farmers' favour is important in the BKS scheme of things. It wants:
- Immediate implementation of the 'Price Deficiency Payment Mechanism' for crops for which procurement cannot be ensured so that farmers can get remunerative prices.
- Increase in the number of crops and outlay in 'Market Intervention Scheme' & 'Price Stabilization Fund', where the centre pays the full cost of intervention.
- Making pulses and millets a greater part of the public distribution system to increase the food basket and nutrition for poor consumers.

Photo: Pixabay

- Funding to increase the number of agriculture market yards and full infrastructure in all agriculture market yards.
- The centre to incentivize states to link each market with E-NAM. Rather than force E-NAM on each state. The BKS wants that states be allowed their own electronic platforms that met the basic criteria of inter-operability with other states and still be applicable for incentives.

Redesign the National Skill Development Council programmes on skill development in agriculture in collaboration with farmer organizations because the current schemes have not yielded desired results

Other areas of intervention that the BKS recommends include:

- The report, "Incentivizing Pulses Production Through Minimum Support Price (MSP) and Related Policies", submitted by the Chief Economic Advisor Arvind Subramaniam be implemented.
- Balanced use of fertilizers; increase in urea price and simultaneously decrease in price of P&K fertilizers, so no added burden is imposed on the farmers or the government.
- Substantial increase in outlays for National Disaster Response Force (NDRF) and State Disaster Response Fund (SDRF) to respond to natural calamities. Improved inter-ministerial coordination.
- Funding of a programme to promote homestead gardens to boost household nutrition.
- Incentivization of panchayats to sustain bio-diversity by making two hectare bio-diversity reserves in each village where cropping intensity is over 150 per cent.
- When funding urban renewal or smart cities, makeing it mandatory for cities to allocate space for farmer markets in residential areas based on population density. More focus on Provision of Urban Amenities to Rural Areas (PURA) to improve the quality of life in villages. Replacing funding of smart cities with a programme to fund 4,000 smart census towns.
- The notification to amend the Central Motor Vehicles Rules, 1989, Rule 2 (b) regarding omission of words "Agriculture Tractor is a non-transport Vehicle" should not be carried-out. If required, the tractor be classified as transport or non-transport vehicle at the time of registration of the vehicle itself as in case of cars. A separate set of taxes be prescribed if not intended for farm use.

INCOME

Routes to Secure Farmer Incomes

Naresh Minocha

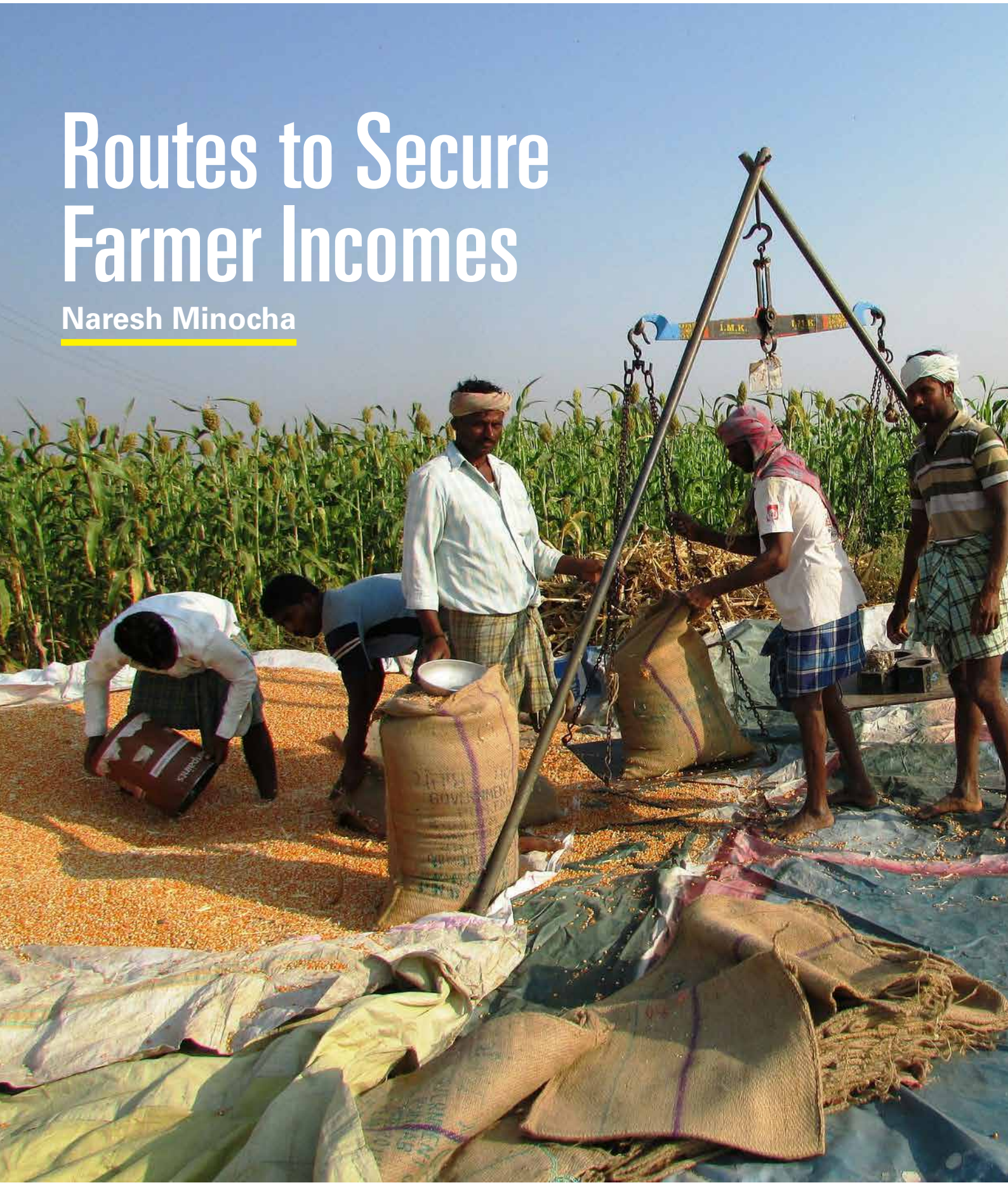


Photo: Pixabay

If India can have a National Food Security Act for consumers, why can it not have a law to safeguard income of farmers? Farmers' income security is the new buzzword in all agrarian crisis discussions. This has been enriched with the articulation of the demand for enacting a law to guarantee certain minimum income to farmers.

NARESH MINOCHA
Senior economic journalist specializing in Indian agriculture

When and how quickly this can spur the centre and states to improve the paltry incomes of farmers has to be watched in the run-up to the 2019 Lok Sabha polls. The latest data about average income of a farm holding would, in all probability, be available only after the elections.

The NDA government has planned a Situation Assessment Survey (SAS) of Agricultural Households and a Debt & Investment Survey in 2019. Hapless farmers and dream merchants seeking to double farm income in five years would thus have to rely on data SAS National Sample Survey Office (NSSO) in December 2014.

SAS computed ₹6,426 as the average monthly income including non-farming earnings per agricultural household during the agricultural year July 2012-June 2013. This is not even half of average income that a household help earns in the National Capital Region.

These are mere statistics for politicians, who never tire of paying lip service to the yeomen. It is thus not surprising that pent-up agrarian dissent led to defeat of Gujarat agriculture minister in recent assembly polls. Political analysts are interpreting the voting pattern in rural Gujarat as a signal to do justice to farmers across the country.

In Andhra Pradesh, the YSR Congress Party has already promised direct cash transfers (DCT) to farmers if the party is voted to power in 2019. In July 2017, the YSRCP president, Y.S. Jagan Mohan Reddy, announced the 'YSR Barosa' scheme proposing a payment of ₹50,000 to small and marginal farmers, who own five acres or less of farm land.

The YSRCP has also a promised a cultivation grant of ₹12,500 each year to all farmers, before

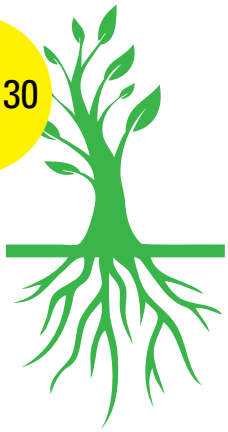
the start of the kharif season. Besides, the scheme moots the setting up of a Price Stabilization Fund.

However, while such promises and one-time loan waiver by some states for small and marginal farmers may be politically expedient, they fall short of a statutory approach to guaranteeing assured minimum income to farmers.

Kerala, however, may become the first state to enact a Farmers' Income Guarantee Act, a proposal that figures in the states Agricultural Development Policy, unveiled in December 2015. The policy says:

"The government will be directly accountable for improving the net incomes of farming households". So there is a necessity for the formulation and enactment of a "Farmers' Income Guarantee Act, which assures all farming households a dignified living income to meet the basic living expenses".

The state government has not indicated when it will transform its intent into a law for assured income for Kerala farmers. It has currently mooted a scheme to provide regular additional income to farmers as a small share of value-added to their produce along the crop value chain.



Kerala may become the first state to enact a Farmers' Income Guarantee Act. A proposal figures in its Agricultural Development Policy, unveiled in December 2015

The scheme is named Actio Apportum (a Greek word that means deserved profit) that Kerala's agriculture minister, V. S. Sunil Kumar, has thus explained: "This will benefit a section of farmers whose produce is used to make value-added products. For example, for a litre of milk, a farmer gets only ₹35 whereas the profit of Milma (Kerala Co-operative Milk Marketing Federation) by selling the value-added products from the milk is ₹185. Once the policy is implemented, a portion of the profit will be given to farmers".

The minister added that: "This will get done by imposing a cess on the farm produce at the point of sale. The finance department is working out how it can be done". The idea of enacting a law for income guarantee to farming households is, however, unrealistic for varied reasons. It is also a herculean task to implement. There are long-overdue, realistic options to end India's agrarian crisis that may also be pursued with vigour (*See Box*).

The demand for enacting farmers income guarantee law grabbed headlines in the first week of December when a section of farm stakeholders mooted the enactment of law to guarantee income security for farming community.

They made this demand in their pre-budget consultations with finance minister Arun Jaitley and ministry officials. The finance ministry, which floated idea of universal basic income (UBI) in its annual economic survey for 29016-17 released in January 2017, flaunted it as "a more effective way of achieving Mahatma Gandhi's objectives of 'wiping every tear from every eye'".

Yet the bitter fact is that the Modi Government does not feel the urgency to even wipe tears from the eyes of families hit by farmers' suicides and to prevent more suicides. Instead of framing a policy to prevent farmers' suicides, the government presents its blurred vision of doubling farmers' income by 2022 as the key to ending agrarian crisis.

Consider the official reply to a Lok Sabha question (LSQ) dated December 19, 2017. Asked whether the government had "any comprehensive policy to address the issue of increasing number of farmers suicide in the country", the government replied: "unfortunate incidents of suicides can be addressed by enabling the farmers to increase their income".

The Modi government has neither initiated efforts to collect yearly/quarterly data on the agrarian situation in the country nor has it implemented the BJP's 2014 manifesto's resolve to ensure minimum 50 per cent profit over cost of production to farmers.

The government's indifference towards the plight of farmers is palpable as evident from a reply to LSQ dated December 19, 2017 on the number of unemployed farmers in the country. The Ministry of Agriculture and Farmers Welfare (MAFW) replied that "the information on unemployed farmers in the country is not available in the data collected", under the last SAS undertaken in the agricultural year July 2012-June 2013.

Another instance in point is inaction on the recommendations of the committee on the review of methodology for computation of minimum support prices (MSP) for crops. Though this committee, chaired by Prof. Ramesh Chand, currently member of the NITI Aayog, submitted its report in March 2015, the government does not know whether and when to bite the bullet.

Four Options to Guarantee Minimum Farm Income

The enactment of National Farmers' Income Guarantee Act (NFIGA) appears logical as a pre-requisite for sustaining food security through the National Food Security Act, 2013.

Enacting the proposed law is, however, as politically challenging as is amending the Constitution of India. Making right to work a fundamental right is something that no political party is expected to muster courage to enact. A comprehensive NFIGA would thus turn out to be hottest political potato for the regime of the day.

There are four broad frameworks on which the NFIGA can be developed:

1. Universal basic income (UBI);
2. Statutory enforceable minimum support prices (MSPs) for all farm produce, including fish;
3. Transformation of all direct and indirect farm subsidies into direct cash transfers (DCT) into bank accounts for farm households; and
4. Contract farming where the contracting entity, be it public or private sector company, supplies quality inputs and agrees to buy entire the produce at a guaranteed price.

The third and fourth option can be implemented as alternatives or in combination after working out details.

The government has to first decide whether the NFIGA should be based on the UBI platform for both farmers and farm workers, without any strings attached. Alternatively, should only poor households and unemployed farm hands receive monthly, minimum guaranteed income? Would this accelerate mechanization to enable farm family members to declare themselves as unemployed?

Farmers earn income from both crop farming, animal husbandry and non-farm activities. The farms are undergoing unabated fragmentation due to population growth, resulting in increase in number of farm holdings and farm households every year.

The data on this comprehensive agricultural dynamics is collected once in 10 years through different census. The data on number of farm households, their source of income and the average monthly income per household would have to be collected every year for effective implementation of the NFIGA. The government would also have decide whether tenant farmers or land owners should receive monthly income under NFIGA.

If the government decides to enact the NFIGA on the MSPs platform, it has to decide the number of crops that should be covered by MSPs. At present, MSPs are announced only for 22 crops. Millions of farmers are unable to sell their produce at MSPs due to marketing and allied problems.

The government has repeatedly spurned the demand for inclusion of more crops in the MSPs ambit. To make the NFIGA a benefit for all, it would have to be extended not only to all crops but also to minor forest produce sold by tribals. The government would also be duty-bound to compute MSPs for milk, eggs, chicken and other animal husbandry produce.

The third and most feasible option is to offer all subsidies given by the centre to agriculture as DCTs to farmers. Similarly, the states can offer power, irrigation and any other existing subsidy as DCTs to farmers. The receipt of cash from two streams would give the farmers the freedom to buy inputs at market prices and do agricultural business as per their own judgment.

The government has avoided taking a full call on third option inspite of recommendations from different committees. The RBI's Committee on Medium-term Path on Financial Inclusion, for instance, pitched for transfer of all farm input subsidies including fertilizer, irrigation and power dole-outs as cash directly into accounts of farmers.

In its report submitted in December 2015, the Committee recommended that "the government may phase out the agricultural input subsidy and replace it with an income transfer scheme, which could potentially transform the agriculture sector besides promoting financial inclusion".

Photo: Pixabay

Pending a decision on options, the government must ensure that no farmer is forced to sell crops below MSPs. The market intervention scheme (MIS) should be revised and made applicable to all other crops. The existing norm of MIS being invoked after 10 per cent drop in prices or 10 per cent increase in production of a crop should be scrapped.

Simultaneously, all farmers must be covered by simple crop and animal insurance scheme. The farmers should be asked to pay only 1-5 per cent premium. The remaining sum of premium should be shared by the centre and the states.

In reply to the December 19, 2017 question on the subject, the ministry stated: "The report has been examined and a number of meetings have already been held with the various ministries and departments concerned on the recommendations. Government has not taken any decision on the implementation of the recommendation of the Committee so far".

It is pertinent to quote a study titled 'Minimum Support Price and Farmers' Income - A Case Study for Wheat Production in Chittorgarh, Rajasthan (India)' conducted by a leading economic institution, CUTS International, in 2015. The study said:

"The transparency in the calculation of MSP is completely lacking. Moreover, the farmers have no direct participation in the determination and selection of parameters which should form a part of calculation matrix. Since, it is not practically possible to hear the say of every farmer on MSP calculation process, the government should encourage the larger farmer bodies and associations to take part on larger fora of stakeholders on deciding the contributing factors for MSP".

Millions of farmers are not even able to sell their produce at under MSP prices, season after season. In any event, MSPs are announced for only 22 crops. The peasants growing other crops thus face greater risk of income insecurity, even incurring losses due to ubiquitous crash in prices when the speed of produce arriving at mandis gains pace. Hence the demand for assured minimum income.

According to BDR Reddy, secretary general of the Consortium of Indian Farmers Associations (CIFA): "The median agriculture income is about ₹1,600 per month. No family can sustain with this even in the remotest part of the country. Hence the farming community of India demands an Income Security Act for farmers, tenant farmers and farm labourers".

CIFA has also mooted a separate union agriculture budget "to address the concerns of 60 per cent of the population" that depends on the farm sector. The Bharat Krishak Samaj (BKS) has urged the government to set up a "Farmers' Income Commission for securing income security". (See article *Time to Shift Focus from Food Policy to Farmer Policy*, page 20).

Another farmers welfare-centric entity, Alliance for Sustainable and Holistic Agriculture (Asha), elaborated the idea of Farmers' Income Guarantee Act in April 2016. Asha says: "There is a need to set up a Farm Income Commission to oversee that minimum living incomes accrue to all farm

Photo: Pixabay

Sustainable food security is impossible if average farmer income is below that of poor migrants in big cities

households. One of the main functions of this commission would be to undertake annual income surveys for various categories of farmers (landholding class, rainfed versus irrigation, particular crops as well as agro-ecological regions). This would meaningfully sharpen any interventions".

While advocating a recast of crop support pricing, Asha suggests: "A price compensation mechanism that pays out the difference between the market price realized by farmers and a derived price entitlement for a minimum guaranteed income should be put into place". It adds: "Where required, either for particular crops or particular regions, direct income support on an annual basis should be paid".

Other non-government/socio-political entities that have pitched for the Farmers' Income Security law include Swaraj Abhiyan and Telangana Rythu Joint Action Committee (JAC). There is both logic and merit in the demand for a Farmers' Income Security Act as there can be no sustainable food security over long run if the farmers' average income is lower than that of poor migrants in big cities.

Ideally, the Farmers' Income Security Act and National Food Security Act, 2013 (NFSA) should have been enacted simultaneously. The two should have been conceived and sustained as two sides of the same coin – Balanced and Adequate Nutrition for All Indians. The least the government can do easily is to amend the NFSA to do some justice to farmers. The NFSA defines "minimum support price" as the "assured price announced by the central government" at which foodgrain is procured from farmers for the central pool.

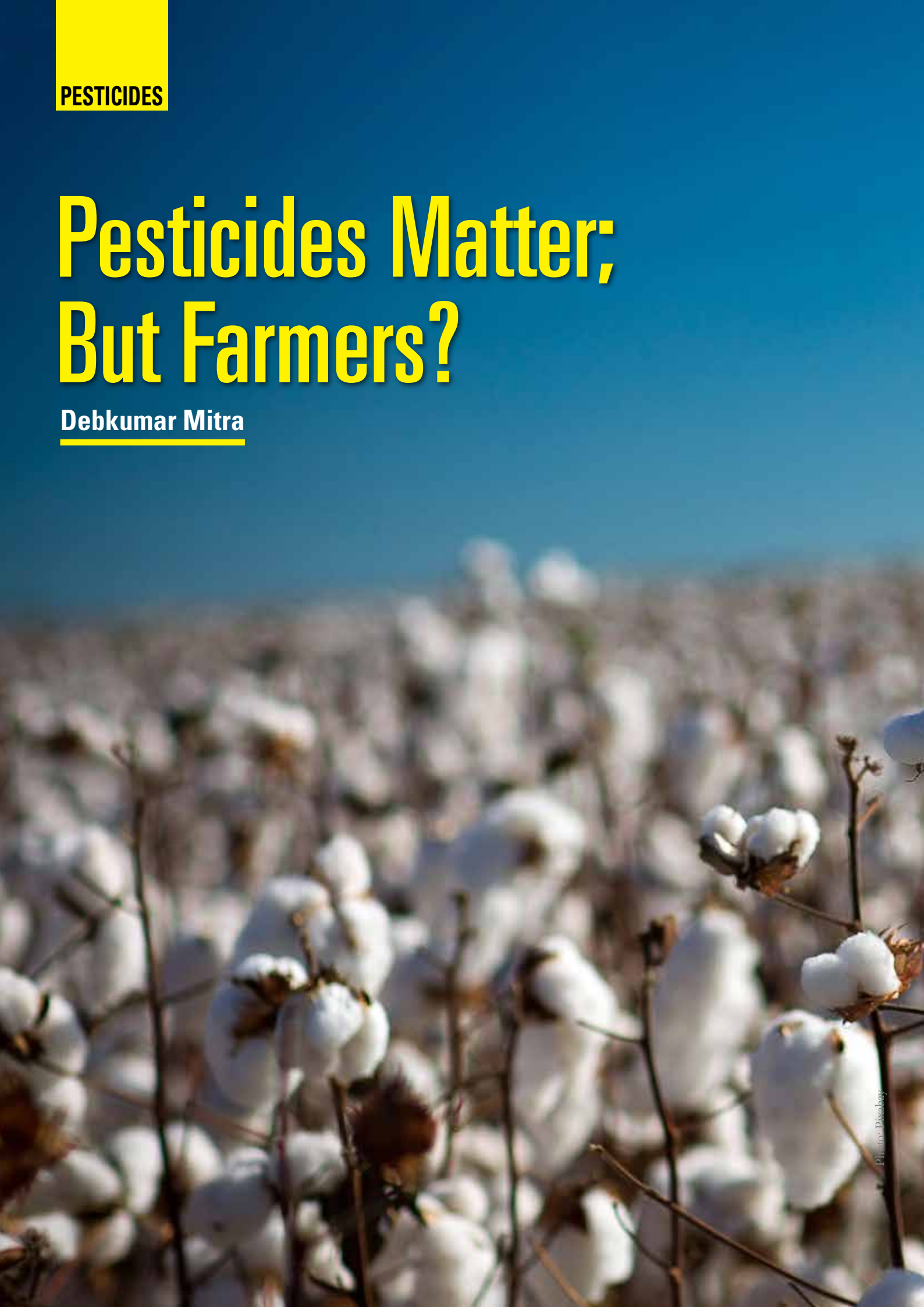
The Act does not provide any statutory mechanism to ensure that farmers get MSP.

This requires amendment. The NFSA should stipulate guaranteed MSPs for foodgrain, pulses and oilseeds sold in all markets.

Similarly, the government should revisit and improve the NFSA's provisions relating to 'Revitalization of Agriculture' and 'agrarian reforms'. These require elaboration and statutory enforcement under the NFSA to provide income security to India's '*anna dataas*'. ●

Pesticides Matter; But Farmers?

Debkumar Mitra



The news started to trickle in from July 2017, in the cotton fields of Maharashtra human lives are lost at an alarming rate – the culprit, pesticide poisoning. Pesticide mediated deaths are not new but 2017 has been particularly deadly. A series of deaths and poisonings among the cotton farming community due to pesticide exposures took an ugly turn in Yavatmal, Maharashtra. There have also been several deaths and hundreds of poisonings of farmers and farm workers from Nagpur, Chandrapur, Amravati, Buldana, Bhandara and Akola districts of the state.

The sheer number of deaths exposes the unscientific use of hazardous chemicals and official apathy in agriculture, particularly in cotton cultivation. Over the years, researchers have gathered compelling evidence to implicate the pesticides. Countries have taken a series of steps to phase out these deadly chemicals but the process of identifying and banning of dangerous pesticides is slow in South Asia. NGOs, independent agricultural researchers and social activists have raised the issue almost regularly over the past couple of decades but to no avail.

DEBKUMAR MITRA
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Consider cotton cultivation, a contentious issue in this country. It is common knowledge that worldwide cotton cultivation covers little more than two per cent of the world's cultivated land but its use of chemicals is way more than for any other major crop – six per cent of the world's pesticides and a staggering 16 per cent of insecticides.

Pesticides are a major global killer. The result of this exaggerated use: close to 1,000 people die every day from acute pesticide poisoning. Many more in the farming community suffer from diseases such as cancers and leukemia, neurological diseases and reproductive problems including infertility, miscarriage and birth defects.

Pesticide-mediated death does not stalk cotton farming alone. As the tragedy was breaking out in Yavatmal, the July 2017 issue of *The American Journal of Tropical Medicine and Hygiene* published a paper indicting the banned pesticide Endosulfan for deaths of children in lychee orchards of Bangladesh. Writing in the paper 'Outbreak of Sudden Death with Acute Encephalitis Syndrome (AES) Among Children Associated with Exposure to Lychee Orchards in Northern Bangladesh, 2012' the researchers said: "Eating lychees was not associated with illness in the case-control study. The outbreak was linked to lychee orchard exposures where agrochemicals were routinely used but not to consumption of lychees. Lack of acute specimens was a major limitation".

The researchers categorically negated any relationships between a naturally occurring toxin in lychees and children's deaths as was posited in an earlier research into similar deaths in Muzzaffarpur, Bihar, published in *The Lancet*. While the jury is still out on the findings, there is a feeling among researchers that scores of children who lost their lives in the lychee orchards could be a combination of Endosulfan use and the fruit toxin. The point to be noted is that a banned pesticide is still used and such violation is common in agriculture among poor farming communities all over the world.

Pesticide poisoning is an enormous problem in India. The government and other watchdog agencies have for years tried to sweep the problem under the carpet. The issue is complex but at the heart of it is crippling poverty that has plagued agriculture in India over the past several decades. Farmer suicides, accidental pesticide consumption, lack of monitoring and near-absence of proper gear for pesticide use have been identified by agricultural scientists as issues that need immediate attention.

Dissemination of scientific information in the local language and strict monitoring of dangerous chemical use among small, marginal and adivasis involved in farming and sustainable poverty-alleviation programme (not the loan waiver melas) can go long way in tackling the problem. In the case of the lychee orchard tragedy it was observed that consumption of fruits' which were sprayed freshly with Endosulfan, by poor, hungry children resulted in those deaths in Bangladesh. Even in Muzzaffarpur, hunger is identified as the cause that led to the children to consume a large number of lychees in empty stomach allowing the fruit-toxin to run amok in their little bodies.

Research has already unveiled "organophosphorus compounds cause most self-poisoning deaths in southern and central India". In parts of northern India, aluminium phosphide causes a lot of deaths. The mentioned pesticides are all highly toxic, with "one hospital reporting a case fatality ratio (CFR) for aluminium phosphide of over 90 per cent". There are several other pesticides that have implicated or used in self-poisoning. These include carbamates, organochlorines and pyrethroids.

One issue that has cropped is medical

Even after Yavatmal, there is no sign of holding agrochem companies accountable though it needs little to put in safeguards that will go a long way in reassuring the public

management of self-poisoning victims. The management is difficult "because there is little evidence with which to determine the best strategies for treatment and there is often intermittent supply of antidotes". In other words, there is very little at the moment that the medical community can do once a person consumes these deadly pesticides. This again opens up the debate on the creation of a monitoring agency that can review, restrict or even ban the use of dangerous pesticides.

The lip-service via statutory warnings and odd lectures at kisan melas are not enough, the agriculture bodies have come up with a comprehensive plan based on research findings to tackle deaths. If such a monitoring body was in place, the pesticide that was allegedly used in Yavatmal and possibly led to 31 deaths could never have been used for spraying on sugarcane fields; the farmers were cotton cultivators.

Post the Yavatmal tragedy, there have been several government agencies looking at the issue and coming up with their own inferences. Even when the government takes some action the result does have the desired effect. In 2016, the Anupam Verma Committee, set up to review the continued use of 66 pesticides that have been banned or restricted for use in farming in other countries, recommended a ban on 13 'extremely hazardous' pesticides, phasing out of six 'moderately hazardous' ones by 2020, and review of 27 pesticides in 2018.

This measure was hailed as historic — never before have pesticides been implicated since Independence and so on — by the administrators but if one looks at action on the ground very little has happened. One can count the number of pesticides that have phased out in these two years since the report was made public on one finger.

Many India agriculture watchers argue that the recommendations of the Anupam Verma committee did not attend to the health and environment impacts of the chemicals in use. According to them, "while the committee recommended a ban on six "likely or probable carcinogenic" pesticides, it has permitted 11 such chemicals to be continued for now. These chemical include Chlorothalonil, Iprodione, Propineb, Thiodicarb, Thiophanate Methyle, Oxyfluorfen, Mancozeb, Malathion, Diuron, 2, 4-D and Butachlor, used in various cereal, vegetable and fruit crops.

With very little as a remedial measure in sight the poor farming community is staring at a pesticide tragedy. Even after Yavatmal, there is no sign of fixing accountability of agrochemical companies or government agencies. This is an area that needs very little to put safeguards in action. Once in place they will go a long way in engendering public confidence. •

FAO's Fight Against POPs

A Farmers' Forum Report

In many countries, when a range of products has been banned or withdrawn for health or environmental reasons, the fate of existing stocks is often given scarce consideration. Stocks remain where they are stored and eventually deteriorate. Good practice in such cases requires pesticide regulatory authorities to allow a phase-out period when products are banned or restricted so that existing stocks can be used up before the restriction is fully applied", says the Food and Agriculture Organization of the United Nations[1] (FAO).

Persistent Organic Pollutants (POP) have been an important focus area for the FAO. These are chemicals that do not break down easily and can remain in the environment for a long time. Many evaporate in hot climates, travel through the atmosphere and settle in colder environments. They have found their way into the food chain because of extensive use to deal with specific problems or exterminate pests generally. Many are currently banned but still in use.

The FAO has a position paper on such banned pesticides that merits attention.

Apart from being survivors, some POPs are also lipophylic; they are soluble in fat. This means that they tend to accumulate in the body fat of animals in ever increasing quantities eventually leading to long term physiological effects such as infertility, cancer and hormonal disruption, says the FAO paper.

Some of these effects can be passed from one generation to another. As they move up through the food chain, POPs also become more concentrated. However, as the world became more aware of the dangers of POPs chemicals, these pesticides were banned such as the donor-funded locust campaigns in the late 1970s. Many POPs pesticides, dieldrin in particular, were widely used in campaigns to eradicate locusts in Africa.

When the POPs pesticides were banned, little thought was given to the fate of the remaining stock. This has become a major problem. Existing data indicate that more than 20 per cent of obsolete

1 http://www.fao.org/agriculture/crops/obsolete-pesticides/world-photos/topic-photos/obsolete-unwanted-andor-banned-pesticides/en/

pesticides stockpiles consist of POP pesticides.

- Some of the stockpiled pesticides are nearly 30 years old.
- They are poorly stored and are leaking into the environment and contaminating soil and water.
- They are very persistent and POPs pesticides, such as dieldrin, can be effective for a long time.
- As a result, the pesticides are sometimes stolen and sold illegally.

Are banned pesticides being sold in developing countries? The FAO says:

There are many cases where highly hazardous pesticides, which are not permitted for use in industrialized countries, are exported to developing countries.

For a pesticide to be banned, it has to be registered first. Some pesticide companies have not registered or re-registered products that they knew would have not have been authorized in their own country but continue to produce and export the same products to developing countries.

There are also cases of pesticide manufacturers increasing exports of products that have been banned or restricted in their own countries, possibly in order to use up existing stocks or to compensate for depleted local markets.

Pesticide companies have also been able to circumvent bans on specific products by building formulation plants for the product in developing countries. They then supply the technical grade active ingredients needed to make the pesticide and claim that the product itself is locally manufactured.

The argument is put forward that developing countries are demanding these hazardous pesticides because less toxic products are often too expensive. ●

Panning the Pesticide World

Pesticide Action Network (PAN) has a list of pesticides that have been banned by countries. The Consolidated List of Banned Pesticides (CL) has been developed to identify which pesticides have been banned by particular countries because there appears to be no other source for such information. The CL also shows whether these pesticides are regarded as highly hazardous according to the criteria established by the FAO/WHO Joint Meeting on Pesticide Management (JMPM) and/or according to the criteria agreed by the Pesticide Action Network.

PAN believes that the JMPM criteria do not adequately cover certain health and environmental hazards. This is why the Pesticide Action Network has taken the basic JMPM criteria and added to them criteria for inhalation toxicity (H330) as this is not covered by WHO classification; endocrine disruption; toxicity to bees and aquatic organisms; persistence in water, soil or sediment; and bioaccumulation.

The CL does not include those banned pesticides regarded as being obsolete according to the 2009 WHO Recommended Classification of Pesticides by Hazard. It also does not include severe restrictions; entries are for complete bans only. This is because experience has shown that, in some countries, severely restricted pesticides can still find there way into prohibited uses relatively easily.

The CL is an ongoing exercise in drawing together information on pesticides that have been banned in various countries. This could be regarded as another means of identifying pesticides that may be regarded as HHPs, at least in some countries, as bans are often made in response to problems experienced in that country, or other countries. The CL is far from complete as many countries do not publish lists of banned pesticides, nor notify them to the secretariat of the Rotterdam Convention.

http://pan-international.org/wp-content/uploads/Consolidated-List-of-Bans-Explanatory-2017April.pdf

PADDY-POLLUTION CONNECT

India's Biomass Burning Scourge

A Farmers' Forum Report

Delhiites are, for a few years, getting used to winters enveloped in a blanket of smoke with its Air Quality Index crossing into dangerous domains. The suspended particulate matter levels (SPM) reach choking levels as the Indian capital manages to win the "most polluted city of the world" crown from Beijing. Meteorologists say inversion and wind direction are the primary culprits and reports hold brick kilns, the unorganized sector, road dust, the burning fields of Punjab as the possible causes. Farmers' Forum looks at the biomass burning, including straw in fields, gobar and straw in traditional stoves and such others and considers possible solutions as presented in a detailed report, Fixing Delhi's Pollution, by Laveesh Bhandari and Chander Shekhar Mehra of the Indicus Foundation, New Delhi (November 15, 2017).

An Indian Institute of Technology (IITK) study found that amongst the possible sources of

Photo: Pixabay

pollution, crop burning and biomass burning in stoves are mainly responsible for the bulk of the biomass based particulate matter in Delhi's air.

While the accompanying charts examine all the problems and solutions presented by the Bhandari and Mehra report, this Farmers' Forum report focuses on the crop residue and straw burning problems because they are farm sector related and greater volumes of straw are being burnt in northern and western India.

This is primarily on account of three forces impacting the crop economy of Punjab and some parts of West Panjab in Pakistan, Uttar Pradesh, Himachal and Haryana.

- More rice-straw is being generated than before.
- Straw is becoming more difficult to collect now.
- Straw is becoming less useful than before with diminishing end uses.

For the farmer then the best option is to burn the aftermath. Since the mid-sixties, the area under kharif rice has increased to three million hectares from 0.3 mh and productivity from a ton per hectare to about six tons per hectare. Apart from the availability of HYV seeds, the skewed support prices and procurement practices, abetted by cheap or free electricity and many other distortions, have incentivized the farmers to grow a crop that agro-conditions are not inherently suitable for. For short-term gains they, perhaps unknowingly harm their own land, the air over it and subsurface water.

"One way of reducing Delhi's haze is to correct the distortions introduced over time by the central and state governments. Lower procurement and price distortions will naturally lead farmers to shift to other crops and therefore to reduced paddy cultivation. This will automatically require some farmers to draw less water and, with the reduced burning, improve sustainability of Punjab's fertile lands. It will also reduce the haze over Delhi", the authors say. Some farmers will, of course, continue with paddy farming as they have always done.

Rice Production in Punjab over the years (in 000 tonnes)

Source: Economic Survey of Punjab 2016-17; R=Revised, P=Provisional, E=Estimate

As far as straw collection is concerned, changing technology has changed agriculture practices. Earlier people harvested paddy mannually and took it to a common point for threshing. Today, harvester-thresher combines throw out straw all over the field. "While it was easier to bale the straw collected at a single point traditionally, now it needs to be gathered from all over the field. Labour is also now relatively expensive for this to be done manually", say the authors. Baling machines are expensive to begin with, need diesel to run on and involve other operational costs.

Straw being bulky also has significant transport and storage costs. "So not only is there more straw, it is also increasingly expensive to collect and use", point out Bhandari and Mehra. The stubble is not as easy to remove from the ground as straw is. Though it is only about 20 per cent of what is left over, it is significant.

The authors suggest that zero-till machines, costing about ₹1.5 lakh a piece be used. They would allow the farmer to retain the stubble while he/she plants the ensuing rabi crop, of wheat typically and reduce the seed, fertilizer, water and even tilling costs. "A profitable service of renting out the use of zero-till machines is feasible and will eliminate the stubble burning problem but will take some time to spread", say Bhandari and Mehra.

Traditionally straw has been used as cattle-feed, roofing, mixed with dung for plastering, bedding for cattle and such other purposes. When ploughed back into the soil it retains moisture and has other advantages too but it is low in proteins and not the best cattle-feed. Besides, thatched roofs and dung plastered walls are no longer in fashion and most farmers do not keep cattle with agriculture turning 'modern'.

There is also the pressing need to get the land ready quickly for multi-cropping; sometimes with even four crops annually, which does not allow the farmer to leave the straw on the land long enough for him to be able to plough it back into the soil. The bottomline, rural Punjab does not need straw anymore; definitely not in the quantities that are being generated. Yet there are uses for straw that can be examined:

- While the straw can be used for power, paper, fibre-board and also as cattle-feed, there are better substitutes available and the use of straw is not significant enough in India.
- There is some use of rice straw for paper, typically used for low strength paper like napkins.
- Its possible use for power generation is negated by its high silica and ash content, with its own complications.

Straw, being bulky, has significant transport and storage costs. Also, there is there more straw today, which is increasingly expensive to collect and use

- Straw-board or fibre-board can be used in construction, though, rice-straw has a wax and silica covering that makes it more difficult to use than wood chips, for instance.
- For cattle-feed as well, its hardness and low protein content make it an inferior feed. For each of these uses, there are appropriate solutions that help circumvent the problem.

However, there are costs associated with each use and current techno-economic conditions do not allow widespread use of rice-straw that are commensurate with the volumes produced.

The best solution, therefore, is to find a substitute that can be grown in the erstwhile fertile lands of Punjab that are rapidly getting degraded, thanks to inappropriate rice production and the overdrawing of sub-surface water. Rice, on such a massive scale, is a new entrant into Punjab and such problems

Fixing Delhi's Pollution: Recommendations

	URGENT	IMPORTANT	SIGNIFICANT	SUSTAINABILITY	AVOID
	Paddy to Other Crops	**Unprofitable Field Burning**	**LPG Home Stoves**	**Green Belt**	**X**
Biomass Burning	1. CG+SG – Incentivize sowing of other crops like pulses, cotton, fruits, vegetables in Kharif. 2. CG – FCI to stop purchases of paddy from Punjab and Haryana.	1. CG+SG – Coal power plants to include straw in their inputs. 2. CG+SG -Real-time satellite image-based warning mechanism integrated with local police stations. 3. SG – Ensure zero-till machines in every gram panchayat.	1. Each District Commissioner mandated with ensuring 100 percent coverage of LPG stoves in Delhi, Punjab, and Haryana. 2. Parallel monitoring to ensure uninterrupted supply of LPG in these states.	1. Thick green belt on the western and northern side of Delhi. 2. In the absence of public land, promote orchards and tree-based farming in western and northern Delhi and bordering areas in Haryana.	1. Banning crop burning cannot work and will only alienate farmers, it is better to work with them in changing crops and practices. 2. Punishing informal sector workers and businesses also has little environmental impact with great human misery.
	Cleaner fuel	**Better engines**	**More public transport less private**	**Urban planning & governance**	**X**
Vehicular Pollution	1. CG – Import or buy low sulphurpetrol and diesel. 2. CG – Accelerate conversion of public sector refineries to low sulphur immediately – not in 2020. 3. CG – Introduce pollution cess that applies to high sulphur fuel, and use it to facilitate conversion to low sulphur fuel.	1. CG – Lower GST for BSVI compliant vehicles OR High Pollution Cess on non-BS VI vehicles. 2. CG – High R&D funding and awards for 2 wheeled BSVI compliant engines. 3. CG – High R&D funding for operation of electric 2 wheelers to ccelerate shift	1. CG+SG – Doubling of Metro carrying capacity – more cars per train and frequency. 2. SG – Subsidy for public transport including to Metro and DTC/Pvt Buses. 3. SG – Increase state taxes/fees/cesses on private 2, 3, and 4 wheeled vehicles by more than 100% – including taxis.	1. CG – Urban planning and design centered on public transport and footpaths. Walkability to take precedence over car parking or traveling. 2. MG – Parking of private vehicles (i) at charges pegged to land values, and (ii) not allowed to block footpaths or roads in residential or commercial areas.	1. Focusing on 4 wheelers or commercial vehicles or luxury vehicles will not solve the problem as more than half the vehicular pollution is caused by 2 wheelers. 2. Electric vehicles are too expensive for now to significantly affect Delhi's pollution. 3. Focusing on old vehicles also ineffective as many more vehicles are added every year.
	Cleaning Emissions	**Better Coal**	**Less Coal**	**Reducing coal dependence**	**X**
Coal and Fly Ash	1. CG – Mandate wet scrubbers and electric precipitators in all coal-using power and industrial plants. 2. CG+SG – 100% disposal of fly ash for example for brick making made mandatory. 3. CG+SG – Community/ public real-time emissions monitoring.	1. CG – Mandate only superior and less polluting coal for plants in North-western India, import if not available in India. 2. CG – Mandate increased use of washed coal in plants in these areas.	1. CG – Stop all small coal power plants and put up additional capacity in gas-based power plants. 2. Subsidize gas power with high pollution cess on coal power.	1. CG – Do away with coal power within 10 years. 2. In the interim, only allow the following type of coal plants (a) large and efficient coal power plants that follow strict emission norms, (b) located in high wind areas such as coasts, and (c) located in low population density areas.	Put up more coal power plants, especially in the northern India region spanning Punjab to West Bengal.
	Unsurfaced Roads	**Poor Quality Roads**	**Unclean Surfaced Roads**	**Rural dust + Implementation**	**X**
Soil and Road Dust	1. SG – Converting all Delhi roads to the surfaced category. Similar actions by Punjab, Haryana, Rajasthan, and UP would benefit all, across North India.	1. SG -Resurface/Repair all roads where bitumen is lose or there are potholes, half the roads of Delhi belong to this category conservatively.	1. SG+MG – Change subcontracting practices to ensure quick completion of digging related public works and road building. 2. SG+MG – Covering and water spraying of all roads that have been dug. 3. SG+MG – Vacuuming roadsides to have complete coverage over all roads.	1. SG – Creation of green belt around Delhi either through forests or through orchards or commercial forestry. 2. SG+MG – For proper monitoring of contractors and municipal workers build a community-based monitoring mechanism whose cost to be borne by vehicle registration fees.	Vacuuming roads during high traffic time periods as during that time the fine particles of road dust are already airborne. Best to vacuum roadsides during low traffic times – night times and early mornings.
	Remove waste rapidly and burn less	**Existing waste plants**	**Waste disposal capacity**	**Segregation**	**X**
Solid Waste Burning	1. CG/SG+MG – Make local police and municipal officers responsible in case burning is detected. 2. Make the process of handing out burning related challans simpler and less time intensive. 3. Municipal commissioners should be made liable for non-collection of waste or open dumping.	1. SG – Ensure proper maintenance and 100% capacity utilization of all plants in Delhi and surrounding areas. 2. SG – Ensure 24x7 monitoring of emissions and maintenance.	1. CG – put up new waste to energy plants with latest emission control technologies. 2. CG – Establish new landfills on land owned by government agencies.	1. SG+MG – Segregation of garbage works everywhere in the world. It requires a system of rewards and liabilities for non-performance or non-delivery, and this is possible with a more empowered set of RWAs to monitor and enforce the rules at ground level and made liable for them as well.	Burning of waste in energy plants or elsewhere without 24x7 monitoring by the community and civil society.
	Construction	**Electricity is best source**	**Improved technology**	**Point specific monitoring and display**	**X**
Others (industrial, construction, etc.)	1. MG – Covering of materials and the area being constructed and also regular spraying. 2. MG – Community and NGO Monitoring and reporting. 3. MG – Simpler challan/Public fining method of construction-related polluters.	1. CG+SG – Guaranteed 24x7 and 100% supply of electricity for all residential and commercial establishments in Delhi NCR. 2. SG – Eliminate all generators and machinery drawing energy from petroleum fuels in Delhi NCR, only battery-based backup systems should be allowed, apart from emergency services like hospital, ICUs etc.	1. SG – Mandatory change of old transformers, generators, etc. 2. SG – Convert presswalas, tandoors etc. to electricity based options, to be done through first, listing of all such units, followed by exchange, involving RWAs and market associations. Some economic incentive and liability required.	1. SG – Real-time public display of data from each of the pollutant made available on the cloud. 2. SG+CG – Use airborne infrared monitoring to detect pollution in hard to get areas such as slum interiors.	1. Stopping or banning economic activity without access to an economically viable substitute. 2. Government functionaries implement with little day to day answerability or overseeing – instituting liability on the government and its functionaries is critical even if it is minor. 3. Retaining current system of hallans without a simple small fee-based punishment regime is avoidable.

CG = Central Government, SG = State Government, MG = Municipal Government

Fixing Delhi's Pollution: Mechanics

	Key Data	Science	Economics	Technology	Policy
Biomass Burning	1. 14.4 mill ha. kharif rice. 2. 5.3 mill households in Delhi, Punjab, and Haryana use biomass/coal for cooking. 3. Similar levels of particulate matter released by burning fields and biomass stoves.	1. Paddy straw has high silica, is hard and difficult to process and is also bulky – high volume to weight ratio. 2. Biomass stoves create both indoor and outdoor pollution.	1. Collection and disposal of straw and stubble are expensive, and its price low because of few uses. 2. Difficult to supply LPG universally.	1. Mechanical harvesters spread straw on the field and leave more stubble than manual harvesting. 2. Zero-till seed drills are expensive and not yet popular among farmers. 3. LPG stoves create far less pollution and insignificant PM.	1. The government gives incentives for paddy and purchases a high share from north-west India, is harmful to due to overdrawing of underground water. 2. LPG use expanded after Ujwala Yojana but many households not yet covered.
Vehicular Pollution	1. 80% of coal despatches in India go for coal power. 2. 27 coal power plants to the west and north-west of Delhi. 3. Most operated by central or state government-run entities. 4. Less than 6% of coal used is washed. 5. Of the 104 units in these 27 power plants, 46 units are 210MW or lower that are most polluting per unit energy.	1. Indian coal is low in sulphur so desulphurization not historically done; low calorific value requires more coal per MW produced. 2. Coal production releases ash, Nox and Sox compounds. 3. New technologies involve very large power plants that pollute less but much more than other sources.	1. Coal believed to be 'cheap' as (i) cost of pollution is not considered, (ii) lower emission equipment not used, and (iii) cheap high polluting inputs used till now. 2. Current pricing policies work against the operation of low polluting Natural Gas power plants. Other renewable substitutes can not be scaled currently.	1. Indian coal power plants among the least efficient and most polluting in the world. 2. Even globally, the latest coal power plants much less dirty but still highly polluting. 3. Coal plants can be converted to Natural Gas or biomass-powered; improved technologies can improve efficiency and emissions, but limited ongoing attempts.	1. Cash-strapped electricity boards, power, and coal govt. monopolies, little focus on environment till now. 2. No program yet for the improvement/closure of coal power plants. 3. Enforcement of emission regulations susceptible to corruption. 4. Information of pollution from each source point not captured or available publicly.
Coal and Fly Ash	1. CG – Mandate wet scrubbers and electric precipitators in all coal-using power and industrial plants. 2. CG+SG – 100% disposal of fly ash for example for brick making made mandatory. 3. CG+SG – Community/ public real-time emissions monitoring.	1. CG – Mandate only superior and less polluting coal for plants in North-western India, import if not available in India. 2. CG – Mandate increased use of washed coal in plants in these areas.	1. CG – Stop all small coal power plants and put up additional capacity in gas-based power plants. 2. Subsidize gas power with high pollution cess on coal power.	1. CG – Do away with coal power within 10 years. 2. In the interim, only allow the following type of coal plants (a) large and efficient coal power plants that follow strict emission norms, (b) located in high wind areas such as coasts, and (c) located in low population density areas.	1. Put up more coal power plants, especially in the northern India region spanning Punjab to West Bengal.
Soil and Road Dust	1. Delhi has 8,686 km of kucha roads. 2. Agriculture land to the west and north-west also contributes unknown amount. 3. Road construction and urban digging for pipes etc. contribute an additional significant amount.	1. Particles on the road that includes – dust, pollution, tire, bitumen, and exhaust are suspended due to the wind, and kinetic energy from vehicle movement. 2. Dug soil from public works and roads, from agriculture and also sands of Rajasthan further worsen the problem. 3. Delays and poor practices in public and road works.	1. Vacuuming or washing are expensive solutions to road dust. 2. Poor road maintenance. 3. Together, these create more road dust than well-maintained ones. 4. Delays in payment to contractors lead to dug soil remaining uncovered.	1. Little understanding of tyre or wheel design, road quality, speeds and how they interact under varying climatic conditions to produce SPM. 2. R&D on the effectiveness of possible solutions such as tire flaps, wheel covers, vacuuming, washing roads, etc. are rare. 3. Reduction in time taken to construct public works/roads needed.	1. Local government unable to monitor own staff or subcontractors. 2. RWAs and Non Profits are neither empowered nor made responsible or liable currently. 3. No liability on city managers for not carrying out functions. 4. Delays in payment to contractors combined with little answerability for delays for both contractors and city managers.
Solid Waste Burning	1. Delhi generates 12,000 tonnes of waste daily. 2. About 8,000 tonnes goes to overflowing landfills. 3. Waste to energy plants exist with capacity of more than 6000 tonnes but, cannot be used well as most garbage is not segregated. 4. Much of the garbage is either burnt to create space or rots in the open or is thrown into waterbodies.	1. If segregated, wet waste can be composted, dry waste such as glass can be recycled, or converted to energy like some plastics. If not segregated, compositing, recycling, and waste to energy – all processes get adversely affected.	1. Segregation best if done in the household, costlier if done immediately after collection, and inefficient later. 2. Waste to energy and landfills require proper maintenance and outside monitoring of practices, emissions, and quick responsiveness. 3. Informal sector undertakes low-cost segregation but not feasible for items like cheap plastics etc.	1. Segregation, well-managed landfills, and waste to energy plants are well-known solutions but need subsidization. 2. Proper operating procedures and following best practices are critical and need organizational strengths. 3. Third party or community 24x7 monitoring, and rapid responsiveness has to be an integral component.	1. Municipal governments under-resourced and incapable, unable to meet the demands of a more service-oriented society. 2. The municipal commissioner is empowered but not liable for poor performance. 3. The political leadership is liable through elections but not empowered. 4. Communities and RWAs not empowered, liable or made responsible.
Others (industrial, construction, etc.)	1. Industrial units that use petroleum or coal-based energy or chemicals based processes form about 2/3rd of this component and also include Brick Kilns in and around the city-state. 2. Construction and stone cutting account for about a third. 3. Data on sales of coal suggests that the informal sector (presswalas, tandoor etc.) are a small contributor.	1. Particles are generated in stone cutting or mining and are also suspended in mixing of cement, sand, concrete etc. 2. Commercial generators, electricity transmission, etc. all naturally generate some emissions. 3. In all such cases, good practices and better technology can substantially reduce pollution.	1. Sources include those from organized, informal and illegal units. 2. Pollution reduction is costly corruption among government staff is common. 3. Greater stringency in law leads to greater corrupt behaviour, not reduced pollution. 4. Open community monitoring can address both pollution and corruption but has not been tried yet.	1. Pollution from construction and stone cutting can be reduced by (a) covering of the area/ materials and (b) spraying water. 24x7 monitoring difficult for both government and managers of such units. 2. Industrial pollution can be reduced via emission reduction equipment and use of better inputs and technologies.	1. Corruption and limited abilities of local government staff prevent good implementation of stringent laws. 2. Need to incentivize the use of less polluting inputs and technologies by taxing more polluting ones. 3. The public sector to stop selling polluting fuels such as PET. 4. Incorporate community monitoring, municipal enforcement and liability for non-enforcement in emissions policy.

associated with it should be addressed. This can be achieved, if the MSP and other incentives are changed to account for greater returns in less polluting crops and the Food Corporation of India follows a more distributed strategy of paddy purchase from other states, say the authors.

The point is that MSP was initially devised for all crops but has been appropriated by wheat and rice. The authors suggest that:

- MSP be used in such a way that other crops like pulses with lower residue are incentivized. That straw/ stubble not be burnt and instead options such as the zero till machines that do not require destruction of the stubble before replanting be considered. These provide livelihood sources as well.
- These machines need to be subsidized and provided to rural entrepreneurs and panchayats on a large enough scale.
- Alternative uses for collected straw be found. Adding straw or its briquettes to coal power production is a feasible option provided plants using them have working fly ash reduction equipment. Straw from rice is high in silica and will otherwise increase greater fly ash generation.
- If the straw can be used and a market created for such uses, there will be an increased incentive for the farmer to collect it and not burn it.
- There is another possible negative impact should higher incomes on account of straw lead to over production of paddy, straw burning may well increase.

The best solution of course lies in governance; monitoring and enforcement. Satellite or air imagery can help pinpoint farms where fields are being burnt.

$PM_{2.5}$ Emission Generated by Crop Burning

State	Gross Cropped Area (000 hectare)	PM2.5 from Crop Residue Burning (tones per year)*
Delhi	33.4	70
Haryana	6471.0	35,800
Punjab	7900.0	83,150
Uttar Pradesh	26100.0	86,760
Rajasthan	24235.3	10,820

Source: "Emission of Air Pollutants from Crop Residue Burning in India." by Niveta Jain, Aarti Bhatia, and Himanshu Pathak: Centre for Environment Science and Climate Resillient Agriculture, Indian Agricultural Research Institute. Economic Survey of Haryana 2016-17. Department of Land Records, Govt. of Haryana. Economic Survey of Punjab 2016-17. Government of Punjab. Economic Survey of Delhi 2016-17. Directorate of Economics and Statistics, Government of NCT of Delhi. "During the year 2008-09. Converted from 1,000 tones per year.

Photo: Pixabay

A 24x7 monitoring mechanism can help identify and enforce the laws if they are directly connected with local police stations. If such enforcement is not possible, such laws and court mandates banning straw burning also should be eliminated.

Clearly, changing the crop mix in Punjab will lead to the most desirable outcome. In any event, rice requires substantial sub-surface water in Punjab and is known to be responsible for great environmental damage. The centre, through the FCI, can be a leading influencer in changing choice of crops; it can make a beginning by not subsidizing crops that are not desirable. "Changing the incentives for the farmer could encourage them to shift to much needed pulses, cotton, or fruits and vegetables, or commercial forestry" and such others. The authors say that while this may be costly "but most likely to be effective if prices are synchronized such that they incentivize the farmers to substitute from one crop to another".

Bhandari and Mehra add that "only in extreme cases, where all possibilities of incentives and substitution of source or technology are exhausted, should measures that involve banning be considered. Banning crop burning, for instance, will harm farmers and rural incomes, it is better to incentivize the use of seeding drills". This substitution of technology (from conventional seeding to zero till seed drills) will need government support. ●

ORGANIC GROWTH

THE WORLD ORGANIC CONGRESS

The Good and Not-So-Good Takeaways

Bharat Dogra

Photo: Reena Mehta

Ramkrishna Murmu, a young farmer from Bankura, West Bengal, visited the 19th World Organic Congress held near Delhi, in Greater Noida recently. The tribal from Bengal's remote rusticity found himself transported to a world of very modern exhibition halls. Murmu, inherently smart, quickly adjusted to the glitz and the glamour and, along with his elderly companion, began enjoying the experience, making friends and engaging with them. He met several farmers from various places and learnt from the interactions, he said.

BHARAT DOGRA
Senior journalist, specializing in the farm sector

In all of this Murmu was well served by one advantage that he and his friend had; one that is not available to most other farmers. Both have been associated with a voluntary organization that could look after their travel, stay and related expenses. Many who had come without such linkages found the expenses for accommodating themselves in the National Capital Region prohibitive. The financial burden was all the more severe because this was a "no selling" event.The rent for a marketing stall at ₹70,000 for three days was harsh on the pocket.

Opinion differed from one participant to another on most issues but there was unanimity over the fact that World Organic Congress — organized by the Organic Farmers' Association of India, teaming up with the union agriculture ministry — had provided an excellent platform for organic farmers and seed conservers from all over the country and the world to engage with each other, exchanging ideas and information with them, learning from them and sharing their own stories, about their own work. For all, this has been a rewarding experience, even through the three-day window was too small for such an important event.

Farmers not generally being au fait with such events took most of day 1 to settle down; day 2 passed quickly and day 3 was cut short by a couple of hours and some scheduled events cancelled. Unfortunately again, all the three days were notoriously high-pollution days in the region with the overpowering smog levels keeping several potential visitors away.

Despite this, the World Organic Congress — organized once in three years and held in India for the first time in its 40 year old history — registered nearly 2,200 delegates from 110 countries and visitors from many others. Organic farmers and seed conservers came from even remote parts of India — the organizers had made special efforts to have them over — and there were government representatives from many states too. This was all the more reason why the congress should have been a seven-day affair, giving more people a chance to visit it. It takes some time for word to spread and for people to start coming to the event that was not well-publicized. It all ended before many interested people even heard about it.

Those who managed to reach were well served by the presence of so many experienced seed savers

The World Organic Congress had nearly 2,200 registered delegates from 110 countries and visitors from many others. Organic farmers and seed conservers came from afar

Seed as lifeline

"Seed being a lifeline of agriculture has become political. Seed conservation is important but at the same time seed saving has a political angle. We are dealing with life itself that is why the act of seed saving is such an important political act in this time.

There is a need to understand the threats to seed saving, organizing ourselves to save the seeds, exchange, do everything that it takes to protect and rejuvenate the seed. But at this point, industry is hungry to have absolute control. Controlling our seed means control over our food, our seed, and our freedom.

The industries will not tolerate even a single farmer to have his own seeds, where he has the liberty to save, exchange or share. As a result, seeds are becoming the private property of a handful of corporations, transforming the tradition of saving seeds into a political act.

In India farmers everywhere have been saving seeds for centuries, preserving the most durable ones for replanting every season. Seed saving was different until India signed an international trade agreement giving multinational corporations permission to patent, own and sell seeds.

— JACOB NELLITHANAM
2nd National Seed Savers Meet, Chandigarh 2015
(http://ofai.org/wp-content/uploads/2012/12/BBSM-2015-_II_.pdf)

Photo: Reena Mehta

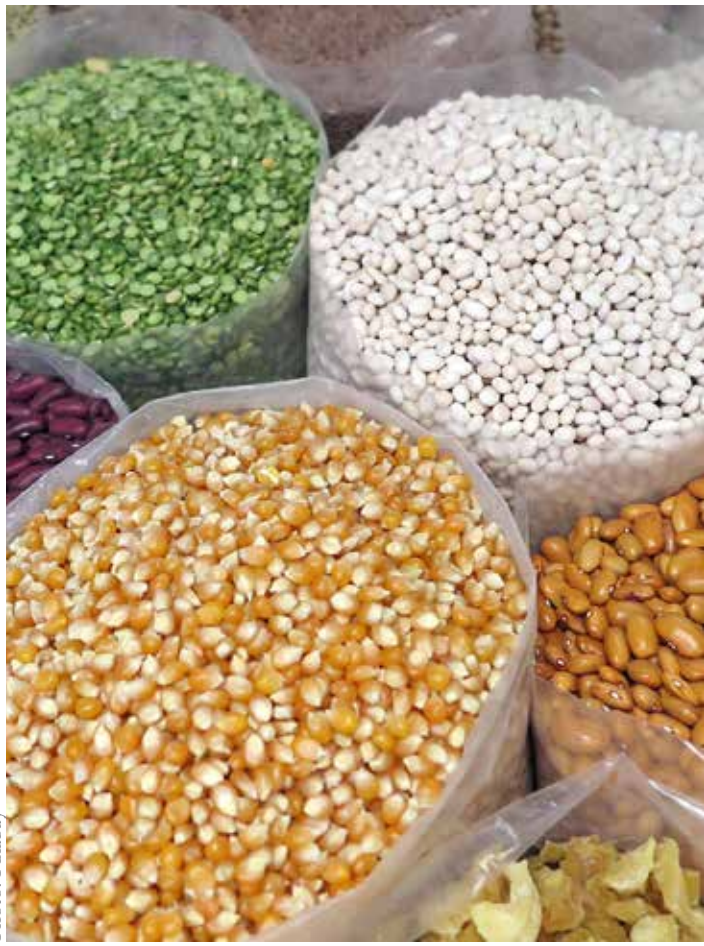


Photo: Pixabay

and conservers from many regions belonging to the wider Bharat Beej Swaraj Manch (BBSM). BBSM or India Seed Sovereignty Alliance is a nationwide network of seed savers for conserving and regenerating crop and plant biodiversity and self-reliance in seeds. Its mandate includes promotion, exchange and sharing of traditional seeds of crops, allied wild plants and food plants obtained from forests as well as protection and strengthening of farmers' seed sovereignty.

This Alliance emphasizes the urgent need for Living Seed Banks of Traditional Varieties. The BBSM opposes any privatization of India's seed

Even government officials seem to be coming closer to an understanding of seeds related issues and devoting attention to the protection and collection of traditional seeds

Building Network

A National level 'Beeja Swaraj Manch' has been formed with 100 dedicated seed committees from 18 states of India. The Manch consisting of farmers, seed savers, intellectuals, individuals, experts, scientists of several states like Karnataka, Orissa, Chhattisgarh, Bihar is in the process of building a network. Maharashtra has already formed seed savers' groups and is organizing Beej Utsav, and Uttar Pradesh has started the process of forming groups. These states have begun their work in identifying local genetic wealth of each area and are organizing support for conservation of seeds. The main objective is to assess the need for a national level network of seed savers', breeders' and representatives of farming communities working towards seed diversity revival and self-reliance in seed. Representatives of each network should create mechanisms and plan objectives and strategies for the network to move forward. Each state could share their experiences and this meeting should be able to reach a consensus towards the next steps.

— KRISHNA PRASAD

National Convenor, Beeja Swaraj Manch, 2nd National Seed Savers Meet, Chandigarh 2015 (http://ofai.org/wp-content/uploads/2012/12/BBSM-2015-_II_.pdf)

Voice of Seed Saver from Orissa

"Hybrid seeds have been developed with only yield being the focus but traditional seeds are being neglected though they have nutritional qualities and could be farm saved and shared among farmers and, importantly, they are rarely bought. Seeds are related to our culture, health and social and national sovereignty. Once you lose seed sovereignty, you lose these rights as well. In Orissa many of our tribal communities have shifted from growing millets, pulses and oilseeds, all attuned to local needs and are growing corn which is used for export only. Now economic benefit takes top priority in agriculture, to this we have lost our culture and tradition. In this context, we have been able to revive some of the rice varieties that have proved to be a challenge to hybrids. This network should focus on unifying the efforts of individual seed savers and handle the issue of purity of seed varieties through capacity building workshops across the country. Even non-farmers should contribute and be a part of the movement which can also contribute to revival and conservation of indigenous seeds".

— 2nd National Seed Savers Meet, Chandigarh 2015 (http://ofai.org/wp-content/uploads/2012/12/BBSM-2015-_II_.pdf)

Photo: Pixabay

and genetic resources and traditional knowledge and calls for their protection and regeneration as a collective open source heritage, free of any exclusive or restrictive Intellectual Property Rights, patents, licences and such other limitations.

The presence of several members of the organization at one compact place for three days clearly presented a major interactive venue not only with the larger audience but within the members themselves on emerging facets of seeds and related issues. Even some government officials and their departments too seemed to be coming closer to a similar understanding of seeds related issues and devoting a lot of attention to the protection and collection of traditional seeds.

One such effort is based in the Nadia district of West Bengal; its stall attracted considerable attention at the Congress. The Agriculture Training Centre at Fulia, Nadia has traversed beyond its given mandate of capacity building and has been endeavouring since 2002 to conserve and nurture several traditional rice varieties, particularly aromatic rice varieties and other related bio-diversity. Highlights of its efforts include conservation of 427 folk rice varieties, including 51 scented varieties, advisory to 26 seed centres/user groups across the state, advisory on organic farming and participatory research. Such state-level initiatives are very important for seed conservation as well as for the organic farming movement in India and it was useful for officials and farmers with similar inclinations to interact.

Marketing was another important facet of the Organic World Congress that was integrated with the Biofach organic produce trade fair. This was to facilitate networking of organic food companies with organic farmers. What was worrisome is that this aspect overshadowed the even more important aspect of strengthening the livelihoods of small farmers and ensuring that organic farming and eco-friendly farming became a way of life. While the business perspective demands better margins on securely certified organic products,

Seed Saver, Madhya Pradesh

Seed is the first link in the food chain. Free exchange of seed among farmers has been the basis of maintaining biodiversity. Such an exchange mechanism should be developed in this network. This network should work for revival of the free exchange of seed, the seed supply system that was followed by the farmers. Seeds were exchanged for free along with exchange of ideas and knowledge, which helps in strengthening of traditional knowledge and skill. Introduction of hybrids has wiped off all this traditional knowledge.

We need to pay attention to all these aspects and this network should further urge all organizations and farmers to form community based agriculture that encourage conservation of genetic resources and traditional knowledge. We need to fight against the current form of seed bill and the anti farmers policy of the Government.

— 2nd National Seed Savers Meet, Chandigarh 2015 (http://ofai.org/wp-content/uploads/2012/12/BBSM-2015-_II_.pdf)

there is a clash with the more humble though even more critical objective of protecting the small organic farmer.

Such farmers have a low resource base and cannot pay high certification costs or aspire to the high margins of marketing firms. For them, keeping costs minimal is important. For some, particularly those from tribal communities, eco-friendly farming and other eco-friendly methods of obtaining food sans any green house gas emissions and pollution are integral to their way of life. It is critical that this way of life be understood and supported, particularly in times of climate change, instead of being condemned as backward. This wider perspective is missing in a 'business only' understanding of organic farming.

Clearly there was a case for a greater highlighting these aspects of organic farming. One initiative

Small organic farmers and farming tribals have a low resource base and cannot pay high certification costs or aspire to the high margins of marketing firms

Photo: Pixabay

Seed Saver, Andhra Pradesh

We need to have a network that voices the farmers' problem. This network should be a platform for farmers to fight for their rights. Our millet seed savers and farmers are deprived from receiving any benefit from the Government. When cyclone occurred in our area all the farmers' fields were destroyed.

The Government visited the area to survey the destruction of crops and compensation was paid only to big estates that have plantations of coffee or pepper, but not the small/marginal farmers. So, poor farmers were not considered, as their crops are not significant. This network would help fight for farmers' rights.

— 2nd National Seed Savers Meet, Chandigarh 2015 (http://ofai.org/wp-content/uploads/2012/12/BBSM-2015-_II_.pdf)

Seed Saver, Chhattisgarh

Conservation as well as the traditional practices need urgent attention. Unless we document the practices and put our traditional knowledge into practice, we may leave nothing for the future generations. Current agriculture system saps soil nutrients, we need to come out of this vicious circle of monocultures and monopolies, we need to create virtuous cycles of diversity and reclaim our biological diversity and knowledge associated with our seeds.

— 2nd National Seed Savers Meet, Chandigarh 2015 (http://ofai.org/wp-content/uploads/2012/12/BBSM-2015-_II_.pdf)

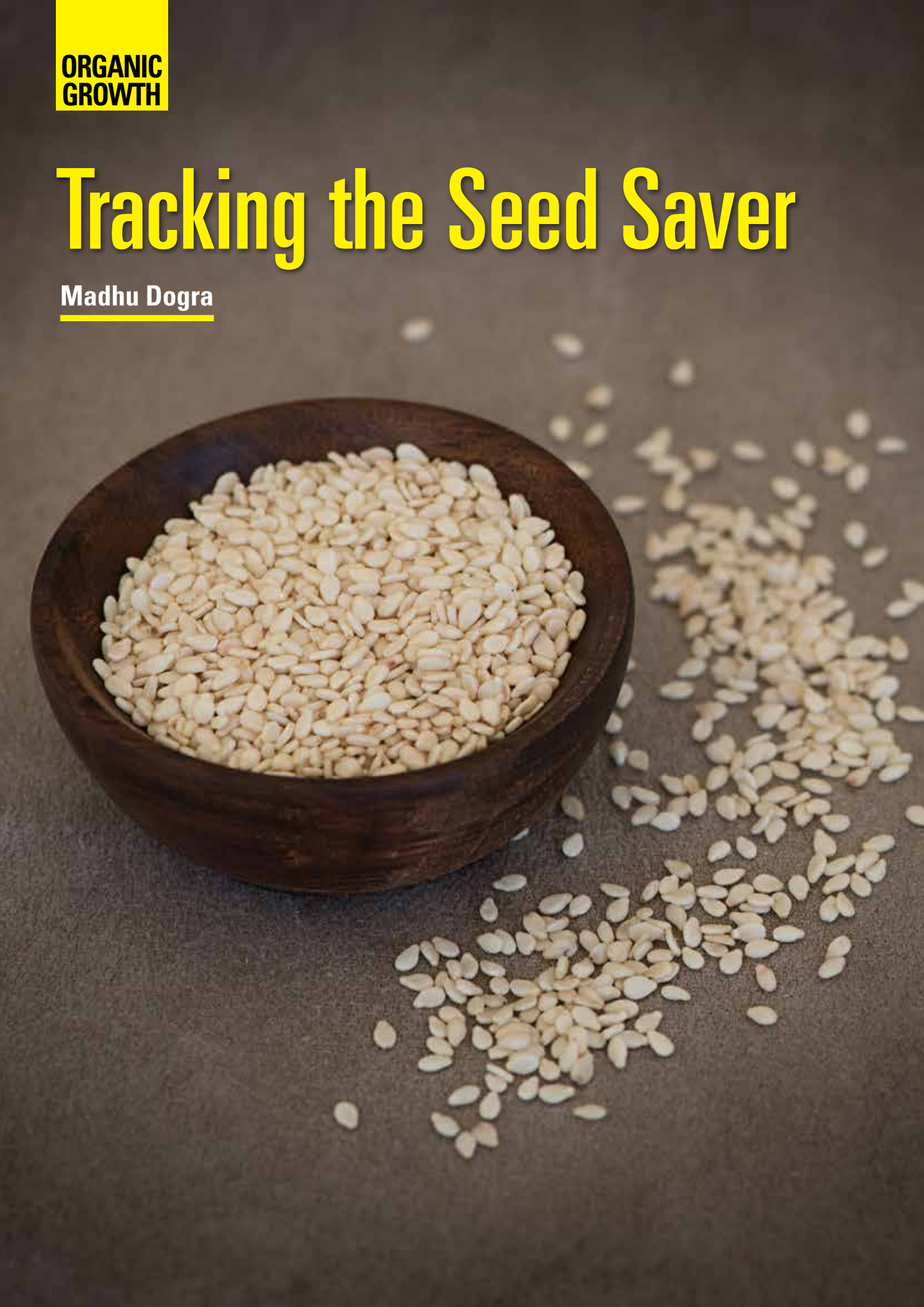
emphasizing small farmer households is Bhumi Ka, supported by organizations like Welt Hunger Hilfe and Living Farms. It has tried to link all people in the food supply chain to ensure clean, green and fair food that is responsibly grown and for which the small farmer gets a fair price. Anshuman Das, a co-ordinator of Bhumi Ka says: "In future efforts of such events, it will be good if the livelihood concerns of smallholders farmers get the highest importance. We need to get our priorities right and we need to be careful about this".

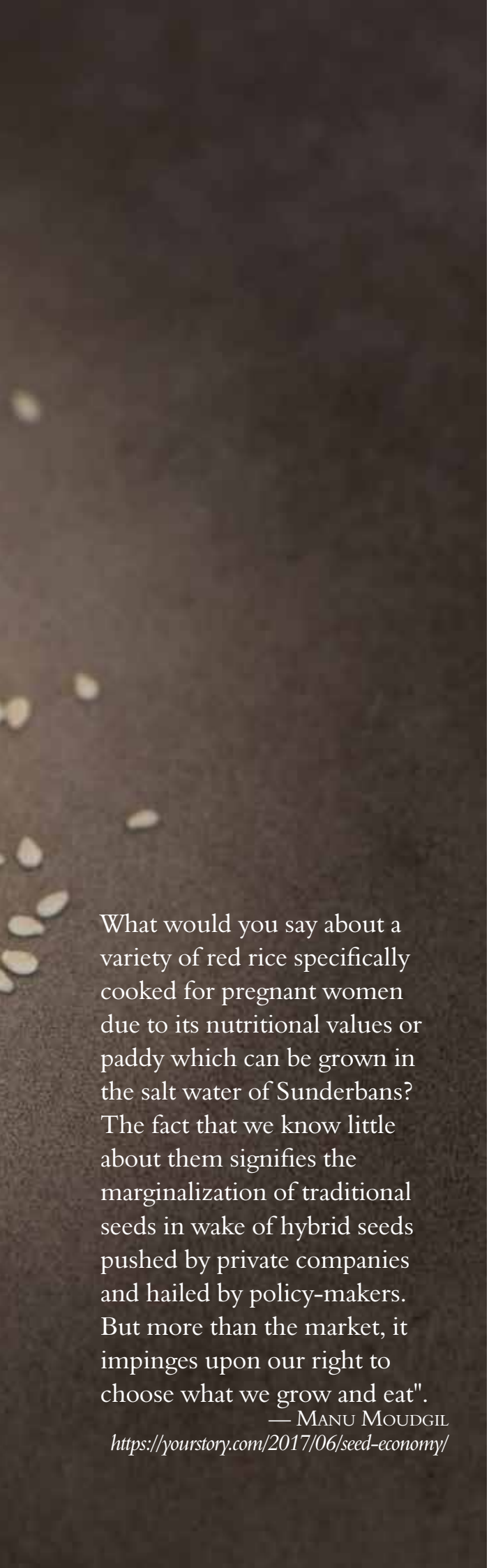
The bottom line is that an excellent initiative that served the cause of the organic movement in India needs to shift the balance of focus on the small farmers. Without that the organic movement, like most others, will be hijacked by the bigger players. ●

ORGANIC GROWTH

Tracking the Seed Saver

Madhu Dogra





What would you say about a variety of red rice specifically cooked for pregnant women due to its nutritional values or paddy which can be grown in the salt water of Sunderbans? The fact that we know little about them signifies the marginalization of traditional seeds in wake of hybrid seeds pushed by private companies and hailed by policy-makers. But more than the market, it impinges upon our right to choose what we grow and eat".

— Manu Moudgil

https://yourstory.com/2017/06/seed-economy/

Photo: Pixabay

Kunwar Prasun and his wife, Ranjana were a picture of dedication. This was several years ago, when Prasun was still around and making extraordinary contributions to the organic movement then in its nascent state. He was on his farm when I visited, sowing some rare varieties of rice that were to be grown there.

MADHU DOGRA is a freelance researcher, involved with publishing socially relevant books and preparing community library book sets

This was Rampur village of Tehri Garhwal district of Uttarakhand. Prasun and Ranjana had taken great pains to acquire the virtually lost seeds from remote places and were now growing them. The idea was to distribute these seeds to other interested farmers as well. These very useful varieties were earlier available near their village but had become locally extinct subsequently.

This very important couple made a significant contribution to the seed saving movement that has been slowly gaining currency in the country. "Seeds cannot be saved by just keeping them in gene banks", Prasun told me. He always preferred the most sustainable and trusted solution: making them available on the farmer's field. That is where they find their natural saviour while they confer benefits to the farmer.

The Henval river valley's contribution to India's ecological well being may be unknown to most. This is the valley where the Chipko Movement for saving forests made important advances and in the process also created a crop of committed activists who understood the critical need to locate and conserve lost varieties of seeds.

The late Kunwar Prasun, Vijay Jardhari and their teacher, Dhum Singh Negi were the pioneers of the Beej Bachao Aandolan; spreading the message to all local homes, sharing seeds, influencing women farmers in particular. Some 300 rice varieties of Uttarakhand have now been carefully documented; the experience with these seeds captured as well; their merits and problems are now a part of this knowledge bank that is available in public domain.

In Nagni village, Vijay and his wife Kamla are just as conscientiously focused on threatened traditional varieties of various crops. They are sowing some dozen crops in an intricate mixed cropping system, which has evolved over several generations, in keeping with the nutritional needs

Photo: Pixabay

as well as the soil, water and climate situation.

One crop that takes nutrients from the soil is complemented by another one which gives nutrients to the soil. Many types of highly nutritious foods become available from a small plot of land. The creepers of some of the crops can get the support of tall stalks of some other crops.

The growing 'big business' entry into the seeds space signifies exclusive control and alien culture while traditional seed varieties denote the spirit of commons and local ethos

The sheer strength of their performance has helped take on the bureaucratic fascination with monoculture and corporate controlled gene banks with their limited focus and narrow objectives.

In Bhopal, the legendary R.H. Richaria had continued his research efforts at his own farm near his home in Bhopal. Additionally, he worked hard to complete his documentation of over 17,000 varieties and cultivars of rice mainly from Chhattisgarh, Madhya Pradesh and nearby areas.

His position had been all about respecting diverse conditions and diverse rice varieties that have evolved over many generations, courtesy efforts of many experienced and committed farmers with a lot of knowledge of local seeds. It is this indigenous germplasm that should be used for ensuring good and secure rice cultivation, he had said.The experienced farmer's knowledge should be integrated with the conservation effort was the second most important lesson.

In Chhattisgarh, Rupantar, tried to implement a seed conservation and farm development effort based on the Richaria tenets in the Nagri Sihwa region in a couple of demonstration-cum-seed multiplication farms. Nearly 270 varieties of rice were being grown here. By pure line selection good quality seeds were obtained so that farmers in several villages could be self-reliant in good quality seeds.

This work was being taken forward by Dr Binayak Sen and Dr Ilina Sen helped by a young botanist, Suresh Sahu but the progress could not be sustained as Rupantar succumbed to state pressure.

There are welcome endeavours in Andhra Pradesh, Jharkhand, Odisha and West Bengal; some of them showcased at the Organic World Congress at Greater Noida near Delhi.

Manu Moudgil (*https://yourstory.com/2017/06/seed-economy/*) talks of Sabarmati, a farmer and seed saver from Odisha, who takes on those promoters of seeds who are bent on monopolizing Indian farming practice.

"Farmers preserved the seeds not just because of the high yield but for their properties like drought resistance, flood resistance, fragrance, etc. Monopolization of a few hybrid seeds reduces our choice to grow and eat the food we want", she says.

The point is that at least among some farmers the organic message is catching on and they are getting to the core of the matter: that growing big business entry into the seeds space signifies the exclusive control and alien culture while traditional seed varieties denote the spirit of commons and local ethos.

Saroj of Paschim Orissa Krishak Sangathan feels that the arrival of seeds alien to the land is the first indicator of political changes bound to happen. "Seeds are related to our culture, health, and social and national sovereignty. Once you lose seed sovereignty, you lose these rights as well".

The India Seed Sovereignty Alliance has given a clarion call "shun and resist the use of Genetically Modified products, to strive to influence public policies to keep them out of our food, farms and environment".

It is time to take the message to the hearts and minds of India's farming community. Fortunately, even committed officials in several states are coming round to this line of thinking and that is the one big cause for hope as the seed saving movement enters year 2018. ●

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