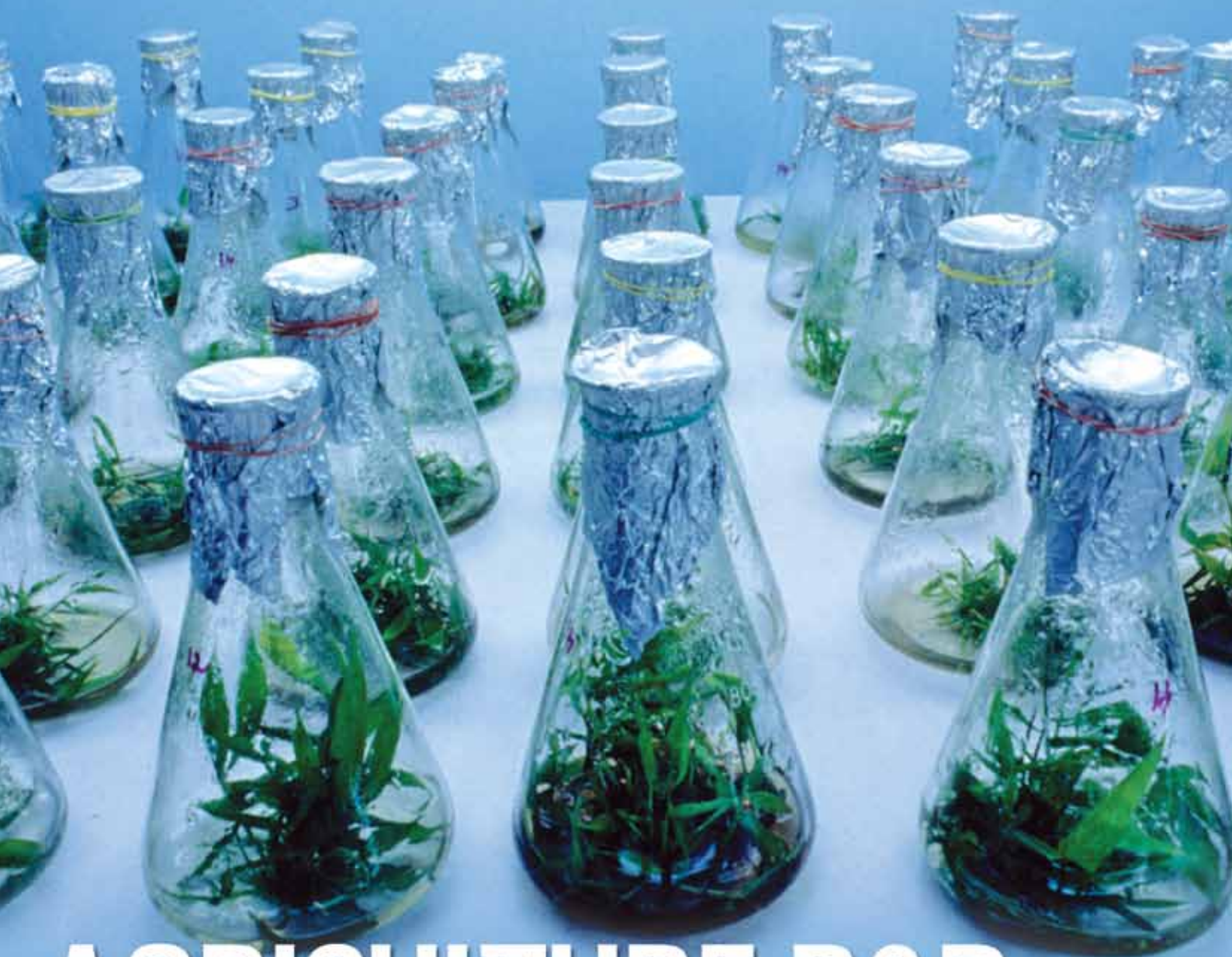


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Issues and Ideas for Indian Agriculture



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The 'BEST' is Rarely 'POPULAR'

Of popular politics and poor policies

The hullabaloo over the deemed success of the Bali meet of the World Trade Organization (WTO) makes it clear even to the meanest intelligence that the WTO is more debated than understood. The WTO was designed, amongst other things, to stem a fall in prices but food prices have been rising for the past so many years; more so from 2007. Food importing countries, usually the developing ones, are not overly interested in reducing subsidies in developed countries because a reduction in subsidy would increase the cost of food imports.

Trade is a given need and, therefore, the requirement for a world trade organization to facilitate it. When India initially signed the WTO agreement, it may not have been detrimental to farmer interests and it would enable exports by other sectors. India did not try to use the fine print to its advantage. A lack of understanding and co-ordination between the different ministries of the government of India and a complacent attitude over the last decade has, however, caused immense suffering.

Cash subsidies can easily be classified as blue box subsidies, which can be continued without attracting quantification requiring reduction, unlike the amber box subsidies. In 1995, the blue box subsidy was agreed to as a temporary measure but it has since become a permanent feature as it has not been conclusively debated to its logical conclusion. Blue box subsidies thus must be abolished and there should be only two categories of subsidies: green box and trade-distorting subsidies.

The developed world did not quite follow the WTO in spirit by reducing subsidies; it did so in letter only. Very cleverly, the USA continually changed much of the form in which it gave subsidies, thereby transferring them from the amber to the blue box. India must share part of the blame, instead of always blaming others. It designed subsidies without application of mind; the subsidy limits should have been quantified with penalties imposed if the limits were crossed.

The point is that if the Food Security Bill provisions had required cash delivery instead of mandated subsidized grain delivery, the country would not need to sign the four-year reprieve of the 'peace clause' in Bali and claim it as a victory. Bharat Krishak Samaj is of the opinion that a lot of changes are required to the WTO agreement.

THE DEVELOPED
WORLD DID
NOT QUITE
FOLLOW THE
WTO IN SPIRIT
BY REDUCING
SUBSIDIES;
IT DID SO IN
LETTER ONLY



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04

WILL 2014 BE THAT MAGICAL YEAR WHEN THE INDIAN FARMER REGAINS HIS PLACE IN THE PRIORITIES LIST OF THE NEW GOVERNMENT IN INDIA?

farming science but more is spent on cosmetics. The global military expenditure in 2012 was \$1,753 billion. Investment in agriculture is a drop in the ocean when compared to the finance available.

For the practicing farmer, the lack of research means tremendous trauma given the compulsions of climate change. To quote from personal experience, at the grassroots level, the arrival of the *kohra* or frost on the ground in December-January – when the nights are clear and the air cold and dry create perfect conditions for a frost attack – fills a farmer with fear. Frost damage leaves the plants scorched and brown as if burnt and the fruit unsaleable. Sometimes, plants simply die. In the yesteryears, the farmer would create smoke in the field at night to stop frost from forming or flood water on the field to mitigate the damage. Today, he would run afoul of environmentalists.

Bharat Krishak Samaj has insisted that environmentally sustainable practices will be adopted by farmers at large if they are economically sustainable in the immediate term. Will research find the answers for these very real life and death issues for the Indian farmer? Will 2014 be that magical year when the Indian farmer regains his place in the priorities list of the new government in India? On that thought, here is wishing you a very happy new year. ●



Ajay Vir Jakhar
Editor

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To the Editor

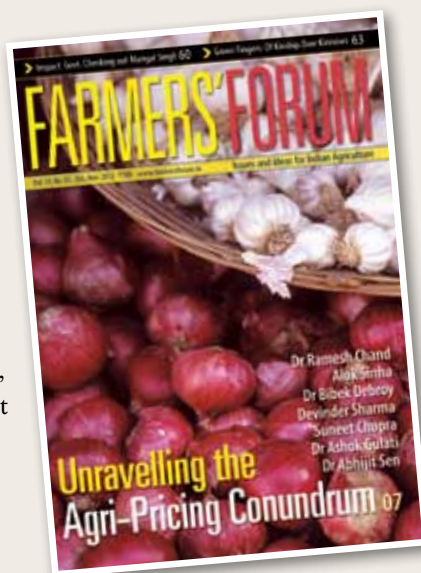
Gems are for polishing

The initiative taken by your magazine in publishing the story of unsung hero Mangal Singh under the 'Impact' column, "Government Checking out Mangal Singh" (*Farmers' Forum*, October-November 2013) is an eye opener. There is little doubt that the Mangal Turbine has a very high potential for saving millions of litres of diesel, reducing greenhouse gas emission and helping farmers to irrigate their fields at a low cost. The government should acknowledge such accomplishments and provide every possible support to these gems so that they do not lose their shine.

Hari Narain,
New Delhi

Sustaining farmers

Your editorial "Disincentivizing the Farmer" (*Farmers' Forum*, October-November 2013) truly reflects the condition of the Indian farmer and plight of Indian farming. When we talk of sustainable agriculture, we perhaps forget that the farmer must primarily find himself in a sustainable occupation if farming is to become sustainable and the country fed with food that is reasonably affordable. There is so much that application of science and technology can do to address problems of Indian agriculture. Why is it that the government, which apparently wants to control food prices and preserve food and even ensure that food is a basic right for every Indian, does not understand this simple issue?



First hand is first class

Your article under 'Green Fingers', "Of kinship over kinnows" (*Farmers' Forum*, October-November 2013), is a must read for every citrus farmer who wants to know what is going on in the neighbouring country. Such first-hand reports by a practicing farmer, after having interacted with other farmers, is educative and presents a picture that is true, honest and useful in terms of giving information that is relevant. It was also interesting to learn that there is no free electricity for farmers in Pakistan.

Rajeev Jain,
Chandigarh

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is now up and running.
Log in to check out all
earlier numbers.**

One cannot but applaud you for concluding that the country needs to introspect if sustainability is to be restored to agriculture and in the lives of those who practice it. Failing this, the dissatisfaction on the farms in other parts of the world will inevitably reach the doorstep of the financially well-endowed, in forms such as migrations and terrorism.

Harit Tyagi,
Sonapat (Haryana)

Water, water

It was most interesting to read Dinesh Kumar Mishra's exposition on "Floods and the river's 'right of way'" (*Farmers' Forum*, October-November 2013). It would seem that ill-informed policies have, over the years, worsened the conditions that lead to flood. As the writer points out, "programmes of flood control continued under the new name of flood management and the result was that the floods that were restricted to the rural areas of the country started threatening urban areas". One can see for oneself that floodwaters that would recede in two-and-a-half days have started remaining for two-and-a-half months instead.

Gopal Krishna,
Ranchi (Jharkhand)

More Indo-Pak kisan meets

I am delighted on your assessment of the Pakistan citrus. Please try for farmer-to-farmer interaction programmes as they will help improve ties destroyed by politicians. Long live India-Pakistan unity.

Javed Ahmed,
Sargodha (Pakistan)



AGRICULTURE R&D: Payback Time Now

A Farmers' Forum Report

07

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It is not a little unfortunate that in an agriculture dependent country, where farmers comprise 50 per cent of the population, a democracy at that, there is not a single cabinet minister who has ever practiced farming? No more than two chief ministers in Indian states have personally been farmers. This, to a large extent, explains the plight of Indian farmers today; the lack of understanding about the real issues; the overall lackadaisical attitude to farming and related issues and the absence of a science and technology focus where it matters the most.

The Bharat Krishak Samaj (BKS) is a farmers' organization; it is non-political, non-sectarian and is trying to increase awareness on agriculture issues in the country and the plight of farmers, said Ajay Vir Jakhar, president of BKS and editor, *Farmers' Forum*, setting off the proceedings at a conference in New Delhi's India International Centre on

11 December 2013. The day-long seminar titled *Research and Development in Indian Agriculture: Issue and Challenges*, was organized by BKS and *Farmers' Forum*. Will the recent elections change perceptions on democracy being truly representative of the population? One fervently hopes so, he said.

What are the key issues and challenges relating to research and development (R&D) that are confronting farmers in India? How can R&D in Indian agriculture, including the spread of extension services, be revitalized in a manner in which the benefits of modern science and technology reach those who work on the land, especially those who cultivate non-irrigated rain-fed areas? Will genetically-modified (GM) crops provide a solution? The recent elections provide hope that policies will be looked at with a fresh pair of eyes. It is hoped that the way policies are formulated and funds are allocated for agriculture

research will see a change. India has lagged behind as far as R&D in agriculture is concerned.

“We are trying to engage with all political parties, all the national parties and, hopefully, we will try and engage with the emerging parties as well”, the BKS president said. Farm-sector policies have not been a priority for either the media or policymakers because there is a general lack of understanding about the value of agriculture research and how it can actually reduce poverty, malnutrition and hunger in the country. Investing in agriculture research, therefore, must also be a political priority for the government.

What can the country do to incentivize private sector research? How should public sector research be funded? How can public sector research be made to deliver? This has been a serious problem made worse by the subsidy regime the world over, which disincentivizes private sector investment, even in agriculture research in India. There is yet another problem with all discussions around agriculture research in India being entirely focused on GM crops: pro-GM and anti-GM. This takes the entire focus away from overall agriculture research. “GM is one spoke in the big wheel; not the wheel itself”, Ajay Jakhar emphasized.

As an organization, the BKS believes that research is required in far more different fields than is taking place now. “As a farmer, I think that the one thing that is really missing is bio-control. How do we incentivize bio-control of pests rather than use chemicals and other things? This is something that the Indian Council of Agricultural Research (ICAR) should specially focus on. Pesticide use must be reduced”, said Ajay Jakhar.

“I was in Pakistan recently and spent two days with fellow citrus farmers – I am a citrus farmer in India – and was surprised that their pesticide consumption is about a third of what India uses. I do not know how they do it because, truth to tell, this is the function of the agriculture research and development regime in the country”. What is different in India is that private companies sell pesticides and agriculture inputs through shopkeepers and dealers while in Pakistan the private companies operate through franchises.

This means that the farmer is directly being advised by the authorized franchisee that is responsible for that private sector company’s products. “One may like or dislike the private sector but the hard fact is the Pakistan way has checked pesticide consumption to a level that is one-third or one-fourth of what citrus farmers in India use. It is this that has opened



my eyes to how things drastically need to change in India. This is just one aspect of where research has to impact on”, the BKS president said.

Adding another dimension to the discussion, Paranjoy Guha Thakurta, independent journalist and educator, who moderated the discussions, said that agricultural extension is another critical area that needs urgent focus. Agriculture accounts for only 16 to 17 per cent of India’s GDP despite more than 50 per cent of its population being directly dependent on it. There are ominous projections that even the automobile sector will account for a higher proportion of India’s GDP than agriculture. This development is of concern and a big structural problem as far the Indian economy is concerned.





This year, India's economic growth has largely been driven by the four per cent growth in agriculture. This was possible because the country has had a favourable monsoon.

This year, whatever be India's economic growth, it has largely been driven by the four per cent growth in agriculture. Once again, this was possible because the country has had a favourable monsoon. "R&D must thus focus on rain-fed agriculture regions too that account for 60 per cent of the cropped area of this country", Paranjoy Guha Thakurta said.

The keynote speaker at the seminar was Dr Y. K. Alagh and the other speakers were Dr Swapan Kumar Datta, deputy director general (crop

science), ICAR, Prof. R. B. Singh, president, National Academy of Agricultural Sciences, Dr Peter E. Kenmore, representative of the Food and Agriculture Organization (FAO) of the United Nations in India, Prabir Purkayastha, president, Centre of Technology and Development, V. V. Sadamate, former adviser agriculture, Planning Commission and principal consultant, FAO and Rajesh Krishnan, co-convenor of the Coalition for a GM Free India. ●

These are the edited excerpts of the proceedings.

INDIAN AGRI-RESEARCH: **Neither Focused Nor Comprehensive**

Y. K. Alagh

One of the difficulties with research and development (R&D) in agriculture is that it tends to go to extremes. If you only talk about the field, you ignore the 'R' (research) part, which is quite dangerous because your own information has a limit and there are problems unless you keep up. There is also the need to focus on long term issues.

It was a mistake – while reorienting planning for the market economy – to knock off the chapter on perspectives in the plans because research or demographics and population issues have a 7-10 year horizon. If you are worried about seeds, it will take you a couple of years to get to the drawing board. If you really want to change the demographic profiles, you are looking at a 10-15 year period and have to start now. The present is important because you work back from the future.

The third is understanding that in India's resource-constrained agriculture, the issues around technology are also vexed. Indian agriculture poses special problems and the availability of resources per person is a constraint. When comparing India with the USA or parts of Europe, it must be remembered that India's per capita/hectare availability of water, for example, is very low – one-tenth or less than what obtains in those countries.

The rapid growth of investment in agriculture is commendable but with investment at between 19 and 21 per cent of agricultural GDP, as estimated from the Central Statistics Office data – the Planning Commission gives a slightly higher percentage – the agriculture rate of growth of slightly above three per cent seems somewhat surprising.

My senior, Professor Hanumantha Rao and I, are known to have been advocating higher capital formation in agriculture. I had argued in an inaugural address to the Indian Society of Agricultural Economics that the incremental capital output ratio was rising on account of the needs of new technology and was probably around three. So a growth rate of four per cent annual would require an investment rate of 12 per cent as against the actual investment rate that had fallen to around eight per cent. Now the investment rate is around 20 per cent so why is the growth rate not picking up commensurately? I have provided some answers in an inexpensive book recently published by the National Book Trust.



DR YOGINDER K. ALAGH is former Union minister of state (Independent Charge) for Planning, Programme Implementation, Science and Technology and Power

There are obvious inefficiencies in the system and we may be reaching the frontiers of resource constraints of land and water. This means that we require more effective resource use. The technology interface is important both for land and water management and for cropping and non-crop farm systems. While a lot of research has been done and is available, there is need for focused technology policies and policy rules for fast replicability of existing knowledge and success stories.

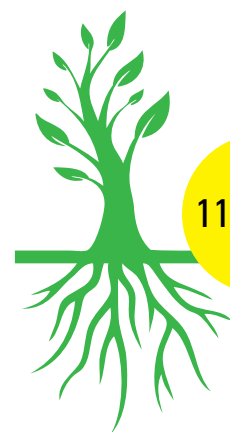
Community institutions and innovations have to be at the heart of this process. There have been varied successes from watershed development,

for settled agriculture, alternate tree crops, reclamation of saline lands, farmer-run lower level irrigation systems, aquifer management in difficult situations, like coastal aquifers, tribal irrigation co-operatives, tank irrigation and such others. The issue is replicability on a larger scale. We have (Y. K. Alagh, 2003) tried to set out some policy rules that, if applied in functioning policies, may reverse the tide. The progress has recently been reviewed (Planning Commission, 2007, 2012).

Our seed systems are honed for cereals and we are particularly good in self-pollinated crops; first wheat and now paddy. The next round of technology needs the spread of super seeds, hybrid paddy and so on since the land under cultivation of grains should come down thereby releasing land for crops with higher demand elasticity such as fruits, vegetables and feed for animal husbandry products. It is quite a tall order and we are only, vaguely, beginning to understand it now.

As an economist, one gets puzzled with what is going on in Indian agriculture. Hanumantha Rao and I kept pleading for investments in agriculture and not just for steel plants. I built the first agriculture sub-model of the Planning Commission and there was no documented case before that. To build a case for agriculture though, one needs to build the Food and Agricultural Organization (FAO) kind of models that will say that if you do not do this, you will be in trouble five years down the line. The point is that the world cannot feed India and we can only use trade to make marginal adjustments.

On its website and pulses portal, the department of agriculture has some details of an excellent pulses development programme that aims to raise yield to



about 12 to 15 quintals per hectare, as strongly endorsed by an expert group on pulses. William D. Dar, the director-general of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), has recently endorsed this for development purposes in different agro-climatic regions where pulses are grown, using seeds with the highest yields in the world; above two tonnes per hectare. If we get on the drawing board now, it would take four to five years. We need such strategies for many crops, in the public-private partnership (PPP) mode.

If you take into account the growth of factor productivity in Indian agriculture in the eighties or the nineties, take whatever little data that there is for the last decade and project it, you get a four to 4.5 per cent growth rate of agriculture, which can really sustain a seven to eight per cent economy. Without that you have food inflation that, in other words, means that you cannot have growth. The technology will source about a third of the growth in the next phase, up to the year 2025 and mostly certainly till 2020. I was pleased to read that the 12th Plan says that technology will source a third

basis to implement technologies, watershed development, even seeds and such others.

Where are the other crisis points? The seed economy is critical to India's development for many reasons. Apart from a few projects, canal irrigation is expanding slowly and is concentrated only in select areas. Groundwater use is under stress and while there are a hundred districts where we know what to do and, as the 12th Plan says – the farmer-managed irrigation systems of Andhra are an example to emulate – we are going to be a water constrained economy. Cropped area is, at best, constant.

A slowly growing agricultural sector, at three per cent a year at the outside, is constraining the sustainability of the six to seven per cent economic growth. In such a situation, seeds, nutrients and crop protection are the main sources of growth. At three per cent growth, the economy is facing a very slow growth of grain demand but there is an eight to 10 per cent growth in the annual demand for commercial crops, fruits and horticulture. A fast growth in animal husbandry will also mean requirement of fodder – maize or corn for poultry

My first job in the Planning Commission was to plan for self-reliance in grains. When we produced the first Plan in 1974, the World Bank wrote it off but we did become self-sufficient

of the growth of Indian agriculture. This is very important for India is a resource-constrained economy where inputs can only take care of so much; the rest has to come from productivity.

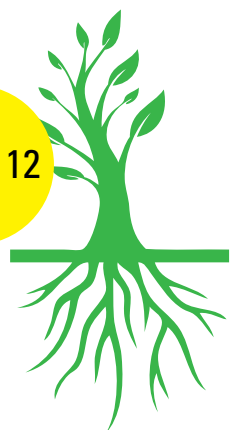
I started with what is called agro-climatic planning in this country, on which I did some work with the FAO in the late seventies and early eighties, when we implemented an agro-climatic plan for India. There are different versions of it and much work has to be done in that framework and our technology application must have a public private mix because of resource constraints. With the kind of soils that exist from Amritsar to Mughalsarai, with good rainfall and perennial rivers, the atomistic peasant farmer matters. Even there, as one gets into modern canal delivery systems, one needs a certain degree of community farmer managed systems.

With watersheds it is a different matter. In the Punjab, they have drought if water has reached 60 feet below the surface. Where I come from, temple bells start ringing if water is found 300 feet below the surface and in many cases, you have to go 900 feet below the surface. They need a community

– and Lucerne and other green fodder for cattle. This is the base of what is called 'food inflation' and so the issue is of the highest importance.

My first job in the Planning Commission was to plan for self-reliance in grains and when we produced the first Plan in 1974, the World Bank wrote it off but we did become self-sufficient. By 1978, we had turned the tide. Today, more rice and wheat will be required and will have to be produced by use of technology because there is no new land. From smaller acreage India will have to produce more for its expanding population. The income elasticity of demand for grains is, however, less than 0.2. Whatever one says, having food security will not make that much of a difference. This is being modelled extensively. That is why at some level it is very easy. It is the question of reaching the people with the available grain; may be five million tonnes.

The problem is not with the self-pollinated crops. The problem lies elsewhere. Pulses, fruits, vegetables and oilseeds represent an economic problem because the income elasticity of demand for grains might be 0.2 but for many of these crops





it is 1, which means that if you are growing at seven per cent, the demand, the per capita consumption growth is five to six per cent and if you have income elastic demand, the growth rate is six per cent. If it is 2, which it is for fruits and vegetables, that demand is going to be 12 per cent.

There is no point thinking that onions will come out of the thin air and it is only the *bania* or trader who is at fault. I know in an agriculture dominated meeting, the *bania* is always at fault but the *bania* is not the villain of a Hindi film. He just faces an inelastic demand curve. If in relationship to demand, supply is expanding fast, he unloads. There is danger in those crops.

In the case of pulses in Maharashtra, for instance, Radhakrishna Mikhi Patil from the co-operative, of which I am a member, has commandeered me to chair a group on revamping of the agricultural universities of Maharashtra. Under ideal conditions they can produce anything but, on an average, do not really go beyond 15-17 quintals per hectare. If we implement what we have, the Maharashtra yield is around 1-1.2 tonnes, on an average yield of around 8-9 quintals. Even if we press with the existing programmes – and there has been an improvement in the growth rate – I do not see us going beyond 14-15 quintals in the field, with the available technology. That means that we will be short by seven million tonnes to eight million tonnes. Without *dal*, that is pulses, one is in serious trouble.

Thus the need to get into the hybrids in a much bigger way along with biotech. There are countries that do 21-22 quintals on an average. They invest

in research because they are interested in exporting to India. You are buying four million tonnes and they wonder: “Is ICAR really going to succeed in pulse research?” Then they are reassured: “We hear a very good piece of news that government of India is cutting ICAR funds”. The point is these guys are preparing to sell to India and putting in research money into the produce.

The experience in India – and please do not get angry – when I headed this expert group was that the roadmap never gets made. “Will you build a roadmap?” “Yes Sir”. Well, I waited and I got two more extensions from the agriculture minister, Sharad Pawar, but the roadmap was still not there. The point is that there are some crops for which some universities get even 50 quintals but one is concerned about what is practical. For that one has to get back to the drawing board and it takes another seven to eight years to come up with something.

Technology has improved. Monsanto and others have developed what is called a chipper machine, which means that you get to the heart of the germplasm and get the details and you cut about two or three years in the research profile, otherwise you have to do it with successive field rounds. I do not like them. They exploit my country but we learnt a long time ago that to survive you cannot bank only on help from friends. It is not only the CGIAR (formerly the Consultative Group on International Agricultural Research) systems giving you effusive lectures that will help. There is the politics of grains and one needs both money and a sense of direction.



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Research demands money and mobilization of scarce technical talent. Given the long-term nature of the problem and that large investment is needed to develop new molecules, a degree of regulation will be needed. Investors need a reasonable assurance of returns or they will not commit finances and, more importantly, experienced managerial and technical resources. For pulses itself, for example, the research plan will cost hundreds of crores of rupees, if the experience of hybrid paddy is any indication.

Such PPP projects will need public-resource commitments in terms of meeting the so-called viability gaps. Also, public-sector involvement is essential for sustainability and environmental-safety aspects. A central organization working on what are called long-range, marginal cost principles, which have been advocated for power projects, for example, could work out fair pricing solutions. Anybody doing better than the average efficiency cost estimates, giving a fair rate of return, would keep the profits.

It has been demonstrated time and again that the nation gains using such strategies. For example, pricing strategies that rely on group efficiency cost norms have given very powerful returns in terms of energy savings in the nitrogenous fertilizer industry. After eight years of discussion, reportedly, a committee under a Planning Commission member is suggesting this approach, which was the basis of pricing that a committee chaired by me had recommended many years ago.

Thus, in the short run, we need a major emphasis on technology, largely for better seeds, soil nutrition and great care in terms of pesticides and insecticides. I am a great admirer of the initiatives taken by the Ministry of Environment but the decision to stop the development of brinjal GM seeds, after they received approval of the highest scientific machinery for the purpose, was a mistake.

It is legitimate for the government to develop a new framework for a policy that was thoughtfully implemented over a decade ago as then designed by top scientists of the country like Professor M. S. Swaminathan. However, it is not fair to change implementation through an administrative fiat at a time when the new policy has not developed and technology holds the only hope for growth of Indian agriculture.

It is reassuring that at a meeting with seed suppliers the environment minister laid down a very positive framework of the development and application of technology in seeds, soil nutrients and crop care, in agro-climatic regimes. One hopes that this forward-looking statement will be pursued by the government with action.

An expert group that I chair on pulses production has developed an interesting experimental PPP model in pulses where technologies are taken to the farmer and their output purchased at fair prices with monies directly credited to their bank accounts. Such models are being upscaled.

The pulses model needs emphasis because the pulses yield has remained low as has the area and total production. The number of districts harvesting more than 0.8 or one tonne per hectare yield of *kharif* pulses is small. The gap between demand and supply is widening and has necessitated import of pulses of around three million tonnes. (GOI, Expert Group on Pulses Production, 2013)

By 2024-25, the Indian Institute of Pulses Research, Kanpur estimates a demand of 25.39 million tonnes. Behavioural estimates using elasticities of demand and per capita income growth in real terms give higher estimates. However, even the lower figures require a near doubling of production from the 2007-08 levels. The Approach Paper to the 12th Plan says: "In the case of fruit and vegetables, milk eggs, meat and fish and also of pulses, there is a need to ensure that output grows at a rate significantly faster than that of cereals so as to service the expanded demand in these areas".

In fact, some econometric estimates of the demand elasticities of pulses range from 1.5 to 2.0. This would mean that with an increase of

irrigation facilities exist and the menace of the *nilgai* (blue bull) is contained.

- With some difficulty the group has been able to isolate around nine million hectares in identified districts where watershed development in recent years gives scope for pushing pulses development.
- Similarly, pigeon pea on rice bunds and intercropping in specific agro-climatic regimes is identified.

The expert group believes that while with the available technologies, given policy support as outlined, pulse productivity can rise by around a quarter, without a long-term plan, there is no question of meeting the demand for pulse towards the end of the decade. If these plans are not set in place now, the desired outcomes will not be achieved.

At least five to seven years are required to develop the next generation germplasm and long-term planning and action are needed. The expert group has regretted that despite repeated requests the research establishment has not given a detailed roadmap and the bare outlines below will need to be fleshed out, costed, milestones laid down and

While available technologies can help raise pulse productivity by around a quarter, without a long-term plan, the demand for pulse towards the end of the decade cannot be met

around 6.5 per cent annual in per capita income, demand for pulses would increase around 10 per cent annually. (Y. K. Alagh, 'The Future of Indian Agriculture', *Indian Economic Journal*, April 2011, pp. 40-55; also the same title, National Book Trust, 2012; Expert Group on Pulses Production, 2013).

The strategy worked out by the expert group:

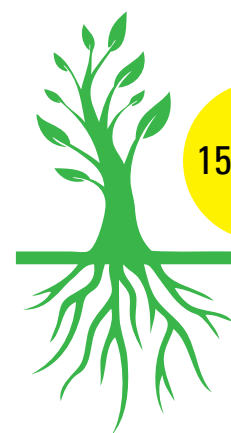
- Identification of additional area having potential for pulse crops
- Utilization of potential area of rice fallow lands of three million to four million hectares that have been identified in specified districts largely in eastern India and can yield around 2.5 million tonnes
- About 5 lakh hectare of upland rice, 4.5 lakh ha area of millet and 3 lakh ha area under barley, mustard and wheat, currently giving low yields can be brought under *kharif/rabi* pulses.
- About 16.5 lakh ha area vacated by wheat, peas, potato, sugarcane, lentil can be used for raising 60-65 day summer mungbean crop in the states of Uttar Pradesh, Punjab, Haryana, Bihar, Gujarat and West Bengal where adequate

implemented in the next six months. Still, one feels, a preliminary listing is useful, if only to underscore the seriousness of the task. This listing is given in the report in a series of tables available to any concerned policymaker. Such plans are possible for each crop.

India must have a crop vision and work back. There is a roadmap with the expert group on pulses, developed by agriculture scientists. It goes by crop, by region, by year. Yet one has done little about it and it is high time that one started. Things were simpler with paddy, for instance, and one could develop a hybrid paddy project for Rs 300 crore in six different locations. It is not so easy for pulses.

The price of brinjal is also rising. Jairam Ramesh (Union minister for rural development) is my friend but I hit him very hard on that brinjal business. He said that brinjal was not that important and I had to tell him that it constitutes 10 per cent of India's vegetable demand and prices are rising by 15 per cent.

There should be a profile for each crop. The ICAR does have something and, if pushed, its people in different locations can develop a plan for each crop very quickly. This is a very serious issue and not just



an issue of agriculture because it involves such a large percentage of the population. In the USA, only three per cent of the population depends on agriculture. It is important for reasons like poverty and employment and it is also important because it is the only macro constraint on Indian agriculture and growth.

One has to be out there in the trenches but not everyone understands that. It is absolute stupidity to try and control food prices in the short run with highly subsidized imports in the name of fighting inflation. You import onions and subsidize them. India, a poor country is subsidizing farmers in other countries, many of them much richer than it. Look at the absurdity of that logic.

There was an Alagh Committee on tariff that Sharad Pawar had set up, which had lot of data and talked of tariff protection for the top quartile of Indian farmers. It took crop wise cost of cultivation data from the department of economics and statistics and said: here are the top quartiles; please protect them for three to four years and they will expand production and you will be all right.

The agriculture ministry was happy and accepted it but it got shot down in the Cabinet by the finance and commerce greats. The report was not even released and I never keep copies of reports that I give to the government. The agriculture minister, Sharad Pawar, is a clever man. He got one of his party members to ask a question on the Alagh Committee; it was not a starred question. So he put the entire report as the answer to that question and I can quote it because it is a parliamentary paper, available in the public domain. The point is that there is no tariff policy for these crops.

In the border of Karnataka and Kerala, in the ghats, is a temple headed by a friend who is doing a lot for agriculture. I visited him and saw them growing vanilla and very happy. Vanilla is used in chocolate and demand was growing. Then the Chinese hit them by pricing their produce at 30 per cent below the cost of these fellows. This is where technology comes in.

India does not have technology across the spectrum for what is called food inflation crops. Where it has, there are no economic systems to sustain it and there is need to do all this. The regret is that when some people do it, we do abominable things to them. We throw the young men and women working on the frontiers on these technologies to the wolves. There is nothing that breaks your heart more than being told in the press that you are anti-national. They are working on hybrids, Bt (*Bacillus thuringiensis*) and sometimes people talk without even knowing the



difference between the two. Our scientists need to be encouraged in each crop. There is need to develop a perspective and this is a long haul business. It cannot be done in a year or two.

There is a seed control act and every state government controls the price of seed. This country that has some of the best economic systems to support technology. I have had the privilege of working as chairman of the Bureau of Industrial Costs and Prices (BICP). We developed the concept of long range marginal cost. It is true that Monsanto and Indo-American hybrids will exploit you but there is nothing that says that you cannot develop an economic system to regulate them such that long-term research is rewarded.

This does not mean going in for billion dollar equipment but giving our boys and girls the freedom to strategize on what they can do with a little bit of support and whether or not they will collaborate with some business or the other. We need to help our people to develop these things where necessary under a public private partnership. You cannot let these things be done by multinationals left to function in an unregulated space.

You need a seed regulator; you need long-range marginal cost pricing but you do not need a state agriculture minister who will announce one day before the elections that seed producers will be given 50 paise less. This is not the way for mature countries to behave. We have regulated sectors earlier





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and have the ability to regulate again. I am very clear about what needs to be done; one can decontrol and control so that our people are not hurt. One can do things in a way that does not exploit the farmers. These are the things that we need and not every experiment needs to be decided by a minister.

There are a lot of problem areas, the Pesticides Act, the overuse of pesticide, residues in mother's milk, the food chain and a lot of areas need bio control and other controls. Initially paddy, tobacco and chillies accounted for 80 per cent of the pesticide use, the largest share being taken by tobacco. Today, cotton and rice account for most of the pesticide consumption with 67 per cent of the total pesticides used in cotton (50-55 per cent) and rice (17-18 per cent). Most of this consumption is just in five states: Andhra Pradesh, Karnataka, Gujarat, Punjab and Maharashtra. The Pesticide Management Bill of 2008, which is meant to replace the Insecticides Act, 1968, is still awaiting parliamentary approval.

Initially, insecticides accounted for 80 per cent of the total pesticide used in India. In the subsequent years fungicides and herbicides gained importance and the share of fungicides increased to 24 per cent by the 1990s. Herbicides have grown to six per cent and the share of insecticides in the nineties have fallen to 68 per cent. Within insecticides, the Indian market continues to be ruled by the demand for organophosphorus pesticides, followed by that for synthetic pyrethroids and organochlorines.

As the market for pesticides got concentrated in a few pockets, a significant change in the consumption pattern occurred, as several technical compounds were available to treat a single pest. This has changed the consumption pattern from a product decision to a brand decision.

In India, bio-control agents are available only for selected pests and rarely for plant diseases, nematodes and weeds. Amongst these, neem is widely available and has been found to be effective in controlling as many as 250 species of insect pests. Many neem-based pesticides are now commercially produced. Besides, cultural methods such as suitable crop rotations, timing of planting, sanitation of crop fields and management of plant residues and alternate hosts to insect pests provide effective control against many insect pests and diseases.

There are Indian companies that have moved completely out of red triangle (pesticide) products and are making money. There are companies that have adopted the franchise model to sell bio-control. There are major companies without a single red controlled product that are developing support systems, which get into advice giving. They are also acquiring seed companies on the side.

Unfortunately, they are too few but a beginning has been made and we do not have a regulatory and support mechanism for all this. We still work in the grand old way. There is a pesticide plan. The ICAR comes to the Planning Commission, we develop a national plan, but that is not the name of the game anymore. The farmer wants the service and he wants service where bio-control is a part of a larger menu. There are companies who are doing it and we need to look at those models and support them.

Pesticide is a dangerous business and I am proud that India has a safety regulation that is very severe and I think it is perfectly legitimate for people who break safety regulations to be sent to jail even if they happen to be very high level technocrats or even richer businessmen. Having said that, to be going around chasing every can of pesticide, bringing in the inspector raj, doing it at the lowest level of *taluka* (sub-division of a district), is not the way to solve the problem. In fact, that creates problems of corruption and dysfunctional systems.

Again, implementing the safety aspect of law and what groups like the genetic engineering advisory committee or equivalent scientific groups in the bio-control sectors say, without fear or favour, not listening to ministers when they intervene at that level, is extremely important. Also, there are

a whole lot of perverse regulations that go back to earlier days when, incidentally, one could not sell pesticides and seeds together.

Under existing laws of the land, in some states, it is still not easy for a company to sell pesticides and good seeds together. Those laws have to be taken off the agenda and we have to move to high value-added agriculture; not just rice and tobacco anymore but vegetables, fruits, oilseeds and such others.

Multi-product retailers in the urban market sell agricultural machinery. Except the tractor industry, the service has been poor for most implements. The farmer's knowledge regarding improved equipment was largely based on the way the equipment has been promoted to the farmer. For example, power tiller has been promoted as a 'mini tractor' and hence the farmers expect it to provide similar services as a tractor. The recent agro service clinics may improve the picture.

It would be important to discuss PACE (Partners for the Advancement of Collaborative Engineering Education) more as a technology input into Indian agriculture. We have great expertise in that area

I have written a book on the future of Indian agriculture. It creates two models. My teacher Lawrence Cline died a month ago. He was the first econometrician to get the Nobel Prize and would tell us that "you have to be what Yoginder would call a coolie to work in econometrics. You have to roll up your sleeves, get into dirty data, bring out insights and then model them". I did so sitting in Ahmedabad, thinking in my garden and working on my computer. When I presented my book to a very senior lady politician, she asked what the main message of my book was. I said that if we do things in the right way, the poorest Indian will be richer by 30 per cent and if we do not do it, we will need more MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Act, 2005) because productivity will not rise, they will not move out of the high sector jobs.

The writing is on the wall. The numbers are there in the future of Indian agriculture. There is the business-as-usual projection where you need more MGNREGA and incomes do not rise. Then there is a projection where productivity goes up. Women

We are a land and water scarce country, most of our water data is three to four years old because the crop and season reports take time before the collector can bring them over

and our 'bird' crosses our continent every week now; earlier it was every fortnight. There are some cloudy fortnights when it does not get pictures. Otherwise, it can locate a buffalo on your field. Our photometry is amongst the best in the world.

We are a land and water scarce country, most of our water data is three to four years old because the crop and season reports take time before the collector can bring them over. Here, you get online information that you are not using it. I will also say that we can use the bird for project planning in agriculture for improving irrigation systems, for doing watershed management, for bio control but we are not doing it.

Some progress has been made on the FASAL (Forecasting of Agriculture Outputs through Satellite) programme. The Alagh Task Force of the National Statistical Commission on Agriculture Statistics has evaluated it but there are enormous possibilities for project planning and for extension. It is not an 'R' area it is a 'D' area because research has already been done. The country has put thousands of crores into it but the development leaves much to be desired.

and men are freed. They go to the small towns and markets and infrastructure gets built there and a third of the poor in India is no longer poor.

She then asked me whether I was sure about all this and I said that I was, up to the second decimal point and then I laughed. She wanted to know why I was laughing and I said only a modeller knows the assumptions that he makes. So, one thing I can predict to you is that even if my numbers are wrong they will not be wrong by 50 per cent. They may be wrong by two to five per cent at the outside.

What one is talking about is at the heart of India's dreams; supporting a seven per cent growth of the economy. It is the backbone of the effort to break poverty and unemployment in India. These are great outcomes. The real dangers, apart from anti-agriculture policies, are running into real resource constraints. Again here the strategies for land and water management are known and agricultural research can fill in the gaps. As member of the Planning Commission it was my good fortune to develop a policy vision of a detailed agro climatic strategy for India. It is more urgent now. ●





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India Not Utilizing Science to Develop Agriculture

Swapan Kumar Datta

Indian agriculture can no longer survive in seclusion; it needs to be connected with our own culture on the one hand and, digitally, with the world because agriculture has problems that cannot be fixed quickly and, sometimes, not without collaboration. The global perspective is, therefore, important.

One of the problems that the South faces is an inability to utilize available technology. The North has local issues but has used technology for several decades, which the more populous and resource constrained South has not done. Nevertheless, in a digital world, this shortcoming may be quickly overcome and a digital roadmap created for taking the country forward. How does



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(FNAAS, FNASc)
is deputy director general (Crop Science), Indian Council of Agricultural Research

one correct and take forward a system that has a population base of 1.25 billion?

Increasingly, science and technology has been making significant contributions to crop management. In 1953, Watson discovered the DNA double helix structure; Amartya Sen is the human face of economics and has talked about the reasons of food shortage. Three people have got the World Food Prize this year because of their contributions in 1983 to the application of modern science in crop improvement, particularly the DNA delivery system in plants. Despite such global recognition, there is considerable negativity about technology-driven science and its use in Indian agriculture. This is very unfortunate and must be replaced by



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an appreciation of all that science, technology and philosophy have achieved here or elsewhere.

It is not just global climate change that causes concern; it is what is being done about it locally as well. What are scientists doing locally, how is agriculture developing and how much science is being utilized? The current land use, urbanization and the changes taking place in India have a long-term global impact. India needs to take urgent and meaningful steps aimed at environmentally sustainable and technologically feasible manner. This year, we celebrate the bicentenary of Charles Darwin who, 200 years back, had identified the connectivity between the wild and agricultural crops through the process of evolution.

There is a lot of negative talk about biodiversity; plenty of misquotes; biodiversity is misused and

people tend to think that the number of species and number of sub-species is the main criteria for maintaining biodiversity. We need to undertake bio-prospecting to explore the potential plant and animal genetic resources, which could be of immense value for food security and healthcare. We also need to respect the farmer's concern at being made to grow crops that give him poor yields and little income.

The point is, farm conservation is possible, and that is what organizations such as the Indian Council of Agricultural Research (ICAR) are doing. There is need to utilize whatever land is available to us and not just leave them in the gene bank and be happy that we are maintaining them. In the USA, two crops, corn and soyabean, with a few lines, generate a market of \$40 billion to \$60 billion per year. In India we expect the farmers to remain poor; ask them to grow landraces and maintain all kinds of agro biodiversity even if they do not get adequate productivity.

In 1865, Gregor Mendel, considered the father of modern genetics, demonstrated the improvements that science could achieve. It is the scientific basis, the recombination of DNA, selected genes that is used for stability and improvement of a trait. Today, all the improved crops that we use are basically GEM (genetically engineered material), and it does not matter if one term them as GEM or genetically modified organism. They are all GEM and because the concept of genetic engineering was there in nature, as we now know from genetics and molecular biology, we have the possibility to improve the crop and improve an animal system. These are the challenges.

If you look at vegetables, of the 144 million hectares area under crops, vegetables account for only 8-8.5 million hectares. The area has not increased despite high demand simply because there is no marketing strategy, no cost benefits, no infrastructure, transport or cold storage. These are the basic things that we do not have. It is not that there has been no scientific research or that no new varieties have been developed. The strategies to deploy technology are all available.

Between 90 and 95 per cent vegetables, in particular, is marketed by the private sector that has the seeds and the best of technology. It has spent money on developing material that is available but the acreage has not expanded in response to market demands because of a lack of infrastructure and other necessary things. This must be addressed to make agriculture remunerative. This is the



only slogan that I would like to raise: agriculture should be made remunerative by addressing all the problems and doing necessary things that befit India's agriculture system.

The history of ICAR in 1995, of the Pusa Institute and the platforms proposed for the 12th Plan indicates the kind of work that has been done and can be done. Yet two years into the 12th Plan, one is told of a 30 per cent budget cut. What road map are we thinking about? I do not know how to keep my young scientists and researchers motivated and keep working within limited resources and do everything that we do it within these constraints. This is a challenge.

From the 1960s to 2012-2013, the rice output increased from 35 million tonnes (mt) to 100 mt and, by 2020, we need at least 125 mt, excluding the export market. In pulses, we produce between 15 mt and 17 mt and we need around 28 mt. This is huge requirement that cannot be achieved without working for resistant pulses with Bt (*Bacillus thuringiensis*) genes but that will raise a furore across the country and some will say: "You cannot use Bt technology for food crops".

Two years into the 12th Plan, one is told of a 30 per cent budget cut. What road map are we thinking about? How do we keep young scientists and researchers motivated?

This distinction between food and non-food crops is unacceptable; technology is the same for all plants and all systems; there cannot be any discrimination between food and non-food. Technology must be served and used, the product developed must be served and we must understand the genetic stability of the crop and it should be deployed in the farmer's field. If farmers do not use it and benefit from it, they should be discarded. This should be straight and simple. I do not see why we are even debating this question.

In all other oilseeds and even potato, sometimes a farmer does not get even Re 1 per kilogramme. Today, some get a little money but why should we be so worried about the farmers making more money? The problem is not that. The current potato requirement is almost double that of production. So, where can we grow more potato? I cannot think of any place in West Bengal to grow more potato or for that matter in Punjab or Uttar Pradesh. That means there is a problem that we need to think about now. We have done quite well since the sixties; reasonably well for our current

needs but I am worried about 2020 and beyond, when the requirement really goes up. We have reached a kind of genetic threshold and beyond that, we need more technology and policy support and investment, or else there will be a problem.

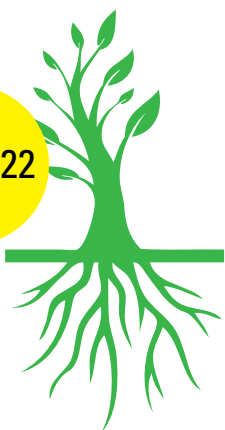
In the last few years ICAR has developed several varieties of rice, plenty of varieties of wheat, maize and nutritional cereals, basically millets, cereals, oilseed and produce that has high nutrition, iron and zinc. It is working continuously on all crops along with the agriculture universities to develop new varieties. Globally too, in rice, the traditional variety yields 500 kg per hectare and there is much new technology coming in, including the bio technology, which will help these developments in rice yield.

One example that I would like to share with you is with basmati, for which there was a significant contribution from the ICAR and the Indian Agricultural Research Institute (IARI), which has, strangely, not been appreciated by all. One crop alone is fetching Rs 15,000 crore to Rs 20,000 crore from exports and the ICAR's five-year budget is only Rs 25,000 crore. India's total rice exports are now valued

at Rs 28,000 crore. That is the difference that one crop, the basmati material, has made in the country.

Japan has a huge Koshihikari (premium Japanese rice variety best suited for *sushi*) industry and has a foundation researching on its development. There is no such thing in India; only some businessmen working on basmati. There is no research component involved, no ICAR, no other agency involved, which is very unfortunate. I wish some percentage of the money from basmati exports came to the ICAR or the IARI and to our scientists working on basmati so that we could continue improving it. Some basmati used today was produced by us with a gene that gives protection against bacterial blight and blast. We also developed basmati that matured early; from 145 days to 120.

India's accomplishment with rice is quite remarkable and it is the world's largest exporter of rice, at about 10 mt. Even China is a rice importing country and India's achievement should be appreciated. With limited resources and support, this is what India has accomplished and is capable of doing.



India has some problems with wheat but is doing well with this crop too. Rust resistance and terminal heat tolerance are serious problems. We are working on rust disease and Indian scientists have developed certain rust resistant varieties, including UG 99 resistant. India is contributing that material to global research, it is being evaluated and the Indian material is being incorporated in other countries' germplasm.

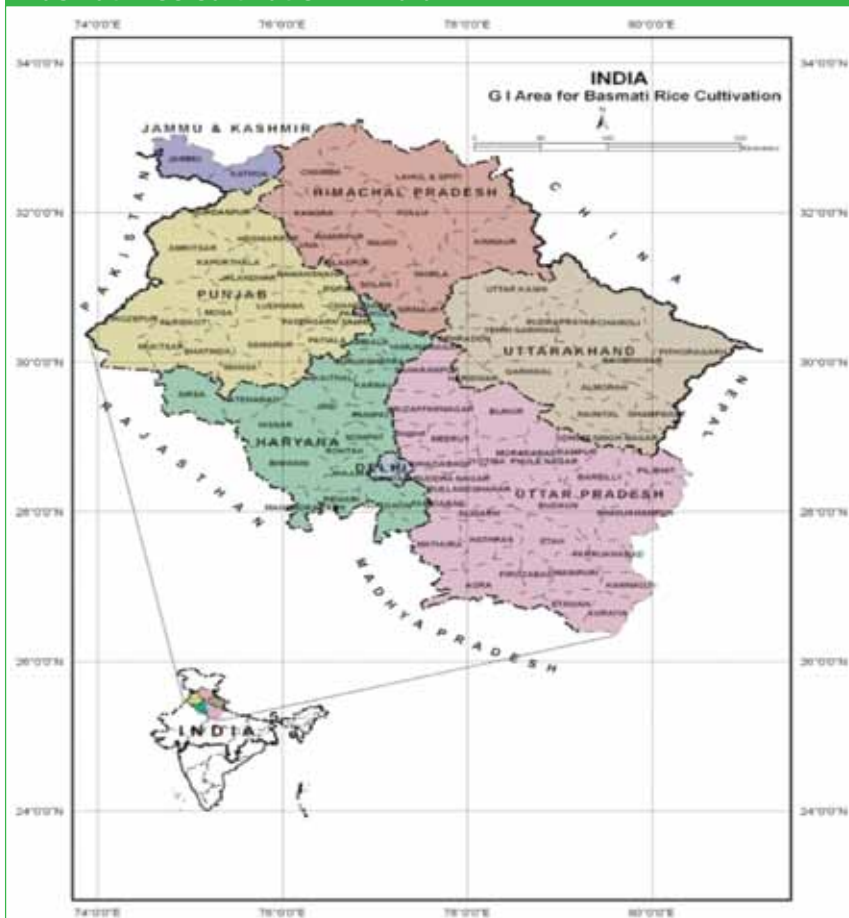
Wheat research has taken place for 100 years in India, but in the last 10-20 years we have reached a level from where it is difficult to go any further, with no hybrids available in wheat. We need to work on hybrid wheat development as well as terminal heat-tolerant and other biotic stress tolerant wheat.

The maize production in India is at 21 mt but our target is 45 mt by 2020, which might sound too optimistic. It is possible, probably at some cost to rice-growing areas. Farmers are moving from rice to maize and from other crops to maize and say it is very simple because – some can even show data to this effect – traditionally, their forefathers grew maize. With rice, sometimes they make money, sometimes they do not and they blame us because the government does not procure the rice. With maize, buyers come to them for the produce because there is a huge demand for maize. The economic benefit to the farmer is much more. Thus, there is a shift and there is a possibility that maize production will go up.

Pulses are a serious problem because the country produces around 70 mt and the requirement is much more. Some countries are trying to produce pulses and sell it to India, including the Saskatchewan (in Canada) group that is in Delhi today. They are visiting some of our institutions and I will have a discussion with them. Their interest is to work with India, the IARI and our institutions on genomics utilization of pulses and other crop development.

With the decoding of the DNA and the genome of pigeon pea and chickpea, it is now known that generally they have similar genetic characters. That means when bred they do not show a significant improvement, which is a concern. If more distantly related species are used for crossing and based on

Basmati rice cultivation in India



Rice

- Total rice area - 44 million hectares (mha)
- Total milled rice production - 103 million tonne (mt)

Basmati Rice

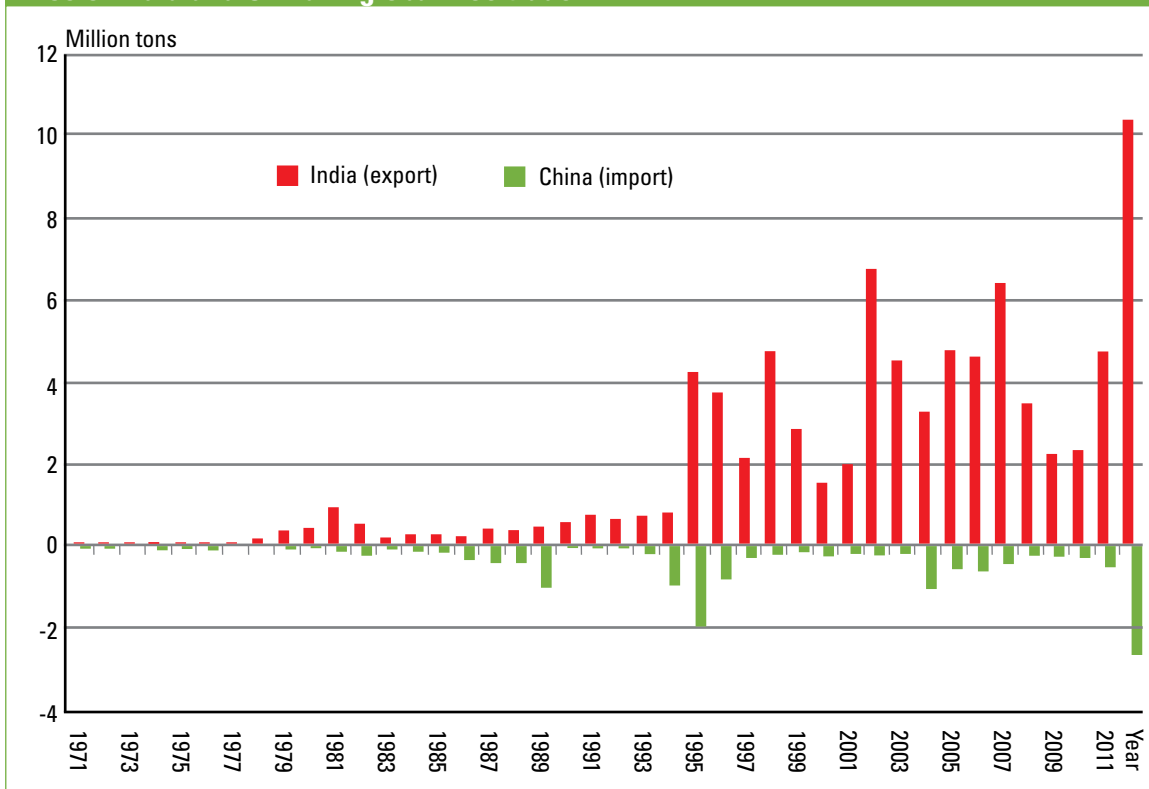
- Total Basmati rice area - 2.0 mha
- Basmati rice production - 7.0 mt
- Basmati rice export - 4.0 mt
- Domestic consumption - 3.0 mt
- Total forex earning - Rs 28,000 crore

Source: Presentation of
Dr Swapan Kumar Datta
at the Farmers' Forum
seminar

genome sequencing data, we might to be able to make a different type of breeding work. Thus, in the future, provided we invest enough, we may get new pigeon pea and chickpea.

Water and fertilizers are definitely serious issues but new terms, such as drought-tolerant rice, wheat, maize, soya bean and cotton are being reported the world over. They can be utilized provided there is free flow of knowledge, science and the utilization of the GM crops that can be accepted and utilized in the country. We may not have any other option after some time. We are just delaying the appreciation and utilization of the technology but, unfortunately, science will wait for no one. There are scientific studies that show that there is great potential to develop these abiotic stress tolerant crops.

Rise of India and China in global rice trade



Source: PSD online database, USDA. Samarendu Mohanty, 'Game changers in the global rice market', <http://trn.org/rice-today/game-changers-in-the-global-rice-market>

India imports 40 per cent of its fertilizers, currently 22 mt. A decade ago, it was only 3.6 mt and we will require much more, according to projections, even though it is known that only 35 per cent of the fertilizer is absorbed by the plant and 65 per cent goes waste.

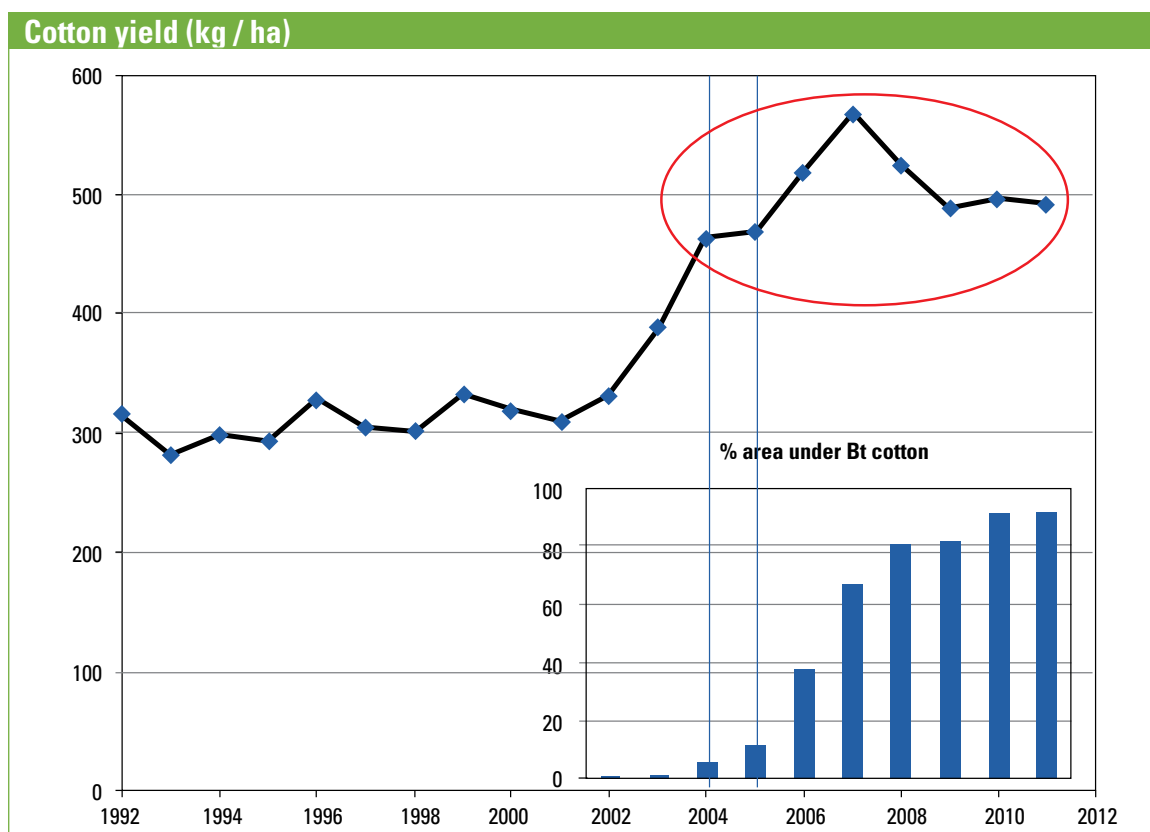
Do we continue with such fertilizer use even though the plants do not utilize them and they enter our soils, pollute our water and the environment? The option is to look at science for a solution that can definitely help us. There are new developments around nitrogen utilization, phosphorous utilization and they are all coming from genetic resources and modern genetics. Genetic engineering can help incorporate those genes in the crop plant whereby the plant will be able to absorb the fertilizers from the soil and convert those minerals to improve crop productivity. There is no better solution than science and much work worldwide is taking place on this question.

The production of cotton is a successful agricultural story in India and 92 per cent of the cotton area is under Bt cotton and that is the farmers' field. We do not need to make a demarcation between Bt cotton and non-Bt cotton. All cotton in the cotton fields is Bt cotton and it is working though some people insist that it is not. I do not know how they say so. If farmers have no

problem, there is no scientific reason why such technology should not be utilized. I can answer any question with regard to *desi* (indigenous) cotton, to the diversification of our cotton variety and such others. These are scientific and academic issues but need to be addressed from the farmers' perspective. Will the farmers be happy growing them or do we need to combine the new technology with *desi* cotton so that it becomes more valuable as value-added cotton? Cotton yield is increasing and the use of pesticide and insecticide is decreasing, which shows that this technology is having an impact.

Climate change is definitely an issue and, apart from the abiotic stress tolerant crops, we are working with germplasm. In case of chickpea, we are evaluating 18,500 germplasm across the country to see if we can select climate resistant chickpea. Similarly with wheat, we have 22,000 germplasm. In case of all crops in India now, we are trying to enhance germplasm diversity. India is gifted vis-à-vis ecosystem diversity. So, we can grow all our germplasm across the country and can identify the materials with potential to withstand those abiotic stress conditions and use them in a better way.

There is also the question of self pollinating versus cross pollinating crops. Cross pollinating crops have a serious problem and the bees and pollinators there are health issues that are important for our crop.



This is why, in the USA alone, the value of cross pollination crops is \$200 billion and in India it is around \$1 billion. There are serious concerns on other issues that need to be addressed. We have one active programme on pollinators and bees alone and are paying special attention to diversification of our pollinators, culturing and maintaining them. Today, pollinators are in a different agricultural practice from what obtained 10-20 years back.

Our crop improvement programme shows that soya bean and rice are being well integrated with technology. USA has a single cross hybrid combined with the biotech traits that has given a 10-tonne per hectare yield, which is the highest. The U.K. also predicted that it would have 20-tonne per hectare wheat by combining all the biotech. The things that the U.K. can do cannot be done in India because of the long-term duration of wheat.

Nutrition is again a serious problem. For the future we will be looking at the next generation of plant genetics based on the genomics data. We would like to see the combination based on computer-generated designer crops and that should be utilized. Sea food rice is possible with biological nitrogen fixation. The ICAR would like to work with the Bill & Melinda Gates Foundation, BBSRC (Biotechnology and Biological Sciences Research Council), other funding agencies and the

best scientists so that cereals (rice and wheat) and not only legumes can fix the nitrogen.

We are trying to improve our crops and agriculture practices using global material and experience; with the Canadian canola, for instance. There is also need to consolidate land, through the co-operatives and use modern agriculture practice to maintain production levels. In 1988, Prof. M. S. Swaminathan said that technology alone cannot reach the farmers and that policymakers needed to support it. The Green Revolution was achieved with support from policy makers in bringing in the dwarf wheat variety from Mexico. Today, we need to see how the policymakers and science and technology can work together because food security is very important. Everyone needs food but that costs money and cost is important and it is important for the ICAR to work on food security issues. This calls for funds and R&D infrastructure that have to be addressed.

The farmers need improved seeds, fertilizers, water and management. These are important from farmers' perspective. Seed encapsulated with science based structural modification, improvement and inheritance provides the potential for comprehensive improvement. Science does not nor should have any boundary. Instead, the best possible science globally should be utilized for India's local needs and utilized to attain suitable and sustainable agriculture. ●

**COVER
STORY**



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Unethical Enigmas Around the Farm Sector

R. B. Singh

There are two basic points that need to be made vis-à-vis any discussion on agriculture research in India. Mindsets around research and development (R&D) have to change – from R&D to research for development. One cannot make a roadmap without a vision of engaging in research for development. The second issue is around the many enigmas surrounding policy, its implementation and the plight of the Indian people.

Consider the Pesticide Act. In November 2013, national newspapers carried reports about all major foods in Indian markets having pesticide loads 100 per cent to 1000 per cent higher than what is internationally recommended. As the president of the National Academy of Agricultural Sciences (NAAS), I wrote to the ministry and to the chairman of the pesticide committee of the country enquiring – since the data was coming from the government of India – if this was true and what the government was doing about it. I am still waiting for the reply.

True, there are rules and regulations. Yet in some



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areas where MGNREGA is being applied. If you visit rural areas in the evening, you will find much of that money goes back to some shops, and one knows which shops those are. Admittedly, there are development processes taking place but some things happening in the name of development need to be questioned.

Income elasticity of demand for high quality food as well as inflation was discussed today. There was talk of the farm produce prices going up and why anyone should question farmer's earning more. We would have been happy if even a fraction of the high prices had gone to the farmer. This

has not happened. This is another enigma.

Even when prices rise, the farmer does not earn more. Instead he suffers from falling productivity gains. These are other elements of the enigma that need to be understood by the authorities that implement policies so that appropriate social sciences are practiced, the right humanware is developed.

About 25 years ago, the ratio between an average farmer's and a non-farmer's incomes was 1:3. If the non-farmer made Rs 100, the farmer made Rs 33 to

There are regulations. Yet in some states, 50 per cent of the pesticides – whether biological pesticides, biological agents or chemical pesticides – are spurious

states, 50 per cent of the pesticides – whether biological pesticides, biological agents or chemical pesticides – are spurious. In Karnataka, in the name of Tricoderma, something like wheat flour mixed with Tricoderma is sold in the open market. Thus, the rules and regulations notwithstanding, their implementation and observance become extremely important. That they are not is a great enigma.

It is equally enigmatic that a country pursuing a growth rate of between eight per cent and nine per cent does not address these basic issues. The coexistence of extreme poverty and hunger with great affluence is another enigma. Yet another enigma is that India has an abundance of talented youth. The highest degree of unemployment amidst such youth is particularly in the rural areas.

Several issues have cropped up today. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was mentioned and there were questions about how good or bad it is. One should consider what is happening in the

Rs 35. Today, if the non-farmer makes Rs 100, the farmer makes only Rs 20. The ratio has worsened from 1:3 to 1:5 but the farmer is subject to the painful price rises. The question is, who is getting the benefit of the rising price? Where is it going? Who is being helped and how is it happening? Besides, what is happening to the total factor productivity growth rate, to the research linkage with the total factor productivity and its translation at the ground level? There is a serious gap.

The Indian Council of Agricultural Research (ICAR) should be able to raise this question and ask why this is being allowed to continue for so long. The average farm size will be going down for a few more years. If that be so, how will the productivity of the 85 to 90 per cent smallholder farmers improve, given the worsening ratio and the wide gap between have and have-nots. These farmers, it needs to be recognized, are the main representatives of poverty and hunger in the rural areas.



Between 50 and 70 per cent of the marginal and smallholder farmers are poor and hungry. If this is the case and the farming population is around 50 per cent of the Indian population, it means between 500 million and 600 million people; very real people. What is happening to them? Somebody should ask these questions. What are the implications of these continuing unethical situations in our country?

We have the Food Bill that is supposed to be implemented on homegrown food. Homegrown food automatically implies self sufficiency. On the one hand, we talk of self sufficiency to keep 65 million tonnes of food every year to be distributed through the public distribution system and, on the other we talk of the free market. We also talk of the subsidy. Will it be a subsidy-free market with the private sector playing its role without making a profit in which India will still have self sufficiency? Will these processes like self sufficiency or self reliance have a meaning or have they been enshrined in the Food Bill without any realization of the internal contradictions of many provisions? If we are participants in a global world, these questions must be asked. Who can answer them or should we keep waiting for answers?

It should also be borne in mind that India is experiencing a falling GDP growth rate, falling rupee and food inflation, which represent total failures of the market system. Indian economists and scientists at the ICAR should be looking these things. There is the bigger question of the entire planet earth being under stress. There are nine boundaries that are supposed to limit us. We have crossed three of them. If we cross any more, we will probably fall. If we cross these limits of sustainability of planet earth and not respect the boundaries set by biodiversity, nitro cycle and climate change and temperature rise, we are inviting trouble. These are the boundaries set by good science and should be honoured. There are ways by which this can be done and these must be brought into the focus of the policymakers.

Equally draconian is having a development plan in which a highly unequal stakeholder is asked to be a partner in the social system. It is not possible to take the system forward at the same speed that one would like to. The very fact that there is such a high degree of inequity in the socio-economic milieu of this nation, handicaps total progress by 15 to 20 per cent. This important point should be brought to the attention of the government of India that should be charged with the responsibility of looking at the question more carefully.

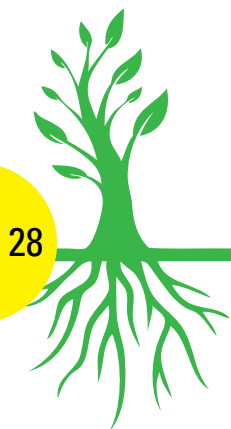



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Then again in small villages there are examples of climate adaptation and one realizes that adaptation-led mitigation is India's cup of tea. There is often separate talk of adaptation and of mitigation; of climate change disaster but adaptation-led mitigation is often ignored. That needs to be highlighted.

Consider the question of nutrition. If India is to feed its population with the kind of food recommended by the WHO (World Health Organization) or the FAO (Food and Agriculture Organization) – with the minimum calories, proteins and nutrients – by 2050, the total productivity of all its crops will have to go up four times and its livestock productivity will have to go up three times.

India is the largest milk producer in the world with 130 million tonnes but the per animal productivity is low. If it is to meet its aspirations of livestock-led development of agriculture – which is a high 28 to 30 per cent of the agricultural GDP today – and if that has to do the job with nutritional and income adequacy, India has to look at those who own one cow or buffalo. The animals are the best friends of the marginal, landless people, and equity has to brought





Livestock productivity must increase by three times; water efficiency 2.5 times; energy use efficiency two times; and labour productivity five times for overall economic growth

in for overall economic development. Therefore, livestock productivity must increase by three times.

Likewise, water efficiency must increase 2.5 times, energy use efficiency must increase two times and labour productivity five times. This has all been worked out by economists and if this is what can be done, probably India will be free from hunger and poverty. The U.N. secretary general, Ban Ki Moon, has come up with the Moon's formula for a 'Zero Hunger World'; a world free of total hunger.

Zero hunger is a very small word but it must be translated into action. How does one go about it? There are certain pillars for ensuring food security: what should the growth be; 100 per cent increase in small-holders productivity, zero tolerance of waste and post-harvest losses; there are some five or six pillars in that process that are extremely important.

The NAAS had the occasion to tell the Supreme Court of India that science is being derailed in the manner that it is being used to serve humanity. Science should be judicious, rigorous and evidence based. No one has the right to refuse humanity the right to be served by science. This demand should emerge from the people who are really looking into all these aspects.

The recent elections in New Delhi demonstrate that with the changing democratic patterns and systems, the youth will ask questions; demand transparency and reject corruption. The middle classes including its top tier too have increasing aspirations and want to play a more important part in society. Three important things must be remembered. One, people in business must remember that there is no place for corruption in the corporate system. Two, science must have a human face. Three, politics should be principled. Mahatma Gandhi had said, amongst many other things, that politics without principles is a sin; science without human face is a sin; corporate sector with corruption is a sin. These are profound messages.

Finally, there is the issue of going green. The Chinese are talking of super green agriculture that was discussed at the last U.N. Biodiversity Summit in Rio de Janeiro in 2012. President Barack Obama and Prime Minister Manmohan Singh were signatories to this green economy. Bold super green agriculture cannot come unless there is bold science to serve it. That is why research for development should be the agenda; not research and development. ●

Challenges of Agricultural Extension

V. V. Sadamate

It is believed that agriculture research is doing very well, economics is doing very well and if you have to blame somebody for the failure of agriculture, it is extension. Everything is all right but extension has failed. I have been with agricultural extension for the last 35 years and do not subscribe to such thinking.

Having been part of the Indian Council of Agricultural Research (ICAR) system with the Ministry of Agriculture and Planning Commission and having worked with Peter Kenmore (of the Food and Agriculture Organization), I find that extension has performed. Though there



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are limitations in the system, in the structure of investments in agriculture, this is one area that can respond to the challenges in agriculture and allied sector.

Extension should be discussed within its contextual issues. For example, 83 per cent of India's farming population is small and marginal, the farm size going down each. Around 60 per cent of India's agricultural area is rainfed. Land, water, soil health and other resources are not only shrinking, they are getting badly affected. Constraints and contextual issues concern between 60 and 70 per cent of India's animal resources that are with small and marginal farmers.



The 11th and 12th Five Year Plans have initiated several missions like the National Food Security Mission and the National Horticulture Mission. The 12th Plan will see the National Mission on Oil Seeds and Oil Palm. The National Mission on Agricultural Extension and Technology is also coming up. More importantly, there is the National Mission on Sustainable Agriculture for Rainfed Agriculture. The Rashtriya Krishi Vikas Yojna (RKVY) is one of India's flagship programmes. Agricultural research will have a consortium of research platforms and the National Dairy Plan and the National Livestock Mission will be very important missions on animal husbandry and dairy.

Besides, there will be field extension programmes and frontline extension programmes of the ICAR and the Department of Agriculture.

Integrated Watershed Management is another major programme in terms of investments. There are also the Backward Region Grant Fund (BRGF) programme and Green India Mission. Admittedly, there is need for more investments but the picture does not look too bad when the 11th and 12th Plans are compared.

The Department of Agriculture and Co-operation that looks after the development missions and development programmes was allocated about Rs 41,000 crore in the 11th Plan. In the 12th Plan, it is going to get Rs 71,000 crore. Agricultural research and education have Rs 25,000 crore in the 12th Plan as against Rs 12,000 crore in the 11th Plan. Animal husbandry allocation has also increased substantially.

The RKVY numbers are very promising too. In

Field and frontline extension programmes of the ICAR and the Department of Agriculture are significant investments as is the Integrated Watershed Management programme



the 11th Plan, it was Rs 25,000 crore and in the 12th Plan, it is Rs 63,246 crore. The states contributed Rs 111,000 crore to agriculture in the 11th Plan. In the 12th Plan, it is going to be Rs 250,000 crore. These numbers add up to Rs 2 lakh crore in the 11th plan and to Rs 4.25 lakh crore in the 12th Plan. Thus money is not a major constraint. The constraint is that how the money is translated into good programmes and how these are delivered to the intended area or intended population. The last segment is a challenging one for everyone: the delivery of the programmes, the convergence of the programmes or the technology transfer or extension issues.

The major investments in extension came during the seventies and the eighties when the training and visit system of agricultural extension was implemented. Many people criticized the touch and vanish system but that is one programme that gave a very good platform to the extension system in the country. In the mid-eighties and mid-nineties, it was implemented along with the Agricultural Technology Management Agency (ATMA) and the Krishi Vigyan Kendra (KVK) programmes.

However, one must understand the fine distinction between frontline extension that is being carried out by KVK and field extension carried out by ATMA. The KVK programme consists of a team of five to six scientists in a district that tests and validates technology coming out of the ICAR institutions or the agricultural universities. The major task of technology transfer remains with the field extension part, which is being carried out by the ATMA. Once we understand the difference between these two there is the question about how they can complement and supplement each other.

Then there is the question of extension reforms. The mid-eighties and mid-nineties saw the advent of private sector extension providers. There were NGOs, farmers' organizations and entrepreneurs amongst others. I come from Maharashtra and there are so many commodities that have farmers' organizations working on technology transfer and extension issues; from Maha mango, Maha grape, Maha banana, Maha pomegranate and such others. One must understand why it is happening in Maharashtra, Gujarat and Karnataka and why it is not getting replicated in a bigger way. The bigger states, Madhya Pradesh, Uttar Pradesh, Bihar and the whole eastern states give cause for concern.

Again, when one talks about extension issues, how are extension priorities for a village or a cluster of villages or for a block or for a district set? That is

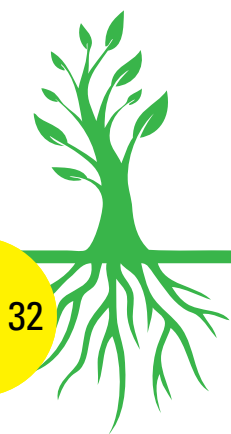


where – never mind whether it is ATMA or KVK or a private sector extension programme – there is a lack of extension priority setting vis-à-vis the extension programme development for a limited area.

It is clear that a uniform extension model will not be able to respond to the needs of the block or a cluster of villages. Therefore, whether it is extension system A or extension system B, it must have a lot of flexibility to respond to the local needs. That is what should be built into the extension programmes in a big way in the 12th Plan. Extension must respond to the local needs, to the local situations and to the local demands.

This is what I have been repeating to the authorities. The extension system needs the mechanism to capture and analyze the feedback coming from the farmers, from the development functionaries and put it in the research system so that the research programmes respond better to the extension needs down the line over a period of time. There are structured extension surveys for the crop sector but other sectors – other allied sectors that contribute very significantly to the GDP such as animal husbandry, dairy, poultry, fishery and horticulture for that matter – do not have very strong extension services. They are either missing or weak or the ATMAs and KVKs are expected to respond to such extension needs.

Public private partnerships (PPPs) have responded in a big way in some states. They are





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badly. The kind of extension workers filling up the positions is another very serious matter.

Typically, one extension worker is surveying a population of 10 to 15 villages. What kind of qualitative advisory will he provide when his physical presence itself has become a limiting factor? Nevertheless, the ATMA and the KVKs are proposing alternatives to the extension model. Let there be chains or links developed by the ATMA or the KVK programme like entrepreneurs, farmer scientists, clubs like progressive farmers and let them be used as extension agents.

Extension in irrigated areas versus irrigation in rainfed areas versus irrigation in tough areas like far-flung tribal settlements as also hill, mountain and desert areas is another challenge. Extension models look better in irrigated areas but fail – not miserably though – or get constrained as they enter these areas.

Capacity building of extension workers, farmers and scientists is another major challenge if they have to respond to the emerging extension demands. As an agricultural convergence expert, working with the

There is a toll free number, 1800-180-1551, for farmer guidance available across the country, though not adequately used and popularized. Any farmer can now phone the experts

known as entrepreneurship-driven agriculture or farmer producer companies and have responded sporadically. This must be expanded during the 12th plan. I also had internationally acclaimed experiences on extension with internationally acclaimed methods like those created by Peter Kenmore: the Farmer Field Schools (which have been used to promote Integrated Pest Management). The ATMAs and the KVKs or the private sector must be made more effective, more participatory in terms of involvement of the small farmers, marginal farmers and such others.

There is a toll free number, 1800-180-1551, for farmer guidance available across the country, though not adequately used. Thanks to the extension division of the ministry and the KVK programme, this number is becoming popular. Any farmer can use this number, get linked to the experts, get linked to the universities and get linked to the KVKs for his technological problems. Extension faces the very serious limitation of numbers down the line. In the early eighties, there was one extension worker (the village extension worker) for one or at the most two villages. The numbers have gone down very

Ministry of Rural Development on a World Bank project, I have been assigned a task of convergence of agricultural development with rural development programmes since the rural development ministry's proposition is that much money is going into integrated watershed development programmes but the expected convergence between agriculture and rural development is not taking place.

When it comes to extension issues down the line, we have discussed this issue for months on how it should take place at the village level and at the district level. How should the programme silos be broken and how should the convergence efforts reflect down the field? What should be the convergence processes, how should they move, who should lead the convergence, who should facilitate it, what is the difference between formal convergence and informal convergence, what should take precedence, what about the convergence plan, what about convergence in rainfed agriculture vis-à-vis irrigated agriculture and while doing so, how should we differentiate between technology transfer versus extension processes? That is a big challenge. ●

**COVER
STORY**

What Ails Public Sector GM Research?

Rajesh Krishnan

It is possibly true that the debate around agricultural research in India is increasingly in the pro-genetically modified (GM) crops and anti-GM space but it is important to understand what is happening there, especially the manner in which the public sector has been conducting research around genetic modification. Some things need to be corrected because agriculture research is an imperative and lab-based research is a must.

I come from a background of laboratory-based research. Thankfully, I take a holistic view of things because of my background in ecological studies. Laboratory-based research needs to respect the larger environment in which technologies will play out. It is not the standard room-condition or room-temperature environment in which technologies play out in the farm.

To understand why the debate about GM takes place, there is need to go into the fundamentals because neither the research nor the debate on GM crops and the opposition to it started yesterday. It did not start with Bt brinjal being put on a moratorium in this country. It started back in 1973 when Stanley Cohen was creating the first GMO (genetically modified organism), which was a bacteria *Escherichia coli* that is found everywhere; even in the gut flora. He was trying to put in a viral oncogene in it and that was challenged by scientists in his own community; within his own lab. The Asilomar Conference of 1975 that followed heard the debate on GM; to release or not to release.

That debate continues not because some rabid activists or myopic political leaders are opposing it. It continues because there is a scientific reason behind it. It continues because the scientific evidence – which is rigorous, which is judicious, which is based on evidence – is showing that there are matters of concern that arise out of fundamental issues.

First, one is not talking about a non-living molecule anymore. One is talking about a living technology here; about a living organism, which is going to be released in an environment that cannot be taken back by any technology. Hence, there is need for prudence about the application of the technology. Again, this is not about the platform technology of genetic engineering. One is talking about an artifact of that platform technology called GM crops. Given the nascent stage at which the science of genetics and its understanding is, it is



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across 20 states
in India

not safe to release it into the environment. This needs to be understood. The discussion becomes infructuous without this fundamental understanding.

We know the effects are uncontrollable and irreversible but there is evidence that we do not know the long-term and cumulative impact that they have. Thus this technology is not going to be in the lab; it is not going to be in the petri dish but is going to be out in the farmers' fields. This technology will impact everything around the farming community and, in a country like India, this means virtually the entire country. The question to be asked then is:

what are those socio-economic consequences that need to be understood. I can say with conviction that those are not in favour of the farmer or the country. So much for research around genetic modification of crops.

Admittedly, there is great need for research in agriculture but what makes one very uncomfortable is that the nature of research is being hijacked by somebody or a thought process that is neither good for the nation or the farmer. This particular technology becomes a tool to be hijacked for purposes of examining agricultural science, policy making and law making in this country. That is what prompts this debate.

There is growing scientific evidence on the adverse impact of GM-based crop, be it on health, environment or socio-economic situations. The Coalition for a GM Free India has brought out a compilation of peer-reviewed published data. People talk about good science and it is important to define what good science. If evidence-based science is good science, there are concerns here because there are peer reviewed published papers that are talking about problems.

The other reason for this debate is the growing public opposition. Coming back to where this technology is playing out, as long as it is within the lab, within contained conditions, it is fine. The moment it goes out in the social space, there will be a debate; questions will be raised about its impact on society. Over the past 10 years, there has been growing public opposition to GM crops and there is a political response to it. Do not blame the politicians because they have to respond to public sentiment. Public sentiment or confidence in this technology has not been built because of various reasons, including the inability to prove that it is safe.



GM crops are not an activist versus scientist issue; this debate has split India's scientific community. The Supreme Court appointed a technical committee to ascertain the issues

When I am asked to talk about GM crops, I am kind of put in a circus with the scientists and I am asked to fight the scientists. This is not an activist versus scientist circus though; one is talking about an issue that has split the Indian scientific community in the middle. Last month, there was a letter by scientists, including six Padma awardees, 10 vice-chancellors and 250 Indian scientists, who actually wrote to the Prime Minister opposing certain views that Dr R. B. Singh and the National Academy of Agricultural Sciences (NAAS) have on GM with reference to the Supreme Court's technical expert committee.

The Supreme Court has set up a technical expert committee in consultation with the government of India that had six members initially. Dr V. L. Chopra, formerly president of NAAS, did not join so it had five members. They gave a report that did not suit the intentions or interests of the Ministry of Agriculture and some other stakeholders. So they brought in another person and there arose a difference of opinion and two reports were given. A majority report by the five members that pointed out two things: one, the concerns over technology and, second, on the failure of the regulatory system.

Many Indian scientists and many people in the political sphere believe that the report needs to be given weightage because of the evidence based points it discusses. That is where the larger GM debate stands. Setting these fundamentals right is very important to understand what ails public sector research on GM, which needs to be corrected.

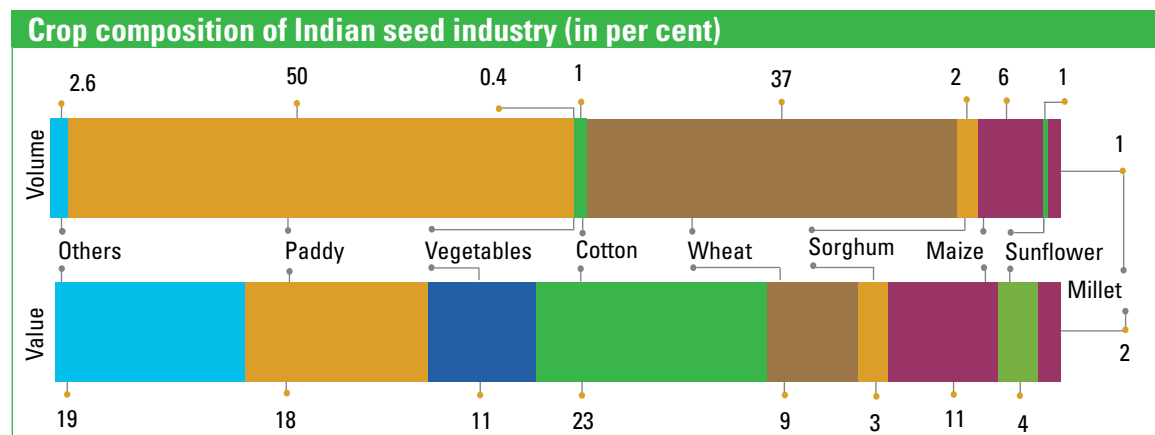
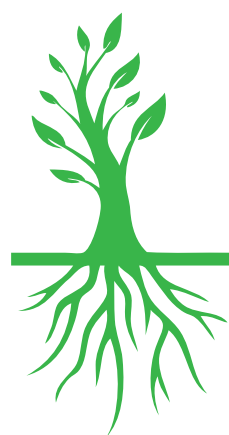
Coming to the seed sector next, GM crops are, ultimately, about playing in the seed market. Along

with India's seed economy, there is also seed politics. Technologies developed do not play out in a vacuum. They play out in the social, economic, political and cultural background and that needs to be understood. India is the fourth largest seed market in the world; it is a Rs 15,000 crore market and it is no wonder that the biggest of multinationals want a pie of it.

The public sector has a leadership position in the seed sector in the country with 17 public sector undertakings, the National Seed Corporations and many others along with more than 500 private seed producing companies, including the largest six multinational corporations that actually have a monopoly over seeds in India and in the world. That is the market structure India presents and which needs to be appreciated when one talks of technology development. Of this market, 30 per cent of the business is in the commercial seed sector and 70 per cent is still about farm seed.

While efforts are on to push the farmer out of the traditional practice of saving seeds and getting into this treadmill of buying seeds from the market, traditional seeds still account for 70 per cent and that probably is the opportunity that the seed industry is trying to seize. The market structure causes concern because of the plight of the public sector – after so much effort, money and passion has gone into building the public sector – which has such disappointing outcomes: 43 per cent in the private organized sector, 33 per cent in the private unorganized sector and 24 per cent only in the public sector.

Returning to the issue of seed economics and seed politics, while the contribution of agriculture



Source: 'Seeds of Fortune', Frontline, 28 June 2013

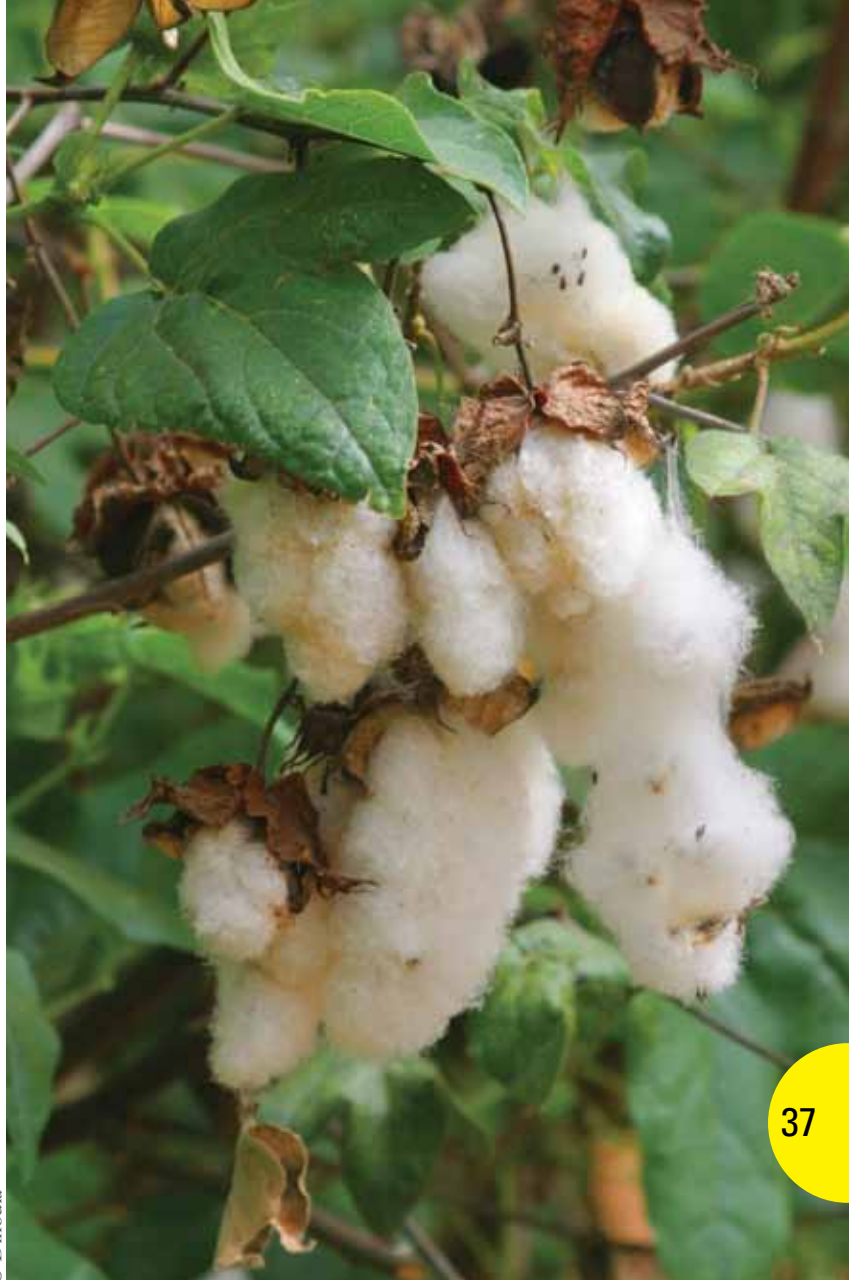
to the GDP is falling, it still has a huge section of Indian society dependent on it. Whatever happens in agriculture also has a political impact. The most important thing in agriculture, the seed, has amongst the biggest political impact. Tomorrow, a private seed company can try to arm-twist and it has started doing so; Monsanto has taken the governments of Madhya Pradesh, Andhra Pradesh and Gujarat to court – asking for increased seed prices and increased royalty. These things have begun to happen and they will actually influence the politics of this country. That needs to be kept in mind when we talk of technology development and public private partnerships.

The structure of the seed market is such that it has low volume high-value seeds and high volume low-value seeds. The private sector is keener on the low volume high-value seeds like cotton, 92 per cent of which is Bt cotton. This means that 99 per cent of the cotton market in this country is now using Monsanto's seeds. That shows how market monopolies can happen when certain technologies that are prone to create those monopolies are used.

Bt cotton was approved in March 2002. In 10 years, one company controls 99 per cent of the cotton seed market in this country. There certainly is a worry here. Tomorrow, if this company decides not to supply its licencees – some 500 companies or so – unless seed prices and royalties are increased, there is no Indian law that can make them do so. What happens if such monopolies develop over other crops? One needs to take into account these things when one talks about technology.

Now, what about the quality of public sector GM research in this country? The National Centre for Biological Sciences (NCBS) is a premier public sector research institution in recombinant DNA technology. Scientists, whom I met there, asked me what was wrong with the public sector conducting GM research. My immediate response was, if there are genuine concerns it did not matter whether it was a public sector scientist, in a public sector lab, who develops GM seeds or his private sector counterpart. A poison is a poison.

That may sound like a knee-jerk response from a layman but that is the fact. It does not matter who develops a GM crop. If the risks are genuine, it is bad. There is a perceived sense of responsibility, the public sector expected to be correct in every respect, and act responsibly since it was created for the welfare of the nation and not for producing opportunities for private profit. It is there to ensure that social welfare exists in this country.



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This is important given the enormity of the agricultural research system in India. The country has one of the largest agriculture research systems in the world that one feels proud of it. One is also concerned about what this system is used for and who is actually driving this system and towards what consequences. I hear the complaint that when somebody says no to GM crops and when policies make things difficult for a certain technology, one is actually discouraging young scientists.

There are 27,500 scientists in the National Agricultural Research System and one lakh non-scientists. They are catering to a nation of a billion plus people. How could it discourage scientists if some policy prevented the creation of a problem for the nation? It is the responsibility of the ICAR and the larger agricultural research system to show leadership and tell them why there is a lack of confidence in this technology in the country. The ICAR should discuss it within the system than rue the opposition to the technology.

What ails public sector GM research? A National Agricultural Technology Project initiative on transgenics has seen Rs 100 crore spent mainly on research on cotton, rice and brinjal apart from maize, sorghum and some others. The bulk of the funds has gone into the first three. What is the outcome? Certain technologies are under development in cotton such as the Bt Bikaneri Nerma. This is an interesting development and needs to be looked at very seriously to understand the failure of the technology as well the failure of the technology regulatory system.

Bt Bikaneri Nerma was jointly developed by the University of Agricultural Sciences, Dharwad and the National Research Centre on Plant Biotechnology, New Delhi. The varietal Bt Bikaneri Nerma was released in 2008 after all the regulatory systems/parameters were flouted because it was a public sector GM crop that everyone wanted. Everyone, especially decision-makers, wanted to force the point that if public sector GM research is brought in, all the ills of GM crops would be solved. The hybrid came out in 2009 but in the same year, both Bt Bikaneri Nerma and the hybrid variety, the first ever GM crops developed by the

beyond the failure of that technology and pointed out something very serious: the failure of the ICAR on scientific, technical, institutional and ethical fronts. That is a serious concern because when you talk of good science, you need to have rigorous, evidence based and ethical science. Science needs a conscience. Mahatma Gandhi did not talk of the human face; he talked of conscience. Science without conscience is evil. That is what he said. So, that conscience part is missing because, in 2005, they knew that this crop is not what it is supposed to be.

There was this whole issue of where the gene came from? It came from a university in Canada. It was not developed by the ICAR or the NRCPB (National Research Centre on Plant Biotechnology). Yet it was claimed to be an indigenously developed technology. When I talk about the problems with the technology and the reason for the debate, it is because this technology is creating a serious loss of values in the agricultural research system.

There are certain questions that this whole issue of Bt Bikaneri Nerma forces. Did the contamination take place and was there any mechanism to revive these varieties/hybrids? If contamination has

The varietal Bt Bikaneri Nerma was released in 2008 after all the regulatory systems/parameters were flouted because it was a public sector GM crop that everyone wanted

public sector, were called back. It was realized that the crop contained a Monsanto proprietary Bt gene.

For two years, nothing happened. I do not know how much introspection or investigation was done at the ICAR until towards the end of 2012, a report into this fiasco by a committee chaired by Dr S. K. Sopory, vice chancellor of JNU, was released. It came up with very strong views, observations, recommendations on the way research was done in the ICAR institutions and the way regulatory system functioned. The whole things seemed to be a propaganda; you are going to get your public sector GM crop but just wait for the right moment, you are getting that but until then, let the private sector also have it. That is the kind of propaganda that is going on.

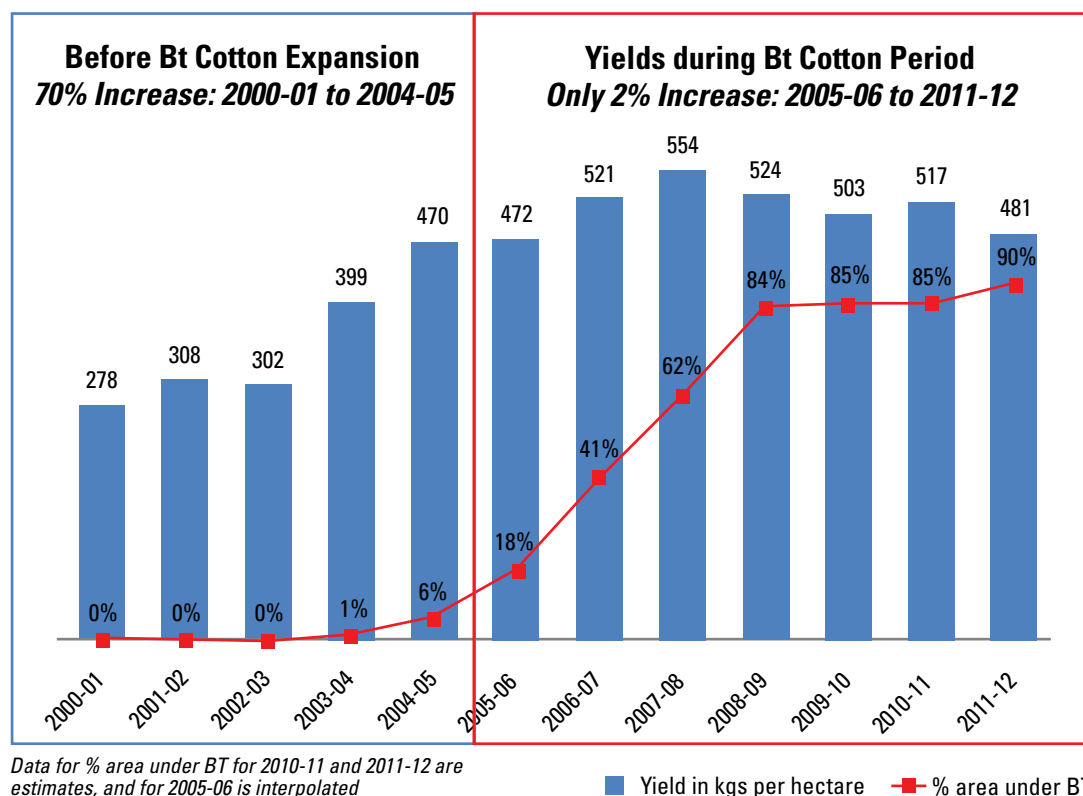
Finally, what do we have now? Almost 99 per cent of the cotton is with Monsanto. The public sector just acts as a Trojan horse, as a propaganda machine for the private sector and that is what Bt Bikaneri Nerma gave us. The S. K. Sopory Committee went

happened and is inevitable, how come the two other events of Bt cotton (one by JK Seeds and another by Nath seeds) are still in market? Why are MON-531 and other events not yet contaminated? The argument that contamination in hybrids can be avoided as the seed is freshly produced every year does not pass muster because Bt NH-44 is a hybrid. If contamination is inevitable, how are the ICAR and the state agriculture universities working on the GM crops with plans to market their GM crop varieties/hybrids in future? More importantly, what action has been taken in the last one year to fix accountability for this scientific fraud?

There are hybrids in the universities, developed by them and this is something more serious because even the foundation seeds have been contaminated. In fact, we have been asking the universities in the country in the cotton belt to provide that seeds are non-Bt seeds, non-GM because all these universities were in the leadership positions in the development of non-GM hybrid seeds.

Bt Cotton – myth and reality

Increase in Cotton Yield : The Full Picture



Note: Considering the period from 2000-01 as the pre-Bt cotton expansion period and the phase from 2005-06 to 2011-12 as the Bt cotton period, a different picture of the yield gains emerges.

Source: <http://indiainfo.org/wp-content/uploads/2012/03/Bt-Cotton-False-Hype-and-Failed-Promises-Final.pdf>

The Dharwad Agricultural University is supposed to have more varieties than the private sector but they are not available in the market because the public sector has failed even in the old seed market. Intentionally or unintentionally it has failed and that is costing us a lot.

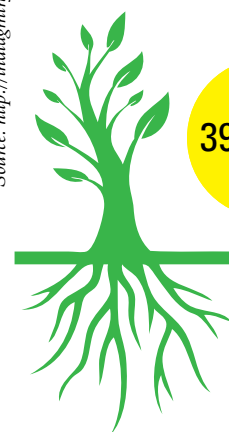
The issue here is lack of accountability. The Sopory report came out in August 2012 but was not put in public domain for four months. It was put on the ICAR website in mid-December 2012. It has been more than a year since the public got the report. What measures has the ICAR taken to ensure that this kind of scientific fraud does not happen in this country? This is a serious governance issue of national interest that needs to be addressed. The ICAR took a different route to answer the questions raised by the report. At a press conference the ICAR said that it was coming out with a Rs 8,200 crore project on super Bt cotton. Something is seriously wrong with this approach.

One has the figures on Bt cotton that show where the hype and myth lie and what the reality is. I come from Karnataka where 50 per cent of the Bt cotton has failed completely. The state's

agricultural ministry has now asked the company to compensate the farmers. There have been serious secondary pest attacks. How does one continue to insist that Bt cotton has been a big success? There has to be more informed discussions with people who know the reality.

Finally, there is the question of pest control but the agriculture system in this country is not ready to accept NPM (non-pesticidal management) as a method and scale it up. Probably, that is where the answer to all controversy lies because, basically, Bt is only for pest management. Why go for Bt if there are better pest management practices? The NPM programme started in Andhra Pradesh in 2004-05. In 2013, it has reached 38 lakh hectares. The state agricultural university has been looking at the results and saying that it is indeed working. So it is high time to consider this approach. In the seed sector too, there is the community-managed seed system and anyone interested can find these seeds.

The point is that problems cannot be solved with the same thinking that created them. Yet that is something that the ICAR is doing and that needs to change. ●



Time for Compulsory Licensing to Break Monopolies

Prabir Purkayastha

Three issues have been discussed today from different perspectives. Genetically modified organisms were identified and discussed but transgenics was also brought in without explaining the difference.

It was said that anything we modify in the genes is genetic modification. Therefore, breeding is also genetic modification. I would like to take a stand in between; a comfortable middle ground and say that genetic modification does



PRABIR PURKAYASTHA is president, Centre of Technology and Development and chairperson, Knowledge Commons

not happen through selective breeding. That is transgenics.

One can easily work with genetic knowledge, which is not a multi-billion dollar proposition. Breaking the genetic code is very cheap today. It is one of the low-cost technologies and will cost less as we go along. That is good for us because we can genotype ourselves to find out where we came from. Was Chengiz Khan one of our progenitors? For about 10 per cent of the world's population, he is.

The need is to do selective breeding to



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the extent possible without really getting into the hazardous issues of transgenics. If things that cannot be recalled are released into nature they represent a different quality of risk but with selective breeding one does not encounter that problem because one could breed it anywhere and more easily because the genes are known, the areas where the genetic material will be transferred are known.

Thus risks can vary qualitatively; there are normal risks like when we practice agriculture and even selective breeding has established protocols to check whether the product has problems or not. This will reduce a lot of the ongoing debate because

many issues being referred to are really transgenics.

The other issue is around the threat of transgenics or GMO (genetically modified organisms). That is not a scientific threat but a socio-political threat that one company may own Indian agriculture that, obviously, is a huge threat to Indian agriculture. If all the seed is owned by a couple of companies or even five or six of them, it is a threat. The question is whether the public private partnership being talked about means that the Indian Council of Agricultural Research (ICAR) becomes the extension programme of Monsanto. This is what we need to think about seriously.

This is a huge threat to Indian science and technology and to Indian agriculture but it is a political threat and not a scientific one. Given India's scientific base and the falling cost of genetic and agricultural research, it will be deeply threatening for Indian agriculture if such political threats are allowed to dominate agriculture.

Scientists must understand that this threat constitutes half the political battle that is coming up against transgenics. The debate is being generated not only from a scientific plane and it is futile for scientists to say that they will talk science and the rest is not their headache. Scientists have to understand the political-social context within which science works. This is an area that they really need to think about.

Public sector science is essential for agriculture to develop and Indian agriculture cannot be made dependent on a handful of multinational corporations. The Massachusetts Institute of Technology's annual budget is eight to 10 times the budget of ICAR and it is important to appreciate that India is not spending a lot of money on agriculture. It is very important to understand that creating cutting-edge technology or breaking the shackles of multinational corporations that have knowledge is an expensive proposition.

Whether the Indian agricultural institutes can absorb additional funding is another question that needs to be considered. Certainly there is need to increase funding if India wants to participate in the business of developing new technology.

Seed is going to be a critical issue and there is a question of monopoly. It is a question of science and technology but also one of biotechnology, which becomes important in the debate. Unfortunately or fortunately, there is a collision here.

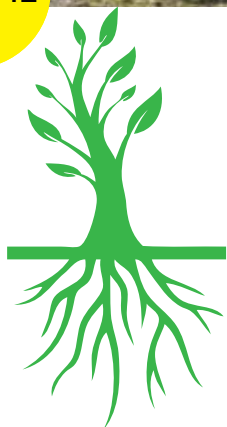
The next point that needs to be understood is the reference to the Monsanto gene. Under the Indian patent laws, there is no Monsanto gene





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Some argue that genes can be patented. I have read the Patent Act several times and do not find it possible to patent a gene under it. So what has Monsanto patented?

because life forms cannot be patented. So genes cannot be patented. That is not a position that only I am taking, that is the position that the Indian government has taken for the time being. There are arguments that genes can be patented. I have read the Patent Act several times and do not find it possible to patent a gene under it.

So what has Monsanto patented? It is essentially a process patent; a process of how to insert the gene and, unfortunately, Monsanto has also tied up the ICAR in a way that it cannot break the pattern, the latter being a partner.

The major issue is two folds. On intellectual property rights, there is need for Indian technology that actually provides substitutes for the gene insertion processes that the multinationals have a patent on. They have a patent thicket. In Australia, the Cambia Bios initiative has worked on how to break these monopolies and they have found very simple ways because they are all vulnerable to one very

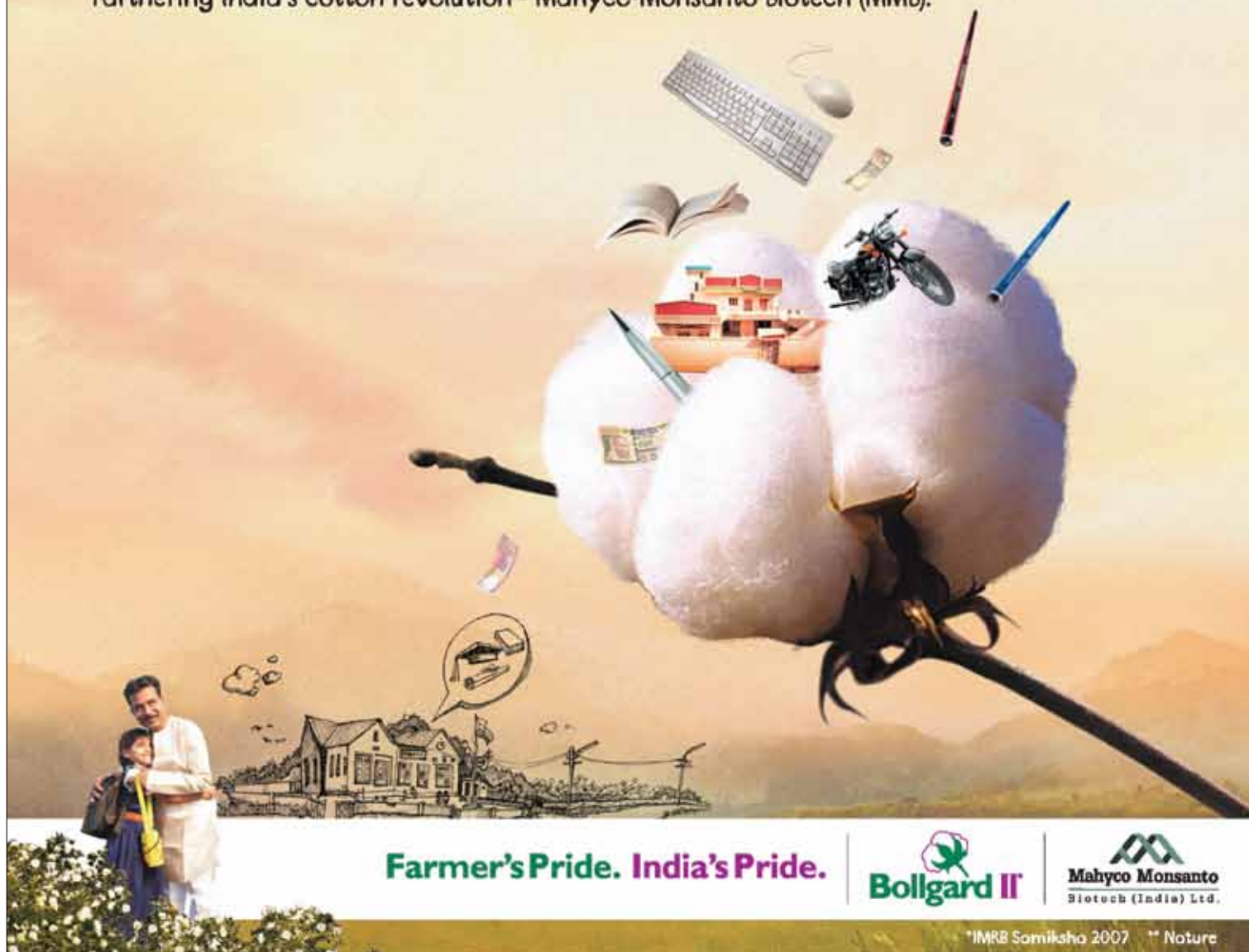
simple process that is common to all of them. If one breaks that, one can break all monopolies; especially Monsanto's monopoly. India should really look at patent busting as an active area of research to break the monopoly of seed companies and for this the ultimate weapon is in its hands – compulsory licensing.

Compulsory licensing is being used for pharmaceuticals. If India becomes dependent on the Monsanto processes, the time has come for the cotton farmers to raise the demand that if the biotech giant asks for too much – they do so because they are really taking a lot of money from the Indian agricultural seed market – the time has come to compulsorily license it. What prevents India from doing it? India must have the law to break monopolies if they are exercised. When there is a 99 per cent monopoly, the time has come to argue that for the monopoly to be broken, India should go for compulsory licensing if this is the state of affairs. ●

India's cotton farmers' lives transform for the better

Research indicated that 87 per cent of Bt cotton farmers enjoyed higher standards of living, 72 per cent invested in their children's education and life insurance, and 67 per cent repaid their long pending debts*. Many more built *pucca* (stone) homes, purchased farm equipment and motorcycles, leased additional land for cultivation etc. Further, women from Bt cotton households had higher access to maternal care services, while children had higher levels of immunization and school enrolment*. Additionally, female earners witnessed a 55 per cent gain in average income, and 42.4 cr. additional days of employment across the total Bt cotton area**.

Partnering India's cotton revolution - Mahyco-Monsanto Biotech (MMB).



Farmer's Pride. India's Pride.



*IMRB Somiksha 2007 ** Nature

• Bollgard® and Bollgard II® in-the-seed trait technologies provide cotton plants in-built insect protection against bollworms infestation leading to lower insecticide use, better boll retention, and higher yields. • Bt cotton is widely planted around the world as an environmentally friendly way of controlling bollworms, which are known to cause maximum yield loss and economic damage to the cotton crop. • Mahyco-Monsanto Biotech India Ltd. (MMB), a joint venture between Maharashtra Hybrid Seeds Co. Ltd. (Mahyco) and Monsanto Holdings Pvt. Ltd. (MHPL) has broadly licensed in-the-seed cotton trait technologies to several Indian companies so farmers can access technologies in the preferred hybrid seeds of their choice. • Bollgard II and Bollgard logo designs are registered trademarks and under the license from Monsanto Company. For information/career opportunities, contact www.mahyco.com or www.monsanto.com.

A close-up photograph of a laboratory setting. A person's hand is visible on the left, holding a pair of long, thin metal tweezers. The tweezers are positioned over a small, green and yellow plant specimen that is being placed into a clear glass petri dish. The petri dish sits on a white surface. Above the dish, the lower part of a microscope is visible, including a black adjustment knob and a silver-colored body. Another hand is visible on the right, holding a pair of metal forceps. The overall scene suggests a scientific or agricultural research activity.

Time for Agri-Research to Get Smart

Peter E. Kenmore



DR PETER E. KENMORE

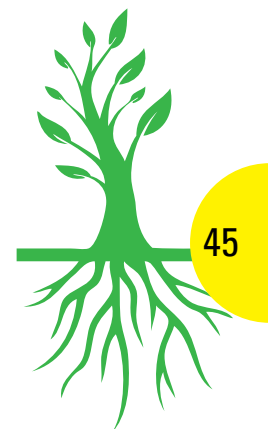
Representative of the Food and Agriculture Organization of the U.N. in India. He has worked in agricultural field research, development, education, and extension in India in 1982 and in rice, sugarcane, vegetable and cotton fields in over 36 districts



While the total spending per year on agricultural research is important, smarter spending, to answer strategic, often location-specific questions can be even more important. Examining trends in agricultural research funding reveals that over 50 per cent of public research funding is now spent in the developing countries. China now spends 13 per cent of the global total public research funding in agriculture, India with 7 per cent, the rest of Asia and the Pacific at 5 per cent and Brazil 4 per cent. In 2008 terms (expressed as purchasing power parity dollars) this means \$2.1 billion in China, \$0.6 billion in India, \$0.5 billion in USA and roughly \$0.2 billion each in Brazil, Argentina, Iran, Japan, Nigeria and Russia.

Significantly, while global public spending remained steady after 2008 at around \$16 billion, private spending grew a bit faster in the world between 2000 and 2008 with a larger share on research into food processing. Private sector spending increased through this period by 26 per cent but public sector spending by 22 per cent. The overall ratio in agriculture was 79 per cent from the public sector and 21 per cent in the private sector in 2008. What is interesting is the continuing importance of the public sector, which is absolutely necessary although, the growth in private spending was larger. Agricultural research and development (R&D) in the private sector focused more on food processing probably because that is considered a safer investment.

Smarter, more strategic research opens up new understanding, new crop and agro-ecosystem management pathways, more sustainable options and not just transplants technologies from exotic places. Strategic research is extremely important, location specific and usually best done in the field. In contrast to when I started working in India 32 years ago, with my bare feet in the mud of rice paddy fields, today only a few scientists work out in the field. The research system no longer rewards those in the field. And yet, India's unique system of



over 630 district farm research centres, the Krishi Vigyan Kendras (KVKs), remains a tremendously unexploited resource. It should be supported a lot better, precisely to do smarter research. Research done in KVKs in co-operation with farmers should then be analysed to generate upstream research questions, and then to guide development and management strategies. Three cases, of rice Integrated Pest Management (IPM), of farmer-managed groundwater systems, and of irrigation and pests in cotton, are providing scope for new approaches in smarter agricultural research.

Field research at the International Rice Research Institute, Philippines showed that rice sprayed with insecticides nearly perished while neighbouring unsprayed rice field yielded 6.5 tonnes per hectare. The pesticides killed the natural enemies and thus allowed a pest, the rice brown planthopper, to explode. The sprayed crops, showed an 800 times increase in pest numbers compared to the unsprayed, in one crop season while spiders were suppressed by 80 to 90 per cent and the other natural enemies were suppressed to the extent of 75 to 85 per cent. Eliminating the natural predators defending the crop permitted the pest populations to explode. Similar studies yielded similar results in Indonesia, Philippines, Vietnam and in Thanjuvar district in Tamil Nadu.

Indonesia took the policy lesson and was able to reduce pesticide use in rice production over a five-year period by between 65 and 70 per cent and the rice production kept going up nicely. This is a nice example of strategic research: showing that the problem was caused by insecticides revealed that



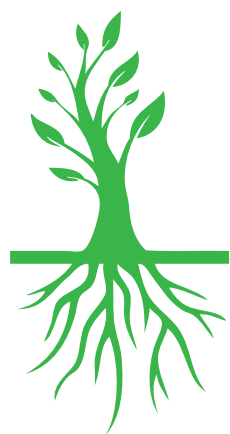
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Smarter, more strategic research opens up new crop and agro-ecosystem pathways, more sustainable options and not just transplant technologies from exotic places

conserving the natural enemies present in the field was a more realistic solution. This was translated into policy change in Vietnam, Philippines, Thailand and Bangladesh. In turn, starting in the mid-1990s, India reduced its total insecticide load, especially in rice production by over 33 per cent. Rice production continued to grow nationally, and by 2012 India's rice production exceeded 103 million tonnes per year.

An example of strategic research on aquifers and groundwater in Andhra Pradesh ten years ago resulted in farmers learning to measure the quantity

of water in underground aquifers during the *kharif* season. They shared the results with thousands of farmers throughout micro watersheds. At the beginning of the next *rabi* season they estimated how much water was left. Instead of growing paddy, they grew sunflowers and only used one third the water per crop. When the actual groundwater went down, the extractive use of that groundwater was brought down. When the rain came back in the following *kharif*, the farmers were again able to use more water. They were empowered to change their crop, strategically. The strategic research into





watershed hydrology and geo-hydrology allowed the farmers' observations to be put into an estimate of how much water there was.

This was a strategic research that then utilized an intensive kind of an extension approach called the Farmer Field Schools (FFS), where the participants come to understand their local technical options better. Farmers measured things in the field, adapted new concepts, clarified those through discussion and became able to apply those learnings and concepts to an important concrete issue. Measuring the water in their common local aquifer, identifying new crop options and then sharing those with the larger community as a 'crop water budget' is an example of what happens in a Farmer Field School. Since the beginning of the FFS movement, now over one crore small and

marginal farmers in over 50 countries around the world have graduated from FFS, learning better how to observe, experiment, and test new solutions to local agro-ecological and production problems. In the 1990s, FFS farmers grew cotton in Guntur district of Andhra Pradesh (at that time India's number one insecticide-using district) and then near Madurai in Tamil Nadu. That was the time of ecological disruption caused by pre-emptive calendar-based use of insecticides, which released problems like the American bollworm. The FFS participants applied an average of one spray per season, instead of the more typical 10-15 sprays per season. The farmers made smarter decisions based on tracking crop-associated biodiversity, the ratio of pests to their natural enemies. In the past three years, FFS have also sprung up through the Better

Cotton Initiative (BCI) with both public and private support. The number of BCI FFS farmers in 2012 reached 1.5 lakh over a 2.6 lakh hectares area with an average yield of almost 800 kg that is between 35 and 40 per cent higher than the average for the country. Although both BCI FFS farmers and those not in that programme all grow Bt cotton varieties, the BCI FFS farmers use less pesticide while getting their higher yields.

This interesting field result, observed over two decades, of high yields with lower insecticides (regardless of the cotton variety) is stimulating exploratory strategic work on cotton. This builds on published data, applying globally proven cotton simulation computer models, of the crop and its key pest in India. Understanding this ecosystem as the previous case of rice suggests that the key pest is not the American bollworm but the pink bollworm, which has been the traditional Indian cotton pest, recorded in scientific literature for more than 150 years. Excessive use of insecticides, from the 1970s through the 1990s, killed natural enemies and released other pests including the American bollworm. Geographical Information System (GIS) data mapped on blocks (each grid represents an area of 10 x 10 km) shows the majority of cotton area is rainfed.

Using the cotton model with historical weather data from 1980 to 2010, it was seen that the rainfed cotton yield was driven by the rainfall. Going through a season, the flowers come out, the buds come out and then the fruit. Throughout the GIS cotton growing areas and yields are simulated modelling, based on recorded weather. These include cases of the pink bollworm – because of the heat coming out in the early part of the season going into cotton crops and eventually causing damage.

Because irrigated cotton is planted earlier than rainfed cotton, pink bollworm attacks the second group of bolls in the irrigated cotton crop, after which the worms come out, then the adults come out and lay eggs. In this case typical rainfed cotton, which is planted quite a bit later than the irrigated cotton, gets hit harder by pink bollworm. One possible strategic conclusion about pink bollworm and intensification and modernization was that irrigated cotton allowed an earlier generation of pink bollworms to get rolling, which hit the rainfed cotton harder, so there was a negative interaction between the two cropping systems. This is the kind of result one gets with strategic, ecosystem-based research. If applied to the major cotton





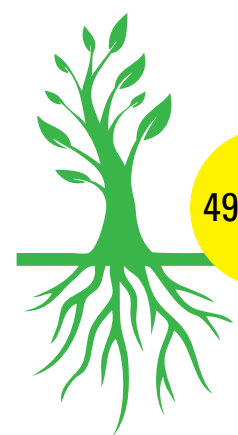
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agro-ecosystems, perhaps in All India Coordinated Research mode, one could obtain better strategic inputs to cotton crop planning in each district, to be supported through the KVKs.

A resented strategic approach to increasing cotton yields is higher density plantation, which the Indian Council of Agricultural Research (ICAR) has researched and developed and Department of Agriculture have been effectively promoting. Although the average density of cotton planting by farmers in India is around 2-2.5 per square metre, crop simulations suggest that yields are higher at six plants per square metre under rainfed conditions and up to eight plants per square metre in irrigated conditions. Over most of India's cotton area, yields would go up if the crop would be planted at higher densities.

Krishi Vigyan Kendras are decentralized and can lead to local innovation when farmers face resources constraints. This makes them very important

KVKs are particularly important because they are decentralized and can lead to local innovation at a time the farmers are facing resource constraints. They should respond to farmer queries and issues; track pest populations and natural enemies in local areas and provide information to farmers. They should be empowered by real time linkages with networks and get better incentives for research in fields and districts so that the research work is localized. The entire national system would work more on local issues, relevant to farmers and getting their feet muddy. That is extremely important and an unutilized potential. KVKs are not the final broadcasters of technology. They are problem solvers and should be rewarded for doing that. Perhaps the best local partners for KVKs could be Farmer Field Schools, where farmers and scientists can identify, observed, and analyze local problems from a comparative point of view. India should seek to synergize KVKs with FFS better to solve and optimize agricultural production and ecosystem services from agriculture at the local level inside each district. ●





Point Counterpoint

Whither Indian agri R&D? Whither Indian farmer? The Q&A following the discussion tried to explore the issue further

COMMENT FROM A GUJARAT-BASED FARMER/INVENTOR:

A comment was made about farmers and non-farmers. Reliance Industries has a turnover of Rs 4 lakh crore while the total turnover of all wheat and rice farmers is about Rs 3 lakh crore. That is the difference in our economy. The second thing is about water. In Gujarat, 95 per cent of the area supposed to be irrigated by the Sardar Sarovar Dam is not getting irrigated as per the latest report of Narmada Control Authority. There is 99 per cent corruption in Gujarat.

COMMENT (UNIDENTIFIED):

We have transformed so many rivers but still have problems between states over sharing of river waters. Water and weather are important issues and we need the government to share information on them.

COMMENT (UNIDENTIFIED):

There was a campaign against Bt brinjal but Bt is widely used in organic farming too. It is supposed to be safe in organic farming. So there is a gap in information somewhere because public perception about Bt brinjal is poor though people think well of organic products.

RAJU KAPOOR:

It has been said that there are pesticides and there are safer pesticides. We need to move to safer pesticides and the green and blue labels become very important.

QUESTION (UNIDENTIFIED):

How do salaries of Indian scientists compare with global salaries for scientists?

**NEHA SAIGAL:**

I am from Greenpeace and I have a question for Dr Swapan Dutta. Why is the Indian Council of Agricultural Research (ICAR) emphasizing genetically modified (GM) crops? Why is only GM crop being equated to modern biotechnology? We know that ICAR is investing a lot in MAS (Marker Assisted Selection). Why do we not hear about that? Also, we know that it takes about \$80 million in USA and ₹24 million in the E.U. for getting a GM crop through the regulatory process, so when Dr Peter Kenmore spoke about smarter research, do we actually think GM is smart research? Here, we are actually talking about having no budget at all and then we are talking about investing so much in GM technology.

SWAPAN KUMAR DATTA:

Is the ICAR pushing GM or making GM more important? No. I did talk about MAS in connection with marker genes used particularly for bacterial blight and blast resistance for basmati and many other crops. The ICAR's budget for GM is only 0.3 per cent of the

**SWAPAN KUMAR DATTA**

total budget. That shows how much money we are putting into research in transgenics. The MAS budget is a little more, around 0.4 per cent. So, the budget or allocation or emphasis given to biotechnology or transgenics is very meagre. We are putting a little bit of money in genomics but that would be 0.1 per cent.



R. B. SINGH



Y. K. ALAGH

The Beijing Genomics Institute has 1,500 scientists working on bio-informatics alone and several thousand people are involved and providing a global service. I do not want to make comparisons but am trying to show the tremendous constraints in terms of what we are trying to address. There are many Indian Agricultural Research Institute students here and I feel sorry for them, given the way we are doing our research.

As far as comparative salaries are concerned, I do not have a figure. I can only talk about myself and my salary at the ICAR, holding one of the top positions, is Rs 1 lakh a month. I have worked for several international institutions for many years. I worked for the Swiss Federal Institute of Technology. My salary had several more zeros when I worked there. The point is that we cannot compare the two though I do not know why. Some people think that the ICAR pays a lot but my children think that my salary is a joke.

R. B. SINGH:

To address the first issue, farmer earnings are extremely important. Socio-politically and otherwise too, the salary one earns is very important. We earn a salary and the farmer too should earn a minimum salary or a minimum income and there must be ways by which he can earn it. It is also imperative for the government to be sensitive about the increasing income disparities between the farming and non-

farming community between the two Bharats or two Indias. We cannot afford this disparity and something must be done. Diversification is one way and there are other ways like high-value commodities, linking farmers with markets and high-value chain markets. There are so many ways in which it can be done and it must be done.

The second issue is about pesticides. The point I made was that there are so many dirty players in the pesticides business that the good ones get lost. There is a very high degree of spurious pesticides even in bio-control agents. Therefore, there is great need to control quality. There is also need for new molecules, safer molecules. Despite all the expenditure, India has not produced a single new molecule for pesticides. However much it spends, India has little competitive advantage in the field of pesticide growth. India imports, refines, repacks and sends it out again. It is now one of the largest exporters of pesticides but it imports and exports and not even one safer molecule can be ascribed to India. I think the ICAR or anyone concerned should take a note of this.

Third, I fully agree that the definitions of biotechnology, GM and transgenics have to be clear. When it comes to genetic modification, the dwarfing genes of wheat and rice, they did tremendous phenotypic modification and change was brought into. With pleiotropy (influence of single gene on multiple traits), a series of genes were impacted, so

There are so many dirty players in the pesticides business that the good ones get lost. There is a very high degree of spurious pesticides; even in bio-control agents



RAJESH KRISHNAN



PRABIR PURKAYASTHA

If Indian public sector scientists, have made a mistake with Bt Bikaneri Nerma, they should be penalized If they have truly made a mistake, it should be known to everyone

many pathways were impacted, so many proteins were impacted inside the plant in the system.

Not everyone understands that. So any trigger that brings into a major phenotypic modification has to be studied, understood and documented. This is why the government is investing more in genomics and phenomics and this has to be understood properly. Transgenics is a different cup of tea and the debate around that should be carefully considered and understood.

Think of the molecular rated selections, think of the Basmati Pusa 1509 that gives you \$4 billion worth of exports. Today, India is the number one exporter of rice of the best quality. This is because of the molecular rated selection of the desired gene that has conferred resistance to the brown planthopper, sheath and blight. This is molecular biology that has collected those genes and more of this should happen and more should be invested into it.

Transgenics is a very small component of the entire biotechnology game. Biotechnology should be defined properly, people should know what it means and no one should come and say – as in the case of green revolution – that there is violence of the green revolution in Punjab. If people say that this has happened because of biotechnology – without knowing what we are doing, ignoring the facts that we have – it is unfair. There should be very strong science coming into risk management and that science is extremely sophisticated.

If Indian scientists, public sector scientists, have made a mistake with Bt Bikaneri Nerma, they should be penalized. If they have truly made a mistake, it should be known to everyone. The ICAR system should be open, transparent and clean about this.

To consider the Séralini instance; it has created havoc all over the world but he has withdrawn the paper and apologized and the publication does not exist. The system has apologized. This is the real truth of rigour. Rigour of honesty. *Vigyan jo hai satya hai, shivam hai, sundar hai*. That is way the science that should be practiced and then nobody can come in your way. There is plenty to do in that way.

RAJESH KRISHNAN:

As far as the difference between the spores that you use of the Bt bacteria as opposed to the Bt Brinjal gene – I suppose you have an informed understanding of that distinction – there is actually a modified gene that goes into the Bt Brinjal.

Secondly, nowhere in nature, do you find a gene added to a primer, added to two antibiotic resistant markers and all strung together into a cassette being put by a plant into another plant by an organism. So there is an effort to increase the expression of a gene. You find the protein and gene being expressed in every cell, the protein in every part of it and there is a problem in that. That is clearly the difference in that.

I think the comparison between the Bt Bikaneri





V. V. SADAMATE



PETER KENMORE

Nerma and the Séralini debate is highly misplaced because Séralini has not apologized for his paper. In fact, he has taken on the fight in the scientific ground and has asked for the reason for the retraction. There is no reason given for the retraction of the Séralini paper. There is definitely politics behind it because the biotechnology editor brought in for that particular journal was an employee of Monsanto and had been brought in only a month before the publication. (The Séralini affair began in September 2012 and involved the publication of an experiment conducted by a group led by Gilles-Éric Séralini, a French molecular biologist. The experiments involved feeding Monsanto's RoundUp-resistant NK103 maize (called corn in North America) and the herbicide RoundUp to rats, over the rats' two-year lifespan.)

PRABIR PURKAYASTHA:

I think the entire Séralini debate needs to be discussed separately because he has not apologized but the paper has been withdrawn and the reason given. Let us not discuss facts because facts are not open to discussion. Only interpretations are. Dr R. B. Singh talked about risk analysis because it is a very important issue. How do you analyze risks of technology, particularly for catastrophic technology? This is what needs a discussion; things like nuclear technology.

There are hazardous chemicals, as in Bhopal,

which are catastrophic. I do not think of GM as a catastrophic technology in spite of all the Séralini papers. The way we analyze risks must be tempered by the kind of damage it creates. Finally, if we must compare, it must a comparison with something similar happening in nature. We need to assess the risks instead of saying that risks cannot be assessed in GM because transgenics did not exist before.

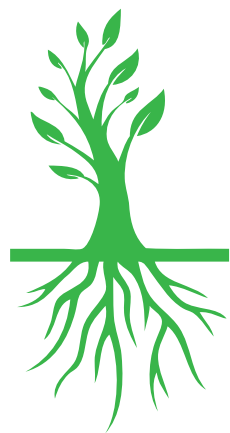
DR Y. K. ALAGH:

Regulation can mean many things; not just control. Of course, it also involves control. There has been very little discussion on the risk question for example; we have this whole series of unregulated domestically produced hybrids in paddy, high yielding varieties, which have spread in Uttar Pradesh, yielding as much as 40 quintals. That kind of Bt technology has not gone through any testing. If, heavens forbid, if there is a mistake and something gets into the food chain or water chain, there will be, with due respects, hell to pay.

Similarly, in terms of pesticides technology, you should be talking about green technologies but there are dangers and in the regulation of dangers. We are putting in much less attention to it than we should. So that is a point very well worth taking.

The catastrophic technology is a very interesting question. I will begin with the Sardar Sarovar Dam that I planned. There was a one-in-a-hundred-year flood model that, I said, that was not enough and we

There is a series of unregulated, domestically produced, high yielding hybrids of paddy in U.P. yielding as much as 40 quintals. That Bt technology has not been tested





SO MANY QUESTIONS; SUCH FEW ANSWERS

Human progress would have been simply impossible if everybody, at all times, was ensuring that no risk is ever to be taken. Taking risk is central to innovation

modelled a one-in-a-thousand-year flood and then a one-in-a-ten-thousand-year flood. Somebody asked what about one-in-a-hundred-thousand-year flood? It turned out that the one-in-a-hundred-thousand-year flood – that is *pralay* (apocalypse) would submerge the whole of Gujarat. Even Surat will be under water. You can take things to absurd levels. There are always possibilities of danger in some technology and one must make a reasonable assessment as to what reasonable risk has to be taken. Human progress would have been simply impossible if everybody, at all times, was ensuring that no risk is ever to be taken. In fact, taking risk is central to innovation, which brings me to Sardar Sarovar.

With due respects to you, the Indian Space Research Organization (ISRO) data shows – they send it to me because I have been a former Minister of Science & Technology and I have been a friend of satellites – that last year, 7.5 lakh hectares was irrigated by Sardar Sarovar. I agree that with Narmada Control we have not completed the distribution system. So, if you are saying how much of water is going officially through the distribution system, it is close to less than two per cent of what is planned. The Gujarati farmer is different – he or she manages seeds in a different way, the farmers pump out water from every branch and every canal. Every time that I feel tired in Ahmedabad, I take out my Maruti car and I go out into the fields and there are lakhs of farmers pumping out water.

In the beginning the Sardar Sarovar Nigam said this was wrong because it believed in controlled water supply but it did not ensure controlled water supply. It did not complete more than 15 per cent of the distribution system. The farmer is, however, taking out water and the bird does not lie. I can send the pictures. There is no question about the big increase in wheat and Gujarat is one of the biggest wheat producers in India. It is no longer Punjab. We have become one of the biggest paddy producers in India and we were not always a paddy-producing state. We had groundnuts and such others. Sardar Sarovar has been planned for diversification but if we do not complete the canal system, the farmer is not going to let the water go. He is using it and uncontrolled water can be used only for paddy. Today, the price of paddy in the Gujarat market is as low as in Punjab and Haryana and the state produces high yielders too.

Another point was raised about the information system. A draft water framework law is ready. It was done under a committee that I chaired. We have built the outlines of what we call a water resources information system. It is in the public domain. We are moving over towards using satellite-friendly, computer-friendly information systems for the agriculture sector. In the water sector, my own impression is that there should be a lot of progress between now and the year 2017. I think it is almost within our grasp. ●



Lessons from Heritage

Bharat Dogra

A very significant, yet neglected, resource in the quest for improving agriculture and helping farmers is the available traditional wisdom on farming and related practices. Even during British rule, several British and European experts had studied traditional Indian agriculture and had spoken glowingly of its very rich traditions and scientific basis. There are also farming families that continue with some of the traditions with fascinating results. Prabhavati and her husband Suryabhan in Dudhai village (Sardarnagar block of Gorakhpur district) are one shining example (see Box 1).

What made Indian agriculture so special? In 1889, Dr John Augustus Voelcker, the consulting chemist to the Royal Agricultural Society of England, was deputed by the British government to study Indian agriculture. Voelcker toured the country extensively for more than a year, published his report in 1893 that has been cited as an authoritative work on Indian agriculture of this period.

The essence of what Dr Voelcker said was summarized in the following extract from his report: “I explain that I do not share the opinions, which have been expressed as to Indian agriculture being, as a whole, primitive and backward but I

believe that in many parts there is little or nothing that can be improved. Whilst where agriculture is manifestly inferior, it is more generally the result of the absence of facilities which exist in the better districts than from inherent bad systems of cultivation.... I may be bold to say that it is a much easier task to propose improvements in English agriculture than to make really valuable suggestions for that of India... the conviction has forced itself upon me that, taking everything together and more specially considering the conditions under which Indian crops are grown, they are wonderfully good. At his best the Indian *raiya* or cultivator is quite as good as and, in some respect, the superior of the British farmer, while at his worst it can only be said that this state is brought out largely by an absence of facilities for improvement which is probably unequalled in any other country... I have remarked in earlier chapters about the general excellence of the cultivations, the crops grown here are numerous and varied, much more indeed than in England. That the cultivation should often be magnificent is not to be wondered at when it

productive of the finest examples of careful cultivation... Further, as regards wells, one cannot help being struck by the skill with which a supply of water is first found by the native cultivators, then by the construction of the wells, the kinds of wells and their suitability to the surroundings and means of the people; also by the various devices for raising water each of which has a distinct reason for its adoption. All these are most interesting points with which I am not called upon to deal, for I see little to improve in them which the cultivator does not know perfectly well".

Another aspect, less widely realized, was that of a scientific rotation system. Voelcker pointed out that it is quite a mistake to suppose that rotation is not understood or appreciated in India. Frequently, more than one crop at a time may be seen occupying the same ground but one is very apt to forget that this is really an instance of rotation being followed. It is not an infrequent practice, when drilling a cereal crop, such as *jowar* (sorghum) or some other millet, to put in at intervals a few drills of some leguminous crop such as *arhar*.

At his best the Indian farmer is quite as good, in some cases even superior to the British farmer. At his worst, this is largely because of an absence of facilities for improvement

is remembered that many of the crops have been known to the raiyats for several centuries, rice is a prominent instance in point".

More specially he stated: "To take the ordinary acts of husbandry, no where would one find better instances of keeping land scrupulously clean from weeds, of ingenuity in device of water-raising appliances, of knowledge of soils and their capabilities as well as of the exact time to sow and to reap, as one would in Indian agriculture, and this not at its best only but at its ordinary level. It is wonderful, too, how much is known of rotation, the system of mixed crops and fallowing. Certain it is that I, at least, have never seen a more perfect picture of careful cultivation, combined with hard labour, perseverance and fertility of resource, than I have seen at many of the halting places in my tour. Such are the gardens of Mahi, the fields of Nadiad and many others".

An important asset of traditional Indian agriculture was the well-developed irrigation system, "Irrigation by wells is at once the most widely distributed system and also the one

There are many systems in ordinary use that are far more complicated than the above. "For instance, not only may there be rows of crops, side by side, as noticed above but the alternating rows may be made up of mixtures of different crops, some of them quick growing and requiring both sun and air, and thus being reaped after the former have been cleared off. Again, some are deep rooted plants. Others are surface feeders, some require the shelter of other plants and some thrive alone. The whole system appears to be one designed to cover the bareness and consequent loss to the soil".

Voelcker was, however, not the only agriculture scientist to point out these assets of traditional agriculture in India. There were several other scientists, other experts and scholars who did so. Quotes from two others, J. Mollison and A. O. Hume are interesting. J. Millison, who later became the first Inspector General of Agriculture in India, published a volume in 1901, "Text Book of Indian Agriculture". Like Voelcker, he stressed the suitability of the implements used traditionally in Indian conditions.



"I believe that the implements in ordinary use are entirely suitable for the conditions of Indian agriculture. This statement may be objected to by other authorities but, if such is the case, I am afraid, I cannot change a deliberately expressed opinion. To those who are skeptical I can show in parts of the Presidency cultivation by means of indigenous tillage implement only, which in respect of neatness, thoroughness and profitableness cannot be excelled by the best gardeners or the best farmers in any part of the world. That statement I deliberately make and am quite prepared to substantiate".

A. O. Hume wrote about weed control by Indian farmers at that time in "Agricultural Reform in India" (1878): "As for weeds, their wheat fields would, in this respect, shame ninety-nine out of hundred of those in Europe. You may stand in some high old barrow-like village site in Upper India and look down on all sides one wide sea of waving wheat broken only by dark green islands of mango groves – many square miles of wheat and not a weed or blade of grass above six inches in height to be found amongst it".

Hume's tribute to the grain-storage practices of Indian farmers is no less glowing, "They are great adepts in storing grain, and will turn grain out of rough earthen pits, after 20 years absolutely uninjured. They know the exact state of ripeness to which grain should be allowed to stand in different seasons."

Another expert Sir George Watt observed in 1891: "It must in fact, be admitted that we have to fall back on Dr Buchanan Hamilton's idea that the chief differences between the thousands of farms of cultivated rices hinge on their properties and peculiarities under cultivation. These peculiarities the Indian cultivator, through the time-honoured practices of his ancestors, is able to recognize far more accurately than botanical science has as yet been able to explain. He determines the suitability or otherwise of this form and that to its contemplated environment with a degree of confidence quite inexplicable."

Dr R. H. Richharia, former director of the Central Rice Research Institute, did extensive and extremely

invaluable work in close co-operation with farmers particularly in Madhya Pradesh, Chhattisgarh and Odisha. He wrote: "Invariably, I found in rice areas some rice growers taking keen interest in their local rice varieties and as they are very much absorbed in them they have all praise for them, so much so that they trace back the history of individual rice varieties to their ancestry with their utility. I also observed that some of them would identify their rice varieties in their own way (not in terms of the modern knowledge of botany) which amount of thousands. This inherent and intuitional faculty of farmers in selection and maintenance of thousands of rice cultivars, gradually being accumulated and descended down for unknown centuries, ever since rice first originated, must be preserved and exploited for the advantage of the present generation and to ensure the safety of those still unborn.

"It may be questioned. Will the rice cultivators absorb and follow up these methods? The answer is that during our extensive surveys of the rice regions of India, we observed that the rice farmers have been following more complicated systems to keep their rice culture vigorous and maintaining their thousands of rice varieties from times immemorial".

In Madhya Pradesh (that then included Chhattisgarh), Dr Richharia's research revealed that several indigenous rice varieties gave high yields without the use of chemical fertilizers and pesticides. This information is provided in *Table 1*. Unfortunately, these traditional high-yielding varieties were not given official recognition.

As Dr Richharia noted: "In fact, in every rice-growing locality, the growers themselves tell us which of their own varieties are high yielding to which they stick. But under the extension services, the definition of high yielding rice variety is different which necessarily involves a dwarfing gene and, therefore, growers' own high-yielding varieties are not recognized which are estimated to be eight or nine per cent in Madhya Pradesh (M.P)".

Writing in the specific context of rice, India's most important food crop, Dr Richharia said that the importance of traditional wisdom of farmers



"In rice areas some growers take keen interest in their local rice varieties and have all praise for them, tracing back the history of individual varieties to their ancestry with their utility"

Box 1: Building on traditional strengths – PRABHAVATI'S FARM

It was a pleasure to visit the garden and farm cultivated by Prabhavati and her husband Suryabhan in Dudhai village (Sardarnagar block of Gorakhpur district). They own only 1.5 acres of land but use this small piece of land very intensively (practising organic farming) and wisely to grow a diversity of crops.

When I started writing the names of various crops and trees in her garden and farm, Prabhavati laughed and said: "Your notebook will fill up and yet you will not be able to write about all that we grow". This gentle confidence, this smiling pride is well-earned. This couple successfully grows a range of produce in a small plot of land.

At the time of my visit, there was paddy, *bajra* (cereals), *maruwa* (millet), groundnut, *til* (oilseeds), *lobhiya*, *tori* or *nenuwa*, lemon, bottle-gourd or *lauki*, *kathal* (vegetables), guava, papaya, mango, *chakotra*, blackberries, mulberry, *mahua* (fruits), trees and shrubs with pest repellent properties like *neem*, *madaar*, *kaner*, trees of timber value particularly *saagwaan*, several medicinal herbs, spices like ginger, *haldi* and even *laung* and also bamboo.

Satyendra Tripathi, a co-ordinator of GEAG (Gorakhpur Environmental Action Group) said that over all seasons Prabhavati grows 52 crops on her small patch of land in a year.

Prabhavati said that her family, her farming and village have benefited hugely from the interaction with the GEAG ever since this organization came to her village about 15 years back. Earlier she



used dung as manure but did this arbitrarily and a lot of its nutritive value for the farmland was lost. She also has a vermicomposting unit, one of the earliest in this region.

"GEAG taught how dung should be put in a trench and composted, how green manuring can be done in a better way, how cow-urine is very useful and how we can do vermicomposting and how Nadep can be prepared. If we could not afford wood and cement for the Nadep (a method of compost manufacture), we used home-grown bamboo and tree-branches. Similarly, we learnt to use produce from various local trees and shrubs to prepare pest-repellents".

Table 1: Potential of some high-yielding varieties of Indian rice with special reference to Madhya Pradesh and Chhattisgarh

S. No.	Original rice variety	Improved version No	Paddy kg/ha	Rice grade	Maturity
1.	Laloo	Bd.12	7024	Medium Fine	Early
2.	Dhour	Bd. 23	6136	Medium Fine	Early
3.	Koyalari	Bd. 811	7350	Coarse	Early
4.	Nungi	Bd. 813	7623	Coarse	Early
5.	Cross 116	Bd. 30	4000	Coarse	Medium
6.	Kalam	Bd. 368	5510	Medium fine	Medium
7.	Beni Kath	Bd. 452	4080	Short fine	Medium
8.	Tedhi Banko	Bd. 207	6290	Long fine	Late
9.	Kala Mali	Bd. 108	7600	Coarse	Late
10.	Safri	Bd. 200	5520	Medium	Late
11.	Dubraj	Bd. 153	4958	Medium fine	Late
12.	Tedhi Banko	Bd. 207	6250	Long fine	Late
13.	Kariya Chini	Bd. 366	5550	Medium fine	Late



Box 2: Cuban lessons from grandpa

Cuba provides a national level example of moving from a highly chemical intensive agriculture to an ecology friendly approach. Peter Rosset, American agro-ecologist, writes that in many cases, peasant farmers had remembered old methods and reapplied them. "In almost every case", Rosset says, "they said they had done two things: remembered the old techniques – like intercropping and manuring – that their parents and grandparents had used before the advent of modern chemicals, simultaneously incorporating biopesticides and biofertilizers into their production practices. Incidentally, many of them commented on the noticeable drop in acute pesticide poisoning incidents on their crops since 1989".

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is tied up with the fact that different varieties are needed for different conditions. He wrote: "If we were to think of a single characteristic feature of the rice crop, which yields food for millions, it cannot be anything else unless it be its (1) variability in the form of thousands of its cultivars, spread in India and in other rice growing belts of the world. This is because of the rice plant's flexible genetic make-up and mutational power to adaption. This means the concept of wider adaptability' does not work in rice and (2) The rice farmers stick to their own varieties, as they (rice farmers) possess their deep knowledge to harvest a crop even under the most stress situations and they also possess high yielding varieties of their own which are generally not included in extension programmes (a major lapse) e.g., in a survey, carried out in Madhya Pradesh between 1971-74, eight per cent of the indigenous rice types were observed to fall under the category of high yielding types, fixing the minimum limit of 3,705 kg/ha.

Dr Richharia, therefore, suggested an approach for improving rice cultivation, which was based on utilizing the wisdom of rice farmers (see Box 2 for a Cuban example). He said: "It is suggested that rural adaptive rice centres (to be known as farmer's rice centres (Kisani Dhan Kendra) may be established, as many as possible, all over the country, with 2-3 acres (about one hectare) of land for each centre.

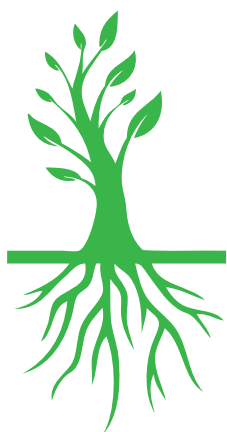
"The adaptive rice centres will be the custodian of all local rice cultivars in respective localities, assembled immediately, supplemented, if necessary, by the already available materials of the locality at

different research centres. They will be maintained under their natural habitat to safeguard the future. They will be known as local treasuries of rice germplasm, a term suggested by Dr Frankel of Australia. In course of time those farmers' centres may be further expanded to embrace varieties of other crops of the surrounding locality with a similar programme, (also to serve as a local gene bank)".

The functions of the centres will be:

1. a) To maintain the evolved rice genetic material for future studies and use, as it is practically impossible to retain it in its original form at a central place in India or abroad. It can be maintained in its original condition at its natural habitat only seeking help of the rice growers themselves.
- b) To educate the young farmers to appreciate the value and importance of their own material, adding new ones as their hobby.
2. The rice growers in general stick to cultivate their own indigenous rice varieties. If the improved seeds of their own varieties by simple selection method (to be done by the trained worker and the nearby local research centres may also do) are offered to them, under their original names, they will gladly accept them.

Such an approach, which links the traditional wisdom of farming practices with present-day scientific efforts of research and extension, all in a framework of environment protection and sustainability, can be very useful for improving India's agriculture. ●



IGNORING THE PULSE OF NUTRITION: The Indian *Dal* Story

Bhavdeep Kang

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Dal, integral to the wholesome traditional meal and the primary source of protein for most Indians, is chronically in short supply – which makes it hard to understand why the latest feed-the-hungry exercise by the central government, the National Food Security Act (NFSA), fails to address India's massive "protein deficit".

Some state governments, notably Tamil Nadu, Chhattisgarh, Andhra Pradesh and Himachal Pradesh, supply *dal* or pulses through the Public Distribution System (PDS), so why is the central government wary of doing so? The National Agricultural Co-operative Marketing Federation of India (NAFED) is procuring and distributing *dals*. It may be argued that there is a funds crunch. The

United Progressive Alliance (UPA) chairperson Sonia Gandhi, the force behind the NFSA, has, however, made it clear that money "to wipe out hunger and malnutrition" would have to be found, the state of the economy regardless.

The other constraint is that there is not enough dal to go around. The government simply would not be able to procure enough from domestic farmers or import enough to meet even half the Indian Council of Medical Research (ICMR) recommendation of a minimum intake of 40 gram of *dal*, per person per day.

Why then, did the food ministry propose a 7.5 per cent import duty on *dals*, based on the Commission of Agricultural Costs and Prices (CACP) recommendation of a 10 per cent import duty? Why



did it do so particularly after it had decided, just three months earlier, to continue the policy of zero duty, in conjunction with the ban on dal exports in order to curb the zooming price of pulses (the inflation rate for dals was 34.5 per cent a year ago).

Also, in place is an import subsidy scheme, where dal for BPL consumers is subsidized, earlier to the tune of Rs 10 per kg, later hiked to Rs 20 per kg. In the current year, Rs 250 crore have been allocated against Rs 577 crore in the previous three years. It may be recalled that subsidized *dal* imports from 2006-11 cost the exchequer losses of Rs 1,200 crore because of mismanagement, according to the Comptroller and Auditor General's (CAG) report of December 2011.

The rationale being offered by the food ministry is that *dal* farmers need protection from cheap imports. The price of pulses has fallen below the minimum support price (MSP). This was attributed mainly to the import of yellow peas *dal* from Canada and partly to imports of chana and tur from Myanmar. With domestic prices low, traders were clamouring for permission to export.

The government feared that with *dal* prices falling, farmers would shift to other crops; a

legitimate point. However, the MSP mechanism is geared in favour of wheat rather than dal. The farmer gets better returns per acre of wheat. This explains why productivity of pulses has grown only 45 per cent in the last 60 years – piffling, as compared to wheat and rice, which have grown at 320 per cent and 230 per cent respectively in the same period. The area under pulses – around 26 million hectares – has grown at 25 per cent during this period, a much lower rate than that for cereals.

Also, if the food ministry was so keen to protect farmers, why did it spend crores of the tax-payers' money promoting Canadian imports in the Indian market? An aggressive advertisement campaign was launched in 2010 to convince consumers that the inexpensive "yellow peas *dal*" imported from Canada was a wonderfully nutritious and tasty product. The fact that it is largely used as bird and cattle feed in Europe and the Americas was, of course, not mentioned.

Imports of the split yellow pea zoomed as a result and now constitute some 70 per cent of India's total pulses imports, comprising between 40 per cent and 50 per cent of Canada's production of the legume. Import estimates of yellow peas for 2012-13 stand



India's policy on pulses would appear to have been shaped by bureaucrats in league with corporate lobbyists and traders rather than the needs of consumers or farmers

at 1.7 million tonnes, 21 per cent higher than the previous year, despite the decline in the rupee.

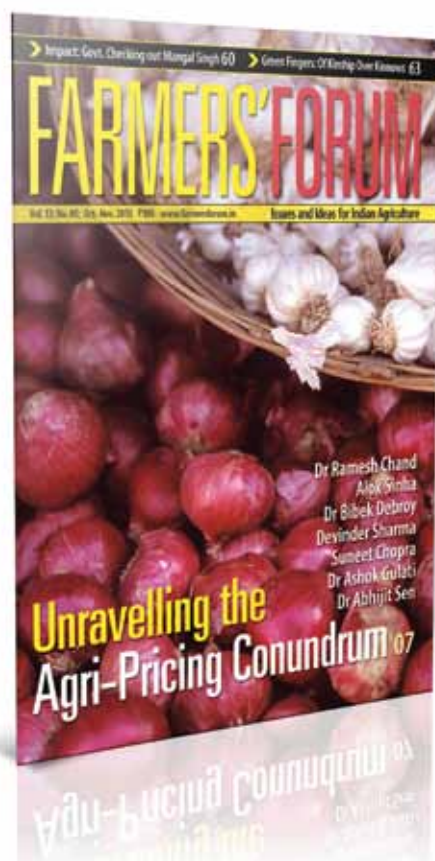
Now, the government is contemplating a levy on pulses – although agriculture minister, Sharad Pawar, made a statement to the contrary, the food ministry is keen – which would increase prices and impact the poor. Traders who have large stocks would obviously make big gains from rising prices. In fact, India's policy on pulses would appear to have been shaped by bureaucrats in league with corporate lobbyists and traders rather than the needs of consumers or farmers.

That brings us to the enduring paradox of Indian agriculture: while per capita availability of *dal* is far below minimum standards, resulting in rampant malnutrition, it still does not attract remunerative prices for the farmer.

Having said that, pulse production has increased, hovering around 17-18 million tonnes in the last three years or so. A 23 per cent increase in pulses, however, translated into a seven per cent increase

in availability, due to population growth. Most of the small increase in pulses availability in recent times was thanks to imports, in any case. Post-Independence, *dals* formed 17 per cent of India's foodgrains basket but now comprise less six per cent. India has a long way to go before it can achieve the goal of "self-reliance in pulses by 2017". That is what India's Green Revolution 2.0 was supposed to accomplish. It wound up boosting rice production.

Given the current levels of malnutrition, there is an urgent need for more pulses. Imports are not the answer in the long term but driving up the price of *dals* through a levy when the rupee has fallen to its lowest point ever, would not make sense. Domestic production can be increased through MSP and technical support and the surplus procured at farmgate. At the same time, *dal* can be introduced into the PDS and a buffer stock maintained. How about the fiscal deficit? As Sonia Gandhi said, "the question is not whether we have the resources but whether we consolidate the resources". ●



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March of the Open Pollinated Varieties: Retreat of Hybrids?

Ajay Vir Jakhar

On my second visit to Maharashtra in a week, I am in Nagpur for the first time. Nagpur is famous for the *santra* or orange but I am here at the invitation of Keshav Kranti, the director of the Central Institute for Cotton Research.

I first visit the institute, where I notice the beginning of the revival of the cotton open pollinated varieties that will push back the onslaught of the hybrids. We drive to village Saheli, Taluk: Arvi, District: Wardha. Our guide and counsellor in this village, off the Nagpur Wardha Road, is Atul Sharma, the dean extension, in the Ramkrishna Bajaj College of Agriculture, Pipri, Wardha.

Given the regular experience of visiting farmers who are dissatisfied most of the time, one tends to get cynical. After a round of short pleasantries, my first question to farmer Ram Bahu Keshav Rao Kokate, aged 71, is about his problems. My meetings with farmers across the country have prepared me for all kinds of surprises but this one is quite out of the blue. Animals like wild boar and the *nilgai* (blue bull) are the biggest menace here.

Saheli is ensconced within the hills of the Tadoba wildlife sanctuary.

If farm animals cross the boundaries of the sanctuary, they are caught and the farmers are arrested. The grouse that Keshav Rao has is simple. When sanctuary animals destroy more than 50 per cent of his crop why is he not compensated by the government? It is a classic case of animal rights versus human rights and it is not difficult to choose sides when one is surrounded by affected villagers.

Half in jest, I guess, he adds that the farmers can look after their animals while sanctuary must look after its own. Gun licences, earlier given to farmers for protection, are not easy to procure anymore. Keshav Rao does not believe in killing animals but expects the government to provide material support for fencing of lands.

Worse still, the Ministry of Environment and Forests is the centre point of all criticism in this village. It has extended the boundaries of the sanctuary without the consent of the *gram sabhas*, despite this being mandatory since 2006. Appeals have failed to arouse any reaction from the ministry that is quite deaf to the problems on the ground, as usual. I suspect that the fate of some 15 to 20 people, allotted land in this extended area decades

ago, is now uncertain; they do not know what will happen to their land next.

These are dry, rainfed hills, where erratic and heavy showers can wash away the crop. Initially, the rain-gauge was kept at the district collector's office. When there was a cloud burst in the villages, there was no compensation for the farmers because the rain gauge in the collector's office had not recorded any rainfall. Now, these rain-gauges are being put up at the tehsil and at lower levels.

Of course, as in most of India, water for irrigation is a problem. Water flowing through these villages collects in the Dham dam, two kilometres downhill and is transferred through water canals to farms 150 km away to Hinganwadi. Villagers want some of the water to be uplifted back for irrigation. This seems to be a valid demand, otherwise they will continue to be at the mercy of the rains. It is a classic case where resources of an area are siphoned off to far away places due to faulty planning much like the minerals from the tribal belt of Jharkhand benefitting everyone else, far and wide, but the tribals. Indian politicians are known to pray to the gods for relief but never for the wisdom to

and 15 quintals. In rainfed places like Saheli, the yield is only two quintals per acre. That is why water is important, even though the watershed programme has helped recharge ground water increasing availability of water, there is need for more.

There are other serious problems of an intellectual nature. There is profligate use of hybrid cotton seeds and hybrid cotton has become synonymous with Bt cotton and the private sector. When two cotton plants are crossed with each other, the progeny plant is bigger than the larger parent, meaning that it has more green foliage requiring more nutrients and water, unsuited for dry land farming.

Keshav Kranthi is propagating a movement back to the open pollinated variety cotton and takes pains to explain the need for GM technology and the need to move away from hybrids.

It is an interesting thought that floored me completely. He faces flak from both the anti-GM movement and from the private sector companies for thinking differently. India is the only country in the world where 95 per cent of the cotton crop is hybrid. It is not even a fraction of that in the rest of the world.

Expenses for growing open pollinated varieties

The ministry is the butt of all criticism. It has extended the boundaries of the sanctuary without consent of the *gram sabhas* despite that being mandatory since 2006

formulate better policies and execute them well.

The National Bank for Agriculture and Rural Development (NABARD) has financed the watershed programme implemented by the farmer covering 3,200 hectares, which includes over 1,000 hectares of forest land. Villagers have made seven check-dams on the main water channel. Good planning has ensured that the collected water is clean. Keshav Rao, who headed the programme, is also head of the 'Van Samiti' or forest committee. The NABARD disbursed Rs 2.5 crore as grant on a five per cent contribution by villagers between 2001 and 2009. Proudly, Keshav Rao tells me that the *samiti* has a corpus upwards of Rs 25 lakh.

As to deposits, the Wardha District Central Co-operative Bank failed and defaulted on returning farmers' deposits. Now farmers may withdraw only Rs 500 at a time. Allegedly, the money was loaned to a relative of a member of the board of directors for a mill that has since declared bankruptcy.

Where water is available, as in village Dhayaegaon (Gundi), the yields of cotton are between 10 quintals

are lesser at Rs 7,000 to Rs 8,000 per acre and yields increase to five to six quintals with high-density planting. Generally, one kilogramme of Bt cotton seeds is planted per acre. The alternate is to plant five kgs of open pollinated variety seed like 'Suraj', a single-stem plant. This may also allow the farmer to produce his own seeds, free of cost.

Village scouts have been appointed for every two villages under the technology mission on cotton. The scout must be a village resident and inspects 10 plants for pests in each farmer's field every week. The reports are collected, reported and analyzed. This process has reduced use of pesticide by more than 50 per cent. This is a perfect example of insecticide resistant management practice. Farmers desperately need this in the Malwa region of Punjab; the cancer capital of India.

Single phase electricity supply for the village is available but three phase electricity for agriculture comes for only five to six hours a day. Farmers complain that electricity connections are cut off for non-payment of bills, even when no person comes





Grazing animals of village Saheli

to read the meters. There are other issues too. The nearest health centre is 15 km away and there is no doctor on call at night. Free schooling is available till class IV and teachers teach regularly.

Nagpur tends to be warm in the day while the night temperature falls sharply. The weather is pleasant, in fact, perfect for me for I like the warmth of the sun. The gram panchayat office is full with local villagers and the discussion turns to policies being only good on paper but never getting implemented. Most agree that the state government is responsible for not implementing central government schemes.

These villagers seem free and relaxed as Keshav Rao and Atul Sharma answer my questions patiently. I venture forth, trying to validate my opinion on the growth versus development model and arouse the interest of the youngsters. Do you want cheap food? "Yes", is the answer. Free electricity (even though supply is erratic)? "Yes". The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), even though payments are delayed? Again, a unanimous "yes".

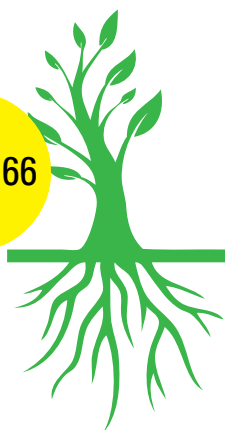
I turn the question around and ask what if there was a choice of not receiving cheap or free food, electricity, MGNREGA jobs or other government

dole outs and the government spending the scarce resources for providing lift irrigation from the Dham dam? What would they prefer? The youngsters, who have been slouching on the floor till now, are up on their feet. They want investment in a lift irrigation system. With that, they explain, they will have better agriculture productivity with which they could pay for electricity and other necessities like fencing; jobs would be created in the village; and people could earn their own livelihood amongst other things.

The government fails to understand that creating equal opportunities for the people needs fair and just determination of priorities; it cannot be achieved through handouts. Handouts or aid exists are required when people cannot sustain themselves economically and not vice versa. One does not need formal education to understand that. Policymakers need to be as well connected to the masses as they were educated.

We drive to the Seva Gram Ashram where Mahatma Gandhi spent many years directing India's freedom movement. It is a pilgrimage that everyone should undertake. We have lunch here and I relish the local food; *jhunkabhakar* (sorghum/jowar bread), *puranboli* (Bengal gram), *kadhi* (warm butter milk mixed with gram flour) and *ambadi* (red sorrel drink). The world-wide slow food movement could learn a thing or two here.

This is the ideological heartland of the Sarvodaya movement, the Gram Seva Trust and the Bajaj foundation's activities are laudable. Atul Sharma comes from an illustrious family of social workers with a community-based development background. That is what the nation requires; the art of self help. Atul is still tormented by memories of the inglorious days of the Emergency. One shudders to look into a future when the curse of the dole out era that has affected the present generation, stalling growth and killing opportunities, will be recalled with just the same sense of torment. ●



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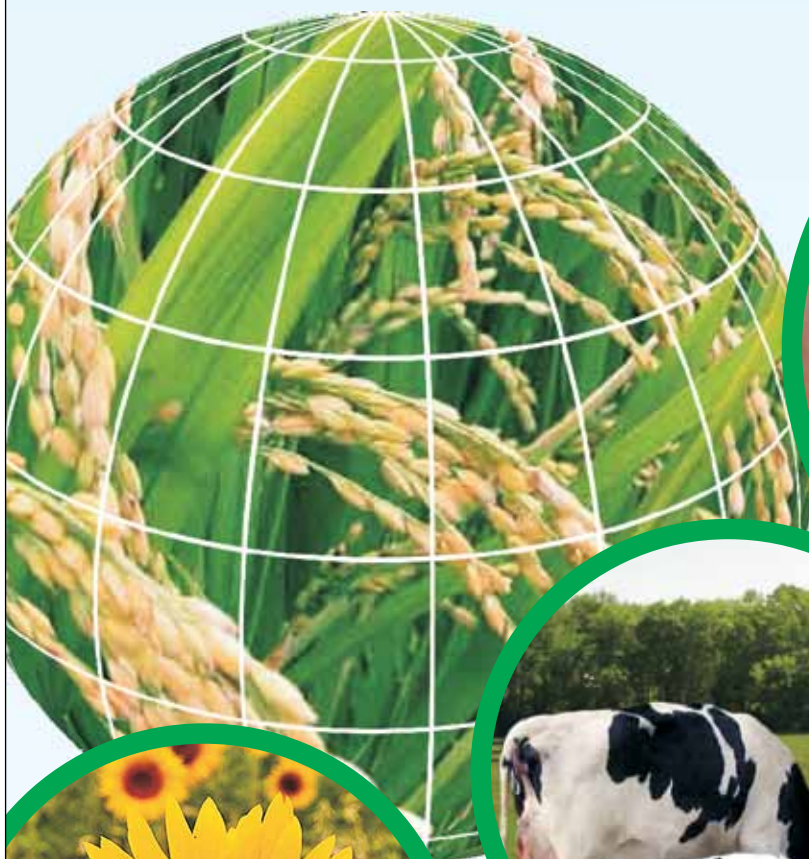
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