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COVER STORY

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Editorial Board
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Editorial Support
Paranjoy Guha Thakurta
Aditi Roy Ghatak

Design
© Peali Dezine
pealiduttagupta@pealidezine.com

Contact us
editor@farmersforum.in

Advertising:
Sunil Kumar (+91 9811222902)
sunil.kumar@farmersforum.in

Subscription:
subscription@farmersforum.in

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Mateusz Stachowski

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India's Fertiliser Curse

"The best fertiliser on any farm is the footsteps of man".

– Confucius

Farmers' Forum is visiting the fertiliser space in one of the most controversial times that the industry has experienced in recent memory. Driven by the need to step up food production amidst a declining response of productivity to fertiliser input, the government has been forced to concede that something is seriously wrong with the fertiliser regime in India that it has been subsidising at enormous cost to the exchequer.

There are several perspectives from which this complex question needs to be examined. The fertiliser ministry is charged with the business of changing the system to some form of nutrient-based subsidy, amidst serious talk about decontrol. The government is equally concerned about a mechanism to give the farmer direct fertiliser subsidy though at this point in time it seems to be a distant dream. Meanwhile, the agriculture ministry is most concerned about the impact that all these changes would have on the price line: any adverse impact would be politically unpalatable. The finance ministry, on its part, is worried about the enormous fertiliser subsidy bill. At Rs 49,981 crore, as per budgetary estimates for 2010-11, this may have been about Rs 3,000 crore lower than the 2009-10 revised estimates of Rs 52,980 crore but there was a whopping subsidy leakage in excess of 10 per cent of the total subsidy in 2009-10. That is likely to remain at the same level this year.[1]

THE GOVERNMENT IS FORCED TO CONCEDE THAT THERE IS SOMETHING SERIOUSLY WRONG WITH THE FERTILISER REGIME IN INDIA

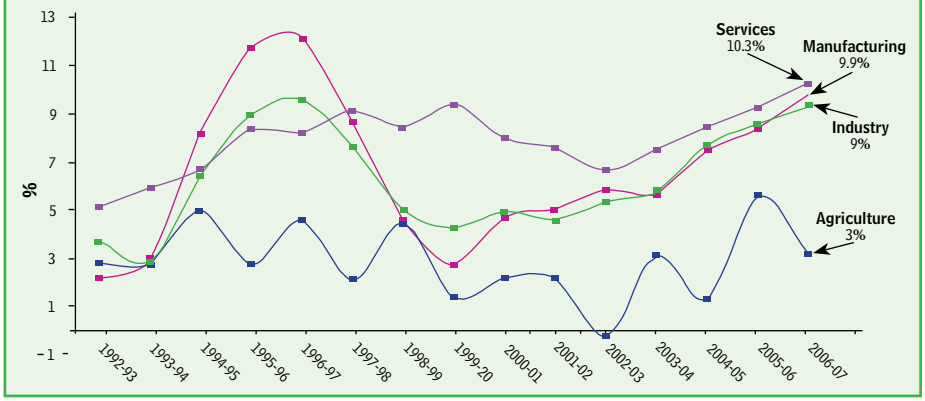
Futile farming

Thanks to the poorly-managed monitoring scheme, leakage and over-charging remain an embedded part of the administered fertiliser subsidy regime in India. Agriculure which it is supposed to support, is thus not being able to play the part that it was expected to in an otherwise buoyant economy (see chart). In fact, large segments of the affluent farming community are under tremendous financial pressure and tens of thousands of farmers have committed suicide – the worst affected states are Maharashtra, Andhra Pradesh, Karnataka, Madhya Pradesh and Chhattisgarh,

1 *The Economic Times*, June 19, 2010: Fertiliser subsidy leakage may add over 10% to bill

THE FARMER WANTS A HIGHER NET INCOME. THE GOVERNMENT WANTS MORE FOOD OF THE RIGHT KIND. WITHOUT SOME CON-VERGENCE AT THIS LEVEL, AGRICULTURE CANNOT HOPE TO FIND ITS RIGHTFUL PLACE IN THE ECONOMY

Services and industry have zoomed but agriculture?



Source: IDC India Limited 2010

which are among India's more progressive and prosperous states. In many other parts of the country, the farmer is eager to move away from farming and seek any kind of job; in the city or in the government sector. This is not surprising because the mindsets of those who produce food and that of those who run the food administration of the country are poles apart. The farmer wants a higher net income; a profit from his produce. The government wants more food of the right kind. Without some kind of convergence at this fundamental level, agriculture cannot hope to find its rightful place in the economy. The second basic understanding must be around the inputs for the farm sector, of which fertilisers have occupied the pride of place ever since the Green Revolution with its wonder rice/wheat variety backed by massive and growing fertiliser support. It is difficult to pinpoint when exactly an acceptable use of fertiliser started assuming the monstrous proportions of today and made agriculture a prime culprit in India's worsening climate change regime and an unacceptable level of soil toxicity. It needs no rocket scientist to understand that foodgrain production is a land-based activity and the focus should be on the land and the grain. Neither seems to be benefitting from the enormous expenditure on fertiliser subsidy every year. Indian soils are losing their fertility and producing capacity. To go back to the Confucian wisdom, conspicuous in its violation here, the footsteps of the farmer have been replaced by chemical sprays and injections. Green, farm-yard manure and bio-fertilisers have become alien to our farmlands. What hope does the small holder-producer and the poor soil have against this assault?

The bottomline? India is losing soil quality that is worth billions of dollars without anyone taking cognisance of it. India is also beginning to literally mine its own territory in its battle on the food security front. ●

Ajay Vir Jakhar
Editor

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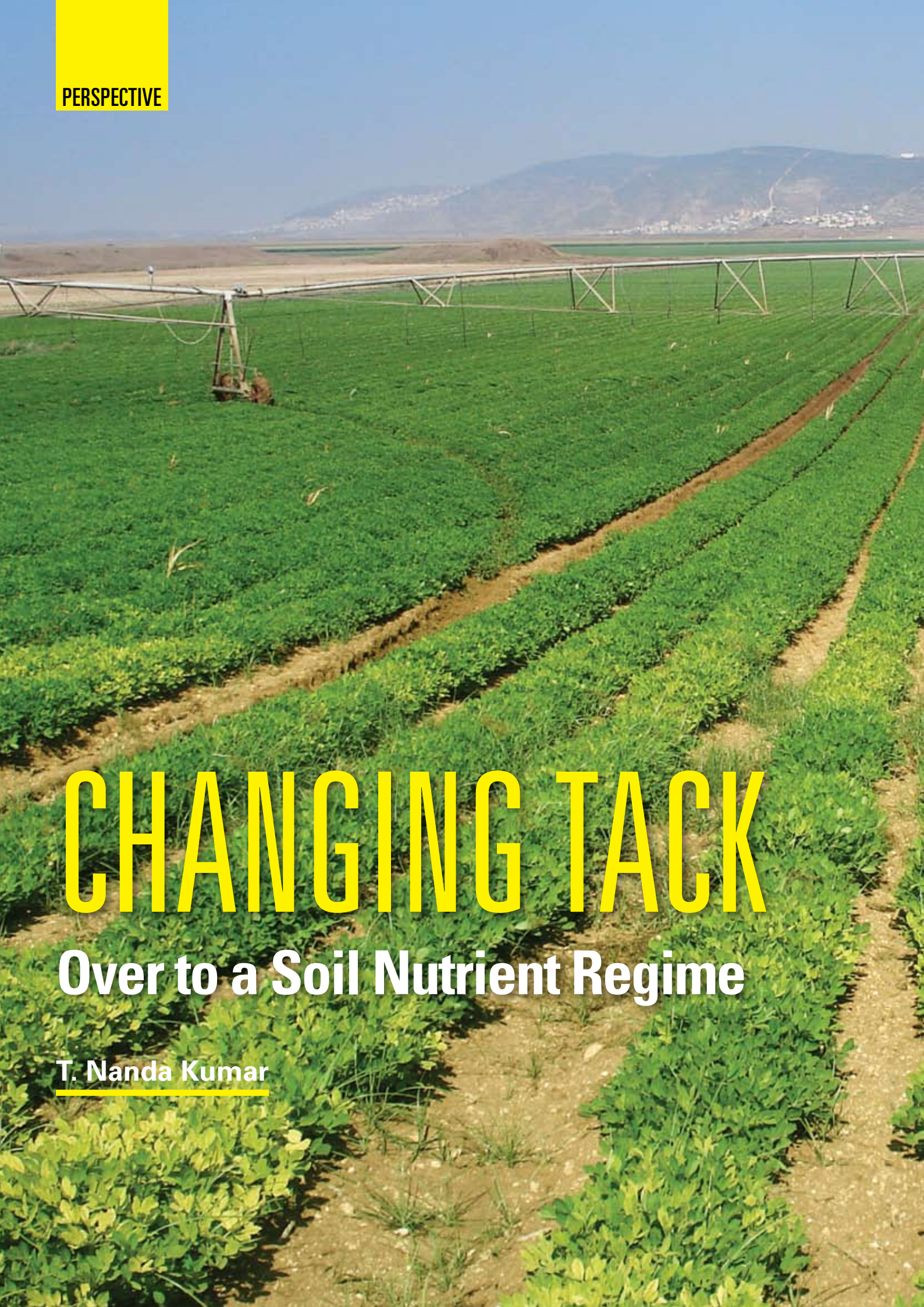


CHANGING TACK

Over to a Soil Nutrient Regime

T. Nanda Kumar

"In the context of the nation's food security, the declining response of agricultural productivity to increased fertiliser usage in the country is a matter of concern. To ensure balanced application of fertilisers, the government intends to move towards a nutrient-based subsidy regime instead of the current product-pricing regime. It will lead to availability of innovative fertiliser products in the market at reasonable prices. This unshackling of the fertiliser manufacturing sector is expected to attract fresh investments in this sector. In due course it is also intended to move to a system of direct transfer of subsidy to the farmers."

Pranab Mukherjee,
Finance Minister
Budget Speech, 2009

The perception that "India has already emerged" that has gained credence following the visit of the U.S. President, Barack Obama, is a welcome change for a country that was hitherto perceived as one struggling with food shortages, foreign exchange worries and inadequate development. Clearly India is on a high-growth path today with global acceptance of the fact that the country will continue to grow at about nine per cent every year in the medium term. The big question is whether this nine per cent growth will encompass agriculture or those at the "bottom of the pyramid".

Sustaining agricultural growth

India continues to have a large number of poor, hungry and undernourished; inadequate infrastructure, inadequate education and healthcare and large gaps in incomes between the rich and the poor continue to be the bane of the country. The growth in agriculture has been slow and erratic despite the government's categorical commitment to pursuing "inclusive growth". This, combined with other interventions like guaranteed employment under the Mahatma Gandhi National

Rural Employment Guarantee Act (MG-NREGA) and such others, is likely to push up the demand for food and other agricultural produce. The challenge, therefore, is to increase productivity along with a better regional balance in agricultural production.

A strategy to increase productivity on a sustainable basis becomes imperative in the context of climate change as well. The sustainability issue brings to question the indiscriminate use of resources in the quest for high productivity. While food inflation has to be kept under check, subsidies will also have to be kept under control. The argument for removing all subsidies to agriculture, including fertiliser subsidies, may not work, though. However, there is a case for looking at reducing subsidies to encourage more efficient fertiliser production and use.

The Finance Minister outlined this approach in his Budget speech of July 6, 2009 where he talked about moving to a system of direct transfer of subsidy to the farmers. He followed it up with a nutrient-based subsidy policy for the fertiliser sector that was approved by the government to be made effective from April 1, 2010. "This policy is expected to promote balanced fertilisation through new fortified products and focus on extension services by the fertiliser industry. This will lead to an increase in agricultural productivity and consequently better returns for the farmers. Over time, the policy is expected to reduce volatility in the demand for fertiliser subsidy in addition to containing the subsidy bill". He promised to ensure that nutrient-based fertiliser prices for transition year 2010-11 would remain around the currently prevailing maximum retail prices and that the new system would "move towards direct transfer of subsidies to the farmers".

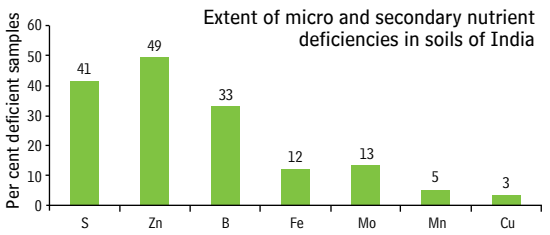
What did this mean in practical terms? It is well known that the Green Revolution and subsequent productivity increases have been propelled and sustained by high quality inputs, namely, seeds, fertilisers and water. There are, at present, serious concerns about the long-term sustainability of these interventions, especially since India will have to produce more to feed its growing population. The mounting dependence on imports of chemical fertilisers and the ballooning subsidy burden raise important questions. Unacceptable N:P:K ratios in many states remain a cause of concern (Table 1) and demand urgent correction.

This phenomenon, probably driven by the extant subsidy regime, which encouraged the use of urea, has now reached unsustainable levels in many parts of the country. The neglect of secondary and micro-nutrients has adversely affected productivity increase as well and the fertiliser management regime in the country has to undergo a paradigm change.

Table 1

State	N	P_2O_5	K_2O
Haryana	32.2	10.7	1
Rajasthan	30.2	13.6	1
Punjab	23.6	6.7	1
Uttar Pradesh	11.5	3.6	1
Madhya Pradesh	8.9.	5.9	1
Gujarat	5.8	2.5	1
Bihar	5.7	1.5	1

Figure 1



Extent of secondary and micronutrient deficiencies in soils of India
Source: Singh, M. V. (2001 a, b)

Site-specific nutrient management

A shift to site-specific nutrient management (SSNM), including integrated and balanced nutrient management, is necessary to optimise the use and efficiency of fertiliser application and to increase crop productivity in India. At present, 100 districts consume about 50 per cent of total NPK used in the country. These districts need to be placed under an SSNM discipline immediately and green/farm-yard manure/bio-fertilisers should be made an integral part of SSNM, based on the specific conditions in various agro-climatic zones. However, the technical data relating to these zones should be converted to implementable district-wise action plans that should fit into the existing schemes of the Rashtriya Krishi Vikas Yojana (RKVY), the National Food Security Mission (NFSM) and such others for administrative convenience.

Improved soil testing

The success of SSNM depends upon the accuracy and timeliness of soil nutrient data. Most states have outdated data that does not capture secondary and micro-nutrient deficiencies. The entire regime needs to be reworked:

- The National Project on Management of Soil Health and Fertility needs to be improved and its implementation accelerated

- The technical capabilities of state soil testing laboratories should be enhanced
- Soil scientists have to be trained in larger numbers
- A public private partnership model could be adopted for this purpose.
- States could create a separate cadre of soil scientists in their agriculture departments.

Most Agriculture Produce Marketing Committees (APMCs) and fertiliser companies can do this effectively. Fertiliser companies get about 4.5 lakh to five lakh soil samples tested every year. This data needs to be integrated with the research data and digitised nutrient maps prepared and placed in the public domain.

Nutrient-based subsidy to encourage SSNM

Nutrients like sulphur, zinc and boron need to be promoted, made affordable with a comparatively higher subsidy vis-à-vis NPK. There is a strong case for reducing the subsidy on urea and allowing a higher price to discourage unproductive use. Farmers should be assisted with appropriate subsidies on other critical nutrients. The underlying concept of NBS is equal subsidy for the same nutrient in any form; either as a straight fertiliser or as a complex/mixture. This concept needs to be operationalised for all Fertiliser Control Order (FCO) approved fertilisers.

Customised fertiliser

The future lies in customised fertiliser and initial investments are taking place in this space while other prospective investors wait and watch. It is important that this effort succeed but that will need a deeper understanding of the soils, climate and crops. Normally application of customised fertilisers should result in optimisation of fertiliser use and higher productivity. This effort can succeed only with the backing of soil-testing facilities. It is necessary, therefore:

- to provide support under soil-testing programmes of the government on a priority basis for these areas;
- to provide research backup on crops grown in these regions through the National Agricultural Research System; and
- to provide fiscal and financial incentives to these units.

Some secondary/micro-nutrients can be provided in the form of fortified fertilisers to help reduce farmers' costs and enhance productivity. Region/crop specific nutrients may be permitted/encouraged for fortification.

Innovation with Indian resources

India is dependent on foreign sources for supply of substantial quantities of fertilisers. It is, therefore, important to develop and adapt, to the extent possible, its own resources and use them effectively. In this context, the following are possible:

Given the quality of rock phosphate in the country, SSP with 14 per cent P_2O_5 granulated needs to be permitted under a different category (this can be called SSP 'lite') and approved within the FCO.

Phosphogypsum, a cheap resource of 'S', is available in substantial quantities in the country. A commercially viable process to use phosphogypsum needs to be put in place immediately.

Industrial by-products from certain industries can be used effectively as soil ameliorants. Paper mill sludge has been used effectively in Orissa. Basic slag from steel mills can also be used and similar efforts encouraged.

Phosphogypsum, a cheap resource of 'S', is available in substantial quantities in the country. A commercially viable process to use phosphogypsum needs to be put in place

Organic farming is gaining ground and needs more support. It is probably difficult to standardise organic fertilisers and bring them all under a subsidy regime. Support to organic farming/use of organic fertilisers needs to be studied separately and a policy evolved.

Promotion of local (village, panchayat) efforts in using organic manure is a better option and may be encouraged. The villages could be supported on the basis of improvement in soil organic carbon levels.

In addition to organic farming, which has limited reach, large-scale use of green/farm-yard manure in combination with chemical fertilisers should be promoted. The suggestion to provide seeds of green manure crops free of cost to farmers may be considered and made a major part of the seed plan of the central and state governments.

Quality issues

Some problems in the fertiliser sector relate to quality, with inferior fertilisers finding their way into the market. This needs to be stopped by ensuring

that only such manufacturers who have the ability to put in process quality control systems are allowed to manufacture fertilisers. Industry needs to take a lead in this.

More value out of industrial resources

There are many practices prevalent in various parts of the country that do not encourage in-situ conservation of moisture and nutrients. Farmers in parts of western India burn their crop residues in the field to clear the land for early sowing. This practice needs to be discouraged. The farmers hope that an "agri-engineering" solution for managing crop residues will be found to help them save time and labour costs. In addition, such initiatives as zero tilling and conservation agriculture need to be actively promoted to ensure that the nutrient value of the soil is not lost for reasons other than agriculture. The management of moisture/water is equally important, particularly in the case of paddy, where overuse of irrigation results in wastage of fertilisers.

Strengthen technology transfer/extension

In any plan to move to district-specific SSNM, the role of technology transfer/extension agencies is crucial. At present, the ATMAs, state extension agencies and Krishi Vikas Kendras (KVKs) are responsible for this work. Most of them need reorientation in terms of technical knowledge for moving towards SSNM. A programme to train personnel in these agencies and to make them responsible for optimising fertiliser efficiency and utilisation on a site-specific, crop-specific basis is needed. In addition, the Agriculture Produce Market Committees should be mandated to support soil-testing efforts and the implementation of SSNM. Wider use of leaf colour charts, as an easy way to recognise nutrient deficiencies, should be propagated. Soil-testing laboratories should, with support from the Krishi Vikas Kendras, state agricultural universities (SAUs) and such others also send advisories to farmers on crop and soil specific nutrients. This could be done using either the common service centres under the e-governance projects or through mobile telephony.

Strengthen research in SSNM

The Indian Council of Agricultural Research, the state agriculture universities and KVKs need to take up site-specific nutrition management as a priority item in their research efforts. They should also focus on combining the use of available natural and other resources with chemical fertilisers to get increase in productivity on a sustainable basis.

Encourage use of urban and rural waste

Both cities and rural areas generate a lot of biodegradable waste that can be converted to manure. Cities struggle with waste disposal while there is demand for manure in the rural areas. However, pricing this and working out the subsidies associated with this effort seem to be holding up initiatives in this space. It is fair for the cities to at least pay for the sorting out and transportation of bio-degradable waste to a location where it can be permitted for conversion to bio/organic fertilisers. Fertiliser companies can also be mandated to sell such fertilisers as part of their SSNM strategy.

FCO and customised fertilisers

The FCO provides for specific trials before a new fertiliser is introduced. While this may be required for new nutrients/elements, there is a case for providing fast-track approvals for such customised fertilisers and complexes as recommended by the ICAR or the SAUs as part of any site-specific nutrient management programme. ●

The author is former Secretary, Ministry of Agriculture

Letters to the Editor

Timely Publication

This refers to the inaugural issue of *Farmers' Forum* focusing on India's irrigation challenges. Such a focused publication is an excellent way to raise issues of vital concern to the farmers.

Sanjeev Rai Puri, *Jaipur, Rajasthan*

Storage; the Key

This refers to your cover story, 'Just a trickle', (*Farmers' Forum*, September-October 2010). The Ganga Cauvery Link was proposed to transfer Ganga waters to Cauvery, even as Cauvery and other south Indian rivers have much more water storage and availability, with higher rainfall spread over six months. The Ganga River basin, over 13 states, has practically no storage. Instead of transferring water we should build larger storage facilities for better utilization.

India is entitled to use 1,200 billion cubic metres (BCM) of river waters but so far 400 BCM or 33 per cent of river waters are diverted to farming and other purposes. Pakistan uses 80 per cent of its river water entitlement that shall increase to over 90 per cent with commissioning of new storage projects.

Ravinder Singh, *New Delhi*

Punjab's Plight

This refers to the article, 'Water Woes, Whither land of five rivers?' by Manpreet Singh Badal. He has correctly placed on record the plight of Punjab and exposed how the state has been neglected by the central government. Militancy here started due to unfair treatment to Punjab on the SYL issue. Punjab, inspite of being the bread basket of the country, is not able to meet its own demand of water, and should not be forced to give its share of water to other states.

Sardar Darshan Singh,
Muktsar, Punjab

Lessons from Haryana

This refers to the article, 'Sutluj-Yamuna Link Canal: Haryana's testament of hope and faith' by Randeep Singh Surjewala. The author has rationally explained the unfair stand of Punjab on the inter-state water dispute and its delaying tactics. Haryana should get its rightful share of waters. Justice must be done. Haryana is progressing due to its better management of water and Punjab can learn from its neighbour.

Brijender Singh Mann,
Karnal, Haryana

Dam Scam

Big dams never come under purview of environment and social impact assessments. If at all, the assessments are always in favour of big-dams, as explains Himanshu Thakkar in his article 'Underperforming Dams; zero canal growth'. The proposed benefits of big dams are only imaginary as the problems created by such large projects are almost never highlighted nor discussed. I am surprised by the statistics provided in the article that indicate that there has been no increase in canal irrigated areas inspite of such large investments. This is a scam that needs to be investigated.

Virender Singh,
Mumbai, Maharashtra

Big Dams are Indispensable

With reference to the article, 'Underperforming dams; zero canal growth', India has progressed because of availability of year round water supply due to storage in big dams. We are able to grow more grain, produce electricity and provide drinking water because of the big dams. Nobody should get confused by any article.

Lakshmi, *Chennai, Tamil Nadu*

Indigenous Knowledge

The government should bring out a policy based on the combination of recommendations by Bhavarlal Jain, 'From micro watershed to micro irrigation' and Rajender Singh's 'Water management: restoring India's indigenous knowledge systems'. These would help solve India's water problems. Such people should be made Members of the Planning Commission.

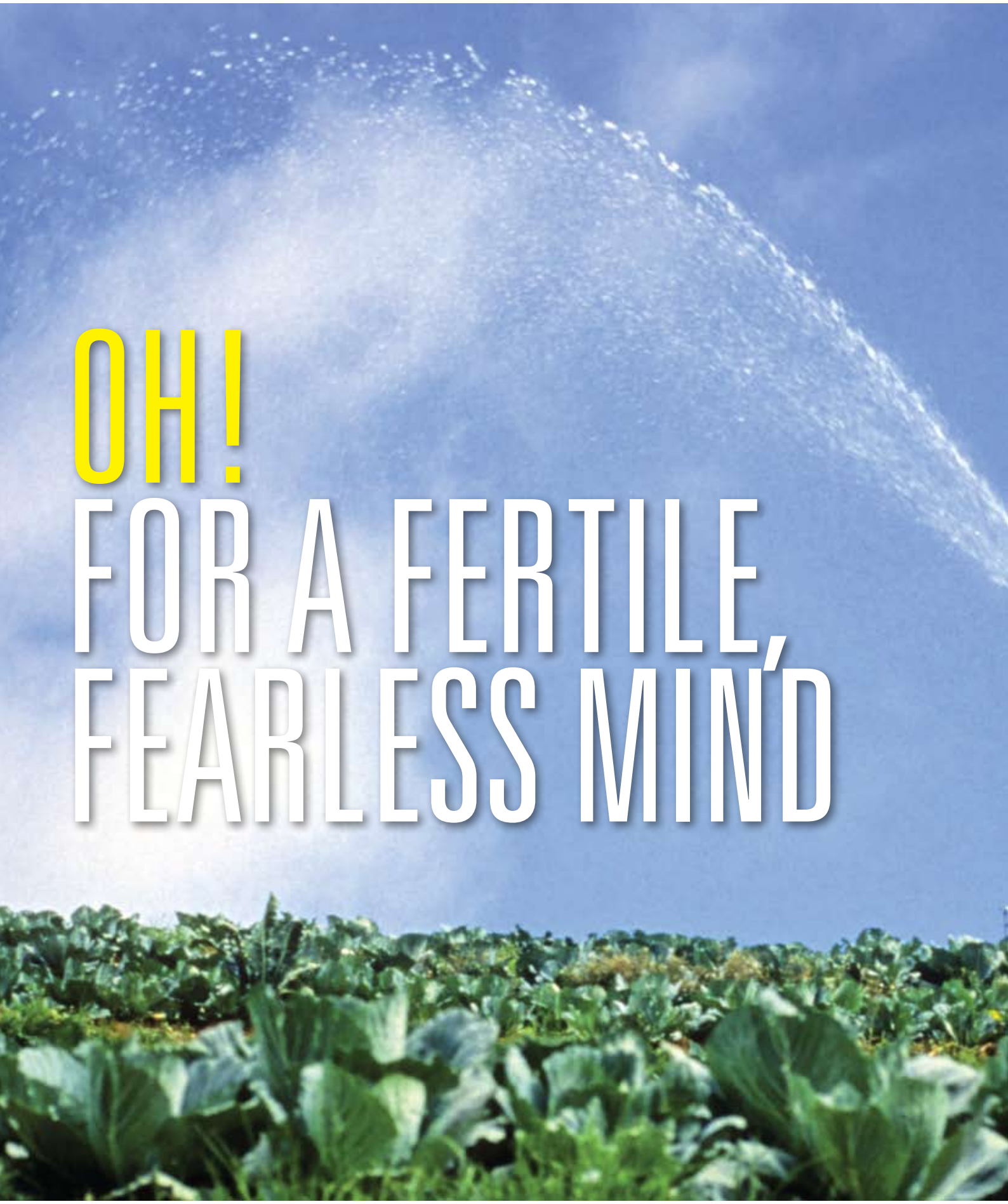
Mukesh Ram,
Indore, Madhya Pradesh

Old and New Knowledge

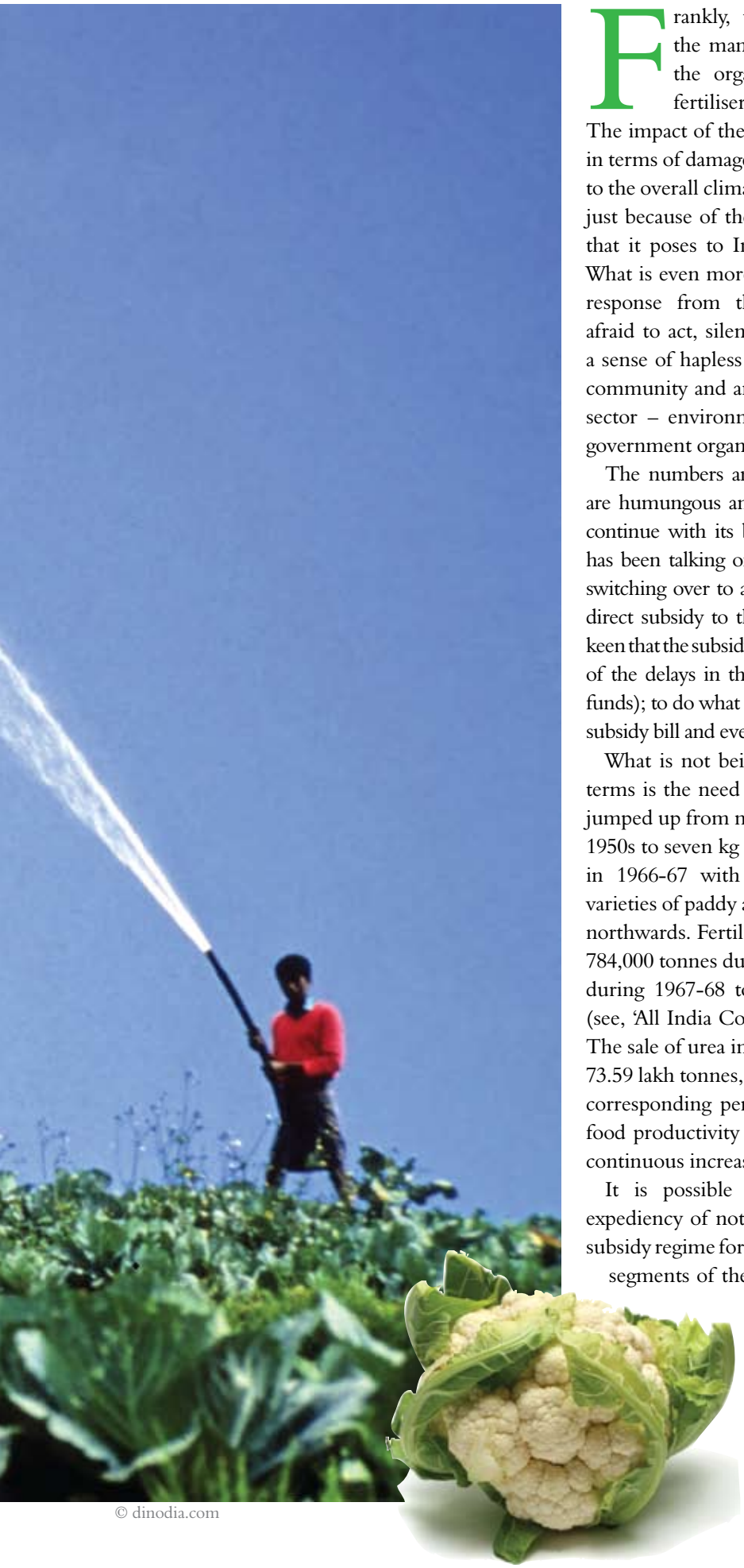
Thank you for highlighting good field practices in 'Marrying science and tradition: Viswasrao Patil's living land', by Ajay Vir Jakhar. It is important to use the latest bio-technologies in combination with age-old practices. Neither are NGOs propagating against agri bio-technology correct; nor are companies propagating their individual technologies. We need to use the best of both worlds to achieve our objectives of food security.

Pradeep Mohanty,
Bhubaneswar, Orissa

COVER STORY



OH! FOR A FERTILE, FEARLESS MIND



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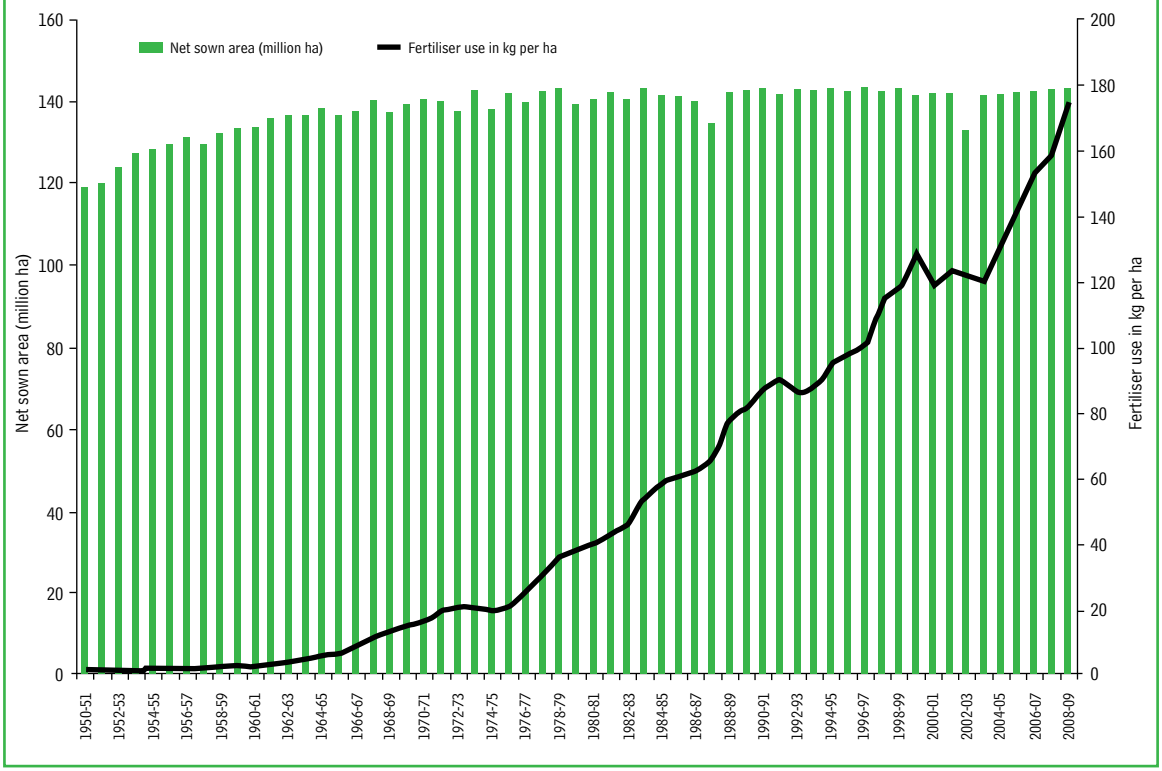
Frankly, this stinks and not because of the manure. In fact, it is the absence of the organic component in the Indian fertiliser regime that is causing the odour. The impact of the chemical inputs in Indian farms in terms of damage to the exchequer, to the soil and to the overall climate change regime is shocking not just because of the sheer dimensions of the threat that it poses to Indian food and climate security. What is even more reprehensible is the obfuscated response from the government that is clearly afraid to act, silence from the fertiliser producers, a sense of hapless bewilderment from the farming community and an impotent angst of the thinking sector – environmentalists, economists and non-government organisations.

The numbers around the actual fertiliser subsidy are humungous and clearly, the government cannot continue with its business-as-usual ways. Indeed, it has been talking of reducing the subsidy burden by switching over to a nutrient-based dispensation; to a direct subsidy to the farmer regime (industry too is keen that the subsidy goes directly to the farmer because of the delays in the final release of the government funds); to do what it takes to bring down the fertiliser subsidy bill and even to decontrol fertiliser prices.

What is not being talked about in the strongest terms is the need to bring down fertiliser use that jumped up from merely 0.58 kg per hectare in early 1950s to seven kg at the onset of Green Revolution in 1966-67 with the adoption of high-yielding varieties of paddy and wheat and continues to travel northwards. Fertiliser consumption increased from 784,000 tonnes during 1965-66 to 1,539,000 tonnes during 1967-68 to 24,909,000 tonnes in 2008-09 (see, 'All India Consumption of N, P_2O_5 & K_2O'). The sale of urea in kharif season, up to July 31, was 73.59 lakh tonnes, up from 68.05 lakh tonnes in the corresponding period last year. The worry is that food productivity has refused to keep up with the continuous increase in fertiliser application.

It is possible to understand the short-term expediency of not wanting to disturb the fertiliser subsidy regime for fear of its political fallout by some segments of the Indian society but it is difficult to understand why a government that chants the reforms mantra feels so squeamish about it. What is it that prevents the myopia around fertiliser abuse and the subsidy overspend from getting transformed into

Figure: 1



Source: http://makanaka.wordpress.com/2010/03/24/indias-fertiliser-addiction-fiddle/

All India Consumption of N, P_2O_5 & K_2O (2000-01 To 2008-09)

(`000 tonnes)

Year	N	P_2O_5	K_2O	Total ($N+P_2O_5+K_2O$)
2000-01	10,920.2	4,214.6	1,567.5	16,702.3
2002-03	10,474.1	4,018.8	1,601.2	16,094.1
2003-04	11,077.0	4,124.3	1,597.9	16,799.1
2004-05	11,713.9	4,623.8	2,060.7	18,398.4
2005-06	12,723.3	5,203.7	2,413.3	20,340.3
2006-07	13,772.9	5,543.3	2,334.8	21,651.0
2007-08	14,419.1	5,514.7	2,636.3	22,570.1
2008-09	15,090.5	6,506.2	3,312.6	24,909.3

a 50-year vision or even for the Five Year Plans to focus on changing the mindsets around soil health? Policies today give incentives for indiscriminate use of fertilisers instead of incentivising a shift away from the over use of chemicals and a switch to a more appropriate nutrient regime over the long term.

The point is that it is entirely possible to maintain soil health and increase production with little money and intelligent policies. It has been estimated that an allocation of just Rs 4,500 crore ($1 billion) to extension services (including soil testing) a year, if necessary in public private partnership programmes, can ensure better-informed farming practices that would lead to a substantial decrease in the subsidy bill by optimising use of inputs and improving soil health for enhanced productivity. The economic returns would be manifold in terms of agricultural output, soil well-being and improved circumstances for the farmer even as the fertiliser subsidy bill is reined in.

The pages that follow examine the various aspects of the fertiliser conundrum, which seems to be a simple enough proposition in terms of what T. Nanda Kumar, former secretary, Ministry of Agriculture, says: the challenge is to increase productivity along with a better regional balance in agricultural production to ensure sustainability, especially in the context of climate change. (see 'Changing Tack: Over to a soil nutrient regime'; Page 6). The sustainability issue brings to the fore the question of indiscriminate use of resources in the quest for high productivity. While food inflation has to be kept under check, subsidies will also have to be kept under control, says Kumar but argues that the logic around removing all subsidies to agriculture, including fertiliser subsidies is not tenable, though a reduction in subsidies to encourage more efficient production and use of fertiliser is feasible. Why is even that not happening?

As Naresh Minocha, a specialist commentator on the fertiliser industry, points out, "the idea of giving fertiliser subsidy directly to farmers appears good on paper but its implementation bristles with controversies. Fertilisers are political commodities

and any mess-up can rock the government of the day" (see 'Direct Fertiliser Subsidy: Problems with this Magic Wand'; Page 26). Thus, we have the sorry situation of successive governments paying lip service to the concept of fertiliser reform and two successive finance ministers flirting with the concept but being able to do little to translate their words into deeds.

There is equal hesitation around switching over to a fully functional nutrient-based subsidy regime. This again is easier said than done because soils have different characteristics all over the country and need to be checked for quality through a professional and annual soil analysis to determine what kind of nutrient is required and where it should be sourced from. It means injecting scientific practices into farming and not just chemicals into the soil. It means funding research to arrive at an optimal inputs regime.

The facts are well known: of the nitrogenous fertiliser (urea) used in soils, no more than 50 per cent can be assimilated by the plants; of the phosphorus used, no more than between 20 per cent and 25 per cent is absorbed; of the potash about 70 per cent is used by the plants and rest either goes waste or remains unutilised. Plants need more potash than any other nutrient but Indian soils are being continuously mined by crop plants while soils are getting depleted of potash at an alarming rate. To dwell a little more on the potash situation, reportedly global stocks of mineral potash are not expected to last beyond 30 to 40 years. When that does happen it will ring a death knell for Indian agriculture and crop production. This clear and present danger demands another kind of response: the government should invest in potash mines worldwide more than in any other commodity even as it incentivises conservation of native potash through crop residues, ground water and sea water.

Noted environmentalist Vandana Shiva says, in her exhaustive interview on the mess in the fertiliser space, that the farmer is just an excuse for transferring huge subsidies to the international fertiliser lobby. (see 'Fertiliser Subsidies are for Global Fertiliser Traders; the Indian Farmer is just an Excuse': Vandana Shiva in conversation with Paranjoy Guha Thakurta and Ajay Jakhar; Page 34). She gives good reasons to believe that most of the subsidy is going to international traders and foreign manufacturers. News of Indian demand jacks up the prices in the international market on one hand and, on the other, the government subsidises segments of the global industry besides doling out cash payments to certain very powerful international companies. "The fertiliser subsidies are for the fertiliser

There is need to inject scientific practices into farming; not more chemicals into the soil

industry. The farmer is just an excuse", she says.

The fertiliser subsidy, in effect, does not necessarily go to the farmer but may well be subsidising the inefficient producers in the industry. Such units should be penalised and efficient units be rewarded but often enough it is all to the contrary. What this means is that professional investment in the fertiliser sector has been discouraged over the past decade and has virtually ceased. There are too many policy bottlenecks for such companies to want to remain or invest in the space.

Yet another disturbing facet of this industry is siphoning off of fertiliser for non-farm use, which is still being subsidised. The leather industry, the explosives industry, the drilling industry and some others also require these inputs and thus receive a benefit that was never intended for them. There is, besides, the large-scale smuggling of subsidised fertilisers meant for Indian farmers to neighbouring Bangladesh and Nepal. Even here the government seems inexplicably impotent.

It is equally important to realise that fossil fuels are a major input for urea production. The government needs to allocate natural gas at reasonable prices on a priority basis to the co-operative fertiliser sector so that the cost of production of urea is reduced and, therefore, the subsidy bill. The intermediaries/ raw material required for DAP (di-ammonium phosphate) production are also imported in large quantities: about five million tons each of urea, DAP and MOP (muriate of potash) every year. The price of petroleum is expected to increase to $200 a barrel over the next 20 years as are the prices of all other imports. At such prices, all systems of agriculture propagated today will fail. The need for self-preservation should have brought around a change in government thinking in terms of reallocating funds for optimum utilisation of inputs and alternate systems of agriculture but curiously the government experiences no such felt need.

Ramesh Chand, Director, National Centre for Agricultural Economics & Policy Research, provides insights into what went wrong. Serious distortion was caused in relative prices of N, P and K during 1990-91, which made a distinct change in fertiliser prices in favour of N, just in one stroke. This is an important factor in shifting the balance of fertiliser use in favour of N and against P and K, he says.

A. K. Yadav, Director, National Centre of Organic Farming, Department of Agriculture and Cooperation, suggests some straightforward measures to improve soil health that includes making the use of organic manures and recycling of biomass mandatory; encouraging mixed/intercrops of pulses in all major cropping systems; and encouraging nitrogen-fixing and other useful trees/ bushes as hedges on bunds for in-situ production of biomass. He urges that green manure crops be promoted wherever possible and for farmers to be compensated appropriately; recommended chemical nutrients be used only on tested soils; biofertilisers be used and such mineral nutrient resources as rock phosphate along with composts be encouraged. Equally important would be to encourage the integration of cattle in the farming system mode. These apart, using lime, gypsum, basic slag and other soil amendments in problem soils would provide simple solutions to serious problems. They would also lead to a rediscovery of India's age-old farming knowledge.

Is there anything esoteric or difficult that these knowledgeable people are suggesting? No. So, will someone act? Let us hope. Is there anyone who seems to have the understanding, vision and courage to act? Where does that leave India's food security, farm productivity and balanced budgets? One does not quite know. What one does know is that the writing is on the wall; alarming, even menacing. Refusing to read it will only be suicidal and nothing could be more fearful than that; not even a lost election. ●

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COVER STORY

HEALTHY SOIL; HIGHER PRODUCTIVITY

A. Subba Rao and K. Sammi Reddy

India faces the challenge of producing 350 million tonnes of foodgrains to feed its projected population of 1,412 million in 2025, amidst a declining rate of response of crops to added fertilisers. This decline, under intensive cropping systems, has possibly resulted from deterioration in physical, chemical and biological health of soils. The partial factor productivity of fertilisers decreased from 42 kg grain/kg NPK applied to 17 in 1985, to 13 in 1995 and to 10 in 2008 (Figure 1).

Soil health denotes a state of dynamic equilibrium between flora and fauna and their surrounding soil environment in which all the metabolic activities of the former proceed optimally without any hindrance, stress or impedance from the latter.

Soil health, as monitored by the plants, is the mirror of the overall environment of which soil is a component. Maintenance of soil health involves the optimisation of soil environment, a pre-requisite for sustaining higher agricultural productivity. In the context of agriculture, soil health may refer to its ability to sustain crop productivity. A healthy soil would ensure proper retention and release of nutrients and water, promote and sustain root growth, maintain soil biotic habitat, respond to management and resist degradation.

The soil health challenge

The major issues around soil health are:

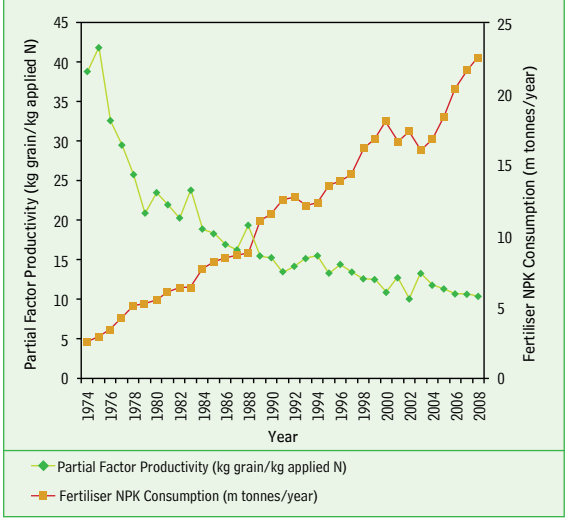
- Physical degradation of soil such as compaction, crusting and such like because of excessive cultivation or puddling
- Chemical degradation of soils due to wide gap between nutrient demand and supply
- High nutrient turnover in soil-plant system coupled with low and imbalanced fertiliser use
- Emerging deficiencies of a secondary nature and micronutrients
- Poor nutrient use efficiency
- Insufficient input of organic sources because of other competitive uses
- Acidification and aluminum toxicity in acid soils
- Salinity and alkalinity in soils
- Irrigation induced waterlogging
- Biological degradation by organic matter depletion and loss of soil fauna and flora
- Soil degradation due to water and wind erosion
- Soil pollution from industrial wastes, excessive use of pesticides and heavy metal contamination.

Soil fertility maps of India show that about 63 per cent of soils are low, 26 per cent of soils are medium and only 11 per cent of soils are high in available nitrogen. Similarly, about 42 per cent, 38 per cent and 20 per cent soils are low, medium and high, respectively, in available phosphorus. About 50 per cent soils are high in potassium, 37 per cent medium and only 13 per cent low in potassium. With intensive cropping using only NPK fertilisers and with limited use of organic manures, soils and crops became deficient in a large number of elements even as food production increased with time (Figure 2, see Page 20).

- About 49 per cent soil is deficient in zinc and this deficiency is spread all over the country.
- The extent of deficiency in iron, manganese and copper in Indian soils is 12 per cent, five per cent and three per cent, respectively.
- Continuous use of sulphur-free fertilisers led to the wide spread of sulphur deficiency.
- The analysis of 1.35 lakh soil samples showed the deficiency of sulphur in 41 per cent soils.

Boron deficiency is widespread to the extent of 69 per cent in acid soils of Orissa, 38 per cent in Bihar

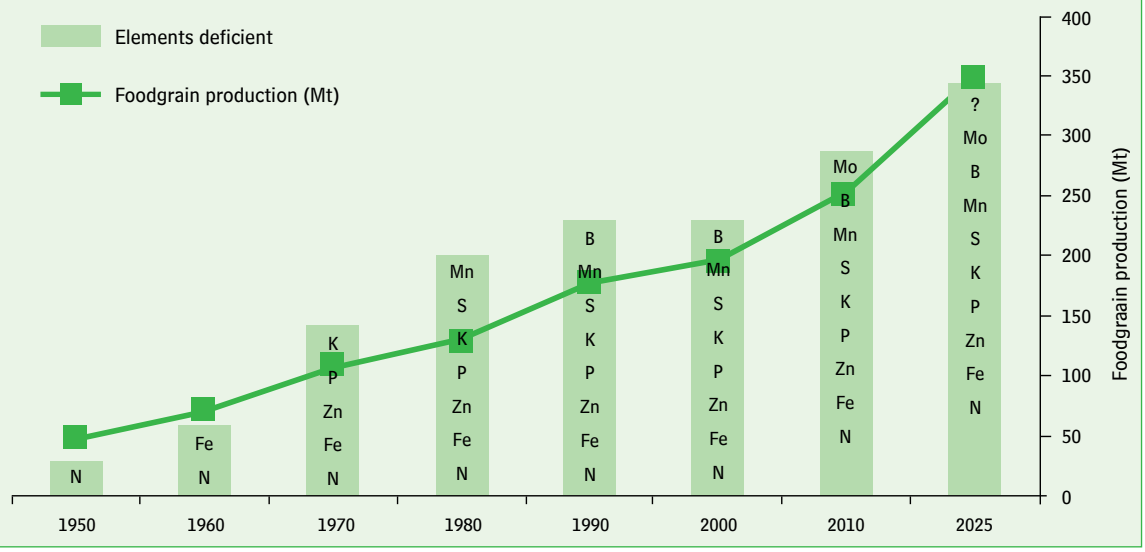
Figure 1. Partial factor productivity of fertilisers over the years in India



Integrated nutrient management not only sustains higher crop productivity but also improves physical, chemical and biological health of soils under different production systems

Soil health denotes a state of dynamic equilibrium between flora and fauna and their surrounding soil environment in which all the metabolic activities of the former proceed optimally without any hindrance, stress or impedance from the latter

Figure 2. Emerging deficiencies of plant nutrients vis-à-vis increased foodgrain production



and 32 per cent in light textured soils of Karnataka, 13 to 24 per cent in different parts of Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Assam and Punjab and 68 per cent in Terai soils of West Bengal. Soil organic matter plays a key role in soil fertility sustenance. The soybean-wheat system in Alfisols of Ranchi, saw a depletion in its organic matter after being denied balanced input of nutrients for more than 35 years. However, a balanced application of fertiliser with NPK and NPK+FYM (farm-yard manure) improved the organic matter status in Vertisols under the soybean-wheat system at Jabalpur.

The growth in fertiliser consumption slowed down in the 1990s and there was a near stagnant situation for four or five years, followed by a spurt in fertiliser use in recent years. After a record consumption of 18.1 million tonnes (mt) in 1999-00, the NPK consumption hovered between 16 and 17 mt during 2001-04, reaching 25 mt in 2008-09. At the present level of crop production, there is a negative balance of 10 mt between the nutrient (NPK) removal by crops and addition through fertilisers annually. The fertiliser consumption ratio was highly imbalanced ($N:P_2O_5:K_2O$, 6:2.4:1) during 2006-07 and 4.6:1.8:1 in 2008-09 as against favourable ratio of 4:2:1 implying that farmers started adding more nitrogen and proportionately less phosphatic and potassic fertilisers.

About 12 million hectares of arable acid soils with pH less than 5.5 have low nutrient use efficiency and crop productivity. Nutrient imbalance is one of the main reasons for low productivity in acid soils. The presence of excess salts in saline soils impairs soil productivity over seven million hectares. The direct effects of salts on plant growth are mainly physiological while the indirect effects are manifested through adverse changes in chemical, physical and microbiological quality of the soil. Nitrogen is the most limiting nutrient in these soils because of low inherent fertility, low amounts of organic matter, poor symbiotic fixation of atmospheric N and higher volatilisation losses leading to low efficiency of applied fertiliser N. Alkali soils are also low in available zinc. Due to poor health of soils, the current status of nutrient use efficiency is quite low in case of P, N, Zn, Fe and Cu (Table 1). The use efficiency in case of micronutrients is extremely low (1 to 5).

Table 1. Nutrient Use Efficiency in India

Nutrient	Efficiency (per cent)
Nitrogen	30-50
Phosphorus	15-20
Potassium	70-80
Zinc	2-5
Iron	1-2
Copper	1-2

Sustaining higher productivity

Managing soil health is a formidable challenge for a country seeking to ensure productivity, profitability and national food security. The United Nations Millennium Development Task Force on Hunger mentioned soil health enhancement among its five key recommendations for increasing agricultural productivity to fight hunger in India. Soil health apart, there are other opportunities to overcome these issues for sustaining higher crop production.

The opportunities include:

- Bringing more area under cover crops/green manures

- Improved nutrient management practices, which include integrated nutrient management (INM)
- Balanced fertilisation through chemical fertilisers
- Soil test based fertiliser recommendations
- Generating more organic manures and composts
- Crop diversification to include legumes in rotations
- Minimum/zero tillage for conserving carbon
- Efficient crop varieties for nutrient stress conditions
- Crop adaptability and adjusting to soil condition and climate change

Legumes not only help in meeting part of the heavy nitrogen needs of modern intensive cereal-cereal cropping systems such as rice-rice, rice-wheat, maize-wheat and so on but maintain soil organic carbon (SOC) in the long run. It was observed that the content of SOC in rice-wheat-green gram crop sequence was higher than rice-wheat-fodder followed by rice-mustard green gram and rice-mustard fodder sequences possibly due to the inclusion of legume in cereal-cereal crop rotation (Sharma and Bali, 2000).

Balanced fertilisation

In a regime of multiple nutrient deficiencies, a single nutrient approach can lower fertiliser use efficiency (FUE). Balanced nutrition implies that there are no deficiencies, no excesses, no antagonisms and no negative interactions. All nutrients must be at an optimum by themselves and in relation to each other enabling positive interactions to enhance yields. Experimental results on the benefits of balanced fertiliser use are numerous. Apart from NPK nutrients, Zn, Fe, Mn, S and B have assumed importance in India due to the deficiencies emerging in them.

Integrated nutrient management

The basic concept underlying integrated nutrient management is the maintainence or adjustment of plant nutrient supply to achieve a given level of crop production by optimising the benefits from all possible sources of plant nutrients. The objectives of INM are:

- to reduce inorganic fertiliser requirement
- to restore organic matter in soil
- to enhance nutrient use efficiency, and
- to maintain soil quality in terms of physical, chemical and biological properties.

Bulky organic manures may not be able to supply adequate amount of nutrients, nevertheless their role becomes important in meeting these objectives.

In a regime of multiple nutrient deficiencies, a single nutrient approach can lower fertiliser use efficiency. Balanced nutrition implies that there are no deficiencies, no excesses, no antagonisms and no negative interactions

Long-term studies being carried out under All Indian Co-ordinated Agronomic Research Project indicate that it is possible to substitute a part of fertiliser N needs of the kharif crop by FYM (farm-yard manure) without any adverse effect on the total productivity of the system in major cropping systems such as rice-rice, rice-wheat, maize-wheat, sorghum-wheat, pearl millet-wheat, maize-wheat and rice-maize.

The INM strategies developed for different cropping systems all over the country are compiled and presented in Table 2 (see Page 23). Sharma et al. (2005) assessed the effect of different nutrient management options such as inorganic fertilisers alone, organic manures alone and integrated nutrient management practices on sustainable yield index (SYI) and soil quality of rice-blackgram-horsegram system under dryland conditions of Phulbani, Orissa. Integrated use of farm-yard manure and inorganic fertiliser nitrogen not only produced higher SYI of rice-black-horsegram system but also maintained the highest soil quality index (Table 3).

Integrated nutrient management not only sustains higher crop productivity but also improves the physical, chemical and biological health of

Several studies have shown that the bulk soil density undergoes more reduction with the application of nutrients through farm-yard manure than with chemical fertilisers

soils under different production systems. Several research studies have shown that the soil bulk density undergoes more reduction with the application of nutrients through FYM (farm-yard manure) than through chemical fertilisers. The infiltration rate and hydraulic conductivity of soils in general and Vertisols in particular are significantly improved by integrated nutrient management practices. Plots receiving recommended levels of NPK recorded higher soil permeability than those receiving N alone or no fertiliser. Application of 100 per cent NPK along with FYM further increased the infiltration rate (Table 4). This is an outcome of improved aggregation and soil structure and subsequent changes in pore-size distribution (Tiwari et al., 2000).

The organic carbon content of a Vertisol under different cropping systems over a 25-year period varied from 0.57 per cent in plots receiving no manure or chemical fertilisers to 0.97 per cent in plots receiving NPK through chemical fertilisers at the recommended level in conjunction with 10 t ha^{-1} FYM applied to rainy season crop only (Manna and Ganguly, 2003).

Soil microbial biomass C and N - following the application of farm-yard manure and inorganic fertilisers alone and in combination was quantified in a fingermillet-maize-cowpea cropping sequence grown under irrigated conditions (Santhy et al., 1999). Data in Table 5 show that the highest microbial biomass C and N contents were observed under the integrated usage of FYM and fertiliser application (Santhy et al., 1999). There was no significant improvement of soil microbial biomass C (SMBC) and N (SMBN) in the treatment receiving inorganic fertiliser alone.

Improved agronomic practices

Globalisation and urbanisation have changed the paradigm for agriculture. The age old paradigm based on massive soil inversion with a plough has changed to a new paradigm of conservation agriculture (CA) with some major shifts observed:

- Conventionally tilled wheat to zero tillage/reduced tilled wheat

Table 2. IPNS Strategies for Major Cropping Systems

Cropping system	IPNS strategy
Rice – wheat	Green manuring of rice with sunnhemp equivalent to 90 kg fertiliser N along with 40 kg N/ha produces yield equivalent to 120 kg N/ha. In an acid Alfisol soil, incorporation of lantana camera 10-15 days before transplanting of rice helps to increase the N use efficiency. Apply 75 per cent NPK + 25 per cent NPK through green manure or FYM at 6 t/ha to rice and 75 per cent NPK to wheat. Inoculation of BGA @ 10kg/ha provides about 20-30 kg N/ha.
Rice – rice	Use of organic sources, such as FYM, compost, green manure, azolla etc. meet 25-50 per cent of N needs in kharif rice and can help curtailing NPK fertilisers by 25-50 per cent. Apply 75 per cent NPK + 25 per cent NPK through green manure or FYM at 6 t/ha to kharif rice and 75 per cent NPK to rabi rice. A successful inoculation of blue green algae @ 10 kg/ha provides about 20-30 kg N/ha.
Rice-potato-groundnut	Use 75 per cent NPK with 10 t FYM/ha in rice and potato.
Sugarcane based cropping systems	Combined use of 10 t FYM/ha and recommended NPK increases the cane productivity by 8-12 t/ha over chemical fertiliser alone.
Maize based cropping systems	Apply 50 per cent recommended NPK as fertiliser and 50 per cent of N as FYM in maize and 100 per cent of recommended NPK as fertiliser in wheat.
Soybean–wheat	To get 2 t soybean and 3.5 t wheat, apply 8 t FYM/ha to soybean and 60kg N+11 kg P/ha to wheat or apply 4 t FYM + 10 kg N+ 11 kg P/ha to soybean and 90 kg N+22 kg P/ha to wheat.
Pulses	Integrated use of FYM at 2.5 t/ha and 50 per cent recommended NPK fertilisers plus rhizobium inoculation helps in saving of 50 per cent chemical fertilisers.
Sorghum based cropping system	Substitute 60 kg N through FYM or green *Leuceana leaucocephala* loppings to get higher yields and FUE.
Cotton	50 per cent of recommended NPK can be replaced by 5 t FYM/ha.
Oil seeds (Mustard, Sunflower and such others)	Substitute 25-50 per cent of chemical fertiliser through 10 t FYM/ha to get higher yield and FUE.

Source: Subba Rao and Sammi Reddy (2005)

Table 3. Relative soil quality index (RSQI) and SYI under rainfed Rice – blackgram - horsegram system after 7 years of cropping at Phulbani, Orissa

Treatment	SYI*	RSQI**
Control	0.13	-
RDF (inorganic)(R-60-30-30 & BG – 20-40-40)	0.32	0.79
25 kg N (FYM)	0.31	0.55
15 kg N FYM + 20 kg N (inorg)	0.45	1.00
15 kg N GLM + 20 kg N (inorg)	0.39	0.66
15 kg N FYM + 15 kg N GLM	0.27	0.70

**SYI- Sustainable yield index; **RSQI- Relative Soil Quality Index*

Source: Sharma et al. (2005)

Table 4. Soil physical properties of black soil (0-15 cm) as influenced by integrated use of FYM and fertiliser

Soil Properties	Control	100 per cent NPK	100 per cent NPK+FYM
Saturated hydraulic conductivity (mm/hr)	0.205	0.284	0.416
Initial infiltration rate (mm/hr)	44.4	116.6	391.6
Constant infiltration rate (mm/hr)	3.0	7.0	10.0

Table 5. Microbial biomass and its relationship with organic C and Total N of the soil

Treatments	Microbial biomass C (mg kg-1)	Microbial biomass N (mg kg-1)	Microbial biomass C:N	Microbial biomass as per cent of soil	
				Organic C	Total N
100 per cent NPK	289	26	9.4	3.3	5.6
100 per cent NPK + FYM	384	34	9.4	4.4	5.8
Control	283	26	13.4	3.3	5.9
CD (P = < 0.05)	10	1	0.4	-	-

- Puddled transplanted rice to direct dry seeded rice (zero-till rice)
- Residue burning/residue incorporation to residue retention (mulching)
- Monocultures to diversified agriculture
- Sole crops to intercrops in bed-planting

The new multi-crop planters enable farmers to plant crops timely in residual soil moisture of preceding crops to save pre-sowing irrigation water, diesel and labour. The drill places seed and fertilisers at an appropriate soil depth in a narrow slit which helps in enhancing the fertiliser use efficiency. By the end of rabi 2006-07, more than 3.13 Mha were planted to zero-till and reduced till systems in the Indo-Gangetic plains. Reduction in tillage intensity will conserve plant residues and may eventually increase soil organic matter. Microbial C has been used as an early indicator of the increase in soil organic matter.

Tailored INM

INM appears to be a viable technology/measure to sustain higher crop productivity and assure better soil health under intensive agriculture systems. Nutrient management strategies need to be tailored to the needs of the farmers with different reference bases. In crop production, all possible resource conservation measures need to be adopted depending on the availability of water, nutrients and agro-climatic limitations.

Future lines of action

Planners and policy makers should take up the following lines of action for sustaining higher productivity while enhancing soil health.

- Distribution of soil health cards to farmers in different states
- Improvement/upgradation of soil test labs to analyse micronutrients and sulphur
- Creation of regional soil testing laboratories for analytical quality assessment and monitoring
- GIS, GPS based soil fertility maps in all states
- Interlinking of on-line fertiliser recommendation system with soil maps
- Promotion of improved methods of composting and value-added organic manures
- Establishment and use of quality standards for municipal solid wastes and metal loading rates for regulating their use
- Promoting recycling of all safe organic wastes/ non-toxic organic wastes.
- Safe use of sewage waters and industrial waters in agriculture, horticulture, forestry and so on
- Monitoring heavy metal pollution in industrial areas, peri-urban areas and mining areas
- Monitoring pesticide, fungicide and herbicide residues in the soil-plant system. ●

Dr A. Subba Rao is Director and **Dr K. Sammi Reddy** is the Principal Scientist, Indian Institute of Soil Science, Bhopal

References

Manna, M. C. and Ganguly, T. K. (2003), Impact of integrated nutrient management practices and land use on soil organic matter dynamics, soil biological processes and sustainable productivity in semi-arid and tropical India. Proceedings of the ICAR-ACIAR workshop on farmyard manure: Life cycle analysis and management (C. L. Acharya, K. Sammi Reddy and A.K. Sharma Eds.), February 18-20, 2003, Indian Institute of Soil Science, Bhopal.

Santhy, P., Velusamy, M. S., Murugappan, V. and Selvi, D. (1999), J. Indian Soc. Soil Sci. 47: 479-482.

Sharma, K. L., Mandal, U. K., Srinivas, K., Vittal, K. P. R. Mandal, B., Grace K. J. and Ramesh, V. (2005), Long-term soil management effects on crop yields and soil quality in a dryland Alfiso. Soil & Tillage Research 83: 246-259.

Sharma, M. P. and Bali, S. V. (2000), Indian Soc. Soil Sci. 48: 181-183.

Subba Rao, A. and Sammi Reddy, K. (2005), Emerging strategies for sustaining higher productivity and ensuring soil quality under intensive agriculture. Indian Journal of Fertilisers 1(4): 61-76.

Tiwari, A., Nema, H. R., Tembhare, B. R. and Sharma, S. K. (2000), JNKVV Res. J. 34 (1&2): 29-33.

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COVER STORY

DIRECT FERTILISER SUBSIDY

PROBLEMS WITH THIS MAGIC WAND

Naresh Minocha

Fertilisers are political commodities and any policy change can rock the government of the day. Several official reports and two successive finance ministers have flirted with changing the subsidy regime. But ideas have remained on paper.

The idea of giving fertiliser subsidy directly to farmers appears good on paper but its implementation bristles with controversies. Fertilisers are political commodities and any mess-up with them can rock the government of the day. It is hardly surprising then to find successive governments treading this uncertain area at snail's pace. Several official reports have recommended it, two successive finance ministers have flirted with it, yet the idea remains stuck at the advocacy stage for a decade.

The idea is now getting rekindled with the Department of Fertilisers (DoF) asking the Hyderabad-based National Institute of Smart Governance (NISG) to prepare a detailed project report for examining the feasibility of transferring fertiliser subsidy directly to farmers. The NISG would also undertake a pilot/proof of concept study on the subject in between 50 and 70 blocks in the country. Direct fertiliser subsidies (DFS) go under different names such as smart market subsidies, fertiliser coupons, fertiliser vouchers, targeted subsidy, direct income support and conditional cash transfer. There are several variants of such dole-outs, tried with varying degrees of success in under-developed farm economies, especially in Africa and developed farming economies such as Turkey and Mexico.

India: a different ball game

It is, however, a different ball game playing in a diverse, politically-conscious and gargantuan farming region such as India. Here the idea possibly emerged as a categorical recommendation for the first time in September 2000, when the Finance Ministry constituted the Expenditure Reforms Commission (ERC), which mooted the introduction of tradable fertiliser coupons.

Dual pricing

In its second report, the ERC recommended the "introduction of a dual price scheme in fertilisers". It suggested that every cultivator household be given tradable coupons with which to purchase 120 kgs of fertilisers (urea 80 kgs, phosphatic 30 kgs and potassic 10 kgs) at a specified

subsidised price. The remaining fertiliser had to be bought in the open market at a higher price that would be raised over a period of time to a price level equal to the import parity price.

The then Finance Minister, Yashwant Sinha, referred to the ERC's recommendations regarding phased decontrol of fertiliser prices in his budget speeches for 2001-02 and 2002-03 but chose to remain silent on the recommendation regarding tradable coupons. The change of government at the centre did not change the faith of the Finance Ministry in direct subsidy. With P. Chidambaram holding the reins at the ministry, the coupons proposal was revived in a report titled 'Central Government Subsidies in India' presented to Parliament in December 2004. It said: "an alternative could be to distribute fertilisers to targeted cultivator households alone (small and marginal) in the form of tradable coupons".

Alternate delivery mechanism

Chidambaram later became forthright on this issue. Presenting the budget for 2007-08 on February 28, 2007, he said: "While fertilisers should indeed be subsidised, we must find an alternative method of delivering the subsidy directly to the farmer. The fertiliser industry has agreed to work with the Department of Fertilisers to conduct a study and find a solution. Based on the report, the government intends to implement a pilot programme in at least one district in each state in 2007-08". About a month prior to this announcement, the Fertiliser Association of India (FAI) had assigned the study to Tata Consultancy Services (TCS).

TCS submitted its report on a 'Alternative Framework for Fertiliser Subsidy Disbursement in India' to FAI in May 2007. It made presentations to both the DoF and the Department of Expenditure but could not get the government to shed its inertia. The study evaluated four options of direct subsidy delivery:

- Subsidy payment directly to farmers through cash deposit in banks without any stipulation for fertiliser purchase
- Subsidy payment through pre-loaded smart cards linked to purchase of agricultural inputs
- Subsidy payment through pre-loaded smart cards linked to a specified limit for fertiliser purchase
- Smart card-based subsidy linked to fertiliser purchase without any quantitative ceiling.

The TCS option

TCS recommended the last option after evaluating them against eight criteria (see table and graphic: Page 29). It also recommended the road-map for implementing its recommendations in three phases, ending 2010.

The report concluded: "The alternative subsidy disbursement mechanism needs a paradigm shift in dealing with farm-inputs and subsidy processes on the part of policy makers, producers, distributors and consumers in the fertiliser sector. A change in the mindset on the part of different stakeholders is called for coupled with the will and determination to leverage appropriate technologies to ensure success of the alternative mechanism and sustain it over a long term. TCS consultants believe it is feasible and can be implemented." Instead of making the TCS report public for getting feedback from different sections of the society, the government quietly shelved the study.

In November 2008, the government constituted an Inter-Ministerial Group (IMG) under the chairmanship of the fertilisers secretary to look into all aspects of the DFS. The IMG recommended the introduction of a nutrient-based subsidy (NBS) scheme under which the farm gate prices of fertilisers were later decontrolled and subsidy was fixed for each fertiliser based on its nutrient content. It suggested that 'NBS' scheme could be carried on till such time that the authenticity of land records allowed a move towards disbursement of fertiliser subsidy as direct cash transfer to the bank account, based on land record details. Chidambaram's successor, Pranab Mukherjee, revived the DFS idea. Presenting the budget for 2009-10 on July 6, 2009, Mukherjee affirmed the

Table 1. Evaluation and rating of direct subsidy options by TCS

Evaluation of Alternative framework – Options									
Parameters	**Weight**	**Option 1**		**Option 2**		**Option 3**		**Option 4**	
		Rating	**Score**	**Rating**	**Score**	**Rating**	**Score**	**Rating**	**Score**
Impact on fertiliser consumption	5	2	10	3	15	4	20	4	20
Simplicity / Ease of administration	5	5	25	3	15	1	5	2	10
Beneficial Impact on stakeholders									
Farmers	5	5	25	4	20	3	15	4	20
Govt (MoC&F)	4	3	12	3	12	5	20	3	12
Producers	4	3	12	3	12	3	12	4	16
Distribution network	4	2	8	2	8	3	12	3	12
Help plan/monitor fertiliser use	3	2	6	3	9	5	15	4	12
Transparency, Built-in Checks	4	2	8	3	12	4	16	4	16
Encourage balanced use of fertilisers	2	3	6	3	6	4	8	5	10
Help combine subsidy schemes	1	5	5	3	3	4	4	4	4
Freedom of choice to beneficiary	3	5	15	4	12	1	3	3	9
Total score	**40**		**132**		**124**		**130**		**141**
Weighted score			**3.30**		**3.10**		**3.25**		**3.53**

Chart 1. TCS chart explaining Option 4th for Subsidy payment through smart cards with no limits (linked to fertiliser purchase)

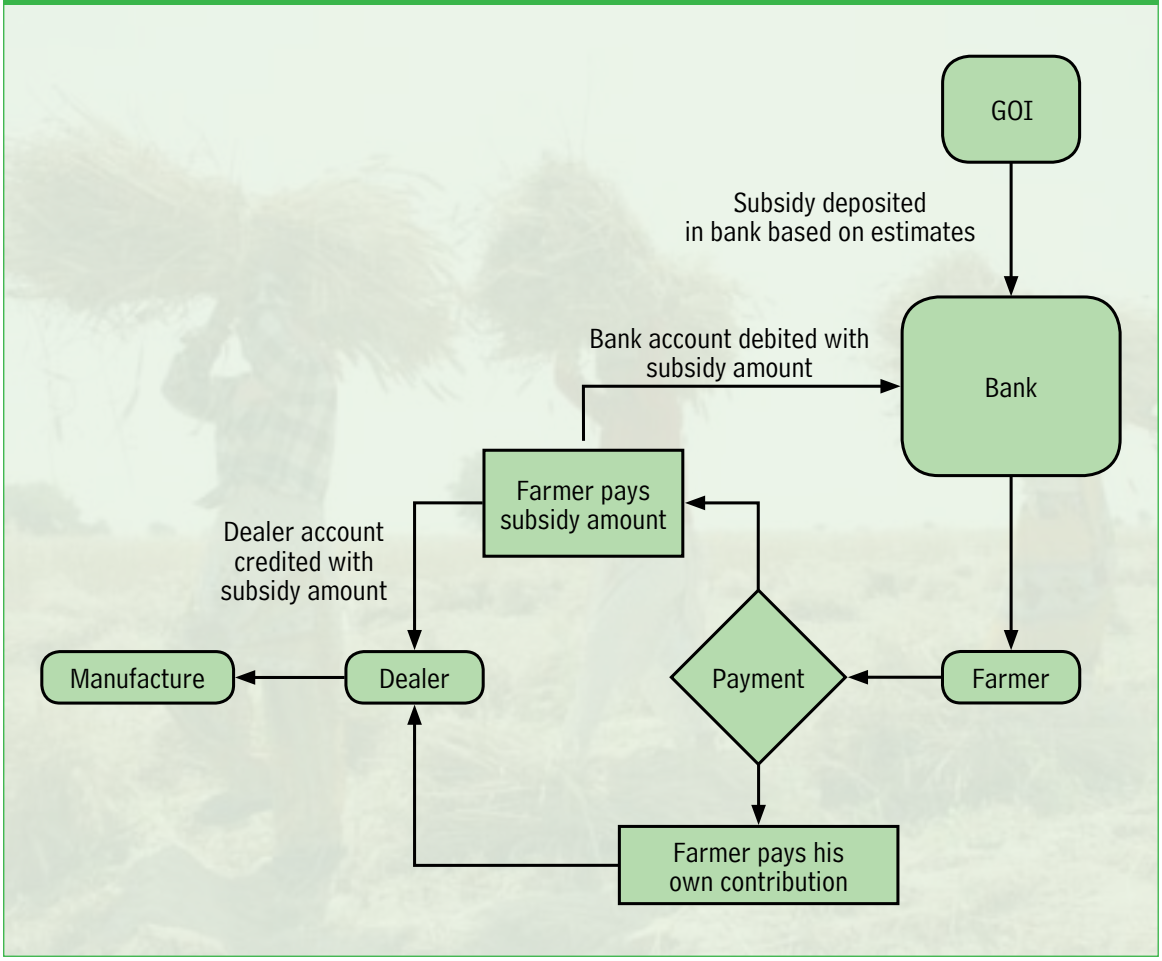
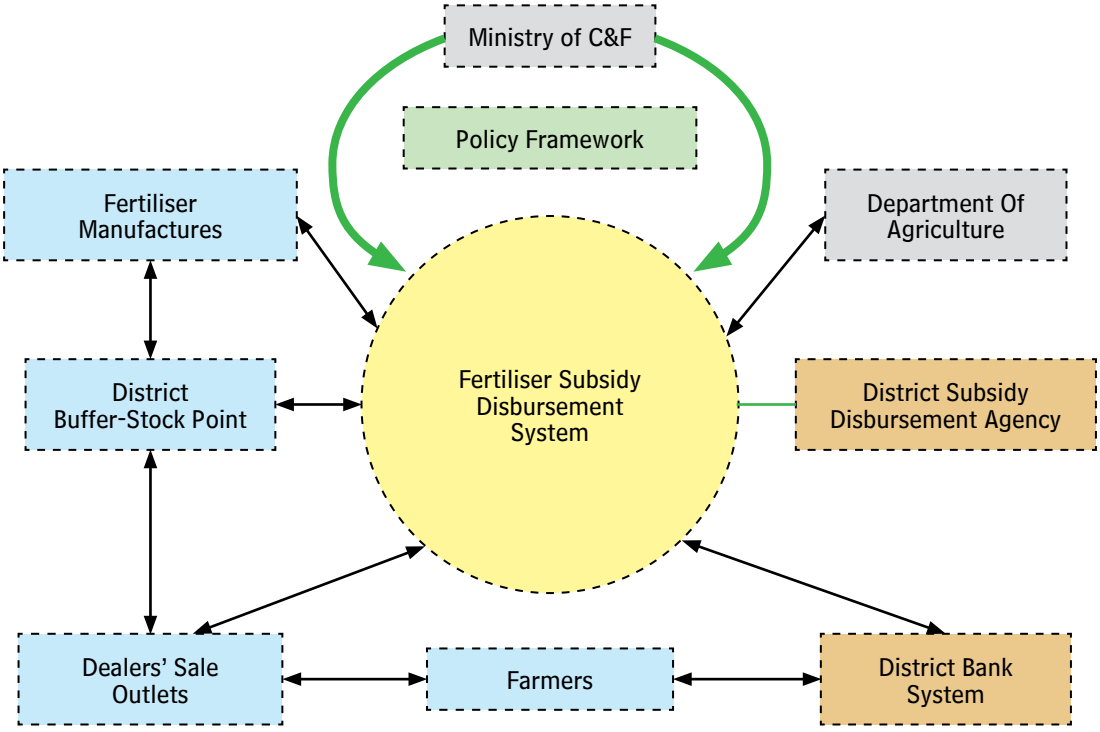


Chart 2. TCS' Conceptual View of Proposed Direct Subsidy system



political resolve to launch NBS: "In due course, it is also intended to move to a system of direct transfer of subsidy to the farmers."

Enter the UID

The Finance Ministry has also been egged on to launch DFS by different entities. The International Monetary Fund (IMF), for instance, emphasised the need for replacing universal subsidies with targeted ones. In its annual country report on India issued on March 16, 2010, the IMF said: "The subsidies on products consumed predominantly by the poor, e.g. kerosene, food, fertiliser, could be replaced by targeted support, which should be facilitated by the planned introduction of a unique identification number (UID). These measures would go a long way in lowering the subsidy bill without unduly affecting the poor." The Unique Identification Authority of India (UIDAI) Chairman, Nandan Nilekani, has lent weight to the prospects of UID-enabled micropayments approach to deliver direct benefits including fertiliser subsidy to targeted sections of the society. Earlier this year, he stated that with the proposed UID, "governments would have the opportunity to transform a wide variety of indirect subsidies into direct benefits". Unlike other ministries such as the Ministry of Petroleum and Natural Gas, the DoF has not yet signed any memorandum of understanding with the UIDAI for ushering a UID-based direct subsidy mechanism.

> "The Committee regret to point out that though they had been repeatedly emphasising the need for payment of direct subsidy to farmers, the department have so far taken no steps in this direction and the subsidy is to be disbursed to farmers through industry." – Parliamentary Standing Committee on Chemicals and Fertilisers in its action taken report submitted to the Lok Sabha on August 12, 2010

Yet another entity pushing for DFS is the Parliamentary Standing Committee (PSC) on Chemicals and Fertilisers. In its action taken report (ATR) presented to the Lok Sabha on August 12, 2010, the PSC said: "The Committee regret to point out that though they had been repeatedly emphasising the need for payment of direct subsidy to farmers, the department have so far taken no steps in this direction and the subsidy is to be disbursed to farmers through industry. Considering the importance of the issue, the Committee reiterate that the department should explore all possibilities for achieving the long cherished goal of direct subsidy to farmers by overcoming any problems/ difficulties and take suitable steps accordingly."

Yet questions remain

Having tracked the path to which the DFS idea has so moved, one may gauge the prospects for its implementation. The two pre-requisites for DFS implementation are computerisation and updating of all land records and issuance of UID or its alternative smart card to all farmers. However, there is no clue about a date for the official launch of a nation-wide DFS. One can safely assume that it would take at least five years to set the stage for a full-blast implementation. One also has to factor in the recommendation of the NISG report and the subsequent launch of pilot-scale DFS.

To avoid glitches or major slippages in the implementation of the DFS, the Department of Fertilisers can learn from the experiences of other countries that have introduced it or its variants. The hurdles anticipated by the Department of Fertilisers in implementing the direct fertiliser subsidy scheme include:

- Deficient land records
- Absentee landlordism
- Types of land tenure
- Different cropping patterns and soil requirements
- The massive dimensions of Indian agricultural economy.

As noted by the TCS study, the DFS targets more than 115 million agricultural land holdings in India and a fertiliser distributor/dealer network comprising 2,85,000 registered outlets. Delivering cash to each farmer's account through smart cards or any other IT-enabled mechanism is one thing; ensuring adequate availability of required fertilisers at the appropriate time across the country is not easy. The DFS does not provide for any mechanism for delivery of freight subsidy to manufacturers and marketers, as the case may be. Apart from addressing the issue, the DFS must also be conducive for dealers to stock and sell all fertiliser products.

The Fertiliser Association of India, which commissioned the TCS study, is again not sure as to when and whether the DFS idea can become a reality. The FAI Chairman, A. Vellayan, says that there are too many complexities in the implementation of DFS. Another vital issue in implementation of any subsidy system is whether the government wants to limit subsidy by specifying a ceiling per kg of entitlement. In its report released on February 25, 2010, the 13th Finance Commission says that it has calculated fertiliser subsidy estimates for next five years by assuming a quantitative ceiling of 120 kgs/ cultivator family.

"The Department of Fertilisers, in their interaction with the Commission, also made the point that the working of the subsidy regime would promote optimal use of fertilisers as well as better targeting of the subsidy. With these considerations in view, we have taken as a reference point the recommendation of the Prime Minister's Economic Advisory Council (EAC) to restrict this subsidy to 120 kilograms of fertiliser per cultivator household", says the Finance Commission. If the government has already made up its mind to curtail subsidy by putting a cap on the quantity of subsidised fertilisers, it is not worthwhile to shift from NBS to DFS. The subsidy bill can be contained by reducing the subsidy per kg for each nutrient as has been proposed for 2011-12.

A Working Paper by two academics of the Indian Institute of Management, Ahmedabad (IIM-A) has already given a thumbs-down to the DFS.

Published in July 2009, the paper titled 'Fertiliser Subsidy in India: Who are the Beneficiaries?', says: "direct transfer of subsidy to farmers is not a right policy decision".

Contending that the basic notion of about one-third of the subsidy going to fertiliser industry being untrue, it says that the policy of direct transfer of subsidy to farmers is neither desirable nor practically implementable. "It would be difficult to ensure that direct transfer of subsidy to millions of farmers is actually used by farmers for only buying fertiliser and there are no leakages in transfer of subsidy. If the subsidy is not used for fertiliser, it might adversely affect agricultural production in the country. Under the changed scenario, it is advisable to route the subsidies through the existing mechanism, which is easy to monitor as well as ensure usage of fertilisers by all categories of farmers."

The need for caution in introducing DFS-type subsidies has also been underscored abroad. It is pertinent to quote a paper titled "The Use of Input Subsidies in Developing Countries" presented by the Organization for Economic Cooperation and Development, an association of rich nations, at two global fora in November 2010. Referring to smart subsidies advocated by the World Bank and others, the paper says that the underlying logic of such concepts "look like sound principles, although it is easy to see why they may not be followed. Administratively, targeting may be difficult and costly; and if vouchers are distributed, there may be the need for complementary measures to ensure local dealers stock inputs".

It would be difficult to ensure that direct transfer of subsidy to millions of farmers is actually used by farmers for only buying fertiliser and that there are no leakages in transfer of subsidy

Subsidy as national food security allocation

The fertilisers subsidy business is part politics and part short-sighted economics. The fertiliser industry is the whipping boy for both politicians and economists. They never get tired of accusing the industry of inefficiencies and snub the manufacturers for demanding more subsidies. Opinion leaders have also debated for long as to who the beneficiaries of the fertilisers subsidies are. Is the industry the major beneficiary or the farmer or both?

It is pertinent to recall the Finance Ministry's report titled 'Central Government Subsidies in India' released in December 2004. It said: "In the case of fertiliser, both farmers and fertiliser industry have been subsidised. There is a need for policy measures to reduce subsidy to both the groups. Fertiliser subsidies should be done away with in their present form". Such attempts to identify beneficiaries of fertiliser subsidy in public discourse degenerates into irrigated lands versus drylands, big farmers versus small farmers, major or staple crops versus minor crops.

Such analysis proving the iniquitous nature of fertiliser subsidy distorts the basic facts that irrigation is the enabler of intensive use of fertilisers, big farmers would use more fertilisers because of their large holdings and purchasing power. Again, major or staple crops would consume more fertilisers because they occupy massive acreage and are in great demand. Such analysis also masks the ultimate and unwritten objective of fertiliser subsidy: to safeguard and strengthen national food security.

Even reputed entities such as the Finance Commission, the International Monetary Fund and the World Bank articulate such distorted analysis and ultimately dub fertiliser subsidy as regressive. They normally end up with the same conclusion that targeting subsidies directly to the farmers can check the unabated rise in fertiliser subsidies. The tight-fisted economist goes a step further and suggests that subsidies be directly targeted to small and marginal farmers, who otherwise cannot afford to buy.

All this public discourse has created an impression that farmers are the real beneficiaries and it is they who actually require subsidies. The very idea of delivering the subsidy directly to farmers hurts the pride of farmers, who toil not only for themselves but for the nation as well. The fact is that the growers, the industry and the country as a whole require subsidy as a shield against the global price volatility in fertiliser and fertiliser raw material markets. More importantly, the food security and, the larger concern for national security, hinges on fertiliser subsidy.

Without fertiliser subsidy and without its non-discriminatory or universal delivery to all farmers, food production would fall drastically and food

prices would rise sharply. Food shortages would accentuate hunger and malnutrition and force the country to slip back to the PL-480 days of the sixties, when India depended on food shipments from the USA for its survival. It is high time that we rename fertiliser subsidy as national food security subsidy and, accordingly, consider ways of optimizing its efficiency and checking its alarming rise.

- Renaming is essential to change the policy mindset that has messed up fertiliser reforms since the start of the big initiative in 1992 that led to decontrol of phosphate and potassic fertilisers.
- The next step should be to list and prioritise all factors that can be tapped to control the growth of national food security subsidy as well as derive maximum benefit from it.
- An initiative that may help check the subsidy bill and facilitate balanced crop nutrient is to include urea under nutrient-based subsidy (NBS) scheme.
- Simultaneously, the government should stop discriminating against products under the subsidy mechanism.

The most outrageous instance in point is the discrimination between ammonium sulphate fertiliser produced by steel and petrochemical plants. While ammonium sulphate produced by petrochemical (caprolactum) plants is covered by NBS, that produced by steel plants is kept out of the purview of NBS. There are several conventional chemical fertilisers and new-generation specialty fertilisers that have been kept out of the purview of NBS.

Having pegged the nutrient subsidy for major and secondary nutrients on per kg basis, the government should give farmers the right to choose the most appropriate fertilisers within the NBS framework. It would not do to lose sight of the ultimate objective: subsidy is meant to increase agricultural production especially for the cause of national food security. Large-scale promotion and use of liquid fertilisers can do wonders not only in saving fertilisers and water but also in reducing subsidy bill.

The government can also whittle down the subsidy bill by shifting the subsidy from the product to raw material. The Department of Fertiliser, for instance, can buy all the natural gas required by fertiliser plants at market prices and supply gas at a subsidised price of say $2 per million British thermal units (MMBTU) to fertiliser plants; fix a normative urea price for all units and provide a 15 per cent post-tax return on net worth. Under such an arrangement, urea price can continue to be controlled statutorily.

A similar approach can be followed in the case of imported phosphatic raw material and intermediates. By thus minimising the need for increasing fertiliser prices, the government can also moderate the increase in crop support prices and thus contain food subsidy. In fact, fertiliser and food subsidies should be combined and treated as budgetary allocation for national food security before considering alternative approaches to subsidise fertilisers. The government can identify more such initiatives and prepare an innovative way out of the current impasse of spiralling food and fertiliser subsidy bill.

It is time to think out of the box. ●

COVER STORY

'Fertiliser Subsidies are for Global Fertiliser Traders; the Indian Farmer is just an Excuse'

Vandana Shiva in conversation with **Paranjoy Guha Thakurta** and **Ajay Jakhar** for ***Farmers' Forum.***

Paranjoy Guha Thakurta (PGT): ***Soil health is a problem that everybody acknowledges in India. The manner in which the government's subsidies on chemical fertilisers has resulted in an imbalance in the pattern of its usage is also recognized. NPK proportions in fertilisers have been used indiscriminately and caused a sharp fall in the health of the soil in some of the most agriculturally prosperous parts of the country. Nutrients in the soil have deteriorated as a result of which farmers have been using more fertilisers for the same yield. What to your mind are the dimensions of the problem?***

Vandana Shiva (VS): The first problem really begins with the assumption that soils need only NPK as external inputs. This is wrong on two fronts. First, because the external NPK is non-renewable in its supply, nitrogen fertilisers being fossil fuel based. The phosphates, which produce the phosphorus for chemical fertilisers, are running out, with just about 20 years of supply left. It is based on a model that cannot carry on beyond 10-15 years, with or without subsidies. It assumes that soil even with right cropping patterns does not make its own NPK.

After all, nitrogen-fixing crops, which were a very important part of India's cultivation system, were wiped out with the Green Revolution inspired monocultures of rice and wheat that, in turn, have led to the absolute extinction of pulses in cultivation patterns; particularly of the Punjab. One does not see even one plant of pulses. Experienced farmers over the age of 45 were surprised to see urad and moong plants at our farm in Dehradun. They had never seen these plants, just as our schoolchildren have not seen such plants.

Incidentally, there was a time when the soil in India was very fertile and virtually pest free. Sir Albert Howard, the father of modern organic agriculture, who was sent here by the British government in 1905 to improve Indian agriculture with chemical fertlilisers, writes as much in his book, *The Agriculture Testament*.

PGT: ***That was more than a hundred years ago…***

VS: Yes and Howard decided to observe the peasants. He writes in his book: "I decided, I could do no better than to turn the peasants and the pests into my professors, on how to do good farming". He further writes, "The majority of farmers in market gardens base their programmes on NPK. What may be conveniently described as the NPK mentality dominates farming alike in the experimental stations in the countryside. Vested interests entrenched in time of national emergency, the war, have continued

to dominate through agriculture because nitrogen fertilisers are made from explosives factories".

So soils need a very, very broad area of nutrients and not just NPK. Also, the soil is not an empty container into which you put industrial inputs. This was wrong in 1905, it is doubly wrong today with the additional knowledge that you are running out of time. At that time it looked like you could not run out of fossil fuels. Phosphatic mineral fertilisers are just the wrong path to go. In any case, by only providing NPK inputs and providing subsidies for these, the government has not just created an imbalance in terms of NPK within the three categories, it has created an imbalance by not allowing the micronutrients and trace elements to be replenished.

Way back in 1984, when the Punjab erupted, I wrote a book as I wanted to understand why such a prosperous community was so angry as to take to the gun and why the land that got Norman Borlaug the Nobel Peace Prize, was today a land of war. Even in the 1980s, the micronutrient deficiencies in the Punjab soil were very evident. Today, 15 years down the road, the practice continues. It is this narrow idea of soil fertility that treats the soil as dead matter, not as living; that treats soil fertility as coming from industrial factories, not from the life of the soil; that is at the heart of the problem of soil health in India today.

Instead of additional production gained per hectare increasing for every additional kilogramme of urea and synthetic nitrogen fertiliser used, it has come down systematically

PGT: ***It is a problem that the government subsidy pattern until very recently has focused on nitrogen fertilisers, urea in particular, as a result of which even within the NPK, there has been an imbalance in the pattern of fertiliser in usage. More urea is used simply because it is relatively cheaper, further compounding the problem…***

VS: Yes, I think, the push for urea is because (one) it is cheaper; (two) it does lead to an instant greening of plants and the farmers feel extremely happy and (three) the lobbies are strong. It is a very, very powerful lobby and, for a while, the Green Revolution was pushed for India to buy more chemicals and seeds from America. It is interesting that Obama was here to do the same thing all over again. At the time of the Green Revolution, India built its own fertiliser capacity but, later, trade liberalisation undermined a lot of the fertiliser capacity. India had to depend on imports again.

In 2008, when the oil prices rose, fertiliser prices rose and Cargill, whose big subsidiary, Matrix, is a major supplier, held back the shipments to allow the prices to go up a little further even though the planting season was getting over. In Karnataka, farmers protested its distribution because these synthetic fertilisers are ecological narcotics. The more you use them, the further you have to use them. So, not only have these subsidies created an abuse and overuse of nitrogen fertiliser, they have created a huge dependence of the farmer on an input whose cost is constantly rising and whose use he must double and triple.

PGT: ***In order to maintain the crop productivity…***

VS: The figures at the global level and at the India level are very clear. The average global level was 8.6 kg/hectare in 1961, which is pre-Green Revolution period and it increased to 62.5 kg/hectare in 2006.

PGT: ***That is the world average.***

VS: For a kg of nitrogen fertiliser, in 1961 one had 226 kgs of maize. In 2006, one gets only an additional 76 kgs of maize. So the additional benefit has dropped to less than a third. For wheat it dropped from 126 kgs to 45 kgs; for rice it dropped from 217 kgs to 66 kgs.

PGT: ***Would you elaborate on these figures…***
VS: Instead of additional production gained per hectare increasing for every additional kilogramme of urea and synthetic nitrogen fertiliser used, it has come down systematically. So, now, the additional amount is one quarter of what it used to be earlier. There are two other problems that we now know that make it a serious issue. First, only between five per cent and 10 per cent of a heavy application is taken in by the plants. The rest runs off into our water bodies; streams. Nitrates pollution is becoming a huge health problem for fish and people. Second, one-third, which is easily between 30 per cent and 40 per cent, of the problems of climate change is related to industrial agriculture. Of these, chemical fertilisers that contribute to nitrogen oxide are a major problem.

PGT: ***You have to explain this one…***
VS: Well, nitrogen oxide is released by synthetic fertilisers as they interact with air. These are 300 times more damaging to climate than carbon di-oxide, which is the main gas that we talk about. Everyone talks of being carbon neutral or of carbon reduction but the real thing that we should be worrying about is fertiliser reduction, especially synthetic fertilisers. The imbalance has many, many implications.

PGT: ***The Government of India has been talking about a nutrient-based fertiliser subsidy regime, which is more rational. The Finance Minister mentioned it in his budget speech last year. A committee headed by former Agriculture Secretary, Nanda Kumar, has presented a report that is currently before the Cabinet Secretariat. It has a very detailed set of recommendations on what needs to be done to ensure that the fertiliser subsidy regime is nutrient-based. Is the government moving in the right direction by looking at a is nutrient based subsidy regime?***
VS: What we should be looking at is a support system to increase the capacity of the soil itself to produce nutrients. That should be the government's focus today, having recognised that its subsidies have created soil ill health and nutrient imbalance.

PGT: ***It is about a lot of money, about Rs 100,000 crore.***
VS: In 2008, it was Rs 1.3 trillion.

Ajay Jakhar (AJ): ***It is going to be the same figure this year.***
VS: It is huge; three times higher than the food subsidy bills, which everyone says is too much. It is even bigger than our defence budget, which itself is huge. Now, we are blowing up a great deal of public money on something that is neither serving the soil nor farmers anymore and I do not think that it is enough to try and bring a balance between the three external input nutrients. If we are serious about a nutrient-based subsidy system, we should look at all the nutrients that a soil produces and needs so that we get those nutrients at the end of the chain. The nutrient deficiency that we are facing in the human diet is linked to soil nutrient deficiencies and that is linked to the fact that we are only giving it a partial diet. It is bit like giving only starch to children, starch, fats, salts and sugar and, of course, they have obesity. In a way, what we see in agriculture is a crisis of a similar kind.

The counter to obesity is a balanced diet, which is more than NPK. So, though the government might have tried to create a balance between nitrogen and other synthetic fertilisers, it is not enough to keep

the focus on synthetic fertilisers. In 2010, with the combination of desertification, a water crisis triggered by fertiliser use…

PGT: ***…. and depletion in the groundwater level.***

VS: Yes, because synthetically fertilised soils need 10 times more water than organically-farmed soils. So with more use, there is depletion of the groundwater and, as more water is drained out of the aquifers, the soil's capacity to recharge is being destroyed. The recharge is enabled by organic matter that holds the moisture; it holds 10 per cent to 20 per cent more water and, when the rain comes, it holds some more water and puts more into the groundwater. Now you have a system that is pulling more water out. As a NASA study shows, a hundred cubic kilometers disappeared in five years in the Punjab-Haryana area.

As more water is pulled out, the soil gets compacted and it is not able to retain water. The instant runoff leads to floods. The hard pans being created (low infiltration, as it is called) further deplete groundwater. The combination of rising costs of fertiliser subsidy, the desertification of our soils, the water crisis that it is triggering, the climate contributions, all of this should make the government think of radical measures. Yet, it may not be enough to ensure that by 2050, Indian soils will be able to produce food adequately.

There has been almost a 666 per cent increase in imports of edible oils since 2008 from the United States and we are promising them more market access! How much more agriculture do we want to destroy?

AJ: ***Intensive agriculture uses a lot of nutrients and depletes the soil as you have just explained. How can we replenish the soil? How can we actually start increasing the capacity of the soil? What should the government focus on doing… if you could define them in three, four, five steps…***

VS: There is only one overall source of replenishing the soil: by returning organic matter to the soil. To do so would mean a different calculus, from yield of single grain commodity per acre to biomass and biodiversity per acre. For example, we always had green manures, as boundary crops, grown primarily to add nutrients and organic matter to soil. As soon as the rabi crop, normally planted in March, is harvested, the green manure is sown. It is one of the richest sources of balanced nutrition for the soil and the kharif or winter crop reaps the benefits. Inter-cropping systems, such as having pulses and legumes – that are nitrogen fixed – as part of the system means that it is rid of huge external inputs, since nitrogen is fixed for the cereal-crops. Composting systems are another route and quite underestimated. Earthworm castings, which can amount to four tonnes to 36 tonnes per acre per year, contain five times more nitrogen, seven times more phosphorus, three times more exchangeable magnesium, 11 times more potash and one and a half tonne more calcium than ordinary salt.

So here is a fertiliser factory that is given by nature herself and that is why things like vermin-compost are very, very important. The cow urine and dung do not just increase soil fertility but act as pest control agents. People are finding that out only now. So what does all this mean? It means increasing nitrogen fixing cultivation. That is why I say, do not just think of synthetic fertilisers, think of organic fertilisers. That means that this kind of programme should become a part of the greening of India. It has a huge role in the government's climate missions. Greening should not be seen as just planting and growing regular forest-based trees. It should also mean nurturing nitrogen fixing trees. Mr Jakhar, since you are from the dry areas, you would know: Rajasthan could not have farming if it did not have the khejri trees. Khejri is a nitrogen-fixing tree. It stabilises the soil and retains soil moisture.

We will also have to think of livestock in the way this country has always thought of it as the key stock, species for a sustainable agriculture. We have ignored this and have allowed farmers to go into such distress. We have destroyed sources of fodder. For example, high-yielding varieties destroy the fodder base and the more such farming spreads, the less fodder farmers have. So, of course, they will sell their cattle to slaughterhouses. However, the crisis of livestock requires that we ensure a fodder base, hopefully in the commons. The commons are being encroached in a huge way.

Thus, we need to look at farming systems in a holistic way. The recycling of nutrients is ultimately about the integration of crops, livestock and trees. This integration was broken by monoculture cultivation based on huge synthetic fertiliser input. We need to bring back the circular nutrient thinking, recycling of nutrients, between the different species and all of the species feeding back to the soil.

AJ: ***There is a perception that with organic systems and without the use of chemical fertilisers, the yield suffers a setback. What is your experience?***

VS: I can speak of my experience with Navdanya. Through organic farming we have increased output and that is why I keep saying measuring yield (as opposed to measuring biomass) is tailored to doing chemical farming of monocultures because this way you look at only one output. However, in a good, balanced system, with all the nutrients in the soil, it is not expected that the wheat will provide the nitrogen. The dals and the chanas should be providing the nitrogen. A diversity of crops is necessary in order to have balanced nutrients in the soil. It is then that one measures output per acre of all diversity rather than yield per acre of a single commodity.

At Navdanya, we have had three to five times increase in the overall output. Not only that, an U.N. survey across the world has the data as proof: the change in productivity of, 30 tonnes per hectare, 15 tonnes per hectare, 16 tonnes per hectare, 30 tonnes per hectare in different parts of the world for different crops, is there for all to see. However, the most important one is the new report from the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). It was set up by the U.N. and the World Bank. I call it the IPCC of agriculture. At least 400 scientists worked for four years to examine all the published literature. They asked if we are really gaining in food production and the conclusion that they have come to after considering all the published literature is that neither the Green Revolution nor genetic engineering increase in food production. Only ecological agriculture does. Under ecological agriculture, they include traditional farming systems, the new forms of various streams of organic farming but ultimately all of them obey the principle of what we call agro-ecology. So, it is not true that production of food comes down.

AJ: ***Would some crops experience variations or would they actually be the same or would they increase?***

VS: Across the board organic farming systems are performing better. We had a group from Ethiopia 15 years ago to train in organic farming. Today their output has doubled, even in dry areas.

AJ: ***Going by what you say, if the use of chemical fertilisers is slowly reduced, the soil's organic carbon content will increase?***

VS: You have to make sure that you are growing more organic matter to be put back into the soil. You have more hedgerows, you have more field-bunds and you have more rotation. That is where the issue of transition comes in. Farmers groomed for more than two generations to blindly throw bags of urea have been left ignorant about the soil and soil health; about alternatives and other potentials. What is needed really is a fast forward in farmers extension work focusing on the living soil and soil health.

PGT: ***What are the most important reasons that the benefits of organic agriculture or ecologically sustainable agriculture have not yet sunk among large sections of the farming community? Is it just the sheer lobbying power or the propaganda machine of the fertiliser producers, the seed companies and the agro-business for obvious reasons?***

VS: It is a combination of two factors: the contemporary lobby and the inertia of an old system. We are talking of very top-heavy, sluggish governance that takes a long time to put things in place. The real issue, however, is lack of the government's commitment to spreading the successes of ecological farming. About 10 years ago, the Andhra Pradesh government realised that the farmers were getting into deep debt and committing suicide because of purchase inputs, at that time both seeds and fertilisers. It took a Vijay Kumar who now heads the Rural Livelihood Mission in the central government to get the government to put a lot of money into farming, to enable farmers to opt for alternatives, to do sustainable agriculture. Their production data is available. In this context, Vijay Kumar is an expert on the Andhra experience. More than a lakh acres were transformed because the government pitched in.

With small organisations such as Navdanya, we can kill ourselves with this tiny team of four scientists and trainers but how many farmers can we talk to per day? Wherever they can do so, there is a change. Some state governments have also taken the lead in organic farming. The Kerala government has announced an organic policy. Our work in Uttaranchal has influenced the government there to announce an organic policy. Sikkim too has come up with one. I am going back to Bhutan where the Prime Minister has invited me to make the country 100 per cent organic and despite the fact that the likes of Jeffery Sachs flew into Bhutan warning them against going organic. Thus, it is a combination of those who are wedded to the old paradigm and the lack of resources to be deployed in sustainable agriculture that lowers the cost for farmers and increases the output of food. The question is why would a government want to push its farmers into debt and suicide?

PGT: ***Why, indeed? If one were to think of a kind of win-win situation, what is that?***

VS: As far as our current environment policy is concerned, there is too intimate a relationship between agriculture and business and a separation

Pioneering the Organic Path

A tribute to Sir Albert Howard

It takes an exceptional person – more so when he is a scientist of global repute at that – to shed his pretentious 'gyan' and choose to become a student of the humble Indian farmer; to learn how to grow a healthy crop in typical conditions in the field. Sir Albert Howard (December 8, 1873 – October 20, 1947) was a mycologist of exceptional learning, wisdom and, of course, great humility, which is why he could shed the standard garb of a 'laboratory hermit' – that typified scientists of his age and many of today's men of science – and don the attire of an Indian farmer, whom he found wise and with a refreshing understanding of nature.

Sir Albert came to India in 1905 and was the Imperial Economic Botanist to the Government of India till 1924, in which period he had the great Indian farmlands as his school. "Everywhere knowledge increases at the expense of understanding. The remedy is to look at the whole field covered by crop production, animal husbandry, food, nutrition and health as one related subject and then to realize the great principle that the birthright of every crop, every animal and every human being is health", he said.

'An Agricultural Testament', which he authored in 1940 was his first book containing his thoughts on organic agriculture, won him the 'father of organic farming' sobriquet but it was his 1931 book, 'The Waste Products of Agriculture', which encapsulated his 26 years of learnings in India, when he examined this country's sophisticated production system in small holdings. It was also in India where he stamped his authority on the famous 'Indore composting

process'. Sir Albert, in essence, translated an ancient Indian practice of composting and made it a work of science, presenting it in scientific language.

Simple and brilliant

His thoughts would appeal both to the layman and the scientist; his logic was as simple as it was brilliant. "The correct relation between the process of growth and the process of decay is the first principle of farming. Agriculture must always be balanced. If we speed up growth we must accelerate decay. If, on the other hand, the soil's reserves are squandered, crop production ceases to be good farming: it becomes something very different. The farmer is transformed into a bandit".

When the baffling problem of indigo wilt was handed over to the Howards [he worked closely with his wife, Gabrielle Louise Caroline Matthaei (1876-1930), who was a very accomplished botanist] – it had eluded the efforts of four or five other departments – there was nothing for it but to plunge into the whole history of this plant, above and below ground. Once this step was taken, the way was marked out for all future investigation", says Louise E. Howard in 'Sir Albert Howard in India'.

"Research was pushed below ground to the roots and root systems of all crops studied; the Howards were pioneers in India in drawing attention to the need for doing this. It may seem incredible that such studies of one whole half of the plant should have been neglected but, in fact, agricultural botanists were commonly satisfied to examine foliage, flower, and fruit and to leave it at that. The most prolonged investigations were the 10 years' detailed work on the roots of eight varieties of fruit trees, pursued by means of an adapted knapsack sprayer to anything from ten to forty feet below ground. Such studies, though now commonplace, were then most original, and enabled Sir Albert to prove so intimate a connection between the state of the soil and the life of the tree as more than justified his first use of the happy phrase, 'the gearing together' of plant and soil, in the paper presented to the Royal Society on 'The Effect of Grass on Trees' (1925)", writes Louise E. Howard.

Indore composting

To return to the Indore composting process, Sir Albert had studied India's green-manuring practices and wanted to place the experience on a scientific footing. at Indore he systematized the work and deputed Yeshwant Wad, a member of his staff, to handle the chemical side. The experiments were very thorough. The principles of composting are sometimes believed to have sprung complete out of Sir Albert's mind, like an Athene out of the head of Zeus, as it were by a sudden inspiration. The reverse is the case. The work was developed slowly and along with the experiments went a testing of results in the field. Eventually 1,000 carts of compost were being made at Indore each year and the extraordinary fertility of the Experiment Station area was the visual proof of its value".

The peasant professor

India's peasants (whom he regarded as his prime "customers"), he valued for their knowledge of the land, for their industry and for their accuracy of eye, and the pests and weeds the scientists were committed to fighting with an ever-widening array of poisons but which Sir Albert called his "Professors of Agriculture". He saw pests in the context of nature's use for them as censors of soil fertility levels and unsuitable crops growing in unsuitable conditions. His aim always was to treat the whole problem of health in soil, plant, animal and man as one great subject. "In nature, animals and plants lead an interlocked existence. The connection could not be closer, more permanent or more crucial. We can observe this partnership in operation in the forest, in the prairie, in marshes, streams, rivers, lakes, and the ocean".

The wonderful learning was that when the unsuitable conditions were corrected the pests departed!

References:

An Agricultural Testament; **The Soil and Health** by Sir Albert Howard
Sir Albert Howard in India, by Louise E. Howard
Bringing it to the Table, by Wendell Berry
(*http://journeytoforever.org/farm_library/HI/HI2.html*)

from the farmers. Maharashtra has witnessed the highest rate of farmer suicides and more needs to be done. At least the Prime Minster announced a loan waiver from public sector fertiliser companies. It did not make much difference because most of the debt is from private agents but the agriculture minister has shown no concern, no compassion, no will to ensure that this amazing agrarian society, which is a quarter of the world's farmers today, thrives. Why is Obama at our doorstep? He talks about bringing jobs to America. He does not talk of the livelihoods he will destroy in the process in India. The USA is looking at the big agricultural economy of the country. It would be sad if our minister were to be persuaded by the intense lobbying. Is our government thinking of serving the interests of U.S. agribusiness by these new deals that they keep making? Is it serving India? We can see what has happened. There has been almost a 666 per cent increase in imports of edible oils since 2008 from the United States and we are promising them more market access! How much more agriculture do we want to destroy?

AJ: ***One of the factors destroying soils is also the burning of agro-waste and obviously the government has realised this. Farmers need to make a turnaround after the first crop because of the nature of intensive agriculture. Time is limited between harvesting the first crop and sowing the second. To your mind is it better to till the waste package of the soil or is zero tillage better, or a combination?***

VS: It is better to till the waste back in the soil. The research is now out. Zero tillage is not really improving the performance.

AJ: ***Another common perception is that a lot of organic manure from cattle is needed for organic farming. If that is true, where are we to get this manure if more and more people convert to organic farming with growing awareness of the problems associated with the excessive use of fertilisers? We cannot increase the number of cattle just to get the manure. Do you think that could be a problem?***

VS: It is wrong to believe that the only source of organic fertility for soils is cattle. Mixed cropping is required; manure is an option; vermicompost is a big option. Also, it is not that our animal population is static. We are losing animals on a very large scale and that is becoming a major threat to small-scale farming in this country. If you do not have livestock, not only do you not have organic manure for your soils, you do not have energy for your farm operations. Like Punjab and Haryana, in most of the country, one rich landlord has a tractor and given the erratic rainfall, you might get one shower in July. On that one day not every peasant can hire the tractor to plough the field. So what we are seeing is total crop failure because the energy options are not available anymore with the disappearance of cattle.

When that huge slaughterhouse for Al Kabeer was being built outside Hyderabad, villages just emptied out their livestock. After that farmers kept waiting for the tractor of the landlord to be free for them to hire. So in a country as poor as ours and with so little capital in the hands of this tiny peasant, agriculture being a livelihood for the majority, we cannot intensify capital for agriculture. We have seen the consequences with farmer's. We have to give every small farmer the power to grow food. That means we must concentrate on livestock and arrest its decline. Anyone saying that we cannot do so is not considering that the absence of livestock would mean the end of farming itself.

For the last two years, we did a big survey on climate change that had led to total crop failure, including fodder failure and total absence of grass. Women were selling buffaloes, which they had bought for Rs 40,000, at Rs 10,000 to slaughterhouses. These

women will never be able to accumulate the Rs 40,000 again to buy a second buffalo. So we should take the threat to India's sustainable practices seriously.

AJ: ***Would you agree that it would be better to use a little chemical fertiliser than use zero chemical because some soils possibly require some chemicals.***

VS: As I said, the sources of organic nutrients provide more than enough nutrients, if allowed to grow but we have killed these resources. We have killed the micro-organisms that produce the nutrients. It is similar to that of our body, which produces many nutrients that we need in order to run the digestive system. The soil has the largest biodiversity that there is in the world. It is just amazing – there is this really powerful data on soil micro-organisms: a Danish study analysed a cubic metre of soil and found that it contained 50,000 small earthworms, 50,000 insects and mites, 12 million roundworms, a gram of the soil contain 30,000 protozoa, 50,000 algae, 400,000 fungi and then there is bacteria. That is what gives soil its fertility. Howard had identified, way back in 1905, that the most important differences between the soils that he found here and the soils where chemical fertilisers had destroyed life in the soil were the presence of microrrizae fungi. In one cubic inch, you can have eight-mile long fungi. They can go half a km away and pick up nutrients but fertilisers kill them. More importantly, the microrizae have a symbiotic relationship with the plant. Even if you keep adding synthetic nitrogen and phosphate, without microrizae, the mechanism for uptake is weak. So you can have much less of the mineral nutrients and much higher uptake of the plant if your soil health is coterminous with the health of soil micro-organisms. That is why increase in micro-organisms is vital. Zero fertiliser creates a possibility of improved yields; a little fertilizer destroys but too much destroys the soil totally.

AJ: ***If a farmer has to change from the conventional type of farming today to organic farming and needs to get his soil tested for deficiencies, where could he go to understand what to grow in inter-cropping to fulfill those deficiencies? Is there an institution or organisation?***

VS: This is the service that the government is supposed to provide but which it does not. So they have this little organic programme, which is not even being funded right now. For our members, for Navdanya members, our small soil lab does offer that service. We do the testing, we sit with the farmers, according to the region that they are in and advise them on what crops would be right to make up those deficiencies.

PGT: ***Would you say that this is a part of the extension service, various agricultural universities, ICAR and such organizations should provide?***

VS: It should be the part of the extension service. All the Krishi Vigyan Kendras (Farmer Science Centres) should be providing this service. A lot depends on the person heading a Krishi Vigyan Kendra; sometimes they are wonderful. I have been to Bihar, Andhra Pradesh, where the local Kendra was offering every piece of knowledge that the farmer needed but in other places they were just sitting around, wasting time and resources.

It would be difficult to ensure that direct transfer of subsidy to millions of farmers is actually used by farmers for only buying fertiliser and that there are no leakages in transfer of subsidy

PGT: ***But what about the system itself?***

VS: The system itself is at this point, by lethargy and inertia, continuing in an old paradigm in a half-hearted way. Off and on, when the government pushes the scheme, the scheme trickles down, targets are set and the push comes for the particular thing. We have stopped thinking of agriculture as a whole in India; agriculture is a fairly neglected area in the government's mind. Even with the Obama visit, discussions were not about agriculture but about the agro-business; it was about CII and FICCI having partnerships and now becoming the extensions: the 'microrizae' for the Cargills'. This means leaving agriculture and the farmer out and we are going to pay a very steep price for this because we cannot live very much longer on the capital built up over the past – the social capital of the farmers, their social resilience, their ability to withstand and the natural capital that is being built over centuries of good practice.

AJ: ***So there are not many places to go to find how to compensate for micronutrient deficiencies; what plant to grow for a particular deficiency?***
VS: That is definitely not available in a very full-fledged way except in pockets. It needs to become available to every farmer.

AJ: ***That is a key requirement for organic to become accepted in a big way.***
VS: Absolutely.

PGT: ***If you were to comment on the way ahead, how do we ensure that Indian agriculture becomes sustainable so that it provides food security? The government is now thinking of legislating food security and there is a huge debate in the country on the contours of this legislation. Should it be 25 kgs of wheat or rice per family per month or should it be 35 kgs, should it be Rs 3 a kilo or Rs 2 a kilo? There is also the debate about the pricing, the subsidy pattern.***
VS: Well, there are two dimensions to the food security issue. First, we have to start looking beyond commodities, rice, wheat and all. That is why it is tragic that the government has said that the Food Security Act will not look at nutrients' security. Because what is food for, except for nutrition; and to reduce it to a commodity!

The answer to food security lies in solving soil health problems. We need to address these as a holistic challenge. Only then will hunger of soil and hunger of people end

PGT: ***You are saying, go beyond wheat, rice. Look at maize, millets, dals (pulses)...***
VS: Yes, because people need all of those. Second, if you produce all of this at very high cost, the farmer who grows it – forget the Punjab farmer, take the tiny farmer of Orissa and Bihar – when he grows his rice on the basis of synthetic fertilisers, purchased seeds, he sells everything he grows. That is why the majority of the hungry people of India are actually the producers of food. They are not able to retain the food because of the debt cycle that external inputs are associated with. So we need to diversify agriculture in order to have the full nutrients balance for human beings and secondly; we need to lower the cost and dependency on debt for the production system so that the hungriest – who are the farmers today – come out of hunger. That is then linked to the sustainable production system. There is all the evidence today; 20 years ago there was not that much evidence and many of us who did this work did it because of the principles. We could see that they were the right principles but now the practice of those principles is generating the evidence that not only do ecological systems produce more food but they also reduce our water use.

Water is going to be the limiting factor for agriculture in India and we had better start taking note of this. For two years we have had no rains. Meanwhile, the government is planning a Green Revolution for eastern India. Farmers have not been able to grow paddy with chemicals at all; only the farmers who have ragi seeds from our community seed banks, have been growing a crop. Paddy farmers have been craving for the rain. So water crisis is also driving an imperative to be water prudent and to produce highly nutritious crops. The balance of it all is that whatever increases the soil health and soil fertility also increases human health. The two are intimately linked. The answer to food security is the answer to solving the health problems of the soil. We need to address these as one holistic challenge and only when we put it together will both hunger of soil and hunger of people end.

PGT: ***This is a very great way to end the interview but one question survives: it is often said that the subsidy on fertilisers benefit the industry more than the farmers. What are your views on that?***
VS: It is not a question of more. The farmer is just an excuse for transferring huge amount of subsidies to the fertiliser industry, including now the international fertiliser industry.

AJ: ***In fact, I think most of the subsidy is going to international traders; almost 90 per cent of the subsidies is going to foreign manufacturers.***
VS: I agree. In 2008, the government was paying cash in foreign exchange to Cargill and to Matrix. Cash! I have never seen government deals in cash before. In any case, why do they (Cargill) want cash? They have a tax-free haven headquarters in Panama; they do not pay taxes on anything. The fertiliser subsidies are for the fertiliser industry. The farmer is just an excuse. ●

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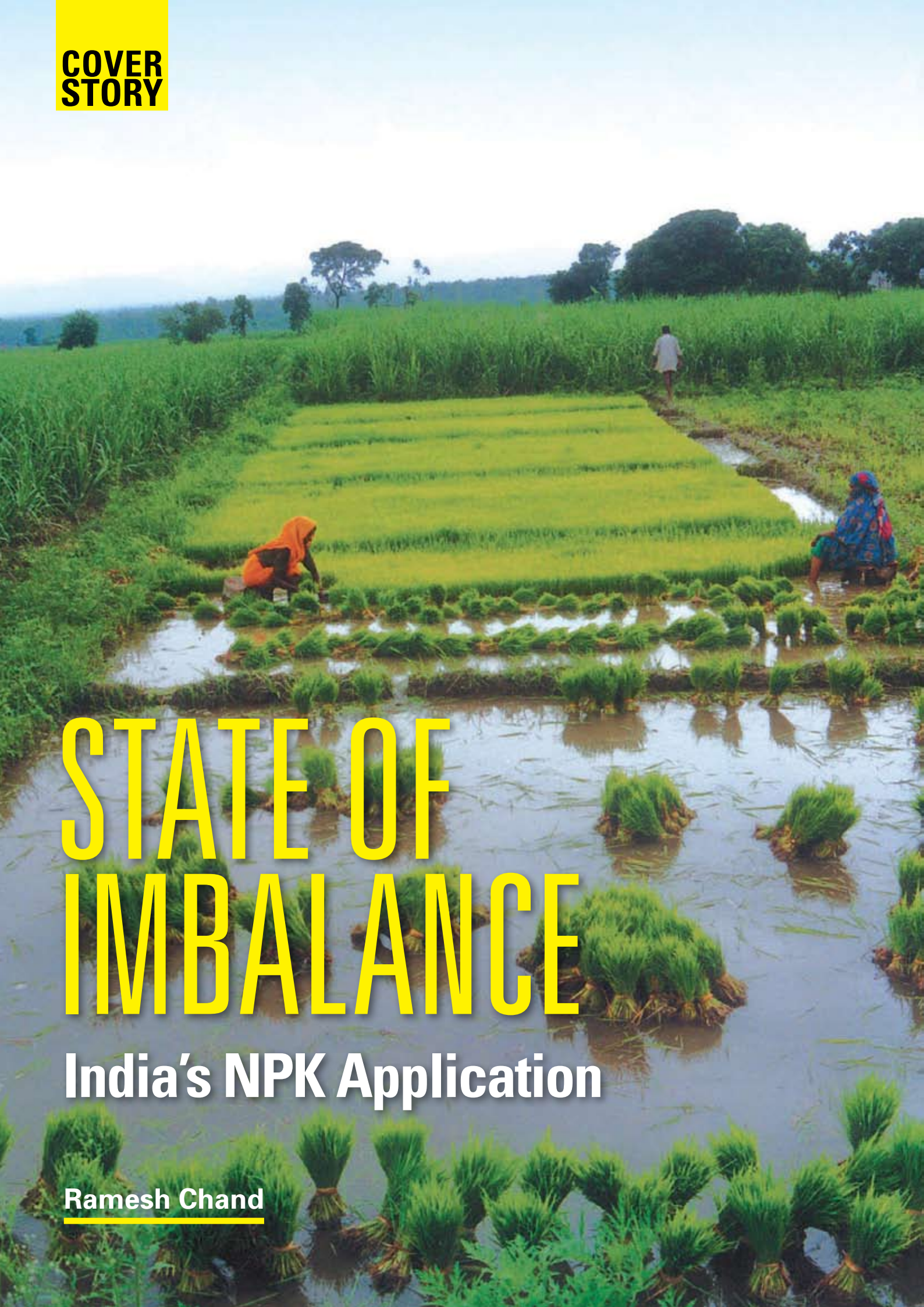


STATE OF IMBALANCE

India's NPK Application

Ramesh Chand

It is widely recognized that fertiliser plays an important role in the growth of Indian agriculture especially as the net area available for cultivation is shrinking due to rising demand for new houses, factories, infrastructure and other commercial uses. It seems that practically all increase in farm output in future has to come from the increase in productivity. This would require improved technology and increased application of yield enhancing plant nutrients. Since the first two decades after the Green Revolution is attributable to chemical fertilisers use, the growth in fertiliser consumption in the country is considered to be of paramount importance for raising agricultural production to meet India's food requirements.

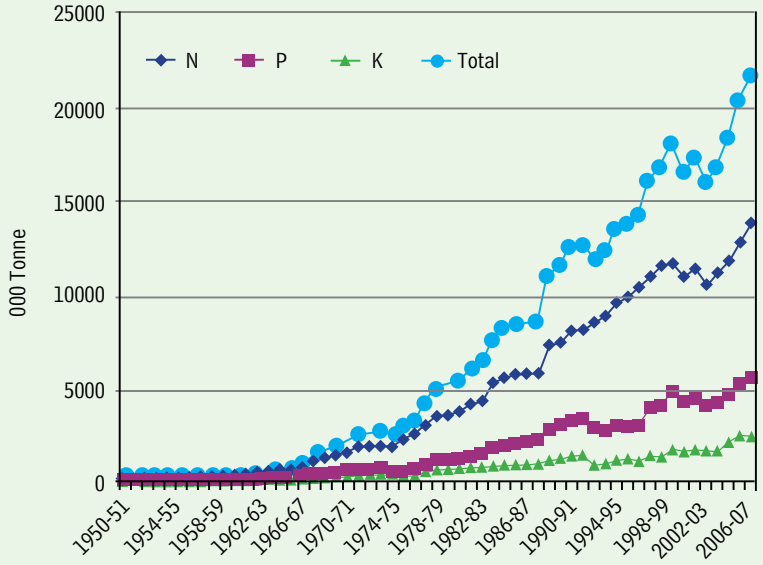
Despite the high growth in fertiliser use, its consumption is quite low in most of the states of India and for most crops. Thus, considerable scope exists to raise agricultural production by raising fertiliser use. Further, the use of plant nutrients in many parts of the country is highly concentrated towards nitrogenous fertiliser and a large imbalance has emerged between ratio of N, P and K as applied by farmers and the optimum ratio. This has led to serious concerns regarding soil fertility, productivity and efficiency of fertiliser use.

It is often contended that the structure of the fertiliser subsidy is responsible for distortions in use of N, P and K that, in turn, is adversely affecting soil fertility and productivity. However, empirical evidence on this is missing. Besides, the subsidy is being debated for its impact on fiscal resources. It is felt that the rising subsidy bill is leading to a resource diversion from investments in the agriculture sector to meet the subsidy bill. The structure of fertiliser subsidy is also allegedly causing distortions in soil nutrients, even as these subsidies are considered deleterious for growth of the agriculture sector due to their adverse impact on public sector investments in agriculture. The counter argument is that if subsidies were slashed, it would have an adverse impact on agricultural production and food security and raise food and agricultural prices. It is also argued that the benefits of fertiliser subsidy mainly accrue to the industry and farmers are not much benefited by this. These are all complex but highly relevant issues.

States of imbalance

The fertiliser use per hectare of net sown area was 42.5 kg during the early 1980s at country level with very large variation across states:

Figure 1. Trend in fertiliser use in India



It is often contended that structure of subsidy on fertiliser is responsible for distortions in use of N, P and K that, in turn, is adversely effecting soil fertility and productivity. However, empirical evidence on this is missing.

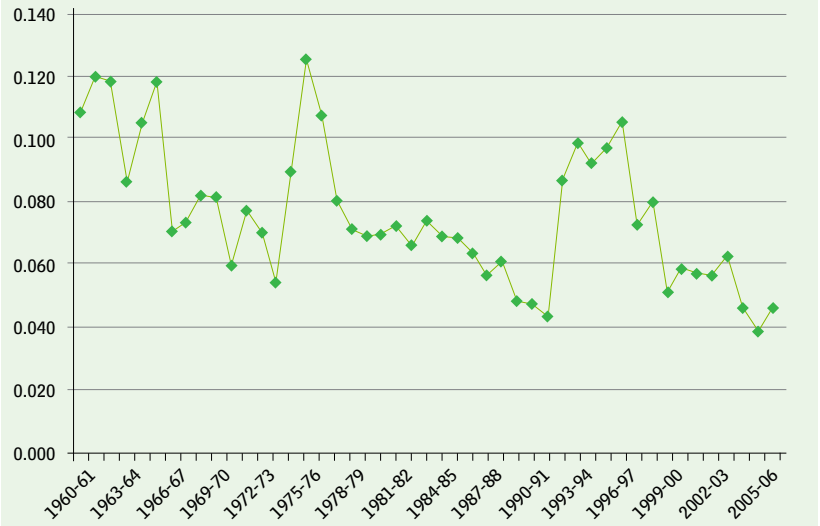
- Punjab took a very big and early lead with close to 200 kgs application of fertiliser per hectare of net sown area.
- The second place was occupied by Tamil Nadu where 85.6 kgs were used on one hectare of net sown area in early 1980s.
- Farmers in Assam, Orissa, Madhya Pradesh, Rajasthan and the north-eastern states applied less than 15 kgs per hectare of NSA.
- The coefficient of variation in state-wise fertiliser use turned out to be 104.4 per cent. Fertiliser use witnessed very strong growth between early 1980s and 1990s.
- The rate of growth was more than 10 per cent in the states of Madhya Pradesh, Bihar, Rajasthan and Assam.
- The lowest growth was experienced in Punjab where fertiliser use had already reached high level.
- The high growth in fertiliser use in the states with low application of fertiliser helped in reducing inter-state variations – coefficient of variation decline to 78.9 per cent during early 1990s as compared to 104.4 per cent during early 1980s.
- Punjab continued to be far ahead of other states with per hectare application of 290 kgs of NPK as compared to 87.4 kgs at national level during triennium ending 1993-94.

Table 1. State-wise fertiliser use (Kg/ha NSA)

State	Year 1983	Triennium 1994	Ending 2006	Growth rate (%) 1983 to 1994	1994 to 2006
Andhra Pradesh	59.7	145.6	205.0	8.44	2.89
Assam	4.1	12.9	66.4	11.00	14.64
Bihar	26.4	80.6	121.1	10.67	3.45
Gujarat	38.9	75.0	119.3	6.14	3.95
Haryana	69.7	182.7	302.1	9.16	4.28
Himachal Pradesh	30.4	54.1	86.3	5.37	3.97
Jammu & Kashmir	34.5	60.4	110.3	5.23	5.14
Karnataka	35.7	77.2	122.5	7.25	3.93
Kerala	45.3	89.9	92.2	6.42	0.21
Madhya Pradesh	12.0	40.5	67.1	11.73	4.29
Maharashtra	26.6	66.7	98.4	8.73	3.29
Orissa	13.9	31.7	63.8	7.74	6.01
Punjab	195.8	289.9	380.0	3.63	2.28
Rajasthan	9.7	29.5	47.6	10.59	4.07
Tamil Nadu	85.6	138.7	183.9	4.48	2.38
Uttar Pradesh	75.0	129.7	197.8	5.11	3.58
West Bengal	48.8	136.9	218.4	9.82	3.97
North East State	9.0	22.1	30.5	8.47	2.75
All India	42.5	87.4	131.1	6.77	3.43
C.V. (%)	104.4	78.9	70.6	—	—

- Haryana and Andhra Pradesh emerged as second and third in per hectare application of fertiliser.
- The other states with more than 100 kgs of fertiliser use were Tamil Nadu, West Bengal and Uttar Pradesh. Assam, Orissa and Rajasthan remained at the bottom with less than 32 kgs fertiliser use per hectare of area.
- The growth rate of fertiliser slowed down sharply during the triennium ending (TE) 1993-94 and TE 2005-06.
- Assam alone experienced more than 10 per cent annual growth rate in fertiliser use while remaining states realized less than 6.1 per cent growth rates.
- For most states, the growth rate varied between three per cent and four per cent. There was little increase in fertiliser use in Kerala after TE 1993-94.
- In recent three years, per hectare fertiliser use was more than 300 kgs in Punjab and Haryana and more than 200 kgs in Andhra Pradesh and West Bengal.
- Uttar Pradesh has almost approached level of 200 kgs. Orissa and Rajasthan continue to be at the bottom. There was only small decline in inter-state variation in fertiliser use after TE 1993-94.

Figure 2. Imbalance in use of N, P and K, 1960-61 to 2006-07



Research conducted under the All India Coordinated Research Project on Long Term Fertiliser Experiments of the Indian Council of Agricultural Research (ICAR) provides strong evidence that continuous use of N alone caused a decline in yield and had a deleterious effect on long-term fertility and sustainability (Indian Institute of Soil Science, 2000). This imbalance is often attributed to the structure of subsidy on various fertilisers.

The estimated imbalance (I) is presented in Figure 2 that shows that at the country level the actual proportion of N, P and K used by farmers deviated significantly from the norm. The imbalance was very high when fertiliser use was low. The overall trend in the imbalance at the country level shows a decline over time but it is still far from the ratio considered optimum for the country.

Another indicator of the imbalance in fertiliser use is provided by the share of N, P and K in the total fertiliser use, presented in Table 2. In 1961-65, nitrogen accounted for more than 70 per cent while P and K constituted 19.2 and 8.9 per cent of the total consumption of major plant nutrients in the country. The share of K reached 12.1 per cent during early

Table 2. Share of N, P and K in total consumption of N+P+K

Period	Share of NPK in total (%)			Ratio of N, P and K		
	N	P	K	N	P	K
1961 to 1965	71.9	19.2	8.9	8.09	2.16	1.00
1966 to 1970	68.5	21.1	10.3	6.63	2.04	1.00
1971 to 1975	66.5	21.4	12.1	5.51	1.77	1.00
1976 to 1980	68.9	20.2	11.0	6.28	1.84	1.00
1981 to 1985	66.9	22.4	10.7	6.23	2.08	1.00
1986 to 1990	65.4	24.7	9.8	6.65	2.51	1.00
1991 to 1995	67.5	23.7	8.8	7.63	2.67	1.00
1996 to 2000	68.3	23.5	8.3	8.27	2.84	1.00
2001 to 2005	65.0	25.0	9.9	6.53	2.52	1.00
2004 to 2007	64.1	25.2	10.7	5.97	2.35	1.00

1970s, declined thereafter and improved a bit after 2001. The share of P has gradually increased but its ratio is found to be higher relative to K and lower relative to N. Though in the recent years, the ratio of N, P and K used in India has moved towards the norm but it is still a long way off from being optimum.

It is pertinent to raise two important issues relating to observed imbalance in fertiliser use. One, even if the imbalance is declining the cumulative effect could worsen the situation. Two, in a large country like India, the country level ratio may be far away from the ratio at disaggregate level, which is more relevant to field situation.

State wise application of N, P and K per hectare of net sown area and estimate of imbalance in fertiliser use are provided in Table 3. Punjab is first in the use of N and P but use of K in this state is lower than the national average. Haryana ranks second in per hectare use of N and P and, like Punjab, use of K in this state is very low. West Bengal and Tamil Nadu are at the top in application of K (47.8 kg/ ha. of net sown area). It is interesting to observe that the per hectare application of K in southern states was more than double the use of K in other states except West Bengal and Assam. The north-east has the minimum use of all the three plant nutrients.

The balanced use of fertiliser is recommended in the ratio of 4:2:1 for N, P and K. In percentage terms, balanced fertiliser should contain 58 per cent nitrogen, 28 per cent P and 14 per cent K. The actual share of N, P and K, in total fertiliser use and the resulting imbalance is presented in Table 4.

- The highest share of nitrogen in total fertiliser is found in Bihar where about 80 per cent of fertiliser use consists of nitrogen.
- In Punjab and Haryana three-fourth of total fertiliser use is in the form of N as against 57 per cent required for balanced use.
- In all the southern states, except Andhra Pradesh, the share of nitrogen in the total fertiliser used is lower than that recommended for balanced use.
- While the share of N in Bihar is quite high, that of P is half of what it should be, which is lowest among all the states.
- The share of P is more than the norm (27 per cent) only in Madhya Pradesh. In Andhra Pradesh, Assam, Jammu and Kashmir, Karnataka, Maharashtra, West Bengal and Rajasthan the share of P in total fertiliser use did not deviate much from the norm.
- In the remaining states, the share of P was lower than 27 per cent.
- The share of K in total fertiliser ranges from about two per cent in Haryana and Rajasthan to 36 per cent in Kerala.
- The share of K was close to the norm in Andhra Pradesh, Himachal Pradesh, Maharashtra and Orissa.

Table 3. State-wise use of N, P and K per hectare of net sown area, average of 2003-04, 2004-05 and 2005-06

Unit kilogramme

State	N	P	K	Total
Andhra Pradesh	122.4	54.6	28.0	205.0
Assam	31.5	18.9	16.0	66.4
Bihar	96.2	16.7	8.1	121.1
Gujarat	78.9	30.5	9.9	119.3
Haryana	227.0	69.0	6.1	302.1
Himachal Pradesh	56.3	16.5	13.5	86.3
Jammu & Kashmir	75.0	30.2	5.1	110.3
Karnataka	62.4	34.1	26.1	122.5
Kerala	39.5	19.3	33.3	92.2
Madhya Pradesh	40.4	22.4	4.3	67.1
Maharashtra	54.9	29.0	14.5	98.4
Orissa	40.1	14.0	9.7	63.8
Punjab	287.6	81.0	11.4	380.0
Rajasthan	33.9	12.8	0.9	47.6
Tamil Nadu	94.5	41.7	47.8	183.9
Uttar Pradesh	141.6	45.6	10.7	197.8
West Bengal	110.1	60.5	47.8	218.0
North East States	22.0	5.8	2.8	30.5
Others	75.3	36.2	29.4	141.0
All India	83.8	32.9	14.3	131.1

Table 4. Imbalances in fertiliser use in various states during TE 2005-06

State	Share of N, P and K in total			Ratios of N, P and K			Imbalance index
	N	P	K	N/K	P/K	N/P	
Andhra Pradesh	59.7	26.6	13.6	4.4	2.0	2.2	0.02
Assam	47.4	28.5	24.1	2.0	1.2	1.7	0.08
Bihar	79.5	13.8	6.7	11.8	2.0	5.8	0.16
Gujarat	66.1	25.6	8.3	7.9	3.1	2.6	0.06
Haryana	75.1	22.8	2.0	37.5	11.4	3.3	0.13
Himachal Pradesh	65.2	19.1	15.7	4.2	1.2	3.4	0.07
Jammu & Kashmir	68.0	27.4	4.6	14.8	6.0	2.5	0.08
Karnataka	50.9	27.8	21.3	2.4	1.3	1.8	0.05
Kerala	42.9	20.9	36.2	1.2	0.6	2.0	0.16
Madhya Pradesh	60.1	33.4	6.5	9.3	5.2	1.8	0.06
Maharashtra	55.8	29.5	14.8	3.8	2.0	1.9	0.01
Orissa	62.9	21.9	15.2	4.1	1.4	2.9	0.05
Punjab	75.7	21.3	3.0	25.1	7.1	3.6	0.13
Rajasthan	71.2	26.9	1.9	36.8	13.9	2.7	0.11
Tamil Nadu	51.4	22.6	26.0	2.0	0.9	2.3	0.08
Uttar Pradesh	71.6	23.0	5.4	13.2	4.3	3.1	0.10
West Bengal	50.5	27.7	21.9	2.3	1.3	1.8	0.06
North East	72.0	19.0	9.0	8.0	2.1	3.8	0.11
Others	53.4	25.7	20.8	2.6	1.2	2.1	0.05
All India	63.9	25.1	10.9	5.8	2.3	2.5	0.05

- The fertiliser mix shows lower than recommended share of nitrogen in Kerala, Karnataka, Tamil Nadu, West Bengal and Assam.
- The ratios of N, P and K with one another indicate imbalance in any two nutrients.
- The use of N is most skewed in Rajasthan and Haryana where farmers apply more than 36 kgs of N for one kg of application, which is nine times the use of N for balanced requirement.
- Punjab comes next with N, P and K ratio of 25:7:1.
- Similarly, the share of N is higher than the norm in Jammu & Kashmir, Uttar Pradesh, Bihar, Gujarat and Madhya Pradesh.

This imbalance does not imply that farmers are making excessive use of N; it implies that farmers are making very small use of P and K. For instance, corresponding to the use of N, farmers in Rajasthan and Haryana use only one ninth of K needed for balanced use. The ratios of N and P show much smaller variation compared to the ratio of N and K and P and K. Bihar topped in imbalance between N and P. Against the ideal ratio of two, Bihar farmers apply about 5.8 times N as compared to P. The ratio of N to P was close to the norm in Kerala, Madhya Pradesh, Karnataka, Maharashtra, West Bengal and Andhra Pradesh.

These results show that except a few states there is an imbalance in use of fertiliser. This is not confined only to higher relative use of N; in some states the proportion of N is much lower than recommended. Therefore, while at country level fertiliser imbalance is skewed towards N, at the state levels there are various patterns. These vary from severe imbalance in favour of N to severe imbalance in favour of P as well as K. As there is lot of variation in status of soil fertility in various parts of the country the imbalances at micro level can be better understood and addressed by developing location specific norms for balanced use of fertiliser.

The Punjab problem

The per hectare use of fertiliser shows that, except in Punjab, there is imbalance with lower than optimum use of fertiliser per unit of area. In such a situation, the imbalance needs to be addressed not by lowering use of plant nutrients having a higher than the norm share but by increasing use of those plant nutrients that have lower share than the norm. In Punjab, nitrogen not only has higher share than the norm,

its per hectare application is also higher than what is considered optimum for wheat–paddy rotation, which represents the crop system in Punjab. In a situation like this, the imbalance can cause adverse impact on yield. In other situations, where the imbalance coexists with sub-optimal use of N or P or K, the impact of imbalance on crop productivity is not clear. In such situations, the imbalance in fertiliser use may not cause detrimental effect on productivity, though balanced use would improve response to fertiliser.

Prices and subsidies

Imbalances in fertiliser use are generally attributed to price structure of fertiliser and variations in subsidies available on different types of fertilisers. The nominal prices of N, P and K in major fertilisers since 1980-81 are presented in Table 5.

- Prices of nitrogen in urea fluctuated around Rs 5.11 per kg between 1980-81 and 1990-91.
- During the decade of the 1990s, the nominal prices of N witnessed large increase.
- Since 2000-01, the prices of nitrogen varied between Rs 10 and Rs 10.50, except in 2002-03 when they were slightly higher.
- In 2003-04 to 2006-07, prices of urea have been kept at the same level as during 2001-02.
- Prices of P varied between Rs 5.27 to Rs 5.94 during 1980-81 to 1985-86. During the six years, from 1985-86 to 1990-91, the prices of P as well as those of N and K were kept at the same level.
- With the economic reforms starting in 1991, the prices of P and K were decontrolled in August 1992 and subsidy on these fertilisers was severely reduced.
- This led to a very sharp increase in prices of P and K. The price of P increased to 16.25/kg in 1992-93 as compared to Rs 5.94 during 1990-91.
- Similarly, prices of K increased from Rs 2.17 to Rs 7.50 in these two years. By the end of 1990, the price of P increased to Rs 17.19 per kg. and the price of K came down to Rs 6.63 per kg.
- After this, the prices of P increased slowly to reach Rs 21.81 per kg. while prices of K hovered around Rs 7.43 per kg.
- During the last 27 years, the nominal prices of N increased by about four per cent compared to about seven per cent growth rate in nominal prices of P and K.

NPK price changes

- Between 1980-81 and 1990-91, the prices of all the three types of fertilisers changed almost in the same way.

Table 5. Maximum retail prices of fertilisers in terms of nutrients (50 kg pack) exclusive of central VAT/ state sales tax and local taxes

Year	Urea (46% N)	Single Super Phosphate (16% w.s. P_2O_5)	Muriate of Potash (60% K_2O)
1980-81	4.35	5.27	1.83
1981-82	5.11	5.85	2.17
1982-83	5.11	5.85	2.17
1983-84	4.67	5.31	2.00
1984-85	4.67	5.31	2.00
1985-86	5.11	5.94	2.17
1986-87	5.11	5.94	2.17
1987-88	5.11	5.94	2.17
1988-89	5.11	5.94	2.17
1989-90	5.11	5.94	2.17
1990-91	5.11	5.94	2.17
1991-92	6.91	8.07	2.93
1992-93	6.00	16.25	7.50
1993-94	6.00	14.25	6.34
1994-95	6.81	14.13	6.26
1995-96	7.22	16.60	7.15
1996-97	7.46	17.36	6.73
1997-98	7.96	17.19	6.17
1998-99	8.33	17.19	6.17
1999-00	9.35	17.19	6.63
2000-01	10.00	18.75	7.09
2001-02	10.50	18.75	7.43
2002-03	10.76	19.06	7.59
2003-04	10.50	20.09	7.43
2004-05	10.50	19.81	7.43
2005-06	10.50	21.56	7.13
2006-07	10.50	21.81	7.43
Annual growth rate %	3.94	6.95	6.97

Source: Fertiliser Statistics, The Fertiliser Association of India, New Delhi, various issues.

- Serious distortion was caused in relative prices of N, P and K during 1990-91, which turned the price of nitrogen lower than that of K, whereas, it was more than double the price of K during the 1980s.
- Similarly, the price of N, which ruled only marginally lower than price of P during 1980s, turned out to be half of price of P after 1991.
- After the big change in price ratio during 1992-93, the prices of P and K increased at a lower rate than that of N but prices of N relative to P and K are far lower than those prevailed during 1980s.
- Thus, 1991 made a distinct change in fertiliser prices in favour of N just in one stroke. This is an important factor in shifting balance of fertiliser use in favour of N and against P and K.

The prices of N, P and K relative to one another are important in affecting substitution among the three types of fertiliser. The second important dimension of prices is prices of fertiliser with

Table 6. Growth rates in prices of N (Pn) P (Pp) and K (Pk) relative to MSP of wheat (Pw) and paddy (Pr)

Growth rates in prices of N,P and K relative to MSP of wheat and paddy						
Period	Pn/Pw	Pp/Pw	Pk/Pw	Pn/Pr	Pp/Pr	Pk/Pr
1980-81 to 1990-91	- 3.93	-3.96	-3.91	-4.68	-4.71	-4.66
1997-98 to 2006-07	- 1.22	-1.34	-2.08	-0.90	-1.02	-1.77
1980-81 to 2006-07	- 4.01	-1.23	-1.21	-3.60	-0.81	-0.79

respect to prices of output. This was analysed by looking at movement in prices of N, P and K relative to minimum support price (MSP) of wheat and paddy. Prices of N, P and K relative to MSP of wheat declined annually by close to four per cent between1980-81 and 1990-91 (Table 6). The rate of decline was more than 4.6 per cent relative to MSP of paddy. Real prices of fertiliser fluctuated widely during early 1990s as major changes in prices of fertiliser were affected during 1991-92 and 1992-93 and some increase was rolled back.

These years are not included in estimating growth rate in the second period, which covered only the recent 10 years ending with 2006-07. The nominal prices of N, P and K deflated by MSP of wheat and paddy declined during last 10 years also but the rate of decline was much lower compared to the decade of 1980s. Considering the entire period of study, the prices of N declined annually by four per cent when deflated by the MSP of wheat and by 3.6 per cent when deflated by MSP of paddy. The rate of decline in prices of P and K varied around one per cent.

Subsidy spurt

The central subsidy on various fertilisers increased from Rs 891 crore during early 1980s to Rs 32,490 crore during 2007-08. A major part of this increase is on account of inflation. However, even in real terms, the subsidy on fertiliser has been increasing in leaps and bounds: at 1999-00 prices this was about Rs 3,500 crore in early 1980s, increasing to more than Rs 7,700 crore in the later half of 1980s. The level of subsidies in real terms almost doubled during the 15 years after 1990. The increase resulted from both an increase in fertiliser use as well as increase in subsidy content per unit of fertiliser.

Subsidies have also grown faster than growth of the crop sector in monetary terms. This is evident from the share of subsidies at current price in the value of output of crop sector (Table 7). During the second half of 1980s, fertiliser subsidies were equal to 2.87 per cent of value of crop output. In the next 10 years, the ratio of subsidies increased to 3.03 per cent and it is approaching five per cent in the recent years. One reason for the increase in the recent years has been that urea price and MOP prices have been almost frozen between 2000-01 and 2006-07. The fertiliser subsidy shot up very high during 2008-09 due to abnormal increase in energy prices and price of imported fertiliser.

Table 7. Central subsidy on fertiliser (Rs crore)

Period	Subsidy at current price	Deflated by crop sector price index base 1999-00	As % of Value of crop output
1981 to 1985	891	3481	1.41
1986 to 1990	2746	7715	2.87
1990 to 1995	5202	9067	2.94
1996 to 2000	9814	10879	3.03
2001 to 2005	13027	12178	3.16
2005-06	18460	15705	3.46
2006-07	26222	20164	4.43
2007-08	32490	23262	4.78
2008-09	99494	--	13.40
2009-10	64032	--	--

State-wise subsidies

The fertiliser subsidies to different states depend on the size of the state (area under cultivation), amount of fertiliser used per hectare and composition of fertiliser used. Of the total subsidy on fertiliser in the country, largest chunk (18.1) goes to Uttar Pradesh followed by Andhra Pradesh (11.41 per cent). Around nine per cent of total subsidies go to Maharashtra and Punjab each. The share of Assam, Himachal Pradesh, Jammu & Kashmir and Uttaranchal was below one per cent (Table 8). This distribution does not indicate which states benefit more from subsidies because of variation in the size of state. The fertiliser subsidy on a per hectare basis varies between Rs 393 in Rajasthan and Rs 3,167 in Punjab. After Punjab, the second most benefited state is Haryana with subsidy of Rs 2,516 per hectare of net sown area. Farmers in West Bengal, Uttar Pradesh and Andhra Pradesh are estimated to get a per hectare subsidy of between Rs 1,626 and Rs 1,730. Among other states, the per hectare subsidy was more than Rs 1,000 in Uttaranchal, Bihar and Tamil Nadu. States with less than Rs 600 subsidy are Assam, Chattisgarh, Jharkhand, Madhya Pradesh, Orissa and Rajasthan. One limitation of this measure, as an indicator of disparity in subsidies, is that it ignores

variation in productivity resulting from variation in use of fertiliser. For instance Punjab and Haryana, which rank at the top in per hectare subsidy, also rank among the top states in productivity.

Another indicator was computed to take care of variations in productivity and to see whether fertiliser subsidy is distributed according to crop productivity. This refers to subsidy as per cent of value of crop output in a state. This indicator also shows that Punjab and Haryana receive the highest benefit from fertiliser subsidy closely followed by Andhra Pradesh. The fertiliser subsidy constitutes close to five per cent of value of crop output (VCO) in these three states. Tamil Nadu and Uttar Pradesh come next with subsidy level close to four per cent of crop output. In Bihar and Karnataka fertiliser subsidy was around 3.5 per cent of VCO. Other states where the fertiliser subsidy was more than three per cent are Chattisgarh and Gujarat. The fertiliser subsidy comprises less than one per cent of VCO in Assam, Himachal Pradesh, Jammu and Kashmir and Kerala.

Table 8. State-wise subsidies on fertiliser, TE 2005-06

	State's share in all India subsidy %	Subsidy/ ha. Rupees	Subsidy as % of value of crop output
Andhra Pradesh	11.41	1655	4.73
Assam	0.74	517	1.43
Bihar	4.22	1115	3.63
Chhattisgarh	1.77	559	3.25
Gujarat	6.23	975	3.12
Haryana	5.89	2516	4.75
Himachal Pradesh	0.25	704	0.91
Jammu & Kashmir	0.45	905	1.43
Jharkhand	0.67	572	1.66
Karnataka	6.55	971	3.57
Kerala	1.03	719	1.05
Madhya Pradesh	5.38	543	2.71
Maharashtra	9.11	788	2.44
Orissa	1.93	518	1.77
Punjab	8.83	3167	4.92
Rajasthan	4.42	393	2.45
Tamil Nadu	4.85	1460	3.90
Uttar Pradesh	18.13	1626	3.93
Uttarakhand	0.66	1286	2.57
West Bengal	6.34	1730	2.39
All India	100.00	1067	3.16

Subsidy estimation

The measurement of subsidy on fertiliser is a complex exercise. The estimate of subsidy varies according to the perspective used to estimate the subsidy. Urea continues to be under the Retention Price Scheme under which a cost plus price is paid to urea manufacturing units in the country and this price is fixed for each unit. In addition, the freight equalization subsidy is paid from the factory to the destination to maintain uniform price for urea throughout the country. Concession at a flat rate is provided to phosphatic and potassic fertilisers.

Economic analysis generally uses international prices to compute the level of subsidy. Between 2007 and 2009, international prices of fertilisers have fluctuated so much that in some instances domestic price, net of subsidy, was lower than the price paid for imported fertiliser (urea). This renders estimation of subsidy based on import parity price irrelevant.

Like any other subsidized commodity, the benefit of fertiliser subsidy accrues to producers of fertilisers, consumers of fertiliser (farmers) and consumer of agricultural products. The fertiliser industry benefits from increased sale, farmers benefit from higher use and lower price of fertiliser and consumers of agricultural products benefit from lower cost of production due to the subsidy reflected into output price. Industry also benefits from assured price in vogue for urea under the system of the retention price scheme. The distribution of benefits over different categories depends upon a large number

Long period average indicates that about two thirds of the subsidy on fertilisers goes to farmers and one third is shared by fertiliser industry

of factors and assumption. Attempts made in this direction show that share of farmers in the fertiliser subsidy have increased over time.

Long period average indicates that about two thirds of the subsidy on fertilisers goes to farmers and one third is shared by fertiliser industry (Gulati and Narayanan 2003).

Conclusions

Fertiliser use at the country level and in many states is highly concentrated towards nitrogenous fertiliser and a large imbalance has emerged between ratio of N, P and K applied by farmers and the ratio that is considered optimum. This is raising concerns regarding soil fertility, productivity and efficiency of fertiliser use. The structure of subsidy and fertiliser pricing policy are largely responsible for distortions in the use of N, P and K. Often farmers are not able to apply balanced fertiliser due to problems in availability of fertilisers other than urea.

Here it is pertinent to clarify that the imbalance exists with lower than optimum use of fertiliser per unit of area. In such situations the imbalance needs to be addressed not by lowering the use of plant nutrients having a share higher than the norm but by increasing use of those plant nutrients that have lower share than the norm. Where the imbalance coexists with sub optimal use of N or P or K, the impact of imbalance on crop productivity is not clear. Our conjecture is that in such situation the imbalance in fertiliser use does not cause a detrimental effect on productivity, though balanced use would improve response to fertiliser.

Serious distortion was caused in relative prices of N, P and K during 1990-91, which made a distinct change in fertiliser prices in favour of N just in one stroke. This is an important factor in shifting the balance of fertiliser use in favour of N and against P and K. Subsidy profile over the past quarter century:

- During the last 26 years, beginning with 1980-81, prices of N declined annually by four per cent, when deflated by price of wheat and by 3.6 per cent, when deflated by the MSP of paddy.
- The rate of decline in prices of P and K varied around one per cent.
- The central subsidy on various fertilisers increased from Rs 891 crore during early 1980s to Rs 32,490 crore during 2007-08.
- The level of subsidies in real terms more than doubled during the seven years after 2000. The increase resulted both from the increase in fertiliser use and the increase in subsidy content per unit of fertiliser.
- Subsidies have also grown faster than the growth of the crop sector. In monetary terms, the share of subsidies at current price in the value of the output of the crop sector has been increasing and is approaching five per cent in the recent years.

Freezing nominal prices of fertilisers at the 2000-01 to 2006-07 level has not only resulted in increase in fertiliser subsidy but also increased share of farmers in total subsidies. According to some estimates, about two third of fertiliser subsidy is shared by farmers and one third is shared by fertiliser industry. ●

The author is Director, National Centre for Agricultural Economics & Policy Research, New Delhi

References

Chand Ramesh and L.M. Pandey (2009), Fertiliser Use, Nutrient Imbalances and Subsidies: Trends and Implications, Margin: The Journal of Applied Economic Research, Sage Pub, Vol. 3, No. 4, 409-432.

Desai Gunvant M. and A. Vaidyanathan, Strategic Issues in Future Growth of Fertiliser Use in India, Indian Council of Agricultural Research and International Food Policy Research Institute, Washington, 1995, published by MacMillan India Limited.

Gulati, Ashok and Sudha Narayanan (2003), 'Fertiliser Subsidies', in The Subsidy Syndrome in Indian Agriculture, New Delhi: Oxford University Press.

Indian Institute of Soil Science, Three Decades of All India Coordinated Research Project on Long-Term Fertiliser Experiments to Study Changes in Soil Quality, Crop Productivity and Sustainability, Anand Swarup and Dr. R.H. Wanjari (ed.), 2000, published by Indian Institute of Soil Science, Bhopal.

Mehta Rajiv, Agricultural Growth Vision and Supply side Issues Concerning Fertilisers, Agricultural Situation In India, Vol. LXIV (5): 21-28, August, Special number.

IFFCO KISAN SEZ - Nellore

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Aquaculture
- Fish
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Tax benefits

Additional Strategic benefits

Realizing the need to bring in high value agribusiness activity into the country, **IFFCO, Asia's largest** fertilizer company through its SPV IFFCO Kisan SEZ Ltd., has embarked on the development of an **Agri-based Special Economic Zone based on the** concept of **"Agroparks" (AP) in Nellore** in the state of **Andhra Pradesh.** The developer has brought in the expertise and lessons learned by the northwestern European agro sector in **innovating metropolitan agriculture by forging strategic consultants with Wageningen University and Research** Center, the Netherlands and YES BANK Limited.

▪IFFCO Kisan SEZ is a notified Multiproduct Special Economic Zone spread over 1000 hectares located 22 KM North of Nellore, A.P. It comes with many customs duty and sales tax concessions provided by the government of India to promote economic activity in notified Special Economic Zones. The concept of Agropark is based on the principles of sustainable development, i.e.

- Application of principles of industrial ecology, i.e. mutual use of waste and by-products.
- Advantages of scale through industrial production and processing.
- Improvement of farmers position as a preferred supplier.
- Independence from seasonality and land during the whole year of production cycle
- Significant reduction of costs

Locational Advantages: IKSEZ is at a distance of just 50 Km from Krishnapatnam Sea Port, a new mega port on the east coast, and within a reach of three hours drive from Chennai International airport.

Nellore, the catchment area which is the Heart of Indian Aquaculture, is a strong source of various agricultural produce such as paddy, sugarcane, fruits & vegetables (especially tomato) and is a prime source of supply of poultry products and milk to near by metropolis. Major fruits include mango, citrus, papaya, banana & sappota.

▪ Infrastructure that is being provided: The IFFCO Kisan SEZ comes with a bundle of world class common infrastructure conforming to international standards including internal roads, high quality rain harvest supported water supply, uninterrupted power supply, common operation, maintenance and management of security, logistics, ICT etc. Moreover, the Agropark offers a framework of industrial ecology, managing waste and byproducts thus significantly reducing costs.

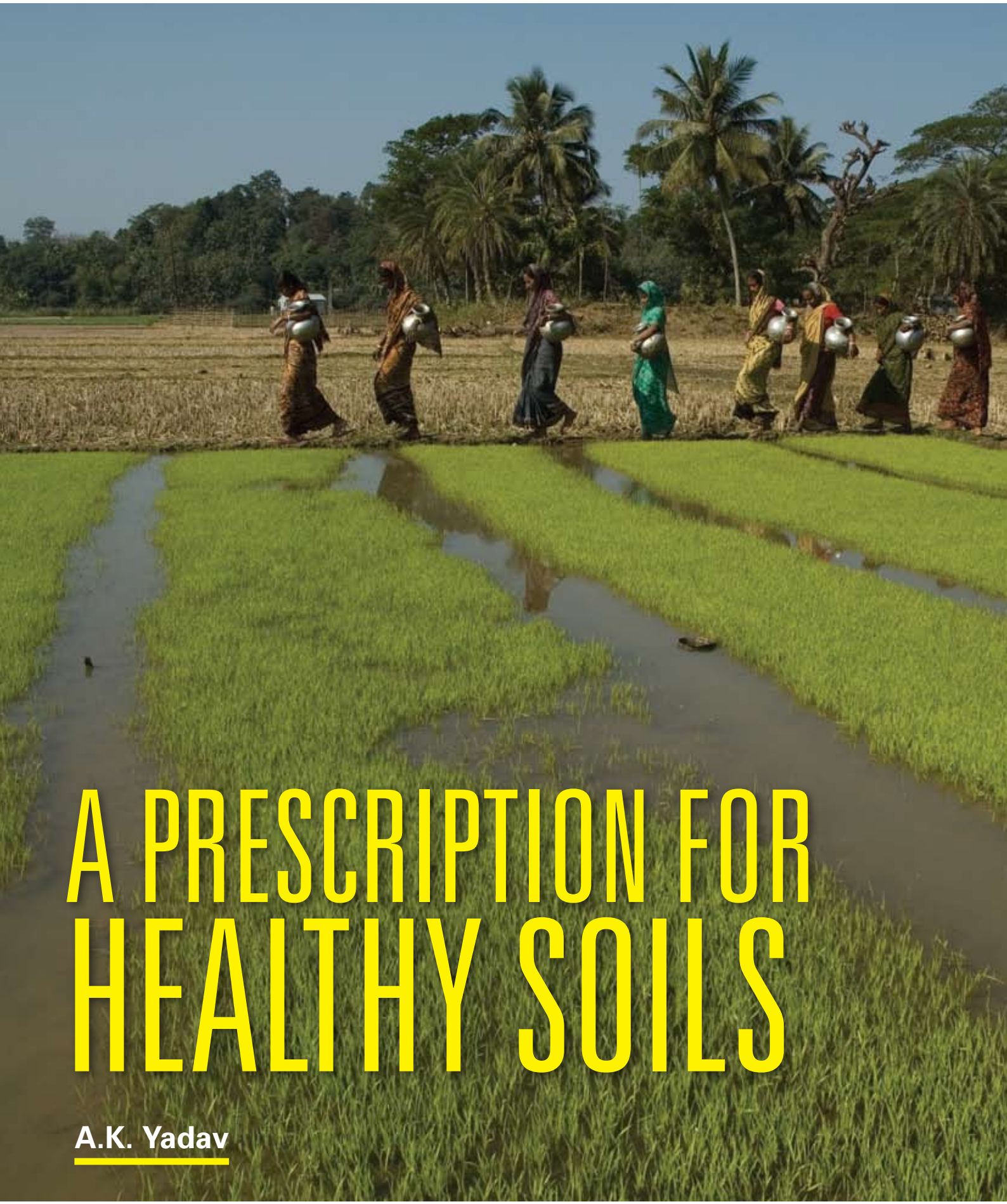
▪ Land at IFFCO Kisan Project site is being offered on long term lease basis for 33 years for potential Entrepreneurs for setting up their units on attractive terms and conditions. For further details contact our website www.iffcokisansez.com or can be obtained from,

Head Office :
Indian Farmers Fertiliser Cooperative Limited
IFFCO Sadan, C-1, District Centre, Saket Place,
Saket, New Delhi-110017
Ph.: +91-11-42592626, 26510001

Project Office:
IFFCO Kisan SEZ Limited
2nd Floor, Srinivasa Towers, Srinagar Colony,
Nellore-524003, Andhra Pradesh
Ph.: +91-861-2320483,

mail-guptark@iffco.nic.in, raja@iffco.nic.in, dsrmurthy@iffco.nic.in, mlnmurthy@iffco.nic.in

COVER STORY



A PRESCRIPTION FOR HEALTHY SOILS

A.K. Yadav

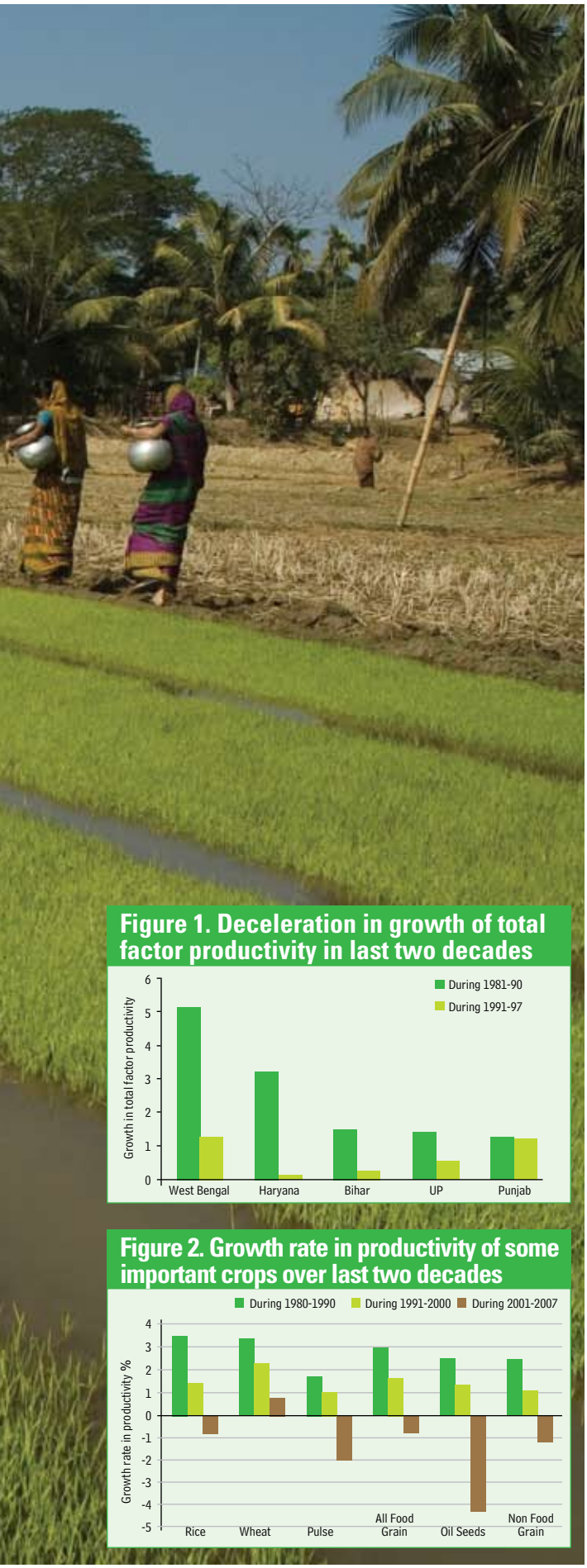


Photo: Dilip Banerjee

Figure 1. Deceleration in growth of total factor productivity in last two decades

Figure 2. Growth rate in productivity of some important crops over last two decades

Soil health is the capacity of soil to function within ecosystem boundaries to sustain biological productivity, maintain environmental quality and promote plant and animal health. In the context of agriculture, it may refer to its ability to sustain plant and animal productivity and diversity. A healthy soil would ensure proper retention and release of water and nutrients, promote and sustain root growth, maintain or enhance water and air quality, maintain soil biotic habitat, respond to management and resist degradation. The underlying principle in the use of the term "soil health" is that, soil is not just a growing medium but a living, dynamic and ever-so-subtly changing environment. India is a sad story of depleting soil health and productivity (Figures 1 and 2).

Falling nutrient use efficiency

- Loss of organic carbon and imbalances in microbial profile in soil has significantly contributed to the problem
- High nitrogen availability and high temperature, coupled with practically zero use of organic manures or no recycling of on-farm biomass has resulted in fast degradation of organic carbon
- Even the carbon present in stable humic fraction has seen a steep decline over the last two decades
- Reducing organic matter and organic carbon has also resulted in the loss of microflora and fauna
- Declining organic matter, microbial activity and imbalances in microbial profile have reduced the soil biological reactions, soil buffering potential, microbial solubilisation potential of nutrients, leading to faster fixation of phosphorus and micro-nutrients
- Poor organic matter and declining microbial life have also resulted in the loss of soil particle aggregation potential resulting in soil compaction, reduced water holding capacity, low aeration and making it prone to soil erosion.

Arresting deterioration in soil health

Maintenance of soil health is a formidable challenge while ensuring productivity, profitability and national food security. The United Nations Millennium Development Task Force on hunger included soil health enhancement as one of the five recommendations for increasing agricultural productivity and fighting hunger in India.

Adoption of integrated nutrient management approach with major emphasis on recycling of on-farm biomass is the key to success. To ensure long-

term sustainability and soil health with sustained productivity, all sources of nutrients need to be provided adequate space in future nutrient management strategies.

To further fine-tune the approach, soil-test based nutrient management protocols with balanced use of external synthetic nutrients and site-specific nutrient packages need to be given priority over blanket recommendations.

Though the chemical correction issue has been addressed, organic and biological correction is largely ignored. Some policy issues also need correction. With the growing awareness about soil health, a lot of effort has been made to ensure balanced use of fertilisers, increased use of secondary and micronutrients and arrest chemical problems with soil amendments such as lime, basic slag and gypsum. However, practically, no serious efforts have been made to ensure biomass recycling, increased organic manure use and microbial life restoration. Organic interventions/practices are largely perceived as on-farm activities and the farmer has been left with just advice on managing biomass recycling on his own.

Some of the problems are related to development and policy issues and have contributed directly or indirectly to the deterioration of soil health and environment. Some of them are:

- Policy promotion of few selected crops (such as rice and wheat) with narrow genetic base has replaced traditional food crops and increased the nutrient demand
- Elite crops are not fit for all soils and, if attempted, require external correction through chemicals
- Increased dependence on mechanical energy made animals irrelevant, thereby reducing dung and urine resource
- Price support to limited crops made other crops (such as pulses) uneconomical
- Cereal-cereal cropping systems with mono-cropping eliminated mixed/ intercropping and pulse rotations
- Heavy subsidy support to chemical nutrients distorted the level playing field and made only chemical sources affordable.

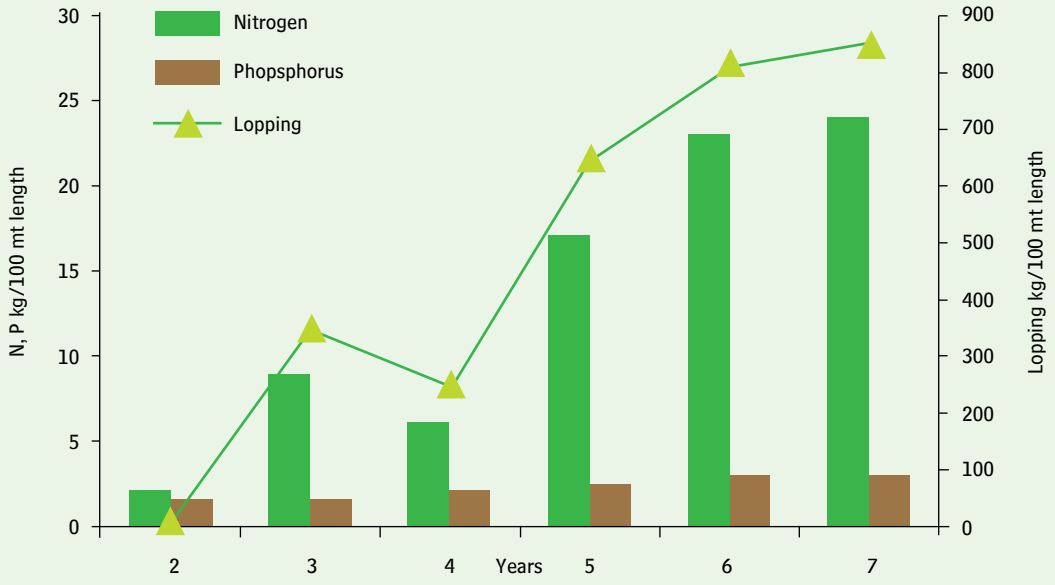
Major issues and corrective measures

1. Use of organic manures and recycling of biomass to be made mandatory
2. Encouragement for mixed/intercrops of pulses in all major cropping systems. At least one pulse crop to be brought in rotation every year in intensively-cultivated areas
3. Encouragement for N-fixing and other useful trees/bushes as hedges on bunds for in-situ production of biomass. Wherever possible, green manure crops to be promoted and farmers need to be compensated appropriately
4. Chemical nutrients need to be used only on soil-test based recommendations in optimum quantities
5. Bio-fertilisers need to be promoted on massive scale similar to chemical fertilisers
6. Mineral nutrient resources such as rock phosphate should be encouraged along with composts (Phosphate rich organic manure – PROM)

No serious efforts have been made to ensure biomass recycling, increased organic manure use and microbial life restoration

Soil is not just a growing medium but a living, dynamic and ever-so-subtly changing environment. India is a sad story of depleting soil health and productivity

Figure 3. Yield of dry lopping and N and P through lopping of Gliricidia grown on boundary (Rupela et al. 2006)



7. Integration of cattle in farming system mode should be encouraged
8. Use of lime, gypsum, basic slag and other soil amendments in problem soils also need the kind of support similar to chemical fertilisers received

Biomass through fertiliser trees

Plantation of nitrogen fixing trees (such as Gliricidia, *Lucanea lecocephela*, perennial pigeon pea or sesbania and such others) on bunds and using their lopping as green manure not only ensure biologically fixed nitrogen but also promise continuous supply of various micro-nutrients from deeper layers of soil. *Gliricidia sepium* grown on the boundary of a field could be a continuous source of plant biomass without seriously compromising on yield of the main crop. Every 100-metre length of 1.5 m wide single row yields at least 245 kgs dry biomass equivalent to about 5.6 kgs N (about two per cent N in its foliage) and its biomass yield increases over years (Figure 3). A one hectare field with 400 m boundary can provide 22.4 kgs N ha^{-1} from Year III and may touch up to 77.2 kgs ha^{-1} by Year VII in rain-fed conditions (Figure 3). The yield may be much higher under irrigated conditions. In addition, the other nutrients in the plant tissue also become available for crops, over time.

The 1.5 mt wide Gliricidia bunds around 10 per cent of total cultivable land (14 million ha) can contribute up to 700,000 tonnes (@ 50 kgs/ year from 400 mt length around every one ha) of biologically fixed nitrogen every year without any significant expenditure.

Weeds as biomass source

Weeds are also important sources of nutrients. Being better adapted to local climatic conditions, they harvest a variety of nutrients from the soil. If weeds are cut/uprooted before flowering and returned to the field directly as mulch or indirectly as compost, they can add to the nutrient reserve. A long-term experiment at ICRISAT observed that weed recycling alone could contribute 800 to 1,500 kg of dry biomass to the soil (Figure 4, see Page 60).

Promoting legumes

Elimination of legumes from rotation has seriously affected the natural fertility restoration mechanism. Policy decisions are required to ensure at least one organic legume season in a year in intensively cultivated areas and integration of legumes as integral component of all cropping systems in rain-fed areas. Farmers need to be incentivised on the same scale as of chemical fertilisers on this front. Research has proved that nitrogen rich legume crops not only require very small doses of nitrogen from fertilisers but also leave behind 20-45 kgs of biologically fixed N for the next crop, besides enriching soil with N-rich organic biomass. Integration of legumes as intercrop or mixed crop also ensures sustained fertility of soils.

Restoration of microbial life in soil is the most challenging task today. Blanket recommendation

for NPK has practically eliminated the importance of organic sources of nutrients that caused various complexities. Conversion of biomass into nutrient-rich compost and recycling of on-farm biomass has assumed unavoidable priority that one must address on a war footing.

The high subsidies on chemical fertilisers make the playing field unequal between chemical and organic nutrient sources and farmers are reluctant to switch over. Also, mechanisation has reduced the number of cattle resulting in low availability of dung and urine. Organic farmers or those using small quantities of chemical nutrients due to limited resource availability are being deprived of subsidy benefits.

Recycling biomass

Although a number of technologies have been developed to convert low nutrient biomass into nutrient rich compost, except for vermicompost no technology has found a place in nutrient management strategies with farmers. This is because of the time-consuming, labour-intensive processes involved in their making and availability of cheap chemical fertilisers.

With declining fertility problems, the use of organic manures in conjunction with chemical, mineral and biological inputs has become an absolute necessity. Keeping in view the large availability of crop residue, animal urine and dung and the emerging potential of some indigenous dung and urine-based microbial manures, strategies can be chalked out to tap this huge resource. In recent years, many technologies have been developed for preparation of value-added composts, value-added crop residues for direct incorporation and use of crop residue through in-situ composting at a fraction of the cost of composting process. What is needed is proper policy support and some incentives.

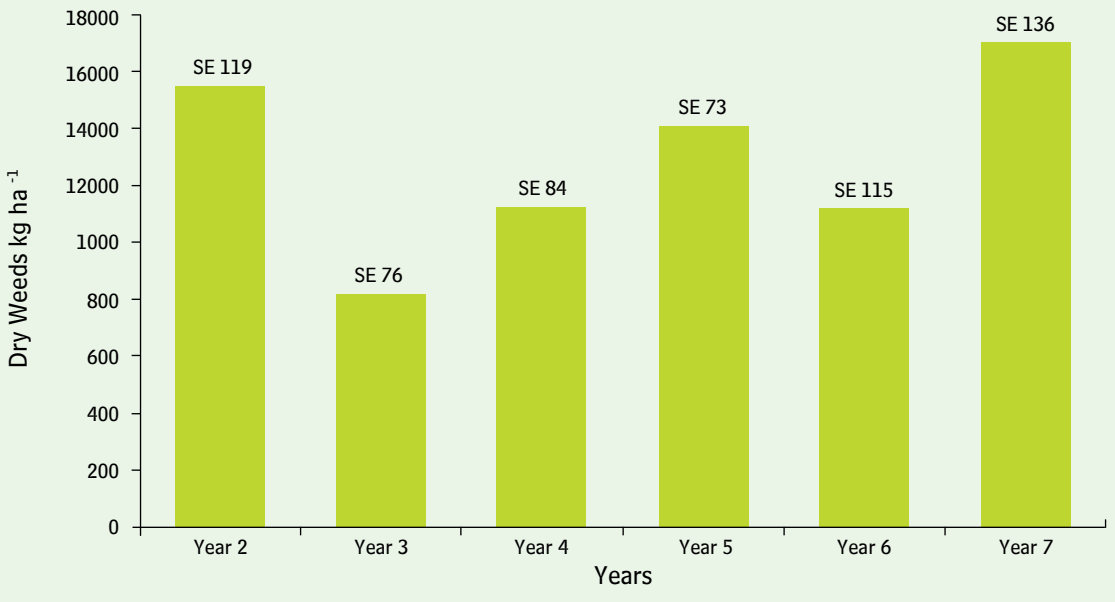
Organic manure potential

Although there is no reliable data on the current status of organic manure production and use, information compiled by the National Centre of Organic Farming indicates that the country has produced approximately 3,486 lakh tonnes of organic manures, contributing almost 1.8 million tonnes of nitrogen, 1.2 million tonnes of phosphorus and 1.5 million tonnes of potash.

Bio-fertilisers are an important component of integrated nutrient management approach. Since the early nineties, bio-fertilisers have assumed an important place in INM strategy and are being promoted both by central and state governments.

- Nitrogenous bio-fertilisers (such as Rhizobium, Azotobacter, Azospirillum, BGA, Acetobacter and such others) can replace 25 to 35 kgs of chemical nitrogen nutrient per ha per cropping season when used in conjunction with recommended fertiliser doses.
- N-contribution under low or no fertiliser use along with some quantity of organic manures is significantly higher and can meet 35 per cent to 50 per cent N demand of plants.
- PSB bio-fertilisers are known to replace 10-15 kg/ha of phosphorus use.
- The uptake of phosphorous by plants from phosphatic fertilisers is only about 20 per cent.

Figure 4. Quantity of biomass generated by weeds



The remaining P stays in the soil but is not lost as in the case of N. PSB helps to make this P available to the plants, thus reducing the requirement of application of phosphatic fertilisers.

- PSB bio-fertiliser along with mineral grade rock phosphate applied through composts can replace the requirement of single super phosphate application.
- Combined application of both nitrogenous and phosphorus bio-fertilisers can give a saving of 25 kgs N and 10 kgs P_2O_5.

Economics of bio-fertiliser use

Depending upon crop and the method of application, 500 gm to 10 kg of bio-fertiliser is used per hectare. Nitrogenous bio-fertilisers are generally used as seed treatment in direct seed sown crops, as seedling root dip treatment in transplanted crops and as soil treatment where the two aforementioned methods cannot be used (such as sugarcane or potato). PSB is generally used as seed plus soil treatment. Crop-wise details of cost involved in bio-fertiliser use and doses required for carrier based and liquid formulations are given in Table 1 (see, Page 62).

Bio-fertiliser output and use

As per the latest compilation, India has about 175 bio-fertiliser production units with an installed production capacity of about 86,000 mt per annum. Against this the actual production during the year 2009-10 was 20,040 mt. Out of various types of bio-fertilisers PSB bio-fertilisers accounted for nearly 45 per cent of total production and use. State-wise details of installed production capacity and actual production during the year 2009-10 are given in Table 2 (see, Page 62).

Elimination of legumes from rotation has seriously affected the natural fertility restoration mechanism. Policy decisions are required to ensure at least one organic legume season in a year in intensively cultivated areas and integration of legumes as integral component of all cropping systems in rain-fed areas

The poor status of production technology and high prevailing temperature were the major limiting factors. Recent introduction of liquid innoculant technology provides relief from both these problems but the technology is available only with very few producers. Most of the production units still use unsterile-carrier based production system.

Under low organic carbon soils and high N-fertiliser use, nitrogenous bio-fertilisers do not give significant results. Soils having moderate to medium organic carbon level with optimum N-fertiliser use are ideal for bio-fertiliser use.

Intense competition for government sales at low prices has also contributed to the deterioration in overall quality. Surprisingly, some manufacturers are selling bio-fertilisers at Rs 12 to Rs 15 per kg, which is far below the direct material cost of the product.

Misplaced subsidies

High subsidy on chemical nutrients and practically no support to biological and organic sources of nutrients has not left any space for level playing field. To ensure that these environment-friendly sources of nutrients find their rightful place in Indian agriculture they need to be supported at the same level at which chemical fertilisers are.

Table 1. Economics of bio-fertiliser use

S.No	Crops	Cost of bio-fertiliser application per ha		Nutrient contribution in terms of chemical N and P and cost	
		Carrier based	Liquid	kg/ha of N & P	Cost of nutrient recovery Expressed as equivalent of N and P/ha as urea and SSP3
1	Pulses (small seeded)	525.00	1225.00	25 + 15	468.75
2	Pulses (large seeded)	575.00	1425.00	25 + 15	468.75
3	Soybean/ Ground nut	575.00	1425.00	25 + 15	468.75
4	Wheat/barley	575.00	1425.00	25 + 15	468.75
5	Rice	575.00	1425.00	25 + 15	468.75
6	Maize/sorghum	525.00	1225.00	25 + 15	468.75
7	Vegetables	750.00	1500.00	20 + 10	422.25
8	Sugarcane/Potato	1000.00	1500.00	25-35 +10	468-580.00

1. For calculation rate of carrier based bio-fertiliser has been taken @ Rs. 50/- per kg while for liquid @ Rs. 300.00 per lit.
2. In case of liquid bio-fertilisers only 50% quantity is needed for seed or seedling root dip and 25% quantity for soil treatment respectively compared to carrier based formulations.
3. Subsidised cost of urea N = Rs. 10.50/kg and cost of SSP P_2O_5 = 21.25/kg (as per MRP)

Table 2. State-wise production capacity and actual production of bio-fertiliser and other microbial inoculants in 2009-10

S. No.	State	Capacity	Total Bio-fertiliser Production (MT)	Other Inoculants*	Total Production (in MT)
1	Andhra Pradesh	5825	1345.28	326.2	1671.48
2	Assam	225	121.04	0	121.04
3	Bihar	0	0	0	0.00
4	Delhi	2000	1021.85	211.99	1233.84
5	Gujarat	1550	1309.19	48.69	1357.88
6	Goa	1000	0	8.44	8.44
7	Haryana	775	6.20	647.08	653.27
8	Himachal Pradesh	25	8.50	0	8.50
9	Jharkhand	50	15.00	0	15.00
10	Karnataka	25488	3695.50	18109.126	21804.63
11	Kerala	10400	1936.45	6736.45	8672.90
12	Madhya Pradesh	1750	1587.68	83.5	1671.18
13	Maharashtra	5315	1861.33	250.86	2112.19
14	Mizoram	75	2.50	0	2.50
15	Nagaland	150	18.25	0	18.25
16	Orissa	470	289.87	12	302.02
17	Punjab	575	301	0	301.23
18	Pondicherry	1900	452.79	1137.63	1590.42
19	Rajasthan	1000	805.57	0	805.57
20	Tamil Nadu	25265	3732.59	17622.49	21355.08
21	Tripura	300	278.40	0	278.40
22	Uttar Pradesh	1090	962.64	8	970.14
23	Uttarakhand	550	32.00	274	305.80
24	West Bengal	300	256.50	0	256.50
	Total	86078.00	20040.35	45475.9058	65516.2542

In spite of the tremendous development in science and technology in crop production, the country is far behind the targeted goals. Declining fertility potential, eroding soil health, emerging environmental and safety concerns and above all diminishing profitability have raised doubts on the long-term sustainability of the technology. Increasing costs and the growing subsidy burden on governments has added to the problems.

Organic and biological approaches in the form of technology inputs provide viable alternatives for correcting soil deficiencies. Current knowledge on all these systems may not be adequate to replace synthetic inputs but can certainly supplement and complement the requirements with added benefits of environment restoration, replenishment of fertility and promise of safe and healthy foods. Quality is important for successful implementation of the technology and it is the country's moral duty to ensure that adequate measures are in place to achieve the goal. ●

The author is Director, National Centre of Organic Farming, Department of Agriculture and Cooperation

देश में सुशासन की नयी परिभाषा

मध्यप्रदेश का लोक सेवा प्रदान की गारंटी का कानून

|| प्रजा सुखे सुखं राज्ञः प्रजानां च हिते हितम्
नात्मप्रियं हित राज्ञः प्रजानां तु प्रियं हितम् ||

(अपने नागरिकों की खुशी में ही उसकी खुशी है, लोगों के कल्याण में ही उसका कल्याण। जो कुछ भी उसे संतुष्ट करता है उसे वह अच्छा नहीं मानेगा लेकिन जो कुछ उसके लोगों को संतुष्ट करे, उसे ही वह श्रेष्ठ मानेगा।)

(कौटिल्य रचित अर्थशास्त्र में कल्याणकारी राज्य की धारणा)

शिवराज सिंह चौहान
मुख्यमंत्री, मध्यप्रदेश

- राज्य की विधानसभा ने इसी मानसून सत्र में सर्वसम्मति से पारित किया मध्यप्रदेश लोक सेवाओं के प्रदान की गारंटी विधेयक 2010, जनाधिकार को मान्यता देते हुये सुराज के पथ पर देश के किसी राज्य में पहली बार उठा यह अभिनव कदम।
- लोक प्रशासन में प्रारंभिक रूप से चिंहित 25 सेवाओं जैसे आय, जाति, स्थायी निवासी के प्रमाण पत्र, खसरे-खतौनी की नकल, राशन कार्ड, बिजली और नल के नए कनेक्शन, सामाजिक सुरक्षा पेंशन और इसी प्रकार की अन्य सेवाओं की समय सीमा की जवाबदेही।
- सेवा प्रदान करने में चूक या देरी करने वाले कर्मचारियों या अधिकारियों के खिलाफ अपील करने का प्रावधान। अपील मान्य होने पर 5 हजार रुपये तक का जुर्माना। जुर्माने की राशि संबंधित नागरिक को।
- सुराज की धारणा को नई ऊंचाई देने वाले इस कानून को लागू करने के लिये नये लोक सेवा प्रबंधन विभाग का गठन।

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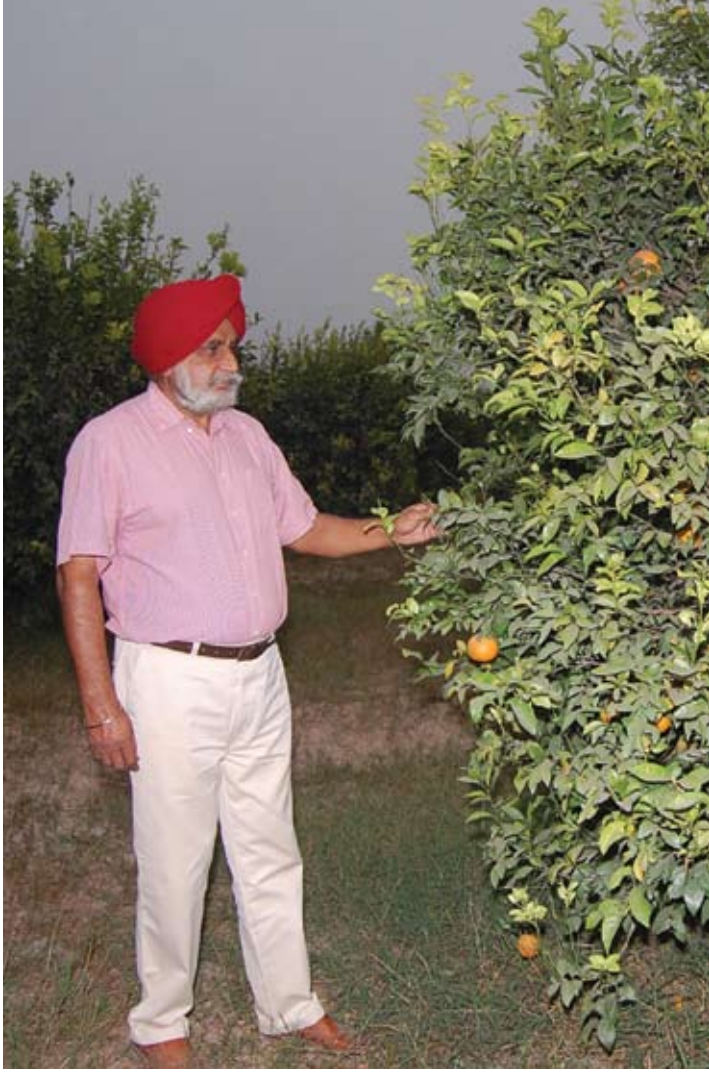

Ajay Vir Jakhar

With a bachelor's degree in history from the Chandigarh University, Sukhvinder Pal Singh Sandhu, 54, is not quite the typical, troubled Indian farmer. A product of the Green Revolution era, with his 30-acre farm resplendent with a crop basket of cotton, kinnow, wheat and mustard, Sukhvinder Sandhu – born and brought up in a traditional farming family and a farmer himself since 1982 – cuts a happier figure. For mustard he used the 'Mahalaxmi' seed sold by the Rajasthan State Seed Corporation. For wheat he has chosen the 1482 and 3077 varieties that he procures from the Ganganagar Research Centre, which collaborates with the Rajasthan Agricultural University. His most profitable crop though is Bt Cotton.

This relative prosperity sits well on this farmer in Sri Ganganagar district of Rajasthan in North India, village 10FF, uniquely named after the canal on whose bank it is located, very close to the India-Pakistan border. Yet life is hardly a bed of roses for him. "We farm against the elements; the climate is very harsh and extreme. The annual temperature varies from 3°C to 47°C; even in a day the temperature could vary up to 25°C".

Farming is all this society knows and under the prevalent social value system, "land is everything"; it is always a part of the farmer's persona and identity. Farming is a matter of life; not a business because one can hardly look at farming as a business proposition these days. Upon the death of his father, his mother told Sukhvinder: "it is not that I alone have become a widow, my land is also widowed". That says it all.

Generally, the farmer's is not a happy lot. Agriculture needs sustained faith in land and god because the farmer is buffeted from every side. "On the one hand there is the high cost of inputs; on the other, the farmers are fleeced by traders and shopkeepers and their innocence and dependence is exploited by the system", says Sukhvinder. Nor is government policy conducive for agriculture and there is little or no agriculture extension service in this area. "Instead of encouraging consolidation, the government promoted division of land, thus making agriculture holdings small and scale of farming uneconomical. Agriculture is now only possible through co-operative activities like participating in 'producer companies' and it is not feasible to

be done individually. It is now costly to buy new implements or run tractors". There is rampant agricultural indebtedness that ruins this most "noble and interesting profession. To make farming debt free is the most stupendous task".

There are other problems galore: water inadequacy, amongst others. Farming is possible in Sri Ganganagar only because of water from the Gang Canal made "under Maharaja Ganga Singh of Bikaner, a great visionary". Given the indifference of the government, the Gang Canal "has been the lifeline for farming in this area". However, even a lifeline has a life span and the demand for water has been growing. Sugarcane is a high water consuming crop and not a local one. Yet the government has put up a sugar mill in Sri Ganganagar and has incentivised farmers to grow sugarcane despite the occasional shortage of even drinking water here. Adding to the inconsistent water supply woes are the tube-wells that the farmers are compelled to bore even when the water is saline, worsening soil health. Even worse, the Rajasthan canal is being extended to areas of the state where agriculture is not feasible. "The flood irrigation of the system will not only waste precious water but destroy the land as well".

Yet the prospect of water makes people lose their ability to see reason. More so because land here is valued according to the availability of water. "The cost of water is a joke. The 'mamla' (payment for water) for six months of water use is Rs 120 per acre for sugarcane; Rs 80 per acre for cotton; Rs 60 per acre for wheat. We are supposed to get water 'bari' twice a month. For one 'maraba' (16 acres) a farmer gets water for approximately three hours per time from the canal. For every 'maraba', one 'bari' of water irrigates a fourth of the land", says Sukhvinder. "Farmers are ready to pay up to 10 times more for canal water, provided they get consistently good supply".

Sandhu inherited the farm from his father and took to farming at a time the Green Revolution was changing the north Indian landscape with its focus on irrigation and chemical fertilisers to increase farm produce. Sukhvinder Pal Singh Sandhu fell prey to the magic wand like most others in the region. For them, all chemical fertilisers were like manna from heaven as they helped increase yield several-fold over the years, as in adjoining Punjab, which became the 'granary of India' even as its soil was gradually being degraded by the often mindless and rampant use of chemical fertilisers. So ask this agriculturist if he has done everything right and he shakes his turbaned head ruefully: "I regret that I did not use fertilisers wisely".

Some three decades later, Sukhvinder Sandhu's soil is ailing; the yields first plateaued off and then started the movement downhill. Deprived of its fertility even the crops it yielded has essential nutrients missing. Today he blames the rampant use of nitrogenous fertilisers that have caused the "decline in productivity, as the quality of the soil has degraded over the years". He points at the overuse of chemical fertilisers that hardened the soil making it unable to retain the amount of water that it normally did. There is also an imbalance of nutrients in the crop produce.

Overuse of chemical fertilisers leads to loss in soil humus and degrades the soil. It also results in poor aeration and drainage, which are essential for the roots. "Even the taste goes missing in the food prepared from such crops" rues Sukhvinder Sandhu.

Another widely used fertiliser is urea, a convenient source of nitrogen. With government subsidy for urea higher than for any other fertiliser, it comes cheaper than most fertilisers in the country and its excessive use is the bane of the sector. Urea has been used extensively in many parts of India apart from the north, rendering the soil hard and alkaline

at all places. This is because excessive use of urea decreases the moisture-retaining capacity of the soil. With progressively increasing soil hardness, the chemical fertilisers required for the soil also increases. Such soil requires a second round of urea treatment just after 10 days because of the decrease of moisture-retaining capacity of the soil. On the other hand, soil treated with fertilisers that have less chemical content require a second round of treatment after 20 days or more.

Even where farmers are well aware of the negative impact of excessive use of nitrogenous fertilisers, they seldom have a cheap alternative. Says Sandhu, "This forces farmers to stick to the usage of nitrogen-rich fertilisers even when they are aware of its ill effects".

Sandhu is equally regretful of his mono-cropping practice. He used to grow crops year after year on the same land without crop rotation with disastrous consequences. Crop rotation is a standard practice for fertility conservation and ensures a permanent cover for the soil. This helps avoid disturbance of the topsoil layer.

The answer now is to "go quasi organic, which is a cost-effective solution to rejuvenate soil", says Sandhu. Using compost laced with small traces of fertilisers would not only protect the soil from the effects of long-term exposure to chemical fertilisers but would also help increase fertility at a far lower cost than that incurred in using chemical fertilisers. "Good compost can be made at home from animal excreta, vegetation, grass and other bio-degradable waste materials", says Sandhu. Farmyard manure if used judiciously, is capable of maintaining soil fertility over long periods of time. Sandhu is now wisened with experience as he has switched over partially to the use of organic fertilisers.

Having lived through the golden years of the Green Revolution and suffered its ill effects, he says: "Farmers should analyse the chemical properties of the soil as well the crops they plan to sow before going in choosing the chemical fertiliser". Fertilisers custom-designed to the needs of a specific environment and soil-type should not be used in other regions without proper assessment and consultations, he cautions.

The biggest issue, of course, is about increasing soil fertility and this demands knowledge about every soil characteristics and qualities. "Farmers also need to be educated about sustainable agricultural practices that would ensure farm fertility on the one hand and increase productivity on the other hand", says Sandhu. This is where the government needs to intervene proactively in terms of enhancing knowledge levels through regular workshops. Farmers should also understand that it is the nature of the soil that gives them sustenance. "Soil is a living and breathing organic matter, we need to take care of it". Simple words; worth their weight in gold. ●

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