Organic Farming and Food Security: A Model for India

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Agriculture is life and blood of our country's economy. It was highly gratifying that India achieved self-reliance in food production in the shortest span of time in the world, but despite everything, our traditional agro system suffered a great setback, especially owing to the indiscriminate use of fertilizers, insecticides, fungicides and herbicides. This has also created the problem of decline in the soil fertility, pollution of water resources, and chemical contamination of food grain. There is an urgent need to take a holistic view of this problem to curb its negative impact. Organic Agriculture is a major pillar for sustainable Agriculture and an answer to our problem of environment degradation, unsafe food, polluted water, degraded land and wide range of illness due to unsustainable Agriculture practiced in the recent past.

The organic agriculture is not only the need of the hour but also a timely answer to the problems of environment-degradation, unsafe food, polluted water, degraded land and a plethora of agro-maladies emanating from unsustainable agro-system. It hardly needs reiteration that organic agriculture can ensure maintenance of soil health, protection of the environment and sustaining of crop productivity. Furthermore, organic agriculture in keeping with the traditional Indian agro-system not only maintains ecological balance but also ensures sustainability in terms of food production and safeguarding the human health.

From the very beginning, the agriculture in India was based on natural farming, meaning thereby that whatever nutrients were drawn from the soil in the form of agricultural produce were returned to the soil in some form or other, as a result all nutrients required for production of crops were always available in the soil in plenty. Thus, the productivity of the soil was maintained and there was no need to add any inorganic nutrient into the soil from out side.

There may be people who feel that by switching over to organic farming the production will decrease. Yes, this may happen in the initial 3-5 years. The reason for this is that during past 50 years, we have drawn out most of the nutrients from the soil by practicing intensive agriculture. Today when we shift to organic farming, it will not be possible to maintain the nutritional balance in the very first year but in subsequent year, the soil fertility status will improve and by 5 years the production will reach to pre-organic level and may increase above it in the years

to come. Once this situation is reached, it will remain sustainable year after year. The pest and disease problems will also be minimized, the number of irrigation will also come down and most of the living forms like earthworms will return to the soil to add to the fertility and to improve its health. This way, the organic farming will cut down the cost on fertilizers, micronutrients, pesticides and irrigation. As a result the overall cost of production will be reduced and farmer will get more economic return with less investment. Besides this, the organic products do not cause any harm to human health and the health of domesticated animals like cattle, goat and sheep. If health improves the expenditure on medicine will be reduced.

Analyzing the economic aspects of organic agriculture, it can be mentioned that marketing of healthy produce from agriculture will earn additional revenue to the farmer and will cut down the cost of inputs needed for such production. Further, there will be gradual improvement in the fertility status of the soil, which will yield more produce per unit area. In sum total, there will be considerable economic benefit on long-term basis and farmer will get rid of maladies associated with the market purchased inputs.

On the cost of soil health if we continue to practice intensive agriculture without making proper nutritional management through organic process the soil will soon become infertile and dead. The produce from chemical treated soil and crop will adversely affect the human health and diseases of different types will appear. In support of this let us take the example of Punjab state. In this state plenty of water is available for irrigation. In greed for taking more yield and benefit, the farmers have made excessive use of chemical fertilizers. There is no doubt it increased the production of wheat and paddy but now 25 per cent of Punjab population is suffering from diabetes. The probe into such happening indicated considerable zinc deficiency in the diet of Punjab people which may have been one of the factors responsible for this. The zinc deficiency is mainly attributed to continuous drain of zinc from soil following excessive use of fertilizers. Likewise, excessive use of pesticides has been responsible for diseases like cancer. Forty year ago in the state only few shops of chemist were there. Today in every village there is one or more shop. It is a testimony of the fact that because of excessive use of chemicals in agriculture, the food, water, soil and air have been polluted to the extent that it has adversely affected the human health in spite of the fact that food availability per capita has increased as compared to past 40 years.

In brief it can be concluded that if one shifts from chemical agriculture to organic agriculture, in the first year there may be 30-40 per cent loss in production which will come down to 15-20 per cent in the second year and 5-10 per cent in the third year. This loss will be compensated by additional income the farmer will get by marketing good quality organic produce. In subsequent years the production will reach the pre-organic level and may increase further over the years. Some loss will also be compensated by lower cost of input in organic agriculture.

It first happened in Brazil. And even the internationally acclaimed agricultural scientist, Novel Laureate Dr. Norman Borlaug, could not first believe it. To grow a bumper crop of soybean and that too without chemical fertilizers, it was beyond the imagination of Dr Borlaug. Prof. Johanna Dobereiner of the Third World Academy of Sciences persuaded Dr. Borlaug to visit Brazil and see the miracle in crop cultivation without nitrogen fertilizer. Almost the entire soybean crop in Brazil today is grown without the application of nitrogen

fertilizers. And unlike the soybean growing tracts of India, which suffer from excessive usage of fertilizers, the entire soybean growing belt in Brazil is healthy, shows no sign of degradation and fatigue. In other words, absence of nitrogen fertilizers has encouraged sustainable cultivation of soybean.

Necessity, is the mother of invention. With nitrogen fertilizers not subsidized in Brazil, and obviously priced beyond the reach of farmers, soybean growers were left with no choice but to depend upon organic sources. Agriculture scientists too were forced to undertake research on increasing the efficiency of organic manures. As result of not applying synthetic nitrogen, Brazil is incurring an annual saving of US $3.2 billion.

Soybean is not the only crop that grows without any application of artificial nitrogen. Sugarcane too has emerged as a key to high energy balance with the elimination of nitrogen fertilizers for the production of bio-energy. Brazil has transformed its rural economy by producing ethanol from sugarcane as an alternate fuel for motor vehicles. The vehicles running on alcohol are far less damaging to the environment, emitting 57 per cent less carbon monoxide, 64 per cent less hydrocarbons and 13 per cent reduced nitrogen peroxide than cars running on gasoline. The ethanol fuel now runs four million cars, saving equivalent of 2,60,000 liters of petrol per day.

Scientists meanwhile succeeded in isolating a soil bacterium that helped in the increased uptake of plant nutrients from organic manure. With the result that sugarcane varieties under cultivation are receiving the highest bacterial nitrogen fixation, directly from the atmosphere, among all non-legume crops. When grown with ample doses of phosphorus fertilizer and with foliar application of molybdenum, the crop takes about 150 kg. of nitrogen directly from the atmosphere. Selecting the favourable genotypes resulted in some of the best sugarcane varieties that can produce enough without the intake of nitrogen fertilizers. And still, the crop yields in semi-organically farmed sugarcane in Brazil are much higher than that of the chemically fertilized crop in India. From 4.2 million hectare, Brazil harvests on an average 64 tones of sugarcane per hectare.

Between 1971 and 1981, the initial years of the Green Revolution, excessive intake of chemical fertilizers had led to an increase in the nitrate content of ground water by two and a half times. The seriousness of the problem lies in the fact that once nitrates get into aquifer, it will be decades before the nitrate level in the water falls bellow the acceptable limit for drinking. High levels of nitrates in drinking water are not only unsafe and cause birth defects but may also lead to nervous breakdown and cancer. Contamination of soils by heavy metals like cadmium through phosphatic fertilizers is yet another hidden threat. And more recently, fertilizers have been found to be playing a significant role in extending the Ozone Hole.

Let us now examine the emerging barriers to crop sustainability. Punjab has often been hailed as the country's granary. The land which once produced a rich golden harvest is now beginning to collapse under its own artificial burden of intensive cultivation. The warning bells have been sounding for quite some time and have gone unheeded – intensive cultivation of wheat and rice has already exhausted the nutrient reservoir of the soil. The indiscriminate marketing of chemical fertilizers, without the accompanying doses of organic manures, has drastically reduced the soil fertility. With the organic content of soil hovering around a pathetically low of >0.2 per cent, Punjab soils are getting increasingly dependent on chemical fertilizers.

A Government task force in 1979, comprising scientist and economists, concluded that "some farmers actually experienced no reduction at all when they gave up the use of chemicals. And those who did, lose some production still made more money because they didn't have to pay for expensive chemicals." In another study conducted by the Centre for the Study of Biological Systems, University of Washington at St. Louis, two groups of farms with similar soil and environmental conditions, with one using chemical and the other without it, were evaluated for five years. The study concluded: "A five year average shows that the organic farms yielded, in dollars per acre, exactly the same returns. In terms of yield, the organic farms although yielded 10 per cent less but gave similar profits due to savings on cost of chemical inputs". Now, before any opinion is made, don't forget that the comparison was between a no chemical farm and an energy efficient farm the likes of which do not exist in India. In Indian context, such study would have been clearly in favour of an organic farm. In any case, it is better to harvest 10 per cent less from a farm than be faced with a near collapse of the farming system.

The answer, therefore, lies in following a non-chemical integrated plant nutrient management system which reinforces the role of organic matter in soil. Since much of the damage to the soil structure and fertility, and the contamination of ground water, is the result of excessive fertilizer usage, the industry need to be made responsible for the damages and also accountable for any further destruction of the soil system.

Be sides above, for revolutionary change to ORGANIC AGRICULTURE establishment of Gobar Gas Plants will be a sustainable option in Indias context. A model for optimum utilization of available organic material dove tailing with Livestock development and conservations is given hereunder, in other words in this script we have advocated for organic Farming, through Livestock Production. For a cluster of 100 Hct of land, it would need 400 animals' especially indigenous milking cows and 200 cubic meter capacity Gobar Gas Plant on community basis. These Gobar Gas plants can even be run and maintained by the panchayats. The Gobar slurry from the plant so obtained will have twice the value of nutrients and simultaneously make available Gobar Gas for cooking or even for lighting. Where there is difficulty in establishing community Gobar Gas Plants, small individual Gas Plants of 5 to 10 Cubic meter be established which will also give same desired benefits.

In this sustainable model subsidy on all the components would be a better option than the Nutrient based subsidy. In nutrient based subsidy the money instead of benefiting the farmers will go in the coffers of the fertilizer companies. To get the Micro nutrient analysis of the soil done for every farmer's field it would need around 1,00,000 soil testing laboratories which is not possible is distant future.

In proposed cluster low cost input alternative in first year simultaneously low three different types of legumes in strips, first of 60 days (like moong) second of 90-120 days (cow pea or soyabean) and third of more than 120 days (red gram) in strips. NADAP compost, Vermi compost, PROM compost, inriched with azoctobactor, PSB, and Rhizobium. Take multiple cropping crop. Rotation seed / planting material treatment. For example hot water treatment, Beejamrut, Panchgavya extract, Trichoderma etc. Some important formutations for soil enrichment like. Sangivak, Jivamrut, Amrit-Pani.

Pest management through cultural alternative, mechnical

alternative, Biological alternative use of Biopesticide, Botanical Peslicide like Neem and its preparations, cow urine, Fermented curd water, Dasparni extract, Chilli-garlic extract etc.

Model of food security for India

Govt. of India is making all efforts to ensure food security to its people. In doing so it has provided sizeable state support for keeping fertilizers affordable to farmers. Quantum of fertilizer subsidy during last few years is given in Table 1. The pattern of Government support on every 50 kg fertilizer bag is given in Table 2 (as mentioned by the then Minister of Fertilizers and Chemicals during 2008-09).

Table-1. Quantum of fertilizer subsidy during last 10 years

Year	Amount Rs. (in crores)
2000-2001	13,800
2001-2002	14,170
2002-2003	14,858
2003-2004	15,252
2004-2005	15,779
2005-2006	18,299
2006-2007	25,952
2007-2008	40,338
2008-2009	98,450
2009-2010 (estimated)	52,000
Total :-	**3,08,898**

Table- 2. Pattern of Govt. support provided for each bag of fertilizer

Fertilizer	Govt. support (per mt in Rs.)	Each 50Kg bag of Fertilizer (in Rs.)
DAP	49234.00	2468.00 (domestic and imported both)
UREA	28336.00	1460.00(imported urea)
MOP	31108.00	1550.00(not produced)
NPK	36722.00	1837.00(domestic)
SSP	8134.00	407.00(domestic)

If this support is reduced, the cost of food commodities will go up. On this ground the state support is being justified and continued and on this logic no one would like to speak against it as this is likely to put the food security in danger.

This has also been made amply clear by the scientists not only in India but world over that excessive and continued use of fertilizers may make soil unproductive and barren if corrective measures are not taken in time. Under such scenario and no alternative solution in sight, the food security may again be threatened in coming 40 to 50 years. By this time where from the food grain will be obtained to feed the 1.50 billion people of the country.

The Govt. of India's stand to keep the state support going on the fertilizer is justified on the ground that the entire 14 crore ha cultivable land can not be brought under organic farming over night and organic matter in the form of dung urine and crop residues etc. can not be generated to meet the need of entire cultivable land. Also there is possibility of 30-40 % reduction in yield in the 1st year of shifting to organic farming.

As per Govt. of India estimates of Rs. 2 lakh per ha conversion cost to organic farming, if we convert India's 1%

cultivable land (1% of 14 crore ha) ie 14 lakh ha. crop area, then Rs 28000 crore additional state support will be needed. If 50% of this state support i.e. Rs. 14000 crores is spent on live stock development and Rs. 25000 per milch animals is provided to individual farmer then 14 lakh small and marginal farmers will get 56 lakh milch animals @ of 4 animal per ha. In other words milk, dung and urine of four animal per ha will become available continuously. These farmers on being converted to organic even if face 30-40% reduction in grain yield will get the following additional produce to compensate the loss.

a) Milk at the rate of 7.5 liter per day/ animal, will yield 30 liter milk per day for 8 months. Annually 7200 liter milk @ Rs.20 will give an additional income of Rs.144000 per year.
b) On the other hand expenditure on feed, fodder and labour per day/ animal will be (Rs.80 per animal per day, for 4 animals Rs. 320 per day, 9600 per month) Rs. 115200 per year. The income from milk per year (Rs 1,44,000) minus the expenditure of Rs.115200 per year will give a net profit of Rs. 28800 with milk alone.
c) Gobar per animal per day will be 10 kg. From four animals it will be 40 kg per day and 14400 kg/ year. With this gobar, desi khad worth Rs.15000 can be produced without any extra cost. From above khad following nutrients will become available to the farmer for use in his farm (Table 3).

Table-3. Nutrient availability from desi khad made from the dung of 4 animals

Nutrients	Percentage	Total nutrients
Nitrogen	1.5%	216 kg.
Phosphorus	1%	144kg.
Potash	1%	144kg.
Total		504 kg. + micronutrients

Summary:

1.Value of milk	Rs 144000
2.Value of gobar khad	Rs 15000
Less expenditure on cattle feed	Rs 115200
Net Profit	Rs 43800 per year

At the present rate of recommendations per ha/year in Rabi, (Wheat) and Kharif (Paddy) the state support on fertilizer is worth Rs. 20000 per year. In lieu of this the farmer gets 80 quintal (wheat+paddy), the market value of this produce is Rs. 96000/- (@ Rs.1200/Qtls approx). If Govt. stops this support of Rs. 20000 on fertilizers to farmers then on the basis of 40% yield reduction under organic farming, the farmer will get only Rs. 76000 per year. This reduction in income due to yield loss will be compensated by additional income the farmer will get from milk and cow dung etc. which will amount to Rs. 43800 (28800 from milk and 15000 from cow dung etc.), therefore farmer will earn additional net income of Rs. 7400 over wheat and paddy if he would have adopted organic in the first year. Five years fertilizer subsidy @ 20,000 per year equals Rs. 1 lac. If Govt assistance is provided to the farmer to purchase 4 milch animals in the very first year then the related impact will be as shown in Table-4.

As is proposed in the Table 4, if the total subsidy to be provided on chemical fertilizer over a period of five years is provided to all the farmer for purchase of good Indian breeds of cows @ of Rs.25000 per milch animal amounting to Rs. 1.00 lakh then by 5th year by making use of the gober (dropping) of these milk animal, he will prepare compost, Nadep compost, vermicompost and other bio

inputs and the production per ha will level up in 5 years and in 6th years there will be additional income of Rs. 48,600/- from milk and dung where as by providing a subsidy of Rs. 20,000/- on fertilizers no additional profit will accrue, instead the amount of subsidy on fertilizer will increase over time with concomitant adverse impacts.

In the proposed model the food security is built in because the milk and gobar obtained from the milch animals will compensate for the yield losses or it may even be more than that. Milk in itself is a complete food and gobar and urine are very useful sustainable bio inputs for crops. This model can be considered as 100% sustainable agriculture model. It has no risk involved for food security. Simultaneously it is eco-friendly as well as health friendly. The specialty of this model will be that Govt. of India will get a permanent relief from fertilizer subsidy over a period of time. Also the farmer adopting this model will earn additional income of Rs 66,800/year/ha in 10th year and the fertility of the field will increase thereby the yield will increase by 25% hence food security will increase and by 10th years the number of animal will increase to reach a number of 13 animals. The increase in animal population has been indicated in table No. 5

Table-4. Yeild reduction and return in organic farming over 10 years period)

Year of organic	Yield (%)	Value of reduction/increase in yield (in Rs.)	Additional income from milk and cow dung (in Rs.)	Gain (in Rs.)
1	- 40	-38400.00	43800.00	5400.00
2	-30	-28800.00	43800.00	15000.00
3	-20	-19200.00	43800.00	24600.00
4	-10	-9600.00	43800.00	34200.00
5	Nil	-	43800.00	43800.00
6	+5	+4800.00	43800.00	49600.00
7	+10	+9600.00	43800.00	53400.00
8	+15	+14400.00	43800.00	58200.00
9	+25	+24000.00	43800.00	67800.00
10	+25	+24000.00	43800.00	67800.00

Table 5. Increase in number of animals from 5 to 10 years

Year	No. Milk animal	Milk animal raised	Additional income in Rs.	Area brought under organic farming in ha.
1st year	4	-	-	1.00
2nd year	4	-	-	1.00
3rd year	4	-	-	1.00
4th year	6	2	50000	1.50
5th year	6	-	-	1.50
6th year	6	-	-	1.50
7th year	9	3	75000	2.00
8th year	9	-	-	2.00
9th year	9	-	-	2.00
10th year	13	4	100000	3.00
Total :-	13	9	225000	3.00

Table 6. Interest free loan for purchase of milk animal are provided,then)
(Yeild reduction and return in organic farming over 10 years period)

Year of organic	Yield (%)	Value of reduced yield (in Rs.)	Additional income from milk and cow dung (in Rs.)	Gain (in Rs.)	Repayment Of interest free loan (In Rs.)
1	- 40	-38400.00	43800.00	5400.00	Nil
2	-30	-28800.00	43800.00	15000.00	Nil
3	-20	-19200.00	43800.00	24600.00	Nil
4	-10	-9600.00	43800.00	34200.00	Nil
5	Nil	-	43800.00	43800.00	25000.00
6	+5	+4800.00	43800.00	49600.00	25000.00
7	+10	+9600.00	43800.00	53400.00	25000.00
8	+15	+14400.00	43800.00	58200.00	25000.00
9	+25	+24000.00	43800.00	67800.00	Nil
10	+25	+24000.00	43800.00	67800.00	Nil
Total					100000.00

As is evident from Table 5 a farmer who receives a subsidy of Rs. 1.00 lakh in the 1st year will be owner of 13 milch animals by the 10th year. With these additional 9 milch animals 2 ha additional land will be brought under organic farming from non organic chemical intensive farming. If this continues then in coming 40-50 years the entire country can be brought under organic farming with residue free food, healthy soil and clean environment.

In an alternative model (Table 6) it is proposed that if a farmer is provided interest free loan of Rs. 1.00 lakh for purchase of 4 milch animals then as per proposed model from 5th year to 8th year at a rate of Rs. 25,000/- year he will repay the entire loan amount to the Bank. After that he will continue to get additional income.

Now the question will arise that, for 1% cropped area (14th lakh ha) out of 14 crore cropped area of the country, if four milch animals/ha are to be provided then from where such a large number of animals i.e. 56 lakh will be managed to implement the proposed model. Not only this, many other question will be raised such as, whether the Govt. of India will be able to earmark a budget of Rs. 14000 crores or farmers will accept the model or what will be the scenario if milk supply is increased. Here for this sustainable agriculture model, we only would like to mention that during past 10 years Govt. of India had spent Rs. 4,18,220 crore on fertilizer subsidy (Table 1) and additional 70,000 crores on waving of the loan amount taken by the farmers but in spite of all this, there has been an increase of only 311 kg/ha in food grain yield over this period. If the calculation of this increase is yield is worked out further then it will come to barely 31 kg per ha/year which itself rings the danger bell for food security.

As per proposed model of sustainable agriculture for 14 lakh ha land support of Rs. 14,000 crores for 56 lakh improved breed of milch cattle to the farmers can eliminate the need for fertilizer subsidy forever for that land and can ensure food security and environmental safely.

If the Govt decides to test the validity of this sustainable model, then such models can be run in each state in a cluster of 100 ha for 5 years (the mark of yield to level-up). After this for implementation of this sustainable model subsidy provision as indicated in the model be made. This model can also be tested over a small unit of 100 ha in an

area where farmers are using 1ton of chemical fertilizer per ha per year and claim subsidy of more then Rs. 50,000 on fertilizer. Large numbers of civil society organizations including our institution “SOAM (Society of Organic Agriculture Movement)” can offer its services.

Table 7. Status of cereal production in some countries
Area(A) -1000 ha Production (P) -1000 MTYield (Y)-Kg/hac.

Countries	Population (x100000)	YEAR 1994-96			YEAR 2006			Yield increased/ decreased Kg/ha	Availability/ capita/day (In gm)
		A	P	Y	A	P	Y		
Bangladesh	16,22.2	10770	27883	2588	11799	44790	3796	(+)1208	756
Brazil	19,24.02	19099	46818	2451	18424	59159	3210	(+)753	1027
China	1,33,55.3	90106	422930	4693	83725	444055	5303	(+)610	890
India	**1,17,63.6**	**99978**	**213568**	**2136**	**99006**	**242887**	**2453**	**(+)311**	**564**
Japan	12,75.30	2340	14526	6208	2006	11742	5853	(-)345	252
Pakistan	16,85.94	12269	24256	1977	12897	32864	2548	(+)571	534
Russia	14,19.27	51065	69380	1359	40574	76866	1894	(+)535	1482
South Africa	49,32.05	5652	12388	2191	3011	9454	3140	(+)943	5626
America	30,85.74	62862	323073	5440	52875	338513	6402	(+)962	2989

Source: 1, Statistics Division FAO 2009 (Area harvested, production and yield), 2. List of countries by population-Wikipedia-The Free Encyclopedia)