MODERN CONCEPTS of AGRICULTURE

Organic Farming

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(9-07- 2007)

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Keywords
Organic management practice, Organic standard, organic market network, organically produced agricultural products, organic production, Soil health

Historical Background

Before 19th century most food in the world was organically produced using organic manures and human and animal power (horses in US and oxen in Asia) (White, 1970). The agricultural revolution in England began in the early 19th century when 'Jethro Tull' invented a horse drawn hoe and a seed drill with tines at right distance to sow the row crops. By middle of the 19th century manufacture of super phosphate fertilizer started in England. The first tractor with an internal combustion engine was therefore developed in US in 1910 (Rasmussen, 1973). Near about the same period the German Chemist Fritz Haber developed the process of ammonia synthesis (Prasad, 2003) which led to the manufacture of nitrogen fertilizer in US (Collings, 1955). Fertilizer N was needed in large amounts to benefit from the discovery of high yielding hybrid corn (maize). Insecticidal property of DDT was discovered in 1939 by P. Muller in Switzerland and was followed by the discovery of BHC in France and BHC in UK (Brown, 1951). Nitrophenols were the first group of selective herbicides developed in 1933 and were followed by the development of 2,4-D and MCPA in 1940's (Rao, 1983). Thus by the middle of 20th century most of the components of the modern agriculture i.e. tractors and associated farm machines, fertilizer and agrochemicals were in the use on the agricultural farms in the developed world (Prasad, 2005).

Modern agriculture has been of great help in alleviating hunger from the world, because the world population more than doubled itself during the last half of the 20th century (Lal, 2000). However, even now globally almost 800 million people still go hungry. Famines and scarcities have been known in India from the earliest times (Randhawa, 1983; Swaminathan, 1996). This was all in the era of organic agriculture. As a contrast, there was no scarcity of food after the severe droughts of 1972 and 1987 (FAI, 2004) due to modern agriculture. India's own achievements in agricultural production after the Green Revolution that set in 1967-68 has been exemplary and mainly due to increased use of the components of modern agriculture, namely, fertilizer, pesticides and farm machinery. Food grain production in India itself more than doubled during the post Green Revolution period with virtually no increase in net cultivated area; it increased from 95 million tonnes in 1967-68 to 209 million tonnes in 1999-00 from the same net area (140±1 million ha) (FAI, 2004). Nevertheless over-use of pesticides especially in vegetables and fruits resulted in residues much above the safety levels (Carson, 1963; HAU, 2003) (Table 1) and this brought to the attention the ill-effects of modern agriculture.

Table 1: Pesticide residue persistence in agricultural produce and food commodities

Commodity	2001		2002	
	Samples (nos.)	Contamination	Samples (nos.)	Contamination
Vegetables* (17 crops)	712	61 (12% above MRL[#])	529	63.5 (8.5% above MRL)
Fruits** (12 crops)	387	53 (Less than MRL)	329	47 (approaches MRL)

* At Hisar all contaminated – 46% above MRL, Heptachlor and Cypermethrin
** Fields in Faridabad – Vegetables, fruits, and flowers highly contaminated
[#] Maximum residue limit (MRL)

Source: CCS Haryana Agricultural University (2003)

The Indian data on pesticide residues are shocking because pesticide consumption in India is only 480 g ha^{-1} as compared to over 10 kg ha^{-1} in Japan (Marwaha, 2005) (Table 2).

Table 2: Average consumption of pesticides in different countries

Country	Consumption (g ha^{-1})
Japan	10,770
Europe	2,500
USA	4,000
India	480

Source: Indian Journal of Fertilizers (2005)

Soon the ill effects of over- use of fertilizer nitrogen were recognized. These were nitrate enrichment of ground waters, river waters and estuaries and release of ammonia and nitrous oxide to the atmosphere, the former added to the problem of acid rain, while the latter led to the reduction of ozone layer (Laegreid *et al*., 1999, Curtzon and Enhalt, 1977). These ill effects of modern agriculture forced people specially in the countries with high income economies (European countries, USA, Canada, Australia etc.) to demand food grown without fertilizer and pesticides and this paved the way for organic farming.

Modern Organic Farming

The roots of organic farming can be traced to the Europe back to the first quarter of the early 20th century (Stockdale *et al*., 2001). In 1924, the Austrian philosopher Dr. Rudolf Steiner conceptualized and advocated organic agriculture and in 1927 a trademark 'Demeter; was introduced for organic food produced. Soil fertility was maintained through crop rotation and careful management and use of animal manure.

The formation of the International Federation of Organic Agriculture Movements (IFOAM) in 1972 gave an international framework for the discussion and codification of internationally recognized principles of organic farming. Some of these are:

1. To produce food of high quality in sufficient quantity.
2. To interact in a constructive and life-enhancing way with natural systems and cycles.
3. To consider the wider social and ecological impact of the organic production and processing systems.
4. To encourage and enhance biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals.
5. To maintain and increase the long-term fertility of soils.
6. To maintain the genetic diversity of the production system and its surroundings, including the protection of wildlife habitats.
7. To promote the healthy use and proper care of water, water resources and all life therein.
8. To use, as far as possible, renewable resources in locally organized production systems.
9. To give all livestock conditions of life with due consideration for the basic aspects of their innate behaviour.

10. To minimize all forms of pollution.
11. To allow every one involved in organic production and processing a quality of life which meets their basic needs and allows an adequate return and satisfaction from their work, including a safe working environment.
12. To progress towards an entire production, processing, and distribution chain which is both socially just and ecologically responsible.

A large number of terms are used as an alternative to organic farming. These are: biological agriculture, ecological agriculture, bio-dynamic, organic-biological agriculture and natural agriculture. According to the National Organic Standards Board of the US Department of Agriculture (USDA) the word 'Organic' has the following official definition (Lieberhardt, 2003): *"An ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on the minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony."*

According to Codex Alimenarius (FAO, 2001) organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people (Scialabba and Hattam, FAO, 2002). The management practices of organic farming are given in Block 1 (Scialabba, 1998).

What needs to be emphasized is that in the production and marketing of the organically produced agricultural products the check is on the process of its production rather than on the product per se although quality standards have to be met. On the contrary in the production and marketing of most industrial products the check is on the quality of the product. This would explain why the check on the organically produced food is so difficult.

Opportunities

Organically produced agricultural products have received global attention in the last four years especially due to their being a multi billion trade. Data on organic food markets in 2000 are given in Table 3.

Table 3: Organic food markets in the world in 2000 AD

Country	Million US $	% of total for sale	Expected growth (% y^{-1})
Australia	200-225	1.8-2.0	10-15
Denmark	350-375	2.5-3.0	10-15
France	800-850	0.8-1.0	10-15
Switzerland	450-475	2.0-2.5	10-15
Germany	2100-2200	1.6-1.8	10-15
Japan	2000-2500	-	-
UK	1100-1200	1.0-2.5	15-20
USA	7500-8000	1.5-2.0	20

Source: Better Crops (2003)

Block 1

Organic management practices

Soil management practices include increasing humus content and biological activity as well as meeting mineral deficiency of soils:

- Manipulation of crop rotations and strip-cropping: deep and shallow rooted plants bring different nutrients to the surface; different crops require different nutrients
- Growing green manure
- Undersowing
- Application of rock dust, crop and agro-industry residues, household waste, compost
- Soil tillage, such as use of an implement which aerates the soil.

***Pest management practices*:**

- Manipulation of crop rotations, to minimize survival of crop-specific pests (in the form of, e.g. insect eggs, fungi) which can infest the next crop
- Strip cropping, to moderate spreading of pests over large areas
- Manipulation of pH-level or moisture level of the soil (in irrigated areas)
- Manipulation of planting dates, to plant at a time most optimal for the crop, or least beneficial for the pest
- Adjustment of seeding rates, to achieve an optimal rate given the need to crowd out weeds or avoid insects
- Use of appropriate plant varieties and livestock breeds for local conditions
- Implementation of stock culling programmes, which emphasize genetic resistance against certain diseases
- Use of stock burying programmes, which minimize the import of diseases onto the farm
- Limiting field size, which aids in weed management by livestock
- Biological control methods, to encourage natural enemies of pests by providing habitat (e.g. hedges) or by breeding and releasing them in areas where they are required
- Trapping insects, possibly with the use of lures such as pheromones
- Biological pesticides (e.g. derris dust, pyrethrum, rotenone) of which the active ingredient is short-lasting, and which may be produced locally.

Post-harvest practices

- In temperate countries, grains can be well conserved when harvested and stocked in conditions which allow air circulation (in jute sacs, ventilated silos, etc.)
- In tropical countries, humidity and high temperatures pose problems which can be overcome through harvesting at complete maturity and during dry weather; storing without stripping off the bark;drying of grains under the sun before storing; mixing sand, china-clay, or wood ash to grains; adding little quantities of nut oil to niebe grains (very effective on weevil); addition of smoke or certain plants to repel insects; etc.
- In ancient Europe and the Mediterranean basin, grains were stored in buried pits for several years; the anaerobic conditions of these pits prevented insect proliferation and the grains underwent an initial fermentation which protected it from insects and mouldiness, despite the high degree of humidity.
- Traditional procedures allow conservation and enhancement of the nutritional value of cereals and legumes, such as fomenting rice (rice is bathed, steamed and dried) destroys insect eggs; transforming wheat in bourghoul (wheat is germinated, boiled, dried and crushed) enriches the cereal with vitamins and essential amino-acids (lysine) and pre-digest starch; fermenting certain legumes (for example, soy in the Far East and nere in Africa) gives high nutritional quality products which can be conserved for years; fermented fish sauce (nuoc-nam) allows simple fish conservation and offers an alternative to fish drying, especially that the latter entails inevitable losses in tropical conditions.

Source: FAO's technical contribution of IFOAM's Scientific Conference (1998)

The global market for organically produced foods in 2005 was estimated at US $ 31 billion (Rs.14,300 crores) (Bhattacharya and Gehlot, 2003) and is likely to increase to US $102 billion by 2020. According to a global survey conducted by Ockologie & Landbau (SOUL) (Formation of Ecology and Agriculture) of Germany, organic food in 2003 was produced on only 5% of the world cultivated area (Table 4). Austria had the highest percentage of its cultivated area under organic farming followed by Switzerland, Italy, Finland, Denmark, Sweden and Czech Republic. India had the least percentage of cultivated area under organic farming. There is thus considerable scope to increase the area under organic farming in India. Further, since India's share in global market for organic food is currently less than 1%, there is tremendous opportunity to increase it.

Table 4: Area under organic farming in relation to GDP and share of agriculture GDP

Country	Arable land (10^6 ha) [1]	Area under organic Farming		GDP in 2003 (10^9 Dollars)	Share of agriculture in GDP[2]
		% of avail. Land[2]	10^3 ha		
High Income Economies					
Austria	1.39	11.30	15.7	251	2
Switzerland	0.41	9.70	4.0	309	NA
Italy	8.29	7.94	65.8	1466	3
Finland	2.20	6.60	14.5	161	3
Denmark	2.28	6.51	14.8	212	3
Sweden	2.68	6.30	16.9	301	2
U. K.	5.75	3.96	22.8	1795	1
Germany	11.79	3.70	43.6	2401	1
Norway	0.87	2.62	2.3	221	2
Australia	48.30	2.31	111.6	518	4
Netherlands	0.92	1.94	1.8	511	3
Spain	13.74	1.66	22.8	836	3
Belgium	0.82	1.61	1.3	302	1
France	18.45	1.40	25.8	1748	3
USA	176.02	0.23	40.5	10882	2
Japan	4.42	0.10	0.4	4326	3
Upper Middle Income Economies					
Argentina	33.70	1.89	63.7	13.0	11
Hungary	4.61	1.80	8.3	8.3	4
Chile	1.98	1.50	3.0	72	9
Middle Income Economies					
China	142.6	0.06	8.5	1410	15
Low Income Economies					
India	161.7	0.03	4.8	599	23

[1]Yr. 2002, [2]yr 2003

Source: Fertilizer News (2004) and Fertilizer Statistics 2003-04 (2004)

Indian Scenario

Organic farming has received considerable attention in India and Ministry of Agriculture and Cooperation, Govt. of India constituted a Task Force on Organic Farming under the chairmanship of Dr. Kunwarji Bhai Yadav, ex-Director of Agriculture, Gujarat in 2000. The Committee in its report emphasized on the need for consolidating the information on organic farming and its benefits. One of the steering committees constituted by this Task Force under the Chairmanship of Dr. M.S. Swaminathan, Chairman, Farmer's Commission has suggested taking up organic farming as a challenging national task and to take up this as a thrust area of the 10^{th} Five Year Plan. The steering committee advocated giving boost to organic farming in the rainfed areas and in the north-eastern states where there is limited use of agricultural chemicals. Madhya Pradesh took early lead in this regard and Uttaranchal and Sikkim followed the suit and these states have declared themselves as organic states (Marwaha and Jat, 2004). The Ministry of Commerce launched the National Organic Programme in April 2000 and Agricultural and Processed Food Products Exports (APEDA) is implementing the National Programme of Organic Production (NPOP) (Gouri, 2004). Under the NPOP, documents like National Standards, accreditation criteria for accrediting inspection and certification agencies, have been prepared and approved by the National Steering Committee.

It is estimated that there is around 76,000 ha of certified organic food production at the farm level and 2.4 million ha of certified forest area for collection of wild herbs in India (Bhattacharya and Chakraborty, 2005), but the actual area under organics is much more. In Maharashtra alone about 0.5 million ha area is under organic farming since 2003, out of this only 10,000 ha is the certified area. In Nagaland, 3,000 ha is under organic farming with crops like maize, soybean, ginger, large cardamom, passion fruit and chilli. The state of Rajasthan has 5,631 ha under organic farming with crops like pearlmillet, wheat, mungbean, guar, mustard and cotton.

Strategies

For promotion of organic farming identification of potential areas and crop is crucial. As regards crops, the Government of India's priority is for fruits, vegetables, spices, medicinal plants, oilseeds, pulses, cotton, wheat and basmati rice. As far as potential areas are concerned three priority zones have been identified:

Category I: Areas where fertilizers and other agrochemicals consumption is very low. These areas are in Assam and other north-eastern states, Jharkhand, Orissa, J & K, Himachal Pradesh, Karnataka, Madhya Pradesh, Chhatisgarh and Rajasthan.

Category II: Areas under rainfed farming.

Category III: Areas with irrigation and heavy use of fertilizers and other agrochemicals.

The appropriate strategy will be to promote organic agriculture in the areas under category I and II.

Constraints

Most farmers in category I and II areas as outlined above have small holdings and are poor. These have very little credit facilities in the region and the farmers cannot afford or find all the necessary inputs to get high yields. They are also not directly connected to markets to buy or sell food. The problem is acute in hill regions of north and north-east India. On the other hand, large

land holders have the resources to purchase the inputs and use them more efficiently. They also have direct access to the markets. Since organic farming's main attraction is export, big farmers can compete better when the international trade brings down prices even in local markets. Small farmers are less able to compete and in some cases even to survive. How small farmers' interest can be safeguarded in organic farming is an issue to be carefully tackled. Also before producing marketable products an organic farm has to have a transition period of 1 to 3 years depending upon the certifying agency's requirements and during this period the farmers have to grow the crops as per standards set for organic farming and thus produce about 3/4th of the normal yield. Yet they have to market the produce in the open general market. Small and marginal farmers can hardly afford to do so.

The most important constraints in the success of organic farming are:

1. Lack of credit at low interest rates
2. Absence of crop insurance
3. Lack of market infrastructure
4. Lack of cold storage facilities (very important for fruits and vegetables).

Maintaining Soil Fertility

Soil fertility is the cornerstone of organic farming. Organic farmers depend on multiple cropping systems and crop rotations, cover crops, organic manures and minimum tillage to maintain and improve soil fertility.

Plants obtain their nutrients from the soils in ionic forms (Table 5), irrespective of the source (organic or fertilizer) and for each tones of grain or any other economic produce a certain amount of each essential plant nutrient is removed (Tables 6 and 7).

Table 5: Ionic forms in which different plant nutrients are taken up by plants

Nutrient	Ionic form
Nitrogen	NH_4^+ NO_3^-
Phosphorus	$H_2PO_4^-$, $HPO_4^=$
Potassium	K^+
Calcium	Ca^{++}
Magnesium	Mg^{++}
Sulphur	$SO_4^=$
Iron	Fe^{++}
Manganese	Mn^{++}
Zinc	Zn^{++}
Copper	Cu^{++}
Boron	BO_3^{+++}
Molybdenum	$MoO_4^=$
Chlorine	Cl^-

Source: Soil Fertility Management for Sustainable Agriculture (1997)

Table 6: Removal of NPK (kg) for each tonne of grain by different crops

Crop	N	P_2O_5	K_2O	Total
Rice	20.4	8.2	24.5	53.1
Wheat	22.6	8.7	33.8	65.1
Maize	24.3	14.6	22.0	60.9
Sorghum	26.1	10.3	25.8	62.1
Pearlmillet	27.1	18.8	47.6	93.5
Chickpea	50.6	19.7	35.8	106.1
Pigeonpea	92.1	18.8	36.8	147.7
Rapeseed-mustard	50.1	18.7	70.9	139.7

Source: Fertilizer News (2004)

Table 7: Micronutrient removal (g) per tonne of dry matter (grain + straw) in some crops

Crop	Fe	Mn	B	Zn	Cu	Mo
Rice[1]	428	167	-	68	26	-
Wheat	232	26	18	21	8	0.87
Sorghum	360	27	27	36	3	0.98
Pearlmillet	264	23	27	22	9	0.80
Potato	160	12	50	9	9	0.80
Cotton	106	14	15	16	8	0.77

[1]Archieves of Agronomy and Soil Science (2005)

Source: Students Guide to Fertilizers and their efficient use in India (2003)

The native availability of these essential plant nutrients is limited and additional amount of nutrient must come from organic manures or chemical fertilizers. The advantage with chemical fertilizers is that bulk of the nutrients contained in them is released immediately after application and if their time of application is synchronized with plant growth, maximum benefits from them can be obtained. However, in organic farming the use of chemical fertilizers is not allowed and the additional nutrient demand of crop plants has to be met with organic manures which are not only low in essential plant nutrients (Tables 8 and 9) but also release them slowly. This makes the synchronization of nutrient release from organic manures and their uptake by crop plants a difficult task. Thus supply of plant nutrients through organic manures requires much more skill on the part of the farmers.

Table 8: Average nutrient content of vermicompost and other composts

Compost	Nutrient content (% of dry matter)		
	N	P_2O_5	K_2O
Vermicompost	1.6	2.2	0.7
Rural compost	1.2	1.1	1.5
Urban compost	1.2	1.9	1.5
Paddy straw compost	0.9	2.1	0.9
Maize stalk compost	1.1	1.3	1.0
Cotton wastes compost	1.6	1.1	1.5
Water hyacinth	2.0	1.0	2.3
Poultry manure	2.9	2.9	2.4
Castor	5.8	1.8	1.0
Cotton seed	3.9	1.8	1.6
Neem	5.2	1.0	1.4
Niger	4.8	1.8	1.3
Rapeseed	5.1	1.8	1.0
Linseed	5.5	1.4	1.2
Sunflower	4.8	1.4	1.2

Source: Fertilizer News (2004)

Table 9: Average secondary and micro-nutrient contents of vermicompost and FYM

Nutrients	Vermicompost	FYM
Ca (%)	0.44	0.91
Mg (%)	0.15	0.91
Fe (ppm)	175.2	146.5
Mn (ppm)	96.51	69.0
Zn (ppm)	24.43	14.5
Cu (ppm)	4.89	2.6

Source: Fertilizer News (2004)

Organic manures do have the advantage of supplying secondary and micronutrient (Table 10) along with NPK and this gives them an upper hand and makes them more suitable for sustained production. Also, organic manures increase biological activity in soil by providing support for earthworms, micro-organisms, fungi and bacteria and this not only helps in nutrient cycling and increasing agricultural productivity but also stabilizes soils against erosion and floods, detoxifies ecosystems and may even help counteract climatic change by restoring soil's capacity to carbon sequestration. Legumes are natural fixers of atmospheric N which leave substantial amounts for the succeeding crops occupy a special place in organic farming. They can become an important supplier of N, an element present in very small amounts in organic manures.

Table 10: Potential of organic and biological resources and plant micronutrients

Name of resource	Annual potential Potential dung/ biomass (M t)							Total
		Zn	Fe	Cu	Mn	B	Mo	
Cattle	744.57	89.35	1824.18	10.42	215.92	16.38	14.15	2170.40
Buffalo	258.02	28.38	647.64	4.13	79.99	7.74	5.42	773.30
Goat and sheep	12.23	1.77	39.74	0.26	4.59	0.51	0.31	47.18
Pigs	4.60	0.69	12.26	0.10	4.60	0.26	0.16	18.07
Poultry	3.40	0.54	11.58	0.09	1.32	0.23	0.15	13.91
Other livestock	6.02	0.69	15.74	0.11	1.87	0.14	0.15	18.74
Human beings	30.38	3.65	79.60	1.70	7.93	3.04	0.82	96.74
Crop residues	100.00	3.60	20.30	2.30	8.80	0.21	0.15	35.36
Forest litter	15.00	0.30	1.55	0.18	0.68	0.02	0.01	2.74
Water hyacinth	3.00	0.29	11.69	0.26	0.45	0.15	0.07	12.91
Rural compost	226.00	27.73	12.60	11.30	54.47	10.40	4.75	127.25
Urban compost	6.00	0.69	15.25	0.33	1.54	0.29	0.15	18.25
Sewage sludge	0.30	0.18	2.37	0.08	0.11	0.01	0.01	2.76
Total	1409.51	153.86	2704.54	31.26	382.27	39.38	26.30	3337.61

Source: International Seminar on IPNS for sustainable development (1997)

The total amounts of tappable NPK available from human excreta, cow dung and crop residue are limited to 6.24 million tonnes per annum by 2010 and 7.25 million tonnes by 2020 (Table 11). The amounts of total NPK available from organic sources will increase by 2.3 Mt when the contribution of green manures, legumes in rotation and biofertilizers etc. are added. Thus only a limited area in the country can be brought under organic farming. Also the logic that areas that currently consume low rates of fertilizer may not really hold because those areas are also the ones that have the least availability of crop residues for manurial purpose; most residue is used to feed cattle and other farm animals. Even with these limitations organic farming has a great future in India.

Table 11: Estimated trappable nutrients from different organic sources for agriculture in India

Resources	Year	
	2010	2025
Generators		
Human population (million)	1120	1300
Livestock population (million)	537	596
Resources (considered trappable)		
Human excreta (dry) (million tonnes)	15	17
Livestock dung (dry) (million tonnes)	119	128
Crop residues (million tonnes)	112	162
Nutrient (genetic potential) (Million tonnes $N+P_2O_5+K_2O$)		
Human excreta	2.24	2.60
Livestock dung	7.00	7.54
Crop residues	7.10	20.27
Nutrient (considered trappable)		
Human excreta	1.80	2.10
Livestock dung	2.10	2.26
Crop residues	2.34	3.39
Total	**6.24**	**7.25**

Trappable = 30% of dung, 80% of excreta, 33% of crop residues

Source: Plant needs supply, efficiency and policy issues (1997)

Organic Farming Infrastructure

The four basic requirements of organic farming are:

1. Organic standards
2. Certification/regulatory mechanism
3. Technology packages
4. Market network

The current status on above 4 requirements of organic farming in India is briefly discussed below.

(i). Organic standards: Globally there are about 60 standards for organic foods. Important features of five of these are given in Table 12.

Table 12: Some characteristics of international standards

IFOAM	• Established in 1972 • Headquarter in Germany • Umbrella organization for Organic Agriculture Association Developed international basic standards of organic agriculture • Established IFOAM accreditation programme (1992) to accredit certifying bodies • Set up International Organic Accreditation Service (IOAS) in July 2001
CODEX	• Codex Alimentarious Commission – a joint FAO/WHO intergovernmental body • Established in 1962 • Produced a set of guidelines for organic production
EU regulation	• Laid out a basic regulation for European Union's organic standards in Council regulation NO 2092/91 (June 1991) • Regulations give guidelines for the production of organic crops in the European Community
Demeter	• Demeter International is a world wide net work of 19 international certification bodies in Africa, Australia, Europe • Developed guidelines for biodynamic preparation
JAS	• A set of guidelines 'Japan Agricultural Standards' for organic production

Source: Indian Journal of Fertilizers (2005)

Under NPOP programme the Government of India has developed 'National Standards for Organic Export. The Ministry of Agriculture, GOI has in principle accepted these standards for domestic purpose also. The scopes of these standards are:

(i) Lay down policies for development and certification of organic products.

(ii) Facilitate certification of organic products conforming to the National Programme containing the standards for organic production.

(iii) Institute a logo and prescribe its award by accredited bodies on products qualifying for bearing organic label. A National Steering Committee (NSC) comprising Ministry of Commerce, Ministry of Agriculture, APEDA, Spice Board, Coffee Board, Tea Board and various other Government and private organizations associated with the organic movement in monitoring the overall activities under NPOP has been constituted. NPOP standard has already got equivalency with standard of EU Commission. Efforts for equivalency with US NOP is under process.

(ii) Certification/Regulatory mechanism: At present there are 12 accredited certifying agencies in the country (Table 13). Tentative tariff structure for certification is as below (Bhattacharya and Chakraborty, 2005).

(i) Travel and Inspection : Rs. 12,000-19,000/- per day

(ii) Report preparation : Rs. 5,000/-

(iii) Certification : Rs. 5,000/-

Table 13: List of accredited certifying and inspection agencies in India

S.No.	Name of certifying & inspection agencies	Address
1.	Association for promotion of Organic Farming (APOF)	Alumni Assoc. Building, Bellary Road, Hebbal, Bangalore-560024 Ph. 080-2356060
2.	Indian Society for Certification of Organic Products (ISCOP)	"Rasi Building" 162/163, Ponnaiyaraja-puram Coimbatore Tamil Nadu-641001 Ph.0422-2471181
3.	Indian Organic Certification Agency (INDOCERT)	Thottumugham P.O. Aluva-683105, Cochin, Kerala Ph.0484-2630909
4.	Skal Inspection and Certification Agency	Mahalaxmi Layout, No. 181, 1st Main Road, Bangalore-560086
5.	IMO Control Pvt. Ltd.	26, 17th Main HAL, 2nd 'A' stage Bangalore-560008 Ph. 080-25285883
6.	Ecocert International	54A, Kanchan Nagar, Nakshetrawadi, Aurangabad-413002, Maharashtra Ph. 0240-2376336
7.	Bioinspectra	C/o Indocert, Thottumugham P.O. Aluva-683105, Cochin, Kerala Ph. 0484-2630908
8.	SGS India Pvt. Ltd.	250, Udyog Vihar, Phase IV Gurgaon-122015 Ph. 0124-2399757
9.	LACON	Mithradham, Chunangardi
10.	International Resources for Fair Trade (IRFT)	Sona Udyog Unit No. 7, Parsi Panchayat Road, Andheri (E), Mumbai-400069 Ph. 022-28235246
11.	One Cert Asia	Agrasen Farm Vatika Road Off Ton Rd., Jaipur, Rajasthan
12.	National Organic Certification Association (NOCA)	Pune

Source: Indian Journal of Fertilizers (2005)

(iii). Technology package: Conventional practices can not be followed for growing crops organically. Technology packages for different crops are being prepared but it will take some time because these will differ even for the same crop in different regions of the country.

(iv) Market network: India is in a very nascent stage when it comes to export of organic produce. During 2004-05 the total export was 6,472 tonnes worth Rs 80-90 crores (Tables 14 and 15). However, some agencies have come up for domestic market (Table 16).

Table 14: India organic: An overview (2004-05)

1.	Area under certified	2.5 million ha
2.	Total certified product	115,238 tonne
3.	Total project certified	332
4.	Number of processing units	158
5.	Accredited Inspection and certifying agencies	11
6.	Number of products exported	35
7.	States involved in organic export: (i) Kerala (ii) West Bengal (iii) Karnataka (iv) Tamil Nadu (v) Punjab (vi) Himachal Pradesh (vii) Maharashtra	 1232 tonne 937 tonne 476 tonne 471 tonne 541 tonne 521 tonne 375 tonne
8.	All India total organic export	6472 tonne
9.	Premium collected against organic export	Rs 80-90 crores (tentative)

Source: Indian Journal of Fertilizers (2005)

Table 15: Export of organic produce from India to the EU (2003-04)

Product	Quantity (tonnes)
Tea	1,997
Pineapple	1,320
Spices	625
Honey	526
Rice	432
Sesame	354
Cashew nut	126
Walnut	89
Fruit	46
Cotton	26
Pulses	12
Sugarcane	8

Source: Indian Journal of Fertilizers (2005)

Table 16: Some agencies involved in domestic marketing of organic produce in India

S.No	Name of the organization	Address
1.	NAVDANAYA Trust	A-60, Hauz Khas, New Delhi-110016.
2.	Devine Agro Industries Ltd.	C-9, Anoop Nagar, Uttam Nagar, New Delhi-110059
3.	Devbhoomi	Rajput Road, Dehradun, Uttaranchal
4.	Back to Nature	Near Kanak Cinema, Dehradun, Uttaranchal
5.	Mahrishi Ved Vigyan Vidyapeeth	Dunda (Kunshi), Uttar Kashi
6.	Institute of Rural Development (IIRD)	54A, Kanchan Nagar, Nakshetrawadi, Aurangabad 413002
7.	ISCON Temple	Bangalore
8.	FAB India Overseas Pvt. Ltd.	B-26, Okhla Industries Area, Phase I, New Delhi
9.	ECO-Nut Health Food Shop	J's Heritage Complex, Opp. Milk Union, P.T. Road, Kodai Kanal-624101
10.	Sresta By-products Pvt. Ltd.	203, Pavani Annexes, Road No. 2, Banjara Hills, Hyderabad 500 034, AP
11.	IOCCA	951C, 15th Cross, 8th Main, Ideal Home Township, Raja Rajeswari Nagar, Bangalore-560 098
12.	D.R. Agro Organic AS	01,, Sai Nagar, Ratnagiri, Kapadganj-387620, Gujarat
13.	Sunstar Overseas Ltd.	40 K.M. Stone, G.T. Karnal Road, Bahalgarh, Sonepat, Haryana
14.	IITC Organic India Ltd.	A-306, Indira Nagar, Lucknow-227 105

Source: Bhattacharya and Chakraborty (2005)

In the early days of global organic industry, the production problems of farmers were emphasized and research topics often concentrated on soil fertility, pests and diseases. More recently as the industry matured and international trade of organic products grew, the importance of market related issues has come to the fore. On the one hand, the need for harmonization of standards and acceptance of equivalence of market development – which would facilitate international trade is recognized, while on the other hand, a more serious push towards domestic consumption seems afoot in several developed countries, which would give advantage to domestic farmers but would disadvantage producers in exporting countries (Wynen, 2003).

Since the organic farming has just started in India, we need to address the production as well as marketing problems simultaneously. Also India's domestic market is quite big and if genuineness and quality is guaranteed there is no dearth of buyers; the demand for organic foods in the metros (Delhi, Calcutta, Mumbai, Chennai, Bangalore, Hyderabad) is on the increase.

Epilogue

Although the ardent supporters of organic farming (Parchure, 2006) maintain that it can produce all that is needed by India, organic farming is not to be taken as an alternative to modern

agriculture (Chhonkar and Dwivedi, 2004; Tiwari *et al*., 2005). In a large part of the country modern agriculture has to continue as at present and even with more input of fertilizers and other agro-chemicals that the country remains self-sufficient in food.

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