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Organic Farming : The Real Green Revolution for Removal Of Poverty, Hunger And Ecological Insecurity

Forum 5: Sustainet - Agriculture as a Global Development Engine

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Introduction

Navdanya is a movement for biodiversity conservation, sustainable agriculture and farmer's rights. "Navdanya" mean nine seeds and has adopted this symbol for our national network of grassroots conservation efforts to protect the rich biodiversity, which is the basis of cultural and material sustenance of the Indian people. Navdanya is working in 10 Indian states, establishing community seed banks and conservation programs. Navdanya sees it's role as a catalyst, creating an ever widening circle of awareness at many levels from the micro to the macro, stepping in to facilitate local groups and communities to take up seed conservation activities and organic agriculture and then stepping out when the local capacities have been built up. Navdanya has been a pioneer organisation in the conservation of agricultural biodiversity and the promotion of sustainable, ecological agriculture. The objective of the conservation programme is to empower local farming communities to protect and regenerate genetic diversity and the knowledge system that support it. Crops such as millets, pseudocereals and pulses have been promoted and saved from being pushed to extinction by expanding monocultures. More than 60,000 farmers are associated with Navdanyas its primary members and they are the backbone of the organisation as far as the conservation activities are concerned. They are promoters and messengers of Navdanya's philosophy and movement in their neighbouring villages, cities and states. Navdanya is also the first initiative in India to have started a direct marketing of organic produce from Navdanya farmer members to Navdanya consumer members wherein more than 2000 members are directly associated. Under the direct producer – consumer marketing, Navdanya is running an outlet for organic foods in Delhi since six years.

Besides conservation activities, the other major part of Navdanya's work is research and advocacy. Navdanya is spreading awareness and education on biodiversity conservation and sustainable agriculture. The Department of Science and Technology, Government of India, supported Navdanya to establish a basic soil ecology laboratory in Dehradun. There Navdanya also runs a training center with boarding and lodging facilities. Navdanya organises training courses on sustainable agriculture, especially chemical free organic farming for farmers, students, teachers, representatives of NGOs and Government officials. More then200,000 farmers were trained.

Navdanya works from the micro to the macro level. At the field level Navdanya works with farmers and communities, for producers and consumers. They also work with farmer organisations, environmental groups and women groups. Navdanya serves as the Secretariat for the national organic movement ARISE.. At international level Navdanya works together with IFOAM (International Federation of Organic Agriculture Movement) and the Slow Food Movement.

Organic Farming and MDG Goals

MDG Goal No. 1 aims at reducing hunger and poverty by half by 2015. Organic agriculture is the most reliable strategy for reduction of hunger and poverty because it reduces costs and inputs while increasing comes and outputs. Organic agriculture also contributes to reversing the loss of the world's environmental resources and improving people's access to safe drinking water by conserving biodiversity and water by conserving biodiversity and water, and producing safe and clean water as an output of ecological agriculture. Organic farming also contributes to Millennium Development Goals 4 and 5, of reducing child mortality and improving maternal health. Malnutrition is the most significant cause of health problems faced by children and women. Organic farming contributes to removing malnutrition by producing more biodiverse, more nutritious, higher quality food. And organic farming promotes MDG Goal 3 on

gender equality and empowerment of women because women play a key role in biodiverse organic farmers but are displaced from their creative and productive roles in organic farming. If the world community made a decade commitment to move to organic farming, the MDG goals could be easily met. Organic Farming is ecologically productive and financially viable. Productivity is output per unit input. In farming systems outputs are diverse and inputs are natural resources like land, biodiversity and water, human labour, energy, and in the case of chemical farming, external inputs like synthetic pesticides and fertilizers. If all outputs and all inputs are taken into account, internal input biodiverse organic farming has higher productivity that external input chemical agriculture. When all the energy and chemical inputs are taken into account, the productivity of industrial agriculture is actually negative. More resources are used as inputs than are produced as outputs. Usually labour productivity is of labour displacing machinery and chemicals are therefore, by definition, increasing “productivity”. However, labour is not the scarce input. Land and water are. If instead of labour, energy and natural resources and external inputs are taken into account, industrial agriculture does not have higher productivity compared to ecological alternatives. The shift from internal input to high external input agriculture reduces productivity from 20 to 0.33m, a sixty six fold decrease in the productivity ratio over the last fifty years.

We need to make an ecological transition to produce more food using less resources.

This productivity analysis is based on a study comparing traditional polycultures with industrial monocultures shows that a polyculture system can produce 100 units of food from 5 units of inputs whereas an industrial system requires 300 units of inputs to produce the same 100 units. The 295 units of wasted inputs could have provided 5900 units of food.

Total Output Vs Yield

'Yield' means the production per unit area of a single crop and thus hides the productivity biodiverse of organic farms, whose 'yields' are obviously low as they have less space to plat the single crop than large farms. It also hides the inefficiencies of a monoculture industrial farm – the bare ground between crops, where 'weeds' grow and have to be removed using toxic herbicides forcing the farmer to invest in or capital.

Organic farms, in the Third World, based on biodiversity fill the empty space with other crops, tend to combine or rotate crops and livestock, with manure serving to replenish soil fertility.

Such biodiverse integrated organic farming systems may produce less 'yield' of a one particular crop, but the total output per unit area (comprising the sum of everything the farmer produces – various crops and animal products) can be far higher.

Data shows that small farms almost always produce far more agricultural output per unit area than large farms everywhere in the world.

The Myth Of Low Yield Of Organic Farming

Studies have shown that the common organic agricultural combination of lower input costs and favourable price premiums can offset and make organic farms equally or often more profitable than conventional farms. Hundreds of farmers in Andhra Pradesh who grew cottonseeds supplied by multinational companies, applying chemical fertilizers and pesticides, committed suicide because they could not control the pests. At the same time ***Tamilnadu farmers practising organic methods were able to get cotton yield of more than 15 quintals an***

acre (The Hindu, 2004). The studies showed that ***the average yield of sugarcane is 40 tonnes an acre in chemical farms as compared to 60-70 tonnes an acre in organic farms in the Erode District of Andhra Pradesh ((The Hindu, 2004).*** Like wise other crops also record higher yields inorganic farming as compared to chemical farming.

A number of research studies have shown that organic farming ensures better yield and fetches more income. ***For instance, in 1998, a paper, "The Greening of the Green Revolution" (David Tilman, Nature 396), showed that not only were the yields of organic maize as high as those of maize grown with fertilizers and pesticides, but also the soil*** quality in the organic fields improved dramatically.

Field trials in Hertfordshire (United Kingdom) reported consistently higher yields in the case of wheat grown with manure than wheat grown with artificial nutrients.

Prof. Jules Pretty of Essex University ("Feeding the World", *SPLICE - a genetic research magazine*, Volume 4, 1998) has shown how farmers in India, Kenya, Brazil, Guatemala and Honduras have doubled or tripled yields by switching to organic or semi-organic techniques.

Cuba, forced into organic farming by the economic blockade, has now adopted it as policy, having discovered that it improves both productivity and the quality of the crops ("Castro Topples Pesticides in Cuba", Renee Kjartan, *Washington Free Press*, August 2000).

Table 13.7 Summary of scale and impacts of certified and non-certified organic projects and initiatives

	Country	*Project*	*Number of farm households*	*Area under organic agriculture (ha)*	*Changes in productivity*
1.	Bolivia	Prodinpo integrated development programme	2000	1000	Potato yields from 4 to 10-15 t/ha
2.	Brazil	AS-PTA alternative agriculture	15000	60000	Bean yields up 50-100%
3.	Brazil	Agroecology in Zona da Mata	215	50	Coffee - nd
4.	Cameroon	Macefcoop organic coffee	600	300	Coffee - nd
5.	Chile	CET organic vegetable gardens	10	5	Vegetables, 20-30 kg per month
6.	Cuba	Organic urban gardens	26000	8000	Total production up from 4000 to 700000 t/yr
7.	Dominican Republic	Plan Sierra soil conservation	2000	1000	Maize - nd
8.	Egypt	SEKEM biodynamic cotton	150	2000	Cotton from 2.25 to 3.0/t ha
9.	Ethiopia	FAO Freedom Hunger	2300	2150	Sweet potato yields up from 6 to 30 t/ha
10.	Ethiopia	Cheha integrated rural development	12500	5000	Cereal yields up 60%
11.	Guatemala	San Jose Poacil ADECCA	1450	1260	Mixed crops - nd
12.	India	SPEECH, Tamil Nadu	500	409	New rice crop in dry season
13.	Kenya	Manor House Agriculture Centre	70000	7000	Maize yields from 2.25 to 9 t/ha; new vegetable crops
14.	Kenya	C-MAD programme	500	1000	Maize from 2 t/ha to 4 t/ha
15.	Kenya	Mumias Education for Empowerment project	2069	217	Beans/groundnut yields from 300 to 600 kg/ha
16.	Kenya	Push-pull pest management	300	150	Maize yields up 60%
17.	Lesotho	Machobane farming systems	2000	1000	Whole system productivity improved
18.	Malawi	Small-scale aquaculture	200	10	New fish crops
19.	Mexico	ISMAM organic coffee	1200	1000	Coffee - nd
20.	Mexico	UCIRI fair trade and organic coffee	4800	5000	Coffee yields from 300-600 kg/ha to 601-1200 kg/ha
21.	Nepal	Community welfare and development	600	250	Maize and rice yields up citrus up from 1.2 to 1.6 t/ha
22.	Nepal	Jajarkot permaculture Programme	580	350	Maize and rice yields up (nd), new vegetable crops
23.	Pakistan	Sindh Rural Women's Uplift Group	5000	2500	Mango yields from 7.5 to 22.5 t/ha; citrus up from 12 to 30 t/ha
24.	Senegal	Rodale Regenerative Agriculture Research Centre	2000	2000	Millet/sorghum yields from 0.34 to 0.6-1.0 t/ha
25.	Senegal	ENDA organic cotton	523	233	Cotton yields - no change at 300 kg/ha
26.	Tanzania	GTZ organic cotton	134	778	Cotton yields - no change at 300 kg/ha
27.	Zimbabwe	Chivi Food Security Project	500	600	Sorghum/millet yields doubled; new vegetable crops
28.	Zimbabwe	Silveira House	1211	735	New vegetable crops
29.	Zimbabwe	Zambezi Valley organic cotton	400	2000	Cotton - nd
		Total	154742	106 197	

(nd = no confirmed data on yields)

Mr. Balbeer Singh, a Navdanya member in Utircha who was amongst the first farmer converted to organic reduced the inputs in his field as given in the table below :

Year	**Urea / Bigha**	**DAP / Bigha**	**Potash / Bigha**	**Cow Dung Manure/Bigha**
1994 – 1995	10 kg (100%)	10 kg (100%)	2 kg (100%)	2 qt (20%)
1995 – 1996	8 kg (80%)	8 kg (80%)	20%	3 qt (30%)
1996 - 1997	4 kg (40%)	4 kg (40%)	Nil	20 qt (100%)
1997 - 1998	Nil	Nil	Nil	40 qt (200%)
1998 – 1999	Nil	Nil	Nil	20 Qt (100%)

(Source Balbeer Singh, Village Utircha and Navdanya Records)

In addition to above-mentioned fertilizers, weedicides and pesticides were also used, of which he was not able to tell the names. But cost of these chemicals was around Rs. 100 / bigha, which he stopped from the first year itself.

Yield analysis of the field of Mr. Balbeer Singh shows that there was a sharp decline in the yield for two years initially, but from the third year onwards the yield was at part with that of conventional farming. Cost of production also reduced slowly because of reduction in the external inputs. Initially labour was much more than today. Now they are also able to take pulses in the field of paddy. He also added that the yield of black gram went down with the increase in the chemical outputs. Slowly soil started responding and we got the good yield of black gram.

Mr. Balbeer Singh also told that we knew that the chemicals are harmful for human beings, animals and environment, and hybrid seeds do not perform well if conserved for seeds. They actually make you dependent on market. Navdanya did a fabulous job of bringing people out from the vicious cycle of market dependent agriculture. Yield analysis of his one bigha field was done continuously during his conversion period. Following table shows that how Mr. Balbeer Singh reduced the inputs, saved the money and got better yield, which is now stable. He has more diversity in the field as well as on the food.

Year	Wheat Yield / Bigha	Cost of Agrochemicals	Rice Yield / Bigha
1994 – 1995	1.60 qt.	100	1.8
1995 – 1996	1.08	68	0.90
1996 – 1997	0.98	32	0.92
1997 – 1998	1.8	Nil	2.00
1998 – 1999	2.2	Nil	2.50
2004 – 2005	2.5	Nil	3.0

(Source : Balbeer Singh, Village Utircha, and Navdanya Records)

The organic project in Madhya Pradesh has also led to increased yields as reported by Dr. G.S. Kaushal, Ex-Director, Agriculture of Madhya Pradesh, who spread organic farming in 21 districts for 11 crops using 12 treatments in the period 2001-2002.

Increase in Yields

2001 – 2002 - **21 districts**

11 Crops

12 treatments

Higher yield in most of the cases under organic farming

PRODUCTIVITY OF VARIOUS CROPS UNDER DIFFERENT ORGANIC TREATMENT BASED ON DATA RECIVED FROM 21 DISTRICTS OF MADHYA PRADESH

UNIT IN QUINTAL/HECT

S. No	Crops	Bhaboot Amrit Pani		AMRIT Sanjivani		Matka Khad		Cow dung urine	
		Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated
1	Soybean	10.22	9.57	13.36	11.16	11.79	11.28	9.64	8.07
2	Paddy	24.00	19.04	27.35	22.52	21.36	18.49	11.53	10.81
3	Maize	7.00	6.00	25.27	23.83	21.46	18.99	35.09	24.27
4	Groundnut	-	-	5.00	4.50	9.73	8.00	-	-
5	Sourgham	7.00	6.00	20.00	18.00	20.00	17.00	-	-
6	Moong	-	-	4.80	4.00	6.20	5.60	1.20	0.80
7	Urad	-	-	-	-	15.28	7.55	8.06	5.96
8	Bajra	-	-	-	-	8.27	5.87	-	-
9	Banana	-	-	-	-	-	-	-	-
10	Chilly	-	-	-	-	-	-	-	-
11	Cotton	11.78	10.86	10.78	9.07	11.19	9.83	14.52	14.52

UNIT IN QUINTAL/HECT

S. No	Crops	Naadep Phospho Compost		Nadap Khad		Culture		Blue Algae	
		Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated
1	Soybean	10.55	9.55	11.52	9.31	11.33	9.68	-	-
2	Paddy	36.40	31.10	27.39	24.83	21.32	26.27	30.08	24.73
3	Maize	38.00	37.00	19.52	17.12	13.66	11.48	-	-
4	Groundnut	5.00	4.00	9.87	9.60	11.14	9.85	-	-
5	Sourgham	11.00	9.60	20.40	19.00	19.05	20.93	-	-
6	Moong	-	-	5.00	4.00	7.40	6.13	-	-
7	Urad	-	-	-	-	7.75	7.02	-	-
8	Bajra	-	-	-	-	-	-	-	-
9	Banana	-	-	-	-	-	-	-	-
10	Chilly	-	-	-	-	-	-	-	
11	Cotton	12.00	11.23	13.34	12.30	11.00	8.08	-	-

UNIT IN QUINTAL/HECT

S. No	Crops	Cowdung Gas Sluree		Green Manuring		Seeng Khad		Amrit Pani	
		Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated
1	Soybean	11.97	10.43	10.34	8.28	9.16	8.30	10.95	9.41
2	Paddy	24.27	21.36	23.36	25.31	-	-	10.80	9.60
3	Maize	22.01	19.61	14.00	12.80	32.62	28.67	20.48	17.38
4	Groundnut	13.40	13.70	5.00	4.50	5.00	4.00	9.30	7.91
5	Sourgham	19.40	21.00	14.94	13.54	20.00	18.00	18.50	16.90
6	Moong	-	-	2.40	2.00	-	-	6.80	4.80
7	Urad	-	-	-	-	-	-	5.45	4.43
8	Bajra	-	-	-	-	-	-	8.30	6.20
9	Banana	-	-	-	-	-	-	-	-
10	Chilly	-	58.00	56.00	-	-	-	-	-
11	Cotton	14.83	14.80	14.41	12.42	11.20	9.86	11.27	10.34

Increase in yield

Dindori district paddy yield increased two to three time by using vermin-compost.

Malgaon district Khandwa

1999 – 2000 Best year

Chemical farming	Cotton	1202 Kg./ha
	Soybean	865 kg./ha
2002-2003 organic Farming	Cotton	1430 kg./ha
	Soyabean	1140 Kg.ha

Increase in Yields

Village Nitaya distt. Hoshangabad

Paddy CR 130	chemical farming	30 Q/ha
	Organic farming	40-45 Q/ha

Andhra Pradesh Kummam district

Large number of farmers are adopting organic farming

Biodiverse Sytems Are More Productivity

Navdanya studies in West Bengal carried out by our Regional Coordinator Dr. Debal Deb show that different crop combinations have different economic potentials. It requires generations of experience to decide on the optimal crop combinations and rotations for sustainable yield and profitability. The study of Smolik et al. (1995) indicated that depending on the crop combinations, alternative agricultural systems with zero chemical inputs were more or less profitable than conventional chemical farming system in South Dacota. More recent studies compare farming systems with similar crop combinations and within the same edapho-climatic regime.

A recent study conducted in four districts of West Bengal shows that multiple cropping (MC) in the same soila nd climatic regimes proves economically more efficient than modern intensive chemical farming systems involving monocultures. The summary of the findings is presented in Table 1. The data clearly show that the net value of the annual production of an average MC farm is uniformly more than that of an average monoculture farm. The selected MC farms of East Medinipur district are sown to a wide range of crop diversity, both

under sequential rotation and intercropping. Some of these farms – mostly smaller than a hectare in size – grow over 50 types of crops excluding rice. Rainfed farms of Bankura district are comparatively less diverse, hardly exceeding 14 crops a year including rice. The irrigated monoculture farms, by contrast, grow two rice varieties in Bankura district and three rice varieties (all HYV) in East Medinipur district. The cost of all inputs (water for irrigation, seeds, agrochemicals, labour and energy) were calculated to compare the relative gain in output value of the modern monoculture farms with that of the MC farms. The data presented in the Table indicate that the net production value of crops from the least productive MC farms of Bankura was considerably higher than the best output of intensive monoculture farms. Furthermore, monoculture farms of East Medinipur appear to be less productive in spite of three rice crops than those of Bankura with two rice crops. Farmers explain this to reflect the "farm fatigue" from monoculture and intensive use of agrochemicals – an essential feature of modern agriculture.

Annual Production Profiles of Multiple-Cropping and Monoculture Farms.

District	Sample size	No. of Crops	Cost of Input	Output Value	Net Annual Profit (Mean)	S.D
		Multiple cropping farms				
BANKURA	3	5	41145	77122	35976	5845
	4	7	57066	99945	42879	21106
	2	8	111190	165664	54474	10503
	3	10	97262	189832	92570	4871
	2	14	74077	168672	94596	18341
EAST MEDINIPUR	2	3	10826	51296	40469	5477
	5	5	18519	62164	43645	8280
	3	36	143374	361165	129140	4687
	2	55	114698	342010	227312	33868
		Monoculture farms				
BANKURA	5	2*	26471	62488	32098	7930

EAST MEDINIPUR	6	3*	39740	75046	35305	8731

* Only rice, grown in succession every year.

A remarkable finding is that the relative value of the farm produce seems to increase significantly with greater diversity of crops. This unimodal distribution of the value of net farm profit (difference between the output and input value) per unit area *vis-a-vis* crop diversity becomes clear when the net profit and crop species numbers are both natural log-transformed. The regression slope is 0.5893, which is significant at 99.9% level of confidence.

Therefore the strategy for increasing productivity of organic farms should be based on biodiversity, not monocultures of a few selected crops.

The Economic Viability Of Biodiverse Organic Farming

Organic farming is economically viable because:

- Reduction in the use of external inputs and increase in on farm organic inputs with the greatest potential to benefit the health of farmers and consumers
- More productivity through the incorporation of natural processes as nutrient cycles, nitrogen fixation, and pest-predator relationships into the agricultural production process
- Greater productive use of the biological and genetic potential of plant and animal species;
- Improvement of the match between cropping patterns and the productive potential and physical limitations of agricultural lands to ensure long term sustainability of current production levels and
- Profitable and efficient production with emphasis on improved management and conservation of soil, water and energy, and biological resources.

A number of studies have shown that under drought conditions, crops in organic agriculture systems produce significantly and sustainably higher yields than comparable conventional agricultural crops, often out-yielding conventional crops by 7 – 90 per cent (Mangala Rai,*Secretary, (DARE) & Director General, I.C.A.R).*

A study by Roberts et al. (1979) compared data from 15 organic farms in the western Corn Belt with USDA data on representative conventional farms in the same area. In most cases the net returns were greater on the organic farms. Both studies showed that production costs were longer on the organic farms.

Navdanya has done a study in the year 2002, on the cost benefit analysis of Rice and Wheat in organic and chemical farming practices. The studies showed that net profits were higher in the organic farming system as compared to chemical farming. Some of the data are as follows:

Yield of Rice per Acre (Dehradun)

	Organic Farming		**Chemical Farming**	
1.	Total Expanses	3360	Total Expenses	4900
2.	Total Yield = 15 Qtl. Price @ Rs. 700	10,500	Total Yield = 20 Qtl. Price @ Rs. 560	11200
3.	Straw Production 5 Qtl. Price @ Rs. 200/bigha	1000	Straw Production	Na
4.	Total Income	11,500	Total Income	11200
5.	Net Profit	8140	Net Profit	6300

Yield of Wheat per Acre (Dehradun)

	Organic Farming		**Chemical Farming**	
1.	Total Expanses	4020	Total Expanses	4415
2.	Total Yield = 12 Qtl. Price @ Rs. 875	10,500	Total Yield = 18 Qtl. Price @ Rs. 600	10,800
3.	Straw Production 12 Qtl. Price Rs 125/Qtl.	1500	Straw Production	Not used
4.	Total income	12000	Total income	10,800
5.	Net Profit	7980	Net Profit	6385

Yield of Wheat per Acre (Bihar)

	Organic Farming		**Chemical Farming**	
11.	Total Expanses	4020	Total Expanses	4415
12.	Total Yield = 12 Qtl. Price @ Rs. 875	10,500	Total Yield = 18 Qtl. Price @ Rs. 600	10,800
13.	Straw Production 12 Qtl. Price Rs 125/Qtl.	1500	Straw Production	Not used
14.	Total income	12000	Total income	10,800
15.	Net Profit	7980	Net Profit	6385

In a survey carried out by Navdanya on economic viability, 90% farmers responded positively.

Peoples perception on pressure on economic viability of organic farming	**Yes %**	**No %**	**No idea %**
Do you think that organic farming is a viable option	90%	Nil	10%
One can get better yield in organic farming than chemical farming	90%	5%	5%
Organic farming is economically beneficial	90%	5%	20%

Farmer's income has also increased many folds. Some of the examples of diverse farming from these villages are given below.

Sri Rajender Singh, Village: Pulinda, 2004-2005, Land Area: 0.5 Bigha; irrigated

S.N.	Name of Crop	Quantity (in kg)	Market Rate (per Kg)	Total cost (in Rs.)
1.	Pyaj (Onion)	100.00	8.00	800.00
2.	Pyaj (onion) seeds	0.500	200.00	100.00
3.	Dhania (coriander) seeds	5.00	30.00	150.00
4.	Dhania leaves	2.00	30.00	60.00
5.	Lehsun	10.00	20.00	200.00
6.	Rai	5.00	10.00	50.00
7.	Palak	5.00	10.00	50.00
8.	Mirch	2.500	20.00	50.00
9.	Tomato	2.500	10.00	25.00
10.	Nimbu Kagji	100.00	Rs. 1 each	100.00
11.	Kela	4 x 60 = 40 (nos)	Rs. 1 each	240.00
12.	Papita	20.00	4.00	80.00
13.	Angoor	10.00	20.00	200.00
14.	Bhimal	120.00	0.50	60.00
15.	Moola	20.00	5.00	100.00
16.	Ogal	5.00	20.00	100.00
17.	Potato	60.00	8.00	480.00
18.	Chichinda	10.00	6.00	60.00
19.	Godri	20.00	6.00	120.00
20.	Baingan	5.00	8.00	40.00
21.	Vitex Leaves	50.00	0.50	25.00
22.	Bhang	1.00	40.00	40.00
23.	Methi	1.00	40.00	40.00

24.	Kandali (fodder)	10.00	0.50	5.00
25.	Almodu	2.00	-	-
26.	Genda	10.00	8.00	80.00
27.	Amrood	100.00	3.00	300.00
28.	Bamboo	1.00	-	-
29.	Chanchri	1.00	-	20.00
30.	Chemi	4.00	35.00	140.00
31.	Chemi green	5.00	10.00	50.00
32.	French bean	4.00	35.00	140.00
33.	French bean green	5.00	10.00	50.00
34.	Shelu from bhimal (Fibre)	4.00	15.00	60.00
35.	Kaddu	50	5.00	250.00
	Total			4260.00

Total Expenditure - Rs. 1200
Gross Income Rs. 4260.00
Less: Expenditure - Rs. 1200.00
Net Income: Per Bigha - Rs. 3060 x 2 = Rs. 7200.00
Or Rs. 90,000.00 per Ha

The above table shows that a farmer in his 0.5 bigha of land (12.5 bigha = 1 ha) by doing multi cropping was able to earn a net profit of Rs. 3060. Cost of production was estimated to be Rs. 1200.00 for one year, which includes the man-days of the farmers as well as FYM from his own farm, although he did not spend any money for cultivation.

If we calculate the net income for one hectare, farmer was able to make as much as Rs. 90,000.00, which is quite high. It is not easy to earn this much profit with any type of farming.

Thus it was observed that more the diversity is more will be the income / profit of the farmer. This is just opposite what supporter of conventional farming tell to the farmers to promote monocultures which is not correct. Such examples also encouraged farmers to grow more and more crops in one field.

Mr. Yogambar Singh: An example of Best biodiverse organic farming

Another example of Mr. Yogambar Singh of Pulinda who is 65 years old tells his story with the great interest. I have about 40-nali of land and I am solely dependent on agriculture for my livelihood. I have no other source of income. He told to us that he was using extensive chemicals before 1995. After joining Navdanya he left using all chemicals and now he is doing organic farming for last 9 years. His father and mother were died when he was a kid. He says that I am illiterate person, but I know how to do farming. I used chemicals for few years in my field, which really deteriorated the soil fertility as well as texture of the soil of his fields. He also says that he married 3 ladies because 2 of his earlier wives died because of illness. He told that I was able to do 3 marriages only because of the farming. He also bought 2 taxis for his son. His annual net income goes above 70,000.00 excluding the expenditure, most of which is for his labour or FYM or compost made by him.

Comparative analysis of his 2 fields one irrigated and another non-irrigated was done during interview with Mr. Yogambar Singh, which is given in the following tables.

Mr. Yogambar Singh 65 Years, Village: Pulinda, 2004-2005
Field I : Land Area - 0.75 Nali Irrigated)

S.N.	Name of Crop	Quantity (in kg)	Market Rate (Per Kg)	Total cost (in Rs.)
1.	Paddy	120.00	6.00	720.00
2.	Moola seed	2.00	40.00	80.00
3.	Moola fresh	55.00	5.00	275.00
4.	Potato	55.00	6.00	390.00
5.	Kotu	(Leaves) 200.00	1.50	300.00
6.	Pyaj	50.00	8.00	400.00
7.	Dhania leaves	2.00	30.00	60.00
8.	Dhania seeds	10.00	30.00	300.00
9.	Lehsun	5.00	20.00	100.00
10.	Baingan	5.00	8.00	40.00
11.	Palak	10.00	5.00	50.00
12.	Palak seed	0.250	40.00	10.00

13.	Mirch	2.00	20.00	20.00
	Total			**2745.00**

(Source: interview with Yogambar Singh)

Cost of production **–** Rs 1000.00
Gross Income - Rs 2745.00
Less Expenditure - Rs 1000.00
Net Income - Rs 1745.00
Or Rs. 69500.00 per Ha

Mr. Yogambar Singh Pulinda, 2004-2005
Land Area: 0.5 Nali (Un-irrigated)

S.N.	Name of Crop	Quantity (in kg)	Market Rate (Per Kg)	Total cost (in Rs.)
1.	Mandua	40.00	5.00	200.00
2.	Mandua straw	3.00	50.00	150.00
3.	Urad	5.00	30.00	150.00
4.	Gahat	5.00	25.00	125.00
5.	Soyabean	4.00	20.00	80.00
6.	Mirch	3.00	20.00	60.00
7.	Baingan	5.00	8.00	40.00
8.	Sem (Chemi) green	5.00	10.00	50.00
9.	Chemi	2.00	35.00	70.00
10.	Chaulai	6.00	18.00	108.00
11.	Kakdi	10.00	6.00	60.00
12.	Dodri	5.00	6.00	30.00
13.	Kaddu	30.00	5.00	150.00
14.	Wheat	80.00	7.00	560.00
15.	Mustard	5.00	30.00	150.00
16.	Chana	2.00	25.00	50.00
17.	Masur	4.00	25.00	100.00
	Total			**2123.00**

(Source: interview with Yogambar Singh)

Field II Un-irrigated
Cost of Production - Rs 600.00
Gross Income - Rs 2123.00
Less Expenditure - Rs 600.00
Net Income - Rs 1523.00
Or Rs. 7615.00 per Bigha
Or Rs. 951887.50 per Ha

The example of Mr. Yogambar Singh shows that from un-irrigated field, farmer could earn equal or even more than that of irrigated field. According to him, now I

am convinced that only hard work and organic farming practices could earn high returns, not the intensive use of agrochemicals.

Organic farmers are not the ones facing a risk in todays context of globalised and liberalized agriculture. Chemical agriculture is leading to ever increasing costs of inputs, and trade liberalization is leading to a collapse of farm prices in globally traded commodities like cotton, soya, corn, potato. Farmers growing cash crops and doing chemical farming are being caught in a debt trap and committing suicide. Nearly 40,000 farmers have taken their lives due to high costs of external inputs like seeds and chemicals.

Organic farming is therefore not just economically viable for small farmers, it also carries fewer ecological risks and financial risks.

Current Status Of Organic Farming In India And Abroad Including Its Role On Food Security And Food Quality

As per a recent report of International Federation of Organic Agriculture Movements (IFOAM) the total organically managed area is more than 24 million hectares worldwide. Organic farming is practiced in approximately 130 countries of the world and the area under organic management is continually growing. Although production of organic crops is increasing across the globe, sales are concentrated in the industrialized parts of the world. In India, at present only an estimated 60,000 acres are under organic cultivation **(The Hindu Business Line, 2005**). By default, poor farmers practice organic farming in many parts of India. Although much of the country practices the traditional system of organic farming, the government has declared only ***5,347 farms covering 37,050 hectares as organic. Uttaranchal, Sikkim, Nagaland and Meghalaya have declared themselves organic-farming states and Madhya Pradesh has declared 3,300 villages as being under organic farming.*** The total cultivated area in these States would aggregate to more than the official figure of 37,050

ha. **Moreover, over 65 per cent of the cultivated area is rain-fed, where the use of chemical fertilizers and pesticides is negligible (Frontline, 2004). About 65 percent of the country's cropped area is not irrigated where the farming practices are still largely 'organic by default' and yet they produce sufficient food.** The use of chemical fertilizers is comparatively low in Eastern and Northeastern parts of the country and yet there is sufficient food production. This explodes the myth that our output would fall if we go back to organic farming.

In organic farming crop management practices such as crop rotations, green manuring, crops residue recycling, water management, efficient plant types etc., are adopted through a combination of structural and planned management options to ensure farm produce of sufficient quantity and quality for livestock and human consumption. Organic farmer preferably grow locally adopted varieties having some quality traits for the premium markets.

Nutritional Qualities Of Organically Grown Food

It has been demonstrated that organically produced foods have lower levels of pesticides and medicinal and hormonal residues and in many cases lower nitrate contents. Nitrates are significant contaminants of foods, generally associated with intensive use of nitrogen fertilizers. Studies that compared nitrate contents of organic and conventional products found significantly higher nitrates in conventional products. Quality after storage has been reported to be better in organic produce relative to chemical based produce after comparative tests.

According to an International report from Journal of Applied Nutrition, 1993, the organically grown food averaged 63% higher in Calcium, 78% higher in Chromium, 73% higher in Iron, 118% higher in Magnesium, 178% higher in Molybdenum, 91% higher in Phosphorus, 125 % higher in Potassium and 60% higher in Zinc. The organically raised food averaged 29% lower in mercury than chemically grown food.

Here are a few examples of the mineral that were found in higher levels in organic foods in different studies.

Nutrient	Property	% Nutrient found more in organic food
Iron	Required for blood haemoglobin formation	21% more in organic food
Phosphorus	Required for bone formation	14% more in organic food
Chromium	Its deficiency is associated with the onset of diabetes and atherosclerosis (hardening of arteries)	78% more in organic food
Selenium	Antioxidant that protects us from damage by environmental chemicals. It is also protective against cancers and heart diseases.	390% more in organic food
Calcium	Needed for stronger bones.	63% more in organic food
Boron	Works along with calcium to keep bones strong.	70% more in organic food
Magnesium	Reduces mortality from heart attacks, keeps muscles from spasming	138% more in organic food
Heavy Metals		

Aluminium	Aluminium has been found to be associated with Alzheimer's disease	40%less than that in commercial food
Lead	Lead can adversely affect children's IQ, can cause impaired neurobehavioral development, decreased stature and growth	29% Lower than that in commercial food
Mercury	Mercury is associated with neurological damage, autism and Alzheimer's disease.	25% lower than that in commercial food.
Cadmium	Cadmium has been linked to lung , prostrate and testicular cancers.	
Tartrazine(the yellow food colouring E102)	Linked to allergic reactions, headaches, asthma, growth retardation and hyperactivity in children.	
Vitamins levels		
Vitamin C	Antioxidant	27% more
Vitamin E & Beta carotene	Antioxidant associated with a reduced incidence of coronary heart disease and some cancers.	10% to 50 % more

Source: soilassociation.org,lookwayup.com, landofvos.com

Data on Availability of protein, carbohydrates and lipids in organic and chemical crops (maximum availability of nutrients mg/100 gm Dry Weight)

Crop	Input	Protein	Carbohydrate	Lipids
Okra	Chemical	0.94	4.00	0.80
	Organic	1.30	6.20	1.15
Peanut	Chemical	1.10	5.70	1.20
	Organic	1.34	6.90	2.00

Source: Sultan Ismail (2002)

In organic farming a diversity of crops are grown and kinds of livestock kept. This diversification means that the risk in variation in production is spread**,** as different crops react differently to climatic variation, or have different times of growing (both in the time of the year and in length of growing period). This implies that, there is less chance of low production for all crops and livestock simultaneously, thus, contributing to food security and stability of food available for consumption. For Uttaranchal biodiversity based productivity would be the best option for the farmers for practicing organic farming.

Organic agriculture can contribute to local food security in several ways. Organic farmers do not incur high initial expenses so less money is borrowed. Synthetic inputs, unaffordable to an increasing number of resource-poor farmers due to decreased subsidies and the need for foreign currency, are not used. Organic soil improvement may be the only economically sound system for resource-poor, small-scale farmers*.*

In an Organic farming system a diversity of crops and livestock are maintained. Many indigenous food crops (e.g., sorghum, millet, oil seeds) supplanted by monoproduction of cash crops, Pseudocereals (e.g. amaranth, buckwheat, chenopods), grain legumes and other under-utilized plants, many of great value, can be reintroduced through crop rotations. This contributes to whole farm health, provides conservation of important genotypes, and creates habitats for beneficial species. It also reduces malnutrition.

Agricultural uniformity with intensification of external inputs has been guided by the science and technology objective of increasing nutritional and food security. However underutilised crops and species often have much higher nutritional and health benefits. They have more varied micro nutrients trace elements.

Millets such as Finger (Eleusine coracana), Proso (Panicum miliaceum), Foxtail (Setaria italica), Kodo (Paspalum scrobiculatum), Little (Panicum sumatrense), Barnyard (Echinochloa colona) which are nearly forgotten as foods are very rich in nutrition. For example, Finger Millet contains 344 mgms per 100 gms of Calcium compared to 45 mgms in Rice and 41 mgms in Wheat. Finger Millet could therefore have very high potential for those suffering from lactose energy as well as Vegens who avoid all animal produce in their diet and often develop Calcium and Protein deficiency. Barnyard Millet contains 4.4 mgms of minerals per 100 gms compared to only 0.6 mgms in Rice and 1.4 mgms in Wheat[1].

In tribal pockets (Central India) and desert areas a variety of food crops are used which are nutritionally rich as well as drought resistant. Species of these crops usually belong to families like Poaceae, Amaranthaceae, Leguminosae (*sensu lato*), Cucurbitaceae. By and large, most of the food comes from these families.

Poaceae and Leguminosae (*sensu lato*) are world's dominant families and occur in most of the niches (Good 1974). In India, members of these two families are present in multiples of hundred while we are using only in tens.

A detailed documentation of plant species, varieties and strains used in the past and/or in a restricted sense, will enhance crop diversity horizontally along with nutritional value.

[1] C. Gopalan et.al 2002, Nutritional Value of Indian Food, National Institute of Nutrition, ICMR, Hyderabad

There are many wild species whose fruits/ tubers are nutritionally very rich but remain neglected as source of food. Promotion of these species for agro forestry program will solve dual purpose: increment in nutritional status of marginal farmer and conservation of these species.

Flowers of *Madhuca indica* are made into a hard drink. These flowers are having 307 mg/100gm of carotene. (Pro- Vit. A) *Diospyros kaki*, a wild species of North East India is having 2268 mg/100 gm of carotene. Lasoda (*Cordia* spp), Khirni (*Mimusops elengii*) are also carotene rich fruits, but used in a restricted area. Lack of Vitamin A is a major cause of blindness among children. Propagation and utilization of these Vit. A rich plants would have major public health benefits.

Nutrient Management In Organic Farming

Organic farming is a specialized form of diversified agriculture, wherein problems of farming are managed using local resources alone. The term organic does not explicitly mean the type of inputs used; rather it refers to the concept of farm as an organism. It is generally suggested that 25% nutrient needs of the Indian agriculture can be met by utilizing various organic sources such as FYM, crop residues, urban and rural wastes and green manuring.

Organic Resources

According to an estimate around 600 to 700 million tones of agricultural waste is available in the country every year, but most of it is not used properly (Veeresh, 1997). ***India produces about 1800 mt of animal dung per annum. Even if two thirds of the dung is used for biogas generation, it is expected to yield biogas not less than 120 mm3 per day. In addition, the manure produced would be about 440 mt per year, which is equivalent to 2.90 mt N, 2.75 mt P_2O_5 and 1.89 mt K_2O (Ramaswami, 1999).***

The potential of rural and urban compost in India is estimated to be 800 and 16 mt respectively. Less than 50% of the manurial potential of the livestock

population is utilized at present in crop production. The major contributor of rural compost is animal dung, which has a potential are about 7 mt of NPK. About 1/3 of the residue potential is available for utilization in agricultural production about 400 mt of crop residues are produced in the country which have potential of supplying about 7.3 mt of NPK. Application of farmyard manure supplies available nutrients to the crops. On an average, well-rotted FYM contains 0.5% N, 0.2% P2O5 and). 5 @ K2O.

Vermicompost

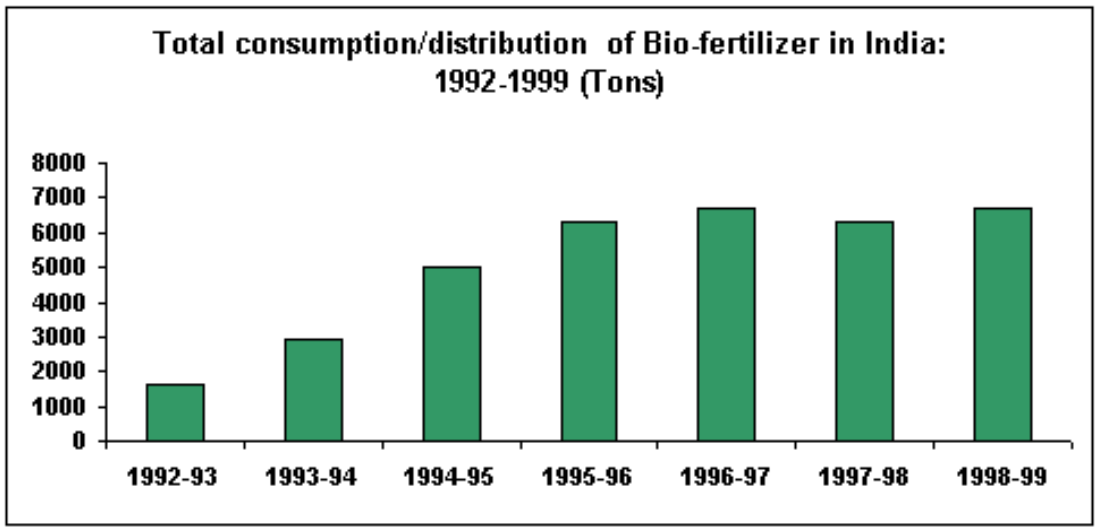
Vermicompost contains 1.5 % nitrogen, 0.5 % phosphorus and 0.8 % potassium in addition it contains other micronutrients. Vermicompost is the single source of all the nutrients required for the crop. Vermicompost also contains 10 % organic carbon and when continuous application of vermicompost increased the organic matter content of soil significantly. Earthworm can convert about 1,000 tonnes of moist organic waste into 300 tonnes of rich dry vermicompost. The earthworm can eat almost all kinds of organic matter including bone and eggshell and consume residue equivalent to their body weight everyday. In 45 to 60 days one kg or earthworm [approximately 1,000 – 1,250 numbers] could produce roughly 10 kg of vermicasting(**Rangasamy and.Jayanthi, 2001)**

Biofertilizers:

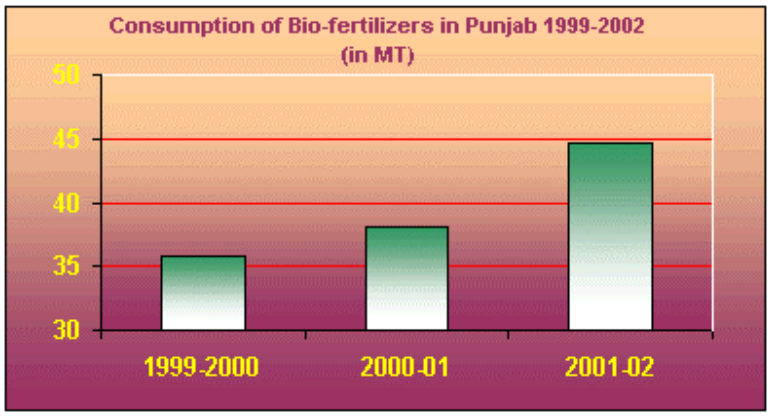
Nitrogen fixation by *Rhizobium* in the root nodules of legumes is in the order of 14 m tons of a global scale and is almost half that of industrial nitrogen fixation. Our requirement for *Rhizobium* inoculants to cover this entire area will be around 15,000 tons and the present production is only around 800 tons. Similarly, we will be requiring about 4 lakh tons of BGA, if the entire rice area is to be covered. Nearly 50% nitrogen fertilizers can be saved through inoculation with efficient strains of *Rhizobia*. Likewise preparations of *Azotobacter, Azospirillum* and BGA can all provide additional savings. *Azolla,* a water fern harbor nitrogen fixing (NIRI-KVIC, 2005).

Inoculation of *Rhizobium.* Azotobactor and Azospirillum substitute, 19,22 and 20 kg N/ha, respectively. Blue green algae (BGA) applied @ 10 kg/ha gave a saving of 20-30 kg N/ha and Azolla @ 6-12 t/ha had an N equivalent of 3-4 kg/t.

Total Consumption / Distribution of Bio-fertilizer in India (1992-99) is as follows: (Source: Adapted by authors from FAI, 2001.)



Consumption of bio-fertilizer in Punjab (1999-2002)



Source: Punjab Agriculture University,

Legumes/Green Manuring

The practice of green manuring for improving soil fertility and supplying apart of nutrient requirement of crop is aged old. Estimates suggest that a 40-50 days old green manure crop can supply up to 80-100 kg. N/ha. Even if half of this N is crop utilizable, a green manure crop can be a substitute to 50-60 kg. fertilizer N/ha. Some of the potential greens manuring legumes are dhanicha, sunhemp, cowpea, mung, bean, guar and berseem etc. Dhanicha, sunhemp, mung bean and guar grown during kharif season as green manure crops have been reported to contribute 8-21 tones of green matter and 42-95 kg. of N/ha. Similarly, Khesari, cowpea and berseem grown during rabi season can contribute 12-29 tons of green matter and 67-68 kg of N/ha. (Nayak and Mishra, 2004)

Depending on the crop grown the N contribution by green manure crops varies from 60-280 kg/ha. ***Leguminous green manures can fix large quantity of atmospheric N_2, which generally can accumulate about 100 kg N ha^{-1} in 50-55 days but can reach up to more than 200 kg N ha.***

Growing green manure crops in dry seeded rice on nutrient addition and soil fertility status

Particulars	**Rice + cowpea**	**Rice + horse gram**	**Rice alone**
Nutrient addition (kg ha-1)			
Nitrogen	103.7	56.2	-
Phosphorus	9.2	5.8	-
Potassium	55.1	28.2	-
Soil nutrient status following green manure incorporation (kg ha-1)			
Nitrogen	454.0	404.8	374.2
Phosphorus	30.3	26.8	21.7
Potassium	223.1	201.1	172.5
Soil nutrient status after the crop (kg ha-1)			

Nitrogen	227.2	233.5	219.5
Phosphorus	16.0	15.3	12.8
Potassium	83.9	75.8	68.7

Source: **Jose Mathew**, K. Mohanasarida and O.N. Resmi, Department of Agronomy, Kerala Agricultural University,

Use Of Organic Nutrients As Allowed For Organic Farming Is Self Sufficient

The generation of organic resource from livestock, crop residues, human beings, composts and wastes of agriculture related activity in India has an approximate potential of supplying NPK nutrients in the range of 10.5 to 16.5 MT of which 3.9 to 5.7 MT can be made available for agricultural production (The Tribune, 2001)

According to a recent estimate nutrient needs of the Indian agriculture can be met by utilizing various organic resources The production of various organic manures at present are as follows:

Farmyard manure (200 MT), crop residues (30 MT), rural and urban wastes (10MT) and green manuring (25 million hectare). Further of the nutrient uptake by the cereal crops, nitrogen (25%), phosphorus (25%), potash (75%) and sulphur (50%) are retained in the crop residue making them valuable nutrient resource of which major portion is used as animal feed and Ca 33% (of the 400 MT estimated) is available for direct use in agriculture. The major contribution of rural composts in the form of FYM is animal dung, which has a potential of about 7 MT NPK of which 50% manurial production is used for crop production (Bhardwaj, 2001)

Use Of Biopesticides And Biocontrol Agents Under Organic Farming:

There are thousands of organisms in the world but we do not consider all of them pests. When the population of an organism reaches a level where it can cause considerable damage to the crop it becomes a pest. They can be either crop

pests or storage pests depending on whether they destroy crops on the field or during storage. Pest damage is a function of the vulnerability of the crop as well as the pest, population, which is determined by the ecology of the farm. Organic crops are less pest prone than chemically produced crops. Diverse crops reduce pest population through pest predator balance while monocultures increase vulnerability of pests

About 80,000 tons of pesticides are used in agriculture in India annually (Srinivasan, 1997), mostly in cotton and rice. While cotton is planted on about 5% of the total cultivable area (on about 8 million hectares out of a total of 170 million), it accounts for about 45% of pesticide application (Dhaliwal and Pathak, 1993). Rice accounts for another 23%. Vegetables and fruit also account for a significant

The potential of biopesticides and biofertilisers for promoting sustainable agriculture has been known for many years. Biofertilisers are considered to be an important alternative source of plant nutrition. They are biologically active products, including bacteria, algae or fungi, with the ability to provide plants with nutrients. Most biofertilisers belong to one of two categories: nitrogen fixing and phosphate solubilising. Nitrogen fixing biofertilisers fix atmospheric nitrogen into forms, which are readily useable by plants. These include rhizobium, azatobacter, azospirillum, blue green algae (BGA) and azolla. While rhizobium requires symbiotic association with the root nodules of legumes to fix nitrogen, others can fix nitrogen independently. Phosphate solubilising micro-organisms (PSM) secrete organic acids which enhance the uptake of phosphorus by plants by dissolving rock phosphate and tricalcium phosphates. PSMs are particularly valuable as they are not crop specific and can benefit all crops

During 1999, due to the inclement weather conditions, the incidence of sugarcane pyrilla appeared in 5,77,901 ha in five Divisions of western Uttar Pradesh. The same was successfully contained by Epiricania melanoleuca

- a potential nymphal and adult parasite of this pest. The farmers were trained to conserve this naturally occurring biocontrol agent in the surgarcane ecosystem. The severe incidence of Diamond Back Moth (DBM) on cauliflower/cabbage crop around Delhi was controlled effectively with *Bacillus thuringiensis* (B.t.) and neem based biopesticides. The incidence of coconut mite in the States of Kerala, Tamil Nadu, Andhra Pradesh, Karnataka and Pondicherry is being controlled with the use of neem based formulations. Fields trials with *Hirsutella thompsonii* are being conducted in the above states. The incidence of Bihar hairy caterpillar reported on soybean in moderate to severe intensity in Maharashtra has been contained successfully. **(AC Meeting 2001, Country Report for India)**

With the background of IPM knowledge, the farmers are practicing farming with minimum use of pesticides as agro-chemicals. Instead they are depending on Biocontrol agents. They are using Biopesticides for the control of pests and diseases. As a result of implementation of IPM Programme, there is significant reduction in the consumption of pesticides from 61,357 MT during 1994-95 to 46,195 MT during 1999-2000 (Country Report for India, 2001)

How The Domestic Market Of Organic Farming Could Be Developed:

According to Dr Samuel Project Coordinator, Asia International Cooperation Division of the Swiss Research Institute of Organic Agriculture (FiBL), there are at present two to three million customers for organic agricultural products in India. But the problem is absence of marketing outlets. In the developed countries, especially in Europe and the US, every supermarket has a green-line where all the certified organic products are available.

Similar marketing network has to come up at least in the major Indian cities. But, it would become viable only when all the products needed by the customers are available at the shops and that needs a consistent supply chain. At the same time, there should be an effective promotional campaign. In general, the sale of

organic produces is limited to metros like Mumbai, Delhi, Kolkata, Chennai, Bangalore and Hyderabad. To a large extent this sale is also based on individual initiative of the farmers, Non Governmental Organizations and some entrepreneurial traders etc. The current domestic green products market demand is mainly for fruits, vegetables, rice and wheat. Other products include tea, coffee and pulses (ORG-MARG Survey, 2002). The market prospects other commodities like organic spices; fruits, herbal plants and cotton are relatively high. For next five years it is projected that organic spices would grow by 14%, fruits 8% and herbal plants and cotton it is estimated to be around 7% (ORG-MARG Survey, 2002). Market for different range of organic agricultural products as shown in Table: 7is estimated to reach up to 1568 tons in 2006-07.

Growth forecast for specific organic products in the domestic market

Product	**% Projected Growth in the 5 next Years**
Spices (all)	14
Pepper	5
Turmeric	4.5
Tea	13
Rice	10
Fruits (all)	8
Banana	15
Mango	5
Orange	5
Pineapple	5

Herbal extracts	7
Cotton	7
Coffee	5
Oil seeds	5
Honey	5
Groundnut	5
Baby food	5
Coconut	5

Source: Org-Marg, 2002

Strategies to Scale Up Organic Farming :

1. Appropriate extension services should be developed to make available to the small farmers all the relevant information on organic farming, in general, and its specific technical details, in particular.
2. Strong linkages between growers and consumers with minimum influence of middlemen should be developed.
3. Certification processes should be made accessible to small farmers by reducing costs without diluting standards.
4. Biofertilisers, bioagents, biopesticides and other organic inputs should be made available to the small landholders in sufficient quantities and reasonable prices. Countries need to make plans to increase availability of ecological inputs for organic farming.
5. Domestic market for organic products, which is still at a budding stage in most countries of the South, should be encouraged and developed.

6. Subsidies and other financial support schemes should be undertaken to help the small growers bear the initial expenses for converting to 'certified organic' farms, and so on. Organic farming should get a level playing field with industrial agriculture
7. Improving infrastructure facilities like roads, transportations, storage facilities etc would enhance forward and backward linkages in the organic products supply chain.
8. Promotion of research for agro ecology organic agronomic practices, bio-control of diseases and pest, bio-fertilizers etc.
9. The positive externalities of organic farming need to be internalized in development policy to reach the Millennium Development Goals.