सत्यमेव जयते

COMPREHENSIVE TRAINING MANUAL
ON
ORGANIC FARMING

PGS-INDIA GREEN

PGS-INDIA ORGANIC

भारत सरकार

Government of India

कृषि एवं किसान कल्याण मंत्रालय

Ministry of Agriculture & Farmers Welfare

कृषि एवं किसान कल्याण विभाग

Department of Agriculture and Farmers Welfare

राष्ट्रीय जैविक एवं प्राकृतिक खेती केंद्र

NATIONAL CENTRE FOR ORGANIC AND NATURAL FARMING

हापुर रोड, कमला नेहरु नगर, गाजियाबाद -201002 Hapur Road, Kamla Nehru Nagar, Ghaziabad-201002

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Index

प्रिय रंजन
संयुक्त सचिव
Priya Ranjan IFS
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FOREWORD

Food quality and safety are two vital factors that have attained constant attention in common people. Growing environmental awareness and several food hazards have substantially decreased the consumer's trust towards food quality in the last decades. Intensive conventional farming can add contamination to the food chain. For these reasons, consumers are quested for safer and better foods that are produced through more ecological and authentic process by local systems. Organically grown food and food products are believed to meet these demands and become one of the best choices for both consumers and farmers. The organic food perhaps ensures food safety from farm to plate. Not only the growing demand for organically farm fresh products has created an interest in both consumer and producer regarding the nutritional value of organically and conventionally grown foods but also organic farming has a protective role in environmental conservation. Long-term economic viability is attainable through organic and natural farming and because of its premium price in the market, organic and natural farming seems to be more profitable.

Implementation of a strategy encompassing food security, generation of rural employment, poverty alleviation, conservation of the natural resource, adoption of an export-oriented production system, sound infrastructure, active participation of government, and private-public sector will be helpful to make revamp economic sustainability in agriculture. The Government of India has implemented number of programs and schemes for boosting organic and natural farming in the country. Organic agriculture promotes the health of consumers of a nation, the ecological health of a nation, and the economic growth of a nation by income generation holistically.

I take this opportunity to congratulate and convey my appreciation for the team of officers of National Centre for Organic and Natural Farming to address the requirement of bringing out the Comprehensive Training Manual on Organic Farming to its publication. This training manual provides detail information about practices, status, government schemes, certification system of organic farming. I urge NCONF to come out with a natural farming training manual.

The training manual for both organic and natural farming may build a nutritionally, ecologically, and economically healthy nation in near future.

Priya Ranjan

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PREFACE

There exists a massive demand for organic and chemical free produce in the world today. A large section of the world's population today is interested in holistic healthcare and is willing to pay more for such organic products. Since the ancient age, India has engaged in the organic farming practice with negligible use of chemical inputs. However, to maintain food security for a large population, the Government of India had started a "Green Revolution" program in the 1960s, which resulted from a rise in the use of chemical fertilizers to boost agricultural yields which exerted negative impacts on soil and consumer health. To avoid the use of the chemical fertilizers both developed as well as developing countries are moving toward organic farming and organic food products. This has improved India's organic food exports as well as the income of farmers by adopting organic farming practices. The Government of India has promoted organic agricultural practices through a number of programs that deal with the study of changes in crop production, soil health and the adoption of scientific techniques in organic farming practices.

The purpose of this training manual is to provide detailed insight into the principles and practices of organic farming. The aim of such initiative is to make the farmers, researchers, scholars, extension workers, service providers, FPOs, FPCs, CBBOs and all other stakeholders of organic farming aware of the ancient knowledge and practices which were based on principles of self-sustainability and environmental protection.

With such notion, I congratulate the dedicated team of officers from NCONF and RCONF for such compilation. I hope the Manual will be an effective training tool for the Government Departments, Officers, Organic producers, processors, traders, certifiers and other stakeholder. I believe that through this publication we will be able to take a step towards self-sustainable organic farming through our endeavor.

Gagnesh Sharma

TWO DAYS TRAINING ON ORGANIC FARMING FOR EXTENSION WORKERS/SPs/CBBOs/FPOs/FPCs	
Syllabus	
Organic Farming Techniques	
1	Status of Organic Farming
2	Organic farming Principles and Practices.
3	Nutrient Management and Cropping Systems
4	Pest and Disease Management
5	Weed Control.
6	Organic Farm Management
	Status of Organic Farming & Organic Input Statistics
Post-Harvest- Techniques	
7	Post-Harvest Management and Value Addition
Organic Certification and marketing	
8	Organic Certification & Marketing strategies for Organic Produce
9	Empowering farmers with FPOs
10	Current Government Schemes for promotion of Organic Farming and Marketing of Organic Produce.
	Biofertilizers and Organic Fertilizers in Fertilizer (Control) Order, 1985
	Annexure-I: List of Regional Councils under PGS ***Annexure-II: List of accredited certification bodies under NPOP*** ***Annexure-III: List of Products for Use in Fertilising and Soil Conditioning (NPOP Standards)*** ***Annexure-IV: Products for Plant Pest and Disease Control***

TWO DAYS TRAINING ON ORGANIC FARMING FOR EWs/SPs/CBBOs/FPOs/FPCs
Programme Schedule

Day 1			
10:00 – 10:30	Introduction – About the Training	Interaction with farmers	Trg Coordinator & OIC, RCOF
10:30 – 11:30	Principles of Organic Farming. Conventional Farming vs Organic Farming.	Lecture	Speaker
11:30 – 12:30	Nutrient Management	Lecture	Speaker
12:30 – 01:30	Pest and Disease Management	Lecture	Speaker
01:30 – 02:30	Lunch		
02:30 – 03:30	Weed Control		Speaker
03:30 – 04:30	Post-Harvest Management and Value Addition		Speaker
04:30 – 05:30	Organic Certification & Marketing.	Lecture	Speaker
Day 2			
10:00 – 01:30	Field Exposure – Field design, Input layouts, Basic requirements, Selection of crops, animals and farm resources.	Practical	Trg Coordinator
01:30 – 02:30	Lunch		
02:30 – 04:30	Certification under PGS-India- Live Demonstration.	Practical	Trg Coordinator
04:30 – 05:30	Evaluation of Training.	Interacting Session	Trg Coordinator & OIC, RCOF

1. Status of Organic farming

Introduction

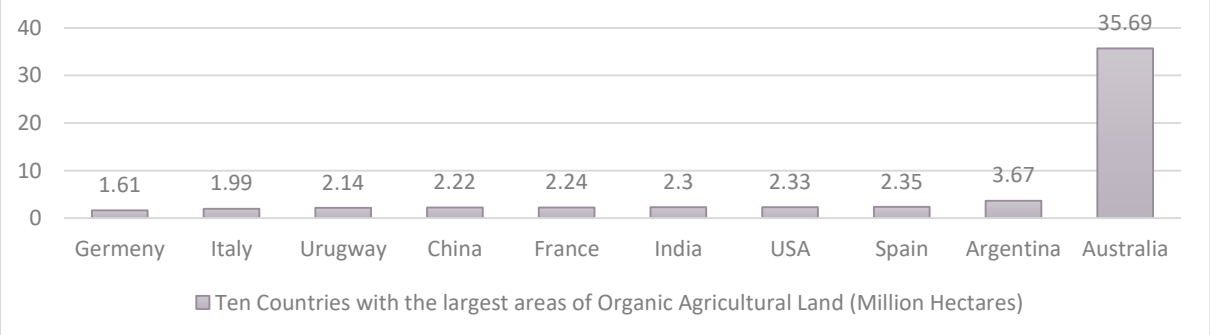
Organic farming ensures that nature stays clean and rich. If we visit an organic farm and we will notice a buzz of animal, bird, and insect activity. Research shows that there are around 30 percent more wildlife and plants near ecological production fields compared to conventional farming. This is because there are no pesticides, and fertilizer is used far less. Covid-19 pandemic has changed the perception of organic food, with spotlight now on safety and healthy food that is nutritious to build a strong immune system. It is time to talk about nutritional security not of food security only (which consist only carbohydrates). Among the host of healthy food options available, organic food is perceived as the preferred choice. Therefore, organic food witnessed an uptake since the onset of pandemic. Organically grown foods generally contain higher levels of antioxidants, certain micronutrients, no harmful chemicals, pesticides and fertilizers, better taste and most important thing is organically grown produce aids in the sustainability of the planet and in maintaining ecological balance.

According to FiBL survey 2021 India holds a unique position among 187 countries practicing organic agriculture. India is home to 30% of total organic producers in the world having 2.30 million ha. Total organic cultivation area, 27, 59,660 total farmers (11, 60,650 PGS and 15, 99,010 India Organic), 1703 total processors and 745 traders. A major relative increase of organic agricultural land was noted in recent past throughout the country.

World Scenario of Organic Agriculture

Organic agriculture is practiced in 187 countries, and 72.3 million hectares of agricultural land were managed organically by at least 3.1 million farmers. With the most organic agricultural land in Australia (35.69 m hectares) followed by Argentina (3.63 m hectares) and the Spain (2.35 m hectares). There has been an increase in organic agricultural land in all regions. The global sales of organic food and drink reached more than 106 billion euros in 2019. According to the latest FiBL survey on organic agriculture worldwide, organic farmland increased by 1.1 million hectares, and organic retail sales continued to grow. Apart from land dedicated to organic agriculture, there are further areas of organic land dedicated to organic activities. The largest part of these is wild collection areas and areas for livestock and beekeeping. Further non-agricultural areas include aquaculture, forest and grazing areas. These are totaled 35 million hectares. And all the organic areas together summed up to 107.4 million hectares (Organic World 2021).

Figure 01: Top Ten Countries in terms of largest certified organic area



Source: FiBL Survey 2021

The No. of Organic Producer increasing worldwide

In 2019, 3.1 million organic producers were reported. India continues to be the country with the highest number of producers (13,66,000), followed by Uganda (2,10,000), and Ethiopia (2,04,000). Most small-scale producers are certified in groups based on an internal control system. (FiBL Survey 2021)

Present Scenario of Organic Farming in India

Organic farming is in a nascent stage in India. About 2.30 million hectares of farmland was under organic cultivation as of March 2019. This is two per cent of the 140.1 million ha net sown area in the country. A few states have taken the lead in improving organic farming coverage, as a major part of this area is concentrated only in a handful of states. Madhya Pradesh tops the listwith 0.76 million ha of area under organic cultivation — that is over 27 per cent of India's total organic cultivation area.

The top three states — Madhya Pradesh, Rajasthan and Maharashtra — account for about half the area under organic cultivation. The top 10 states account for about 80 per cent of the total area under organic cultivation.

Need for Organic Farming in India

The Green Revolution in the year 1960 changed the whole scenario in the field of agriculture where the farmers were introduced to high yielding seeds and fertilizers to maintain food security. Increasing productivity ensured profit but ultimately the land was turning barren due to the excessive usage of fertilizers making the soil infertile and pesticides turning the product dangerous to consume.

There are reasons for the need of the Organic Farming in India –

- The organic food industry is rising and is growing very fast ensuring high profitability.
- Food security needs to be addressed with the growing population and decreasing supply of resources which is why there is a need to increase the production but in a feasible and sustainable manner.
- Maintaining a clean and green environment is equally important, thus environmental sustainability needs to be maintained which can be achieved through organic farming.
- There needs to be an improvement in the health as the consumption can lead to many diseases such as cancer, infertility which happens when the toxic residue remains in the body, thus the safety of humans and animals are of utmost priority.
- The strike of balance between the environment and the livelihood becomes immensely important due to the risks caused by conventional agriculture practices.

Table-Indian Organic Agriculture Statistics for last 10 years (2011-12 to 2020-21)

Sl No.	Year	Area Under Organic Cultivation		Number of farmers		Organic Production (MT)		Biofertilizer production		Total Organic Manure Production (MT)
		NPOP	PGS-India	NPOP	PGS-India	NPOP	PGS-India	Liquid (in KL)	Career Based (MT)	
1	2011-12	5550405	0		0		0	40324.21		34863600
2	2012-13	5211141	0		0		0	46836.82		41157700
3	2013-14	4719816	6064.14		5809		23612.42	2922.38	53838.3	22941500
4	2014-15	5690000	9249.39		11118		1079*	4054.56	80696.45	22986200
5	2015-16	5710384	19281.91		19355		6321660.53	6240.92	88029.3	25478600
6	2016-17	4452987	96291.6		173846		8760810.96	7526.33	109020.11	28029900
7	2017-18	3566538	6455.29		84618		17132676.09	9033.06	121066.54	33872000
8	2018-19	3428639	124989.9		166571		989255.06	22555.27	70417.77	41100974
9	2019-20	3669801	222369.55		365253		2047535.9	30105.94	79446.61	60594104
10	2020-21	4339185	7568.3	1599010	12074	3496800.34	3399520.21	42239.94	192329.29	42940832

Source:

as per IFOAM FiBL The world of Organic Agriculture, Statistics and emerging trends for respective years

PGS-India Web Portal

*As per year wise certificate data available on PGS-India portal dashboard

NCOF Annual report for respective years

CONSOLIDATED ORGANIC AGRICULTURAL STATISTICS FOR THE YEAR 2020-21 (https://apeda.gov.in/apedawebsite/organic/data.htm)

Data Not avilable

Data from source yet to identified

STATE WISE PRODUCTION OF ORGANIC FERTILIZERS IN INDIA (2020-21)

Sl. No.	State	City Compost (A)	Organic manure (B)	Vermi0compost (C)	PROM (D)	Bioenriched Organic Manure (E)	Rural Compost (F)	Farm Yard Manure (G)	Total Manure MT {A+B+C+ D+E +F+G)	Deoiled Cake MT
1	Andhra Pradesh	0	8.02	336.00	0	88.5	0	0	432.52	4108.00
2	Arunachal Pradesh	0	0	0	0	0	0	0	0	0
3	Assam	2350	49100	107731.22	1702	803.6	1312	11945	174943.82	121
4	Bihar	0	29215.1	75556.95	0	0	0	0	104772.05	0
5	Chhattisgarh	3998	829643	76150.46	0	0	515333	1002801	2427925.5	0
6	Delhi	21677	269	1098	0	0	0	0	23044.00	0
7	Goa	0	00	460	0	0	0	0	460.00	0
8	Gujarat	44236.56	87295.6	2128	27446.18	3500	4290	125450	294346.338	7130
9	Haryana	0	223.15	0	4576.410	0	0	0	4799.54	0
10	Himachal Pradesh	0	0	22.00	0	0	0	0	22.00	0
11	Jammu & Kashmir	0	0	0	0	0	0	0	00.00	0
12	Jharkhand	6196	5	360	40	4	0	0	6605	0
13	Karnataka	68824	183769	31355	14704	15092	1011125	37542874	38867743	2031
14	Kerala	9885.88	26038.75	752.5368	144	6489.032	312.6	356.89	43979.68	2330.25
15	Madhya Pradesh	5436.7	28377	25520.9	11140.9	0	0	0	70475.4	0
16	Maharashtra	42231.00	34909.00	13312.00	40993.00	0	0	0	131445.00	7678.3
17	Manipur	0	100	0	0	50	0	0	150	0
18	Meghalaya	0	0	0	0	0	0	0	0	0
19	Mizoram	0	0	6	0	0	0	0	6	0
20	Nagaland	0	15015	1060.5	0	0	12726	52520	81321.5	0
21	Odisha	13153.5	12,102	17064.5	680	785	0	5565	49,350	0
22	Punjab	36005.22	1458.66	545	6116.98	37.22	0	0	44163.08	236.47
23	Rajasthan	17870	2960	12425	11442	70	0	0	44767.00	0
24	Sikkim	0	0	0	0	0	0	0	0	0
25	Tamil Nadu	57456.8	55461.55	4451.042	588.9816	157.7	324149	0	442265	20138
26	Telengana	24706.00	1197.1	29.121	927.3	230.0	0	0	27134.00	0
27	Tripura	0	0	522.015	383.05	85.151	0	0	990.216	0
28	Uttar Pradesh	0	7703	131	7614.75	17789.49	0	0	33238.24	0
29	Uttarakhand	2100	396.64	0	3462.63	0	0	0	5959.27	2700
30	West Bengal	50750	261	2343.09	810.7	7983.84	0	114.69	59294.32	0
31	Chandigarh	0	0	0	0	0	0	0	0	0
32	Puducherry	0	0	0	0	0	600	600	1200	70
	Total	**406876.66**	**1,365,507.57**	**373360.3348**	**132772.8816**	**53077.033**	**1869847.6**	**38742226.58**	**42,940,832.474**	**46543.02**

Source : Data received from states.

STATEWISE PRODUCTION OF BIOFERTILISERS IN INDIA (2020-21)			
Sl.No.	State	Carrier based (MT)	Liquid based (KL)
1	And &Nic island	0	0
2	Andhra Pradesh	123.19	98.49
3	Daman & Diu	0.00	0.00
4	Karnataka	1446.50	870.53
5	Kerala	164.98	2612.00
6	Lakshdweep	0.00	0.00
7	Puducherry	97.17	2.16
8	Tamilnadu	88652.43	434.313
9	Telangana	448.72	150.14
9	Chattisgarh	558.88	268.68
10	Gujrat	19483.31	8055.72
11	Goa	30.00	0.00
12	Madhya Pradesh	21834.30	15811.10
13	Maharashtra	5328.18	2140.95
14	Rajasthan	10612.00	0.00
15	D & N Haveli	0.00	0.00
16	Delhi	0	0
17	Chandigarh	0.00	0.00
18	Haryana	3105.42	113.17
19	Himachal Pradesh	0.22	0.22
20	Jammu & Kashmir	0.00	0.00
21	Punjab	16042.27	361.37
22	Uttar Pradesh	0.00	5725.64
23	Uttarakhand	3708.83	1150.81
24	Bihar	74.59	2.11
25	Jharkhand	0.00	0.00
26	Odisha	19406.64	859.60
27	West Bengal	448.59	33.54
28	Arunachal Pradesh	0.00	0.00
29	Assam	438.54	3447.35
30	Manipur	20.00	24.01
31	Meghalaya	0.00	0.00
32	Mizoram	1.40	0.00
33	Nagaland	19.14	0.00
34	Sikkim	0.00	69.02
35	Tripura	283.99	9.02
	Grand Total	192329.2896	42239.9351

STATEWISE PRODUCTION OF BIOFERTILISERS IN INDIA (2020-21) (Zone wise)			
	State	**Carrier based (MT)**	**Liquid based (KL)**
South Zone			
1	Andaman & Nicobar	0	0
2	Andhra Pradesh	123.19	98.49
3	Daman & Diu	0.00	0.00
4	Karnataka	1446.50	870.53
5	Kerala	164.98	2612.00
6	Lakshadweep	0.00	0.00
7	Puducherry	97.17	2.16
8	Tamil Nadu	88652.43	434.313
9	Telengana	448.72	150.14
West Zone			
1	Chhattisgarh	558.88	268.68
2	Gujarat	19483.31	8055.72
3	Goa	30.00	0.00
4	Madhya Pradesh	21834.30	15811.10
5	Maharashtra	5328.18	2140.95
6	Rajasthan	10612.00	0.00
7	Dadar& Nagar Haveli	0.00	0.00
North Zone			
1	Delhi	0	0
2	Chandigarh	0.00	0.00
3	Haryana	3105.42	113.17
4	Himachal Pradesh	0.22	0.22
5	Jammu & Kashmir	0.00	0.00
6	Punjab	16042.27	361.37
7	Uttar Pradesh	0.00	5725.64
8	Uttarakhand	3708.83	1150.81
East Zone			
1	Bihar	74.59	2.11
2	Jharkhand	0.00	0.00
3	Odisha	19406.64	859.60
4	West Bengal	448.59	33.54
North East			
1	Arunachal Pradesh	0.00	0.00
2	Assam	438.54	3447.35
3	Manipur	20.00	24.01
4	Meghalaya	0.00	0.00
5	Mizoram	1.40	0.00
6	Nagaland	19.14	0.00
7	Sikkim	0.00	69.02
8	Tripura	283.99	9.02
	Total	192329.2896	42239.9351
*** Source : Data received from States**			

2. Principles of Organic Farming. Conventional Farming vs Organic Farming.

Organic farming system is a method of farming system which primarily aimed at sustainable agricultural production in an eco-friendly pollution free environment and being followed from ancient time in India. Organic Production system, keep the environment and ecology alive and in good health by use of natural resources to harness desired agricultural production for human consumption. In Organic production, environment focus is on using naturally available resources as inputs, such as organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers/ bio control agents) to release nutrients to crops and protect them from insect pest and diseases for increased agricultural production.

DEFINITION AS PER USDA:

"organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection".

DEFINITION AS PER FAO: "Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs".

NEED OF ORGANIC FARMING

The stress of feeding the growing population pressure on agriculture necessitates not is only to keep agricultural production continuous but to surge it further in sustainable way. Modern conventional farming using pricey chemicals and synthetic inputs is now facing sustained production with high input cost and weakening returns surpluses.

CHARACTERISTICS OF ORGANIC FARMING

- Effective recycling of organic materials including bio-mass, crop residues and livestock manures.
- Maintenance of soil fertility and land productivity by improving organic matter, boosting soil biological activity, and careful mechanical interventions.
- Using relatively insoluble soil nutrient sources to provide crop nutrients indirectly to the plants with action of soil micro-organisms.
- Use of legumes and biological nitrogen fixation for Nitrogen self-sufficiency.
- Weed, disease and pest management by crop rotations, natural predators, diversity, organic manuring, solar and biological intervention.
- Preference to traditional varieties for protection against various biotic and abiotic stress.
- The livestock management as per their evolutionary adaptations, behavioral needs and animal welfare issues with respect to nutrition, housing, health, breeding and rearing
- Attention to the influence of the farming system on the wider environment and the conservation of ecology.

PRINCIPLES OF ORGANIC AGRICULTURE

1. Principle of health: Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible. In view of this it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects.
2. Principle of ecology: Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.
3. Principle of fairness: Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities. Fairness requires systems of production, distribution and trade that are open and equitable and account for real

environmental and social costs.

4. Principle of care: Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment. Decisions should reflect the values and needs of all who might be affected, through transparent and participatory processes.

ORGANIC AGRICULTURE V/S CONVENTIONAL AGRICULTURE

Organic and conventional agriculture are two different farming systems.

Organic Farming	Conventional Farming
Decentralization of resources	Centralization on limited sources
Independence from monitory inputs	Dependence on monitory inputs
Community participation and healthy competition	Competition only for maximum production by individuals
Harmony with nature for sustainable production	Dominance on nature for maximum output
Ecological diversity	Monopoly with limited crops
Restraint and tolerance	Exploitation and exertion

COMPONENT WISE DIFFERENCES

Component	Organic Farming	Conventional Farming
Land exhaustion	Use of natural resources to improve soil health.	Dependence on synthetic chemicals for primary nutrients.
Fertilisers	Only fertilizers obtained through plant based or biological sources are used	Synthetic chemicals used
Nutrient quality	Healthy and nutritive production	Significant loss of nutrient quality in produce.
Impact on soil	Healthy soil with sustainable production potential	Ignorant about soil health
Impact on the environment	Harmony with ecology	Toxic effect on ecology.
Health safety	Production system is healthy for every component of ecology.	Detrimental to health, even for primary consumer.
Farming methods	Mix farming	Focused on crop production .
Lifestyle change for farmers	Towards sustainability…	Short-sighted approach…

Nutrient Management

Introduction:-

For nutrient management organic farmers mostly relies on the natural breakdown of available organic matter, using various techniques i.e. green manuring; vermi-composting and composting to replace nutrients taken from the soil by previous crops. Organic farming uses a variety of methods to improve soil fertility, including crop rotation, cover cropping, reduced tillage, and application of compost. By reducing tillage, soil is not inverted and exposed to air; less carbon is lost to the atmosphere resulting in more soil organic carbon. This has an added benefit of carbon sequestration, which can reduce greenhouse gases and help reverse climate change.

Organic farmers use cover crops; crop rotation; crop residue and animal manure, certain processed fertilizers such as de-oiled cakes ; bone meal; biofertilisers and various mineral powders such as rock phosphate and green sand, a naturally occurring form of potash that provides potassium. In some cases pH may need to be amended, therefore, natural pH amendments include lime and sulfur.

Biological research soil and soil organisms has proven beneficial to organic farming. Varieties of bacteria and fungi break down chemicals, plant matter and animal waste into productive soil nutrients. In turn, they produce benefits of healthier yields and more productive soil for future crops. Fields with less or no manure display significantly lower yields, due to decreased soil microbe community. Increased manure improves biological activity, providing a healthier, more arable soil system and higher yields.

Soil Health :-

Optimising soil 'health' is the foundation of any organic production program with the more emphasis on maintaining high levels of soil biological activity and organic matter, coupled with balanced/ optimum nutrient levels. Organics aims to 'feed the soil to feed the crop' by maintaining soil biology and nutrients at optimum levels throughout the rotation rather than the non-organic approach of applying nutrients to feed the current crop to maximise yield.

Soil management practices include the following :

1. Prevention of soil erosion and management of all type of soil degradations and of problematic soils.
2. Adoption of crop production systems that return back nutrients, organic matter and other resources removed from the soil by crops grown through recycling, regeneration and addition of organic materials and nutrients in to the soil.
3. Management of crop nutrients and soil fertility through companion plants, cover crops, crop rotation and application of crop refuse and plant materials
4. Management of animal and crop waste to maintain /improve soil organic matter content in a systematic manner so that it does not contribute to contamination of crops; soil or water by plant nutrients, pathogens, heavy metals or prohibited material residue.
5. Selection of Agricultural implements and cultivation practices to maintain / improve the physical, chemical and biological properties of soil.

Soil Organic Matter :- It is the fraction of soil consisting of dead organic plant or animal residues in various stages of decomposition, cells & tissues of micro or macro-organisms and substances from plant roots and soil microbes. As the soil inhabitates macro and micro-organisms that live or die in soil, they contribute to soil organic matter. Soil organic matter can also be added to the system by incorporating organic amendments i.e. compost , animal manure or off farm manures /minerals i.e. rock phosphate et. Beneficial soil inhabiting bacteria, fungi and Actinomycetes recycle soil organic matter and convert it into nutrients and other substances that ultimately contribute to soil productivity.

Soil Biological Activity :-

Soil organisms are building block of Healthy Soils, which make it live Soil. Such soils are full of biological activities in it and can support the plant growth to yield high quality crops and is sustainable in terms of productivity. Soil organisms also need food, water and shelter, proper organic management provides this sustenance and habitat to both micro (bacteria, fungi, actinomycetes) and macro organisms in the soil, i.e. earthworms, insects etc. When the plant or animal residue / waste is incorporated in to the soil, the microorganisms use them as Carbon source for their food. The soil biological activity can be maintained in an organic farm by the following practices:-

1. Use of seed treatment with Biofertilisers/ biopesticides / Beejamrit
2. Incorporation of Organic matter in to the soil, giving sufficient time for its decomposition well before sowing the crop.
3. Appropriate crop rotations, mixed cropping and avoiding intensive cultivation.
4. Use of organic mulches for maintaining optimum moisture conditions.
5. Slash burning is strictly prohibited.

Soil Nutrient Management :-

In organic farms the focus is on maintaining or enhancing long-term soil productivity, by improving soil health. This can be achieved by balancing use of cover crops; manures; compost and approved organic fertilisers and natural mineral supplements to improve soils over the time, which reflects in increased soil biological activity and improved soil structure; improved soil drainage and moisture holding capacity; it helps in reducing nutrient leaching and erosion and enhancing crop productivity and soil fertility cumulatively over the time.

The different strategies of long term soil nutrient management plan in an organic farm can be achieved by the combinations of following components:-

i. Cover crops

Every plant which covers the soil and improves soil fertility can be a cover crop. It could be a leguminous plant with other beneficial effects, or it could be a weed characterized by its rapid growth and enormous production of biomass. The most important property of cover crops is their fast growth and the capacity of maintaining the soil permanently covered. In order to ensure a permanent plant cover it is important to consider the following aspects:

- Timing of soil cultivation and planting or sowing.
- Producing seedlings and transplanting thereof.
- Mixed cultivation, intercropping; cover crops and mulching.
- Time of weeding
- Sowing of a green manure crop in the off-season
- Expected effect on yields
- Availability of suitable species at reasonable cost of seeds.
- Availability of water and labour
- Additional use of side-crops
- Reduction of the risk and ensuring food security

Cropping systems should be designed in such a way that the soil is almost permanently covered with plant canopy. In arable crops, careful timing of sowing and planting can help to avoid uncovered soil being washed away during the rainy season. The following characteristics make an ideal cover crop:

1. The seeds are cheap, easy to get, to harvest, to store and to propagate
2. Be of rapid rate of growth and be able to cover the soil in short time
3. Be resistant against pests and diseases
4. Produce large amounts of organic matter and dry material
5. Fix nitrogen from the air and provide it to the soil
6. Have a de-compacting root system and regenerate degraded soils
7. Easy to sow and to manage as single crop or associated with other crops
8. Can be used as fodder, grains as food grains

Cowpea (*Vigna unguiculata*) is an important grain legume throughout the tropics and subtropics. Mostly organic farmers usually intercrop cowpea in maize, sorghum, millet etc. It has some properties which make it an ideal cover crop:

a) It is drought tolerant and can grow with very little water
b) It can fix nitrogen and grows even in very poor soils
c) It is shade-tolerant and therefore compatible as an intercrop
d) It yields eatable grains and can be used as an animal fodder rich in protein
e) It is quite resistant to pest attack

Fig. Cow pea as cover crop in Maize field

Other legumes used as cover crops are alfalfa (*Medicago sativa*), crimson clover (*Trifolium incarnatum*), Faba beans (*Vicia faba*), hairy vetch (*Vicia vellosa*).

Some cover crops are used to improve the soil structure and to add organic matter to the soil, examples of non-legumes crops used for this purpose include barley (*Hordeum vulgare*), buckwheat (*Fagopyron esculentum*), oats (*Avena sativa*) etc.

ii. Mulching:-

Mulching is a method of covering the soil with a thin layer of biomass. For mulching, leaves, bark, nut shells, weeds, grasses, wood chips, silage, paper, pine and conifer needles, paddy or wheat straw, rice husk, coir dust, saw dust, banana and sugarcane leaf trashes etc which are easily available in the farm area can be used.

Fig. Rice straw mulching in Potato crop

The benefits of mulching are to prevent the loss of water by evaporation and transpiration, keep down weeds due to soil solarisation, dampen temperature fluctuations, increase soil moisture storage and facilitate uniform distribution of moisture in the soil horizon. Mulching also reduces the runoff and soil losses, prevents crusting and soil compaction, and reduces blowing and beating action of water and wind. Mulches modify the micro-climate, alter the environment of soil microbes, enhance soil flora and fauna activity, modify soil moisture regimes and properties associated with it and soil temperature in the root zone, improve rooting environment and soil productivity. Water use efficiency can be doubled with mulching, frequency and intensity of irrigation can be reduced drastically.

For mulching one-hectare area of any agricultural crop about 4-5 tons of the biomass is required. In most of the agricultural crops, mulches should be applied uniformly after the first weeding which generally occurs after 2-3 weeks of sowing/transplanting.

Mulching is also very useful in horticultural crops as it reduces the water requirement by reducing the loss of water due to evapo-transpiration. In most of the perennial crops like apple, pears, plums, mandarins, walnuts and fruit crops fallen leaves of the same plant can be used as mulch.

iii. Green Manuring: -

It is a practice of ploughing in the green plant material grown in the field or adding green plants with tender twigs or leaves from outside and incorporating them into the soil for improving the physical structure as well as fertility of the soil. It can be defined as a practice of ploughing or turning into the soil, undecomposed green plant material for the purpose of improving the soil fertility. The main objective of green manuring is to add an organic matter into the soil and thus, enrich it with 'N' which is most important and deficient nutrient.

Types of green manuring: There are two types of green manuring:

a. Green manuring *in-situ*: When green manure crops are grown in the field itself either as a pure crop or as intercrop with the main crop and buried in the same field, it is known as Green manuring *In-situ.* E.g.: Sunnhemp, Dhaincha, Pillipesara, Shervi, Urd, Mung, Cowpea, Berseem, Senji, etc.These crops are sown as main crop,inter row sown crop, on bare fallow, depending upon the soil and climatic conditions of the region.

b. Green leaf manuring (*Ex situ* Green Manuring): This refers to composting green leaves and tender green twigs, collected from shrubs and trees grown on bunds (Glyricidia, wild Dhaincha, Karanj) , waste lands and nearby forest area or weeds before flowering stage by collecting and decomposing as such by mean of turning in soil.

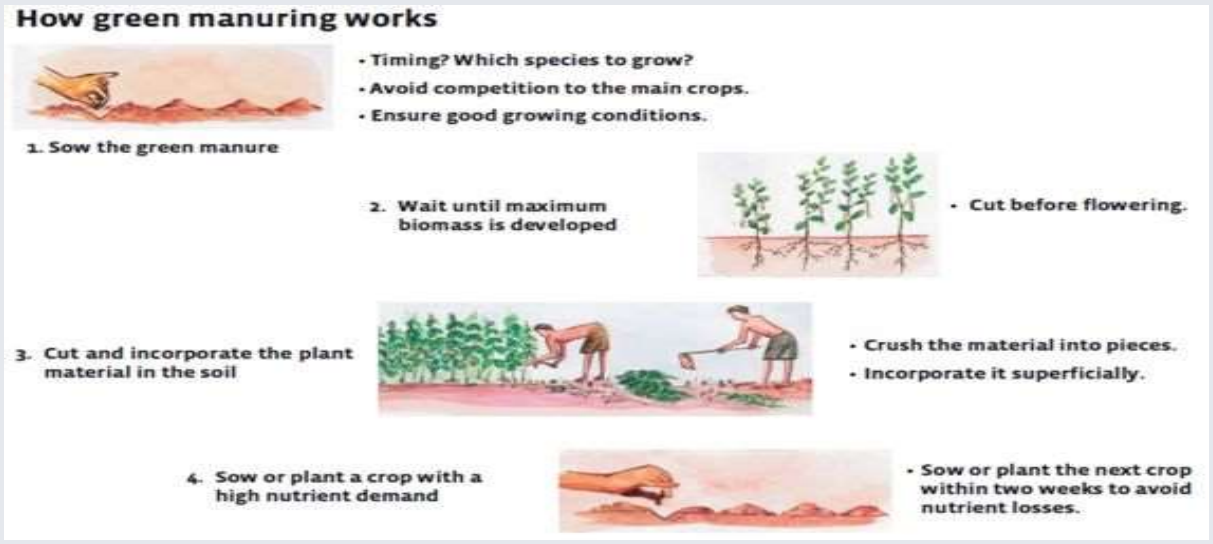


Fig : Steps for using green manures, with some points to consider

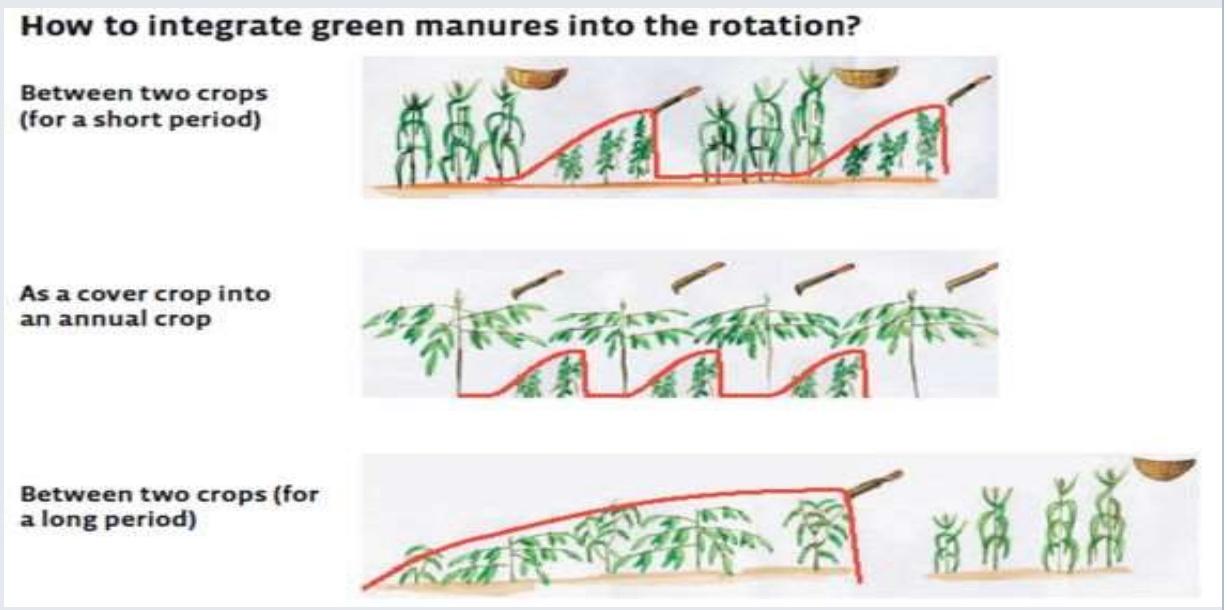


Fig : Possibilities of integrating green manures into the crop rotation

Characteristics of a Green manuring plant :-

1. Yield a large quantity of green material within a short period.
2. Be quick growing especially in the beginning, so as to suppress weeds.
3. Be succulent and have more leafy growth than woody growth, so that its decomposition will be rapid.
4. Preferably is a legume, so that atmospheric 'N' will be fixed.
5. Have deep and fibrous root system so that it will absorb nutrients from lower zone and add them to the surface soil and also improve soil structure.
6. Be able to grow even on poor soils.

Azolla As Green Manure :

Azolla is one of the waterborne blue green algae or fern which is mainly used as organic fertilizer in rice field in many parts of world. Azolla has micro leaves, fibrous roots as body parts & these small leaves are greenish from above & whitish in color below. However the anatomy of leaves has concern, these leaves have small vacuum in upper part which consist of Blue green algae called as "ANABINA AZOLLY" which fixes nitrogen from surrounding environment. There is symbiosis between Azolla & blue green algae in which nitrogen required for Azolla provided by blue green algae & algae requires some essential nutrients from Azolla (Fig 15).

Fig . Green Manuring through Azolla in Paddy Field

Production Methodology - Azolla is produced under the 2 m pit with clean edges and base of pit should be kept under shadow of tree. Put plastic paper in pit then place silpaulin sheet above the plastic sheet. Put 10 – 15 kg fine soil after that spray slurry which contains 2kg cow dung& 30gm super phosphate in 10 liters of water. Add water to make the level of water of 10 cm. Then add 0.5-1kg of fresh Pure Azolla culture. After 10-15 days there is uniform growth of Azolla and from each bed 500-600 gms of Azolla can be procured .Regularly after each 5days 1kg of Dung and 20gms of super phosphate to be added in each bed. It is necessary to harvest 200gms of Azolla per week. Also temperature of surrounding should not go above 25^0C,maintain water pH 5.5 -7.0 .At each month,5kg soil should be replaced and at the age of six month ,these bed should be totally replaced with new beds.

Azolla consist of 25 to 35% proteins as well as Ferous, Copper, Magnesium in good proportion than that of ordinary fodder grasses, if we use Azolla in feed of milch animals then milk production will improve. As far as use of Azolla for milk animal is concerned, now a days, there is much attention on the aspect of animal nutrition and Azolla. Azolla has abundant amount of proteins & vitamins. It is also studied that by using Azolla in feed of animals, there is decrease in cost of feed than that of whatever ordinary feeds & feedstuffs used in diet of animals. If we use EM along with Azolla then this also increase milk production. If we consider these practices on the basis of Dry Matter, besides above mentioned proteins values, there is additional 10 to 15 % minerals & 7 to 10 % amino acids and bioactive enzymes.

Stage of green manuring: A green manuring crop may be turned in at the flowering stage or just before the flowering. The majority of the G.M. crops require 6 to 8 weeks after sowing at which there is maximum green matter production and most succulent.

Advantages:

I. It adds organic matter to the soil and simulates activity of soil micro-organisms.
II. It improves the structure of the soil thereby improving the WHC, decreasing run-off and erosion caused by rain.
III. The G.M takes nutrients from lower layers of the soil and adds to the upper layer in which it is incorporated.
IV. It is a leguminous crop, it fixes 'N' from the atmosphere and adds to the soil for being used by succeeding crop. Generally, about 2/3 of the N is derived from the atmosphere and the rest from the soil.
V. It increased the availability of certain plant nutrients like P2O5, Ca, Mg and Fe.

Limitations of green manuring:

I. Under rain fed conditions, the germination and growth of succeeding crop may be affected due to depletion of moisture for the growth and decomposition of G.M
II. G.M crop inclusive of decomposition period occupies the field atleast 75-80 days which means a loss of one crop.
III. Incidence of pests and disease may increases if the G.M is not kept free from them. Application of phosphatic fertilizers to G.M crops (leguminous) helps to increase the yield, for rapid growth of Rhizobia and increase the 'P' availability to succeeding crop.

iv. Crop –Animal Association :-

These practices integrate crop and livestock systems. In this case, cropping provides animals with fodder from grass and nitrogen-binding legumes, leys, weeds and crop residues. Animals graze under trees or on stubble, they provide draught and manure for crops, while they also serve as a savings account.

Animal wastes are used for fertilizer, fish feed and biogas generation. Crop and human wastes are also added to the biogas unit. Liquid effluent from the biogas generator is used in the fishpond and solid residues on the garden. Periodically, the locations of the garden and the pond are reversed, so residues from one serve as nutrients for the other.

Crop Manuring and soil enrichment

During conversion period, soil fertility can be improved and maintained initially through use of organic inputs like well decomposed organic manure/ vermicompost, green manure and biofertilizers in appropriate quantity. These organic inputs are used for feeding the soil. Well-fed healthy soil rich in micro-flora and micro-fauna takes care of the crop nutrient requirement. Plant biomass, FYM, Cattle dung manure, enriched compost, biodynamic compost, Cow-pat-pit compost and vermicompost are key sources of on-farm inputs. Among off-farm inputs, important components are non-edible oil cakes, poultry manure, biofertilizers, mineral grade rock phosphate and lime etc.

Lopping from Glyricidia and other plants grown PROM, Organic fertilizers on bunds, on-farm produced compost and vermicompost, animal dung and urine and crop residue should form the major source of nutrient and concentrated manures such as crushed oil cakes, poultry manure, vegetable market waste compost and other novel preparations such as biodynamic formulations etc can be used in appropriate quantity. Use of high quantities of manures should be avoided.

Changing crop rotations and multiple crops ensure better utilization of nutrient resources in an organic farm. Depending upon the type of crop and requirement of nutrients for different crops, the quantity of externally produced inputs is determined. This can be achieved by the following means:-

i. Biofertilizers and microbial cultures

Biofertilizers are product formulations designed to provide enhanced nutrient availability and uptake, stimulation of crop growth, biological nitrogen fixation, and protection against insect pests and disease. Depending on the purpose, biofertilizer products can be applied to soil, seeds, or foliar application. Several common categories of biofertilizers include nitrogen-fixers, phosphorus-solubilizers, phosphorus absorbers/mobilisers. Nitrogen-fixers such as Rhizobium (in symbiosis with

legumes), *Azospirillum*, and *Azotobacter* convert atmospheric nitrogen into ammonia. *Bacillus* and *Pseudomonas sp.* are examples of microbes found in phosphorus-solubilizing biofertilizers that lower the soil pH to dissolve soil-bound phosphate for plant availability and may be most effective for calcareous soils. Arbuscular mycorrhizal fungi (AMF) take up soil phosphorus, zinc, and copper and transfer these to plant roots.

Biofertilizers such as *Rhizobium, Azotobacter, Azospirillum*, PSB and *Pseudomonas* etc have been found to be very effective tools of fertility management and biological nutrient mobilization. Recently customized consortia of such biofertilizer organisms, better adapted to local climatic conditions have also been developed and are available commercially. Efficiency of such microbial formulations is much higher under no-chemical use situations, therefore application of such inputs need to be ensured under all cropping situations.

Method of application:

Biofertilizers can be applied to different crops and plants by three different ways.

1. Seed treatment Suspend 200 gm each of nitrogen fixing and PSB in 300-400 ml of water and mix thoroughly. Pour this slurry on 10 to 12 kg of seed and mix by hands, till all the seeds are uniformly coated. Dry the treated seeds in shade and sow immediately. For acidic and alkaline soils it is always advisable to use 1 kg of slacked lime or gypsum powder respectively for coating the wet biofertilizer treated seeds.
2. Seedling root dip treatment: - Suspend 1 to 2 kg each of nitrogen fixing (*Azotobacter*/*Azospirillum*) and PSB into just sufficient quantity of water (5-10 lit depending upon the quantity of seedlings required to be planted in one acre). Dip the roots of seedlings in this suspension for 20-30 min before transplanting. In case of paddy make a sufficient size bed (2mt x 1.5mt x 0.15mt) in the field, fill it with 5 cm of water and suspend 2 kg each of *Azospirillum* and PSB and mix thoroughly. Now dip the roots of seedlings in this bed for 8-12 hours (overnight) and then transplant.
3. Soil treatment: - For soil treatment depending upon the total number of plants per acre 2-4 kg of *Azotobacter*/*Azospirillum* and 2-4 kg of PSB are required for one acre. Mix two types of biofertilizer in 2-4 liters of water separately and sprinkle this suspension on two separate heaps of 50-100 kg of compost. Mix the two heaps separately and leave for incubation overnight. After 12 hours, mix the two heaps together. For acidic soils mix 25 kg lime with this mixture. In plantation crops apply this mixture at the root zones by dibbling. In some field crops the mixture is broadcast evenly in the moist field and mixed with soil just before sowing. In sugarcane the biofertilizer manure is to be applied in furrows near the root zone, after 30-40 days of planting and covered with soil. In potato it is to be applied after 20 days of planting or at the time of earthing-up operations. In case of sugarcane and potato, if setts/tubers are not treated with plant protection chemicals then biofertilizer compost mixture can be applied in furrows immediately before planting

ii. Composting:

Composting is the natural process of 'rotting' or decomposition of organic matter by microorganisms under controlled conditions. Raw organic materials such as crop residues, animal wastes, food garbage, some municipal wastes and suitable industrial wastes, enhance their suitability for application to the soil as a fertilizing resource, after having undergone composting.

a. Need of Composting the Organic Waste:-

I. The rejected biological materials contain complex chemical compounds such as lignin, cellulose, hemi-cellulose, polysaccharides, proteins, lipids etc.
II. These complex materials cannot be used as such as resource materials.
III. The complex materials should be converted into simple inorganic element as available nutrient.
IV. The material put into soil without conversion will undergo conversion inside the soil.
V. This conversion process takes away all energy and available nutrients from the soil affecting the crop.
VI. Hence conversion period is mandatory.

b. Advantages of Composting:-

i. Volume reduction of waste.
ii. Final weight of compost is very less.
iii. Composting temperature kill pathogen, weed seeds and seeds.
iv. Matured compost comes into equilibrium with the soil.
v. During composting number of wastes from several sources are blended together.
vi. Excellent soil conditioner
vii. Saleable product
viii. Improves manure handling
ix. Reduces the risk of pollution
x. Pathogen reduction
xi. Additional revenue.
xii. Suppress plant diseases and pests.
xiii. Reduce or eliminate the need for chemical fertilizers.
xiv. Promote higher yields of agricultural crops.
xv. Facilitate reforestation, wetlands restoration, and habitat revitalization efforts by amending contaminated, compacted, and marginal soils.
xvi. Cost-effectively remediate soils contaminated by hazardous waste.
xvii. Remove solids, oil, grease, and heavy metals from stormwater runoff.
xviii. Capture and destroy 99.6 percent of industrial volatile organic chemicals (VOCs) in contaminated air.
xix. Provide cost savings of at least 50 percent over conventional soil, water, and air pollution remediation technologies, where applicable.

c. Methods of composting:-

In the Indore method of composting, organic wastes are spread in the cattle shed to serve as bedding. Urine soaked material along with dung is removed every day and formed into a layer of about 15 cm thick at suitable sites. Cattle urine soaked earth, scraped from cattle sheds is mixed with water and sprinkled over the layer of wastes twice or thrice a day. Layering process continued for about a fortnight. A thin layer of well decomposed compost is sprinkled over top and the heap given a turning and reformed. Old compost acts as inoculum for decomposing the material. The heap is left undisturbed for about a month. Then it is thoroughly moistened and given a turning. The compost is ready for application in another month.

In the Bangalore method of composting, dry waste material of 25 cm thick is spread in a pit and a thick suspension of cow dung in water is sprinkled over for moistening. A thin layer of dry waste is laid over the moistened layer. The pit is filled alternately with dry layers of material and cow dung suspension till it rises 0.5 m above ground level. It is left exposed without covering for 15 days. It is given a turning, plastered with wet mud and left undisturbed for about 5 months or till required.

In Coimbatore method, composting is done in pits of different sizes depending on the waste material available. A layer of waste materials is first laid in the pit. It is moistened with a suspension of 5-10 kg cow dung in 2.5 to 5.0 I of water and 0.5 to 1.0 kg fine bone meal sprinkled over it uniformly. Similar layers are laid one over the other till the material rises 0.75 m above the ground level. It is finally plastered with wet mud and left undisturbed for 8 to 10 weeks. Plaster is then removed, material moistened with water, given a turning and made into a rectangular heap under a shade. It is left undisturbed till its use. In Coimbatore method, there is anaerobic decomposition to start with, following by aerobic fermentation. It is the reverse in Bangalore method. The Bangalore compost is not so thoroughly decomposed as the Indore compost or even as much as the Coimbatore compost, but it is bulkiest.

d. Compost Enrichment:-

In most of cases the farm compost is poor in P content (0.4-0.8 percent). Addition of P makes the compost more balanced, and supplies nutrient to micro-organisms for their multiplication and faster decomposition. The addition of P also reduces N losses. Compost can be enriched by:

1) Application of superphosphate, bone-meal or phosphate rock: 1 kg of superphosphate or bone-

meal is applied over each layer of animal dung. Low-grade phosphate rock can also be used for this purpose.

2) Use of animal bones: these can be broken into small pieces, boiled with wood ash leachate or lime water and drained, and the residue applied to the pits. This procedure of boiling bones facilitates their disintegration. Even the addition of raw bones, broken into small pieces and added to the pit, improves the nutrient value of compost significantly.
3) Wood ash waste can also be added to increase the K content of compost.
4) Addition of N-fixing and P-solubilizing cultures (IARI, 1989): The quality of compost can be further improved by the secondary inoculation of *Azotobacter*, *Azospirillum lipoferum*, and *Azospirillum brasilence* (N-fixers); and *Bacillus megaterium* or *Pseudomonas* sp. (P solubilizers). These organisms, in the form of culture broth or water suspension of biofertilizer products, can be sprinkled when the decomposing material is turned after one month. By this time, the temperature of the compost has also stabilized at about 35 °C. As a result of this inoculation, the N content of straw compost can be increased by up to 2 percent. In addition to improving N content and the availability of other plant nutrients, these additions help to reduce the composting time considerably.

Compost is a rich source of organic matter. Soil organic matter plays an important role in sustaining soil fertility, and hence in sustainable agricultural production. In addition to being a source of plant nutrient, it improves the physico-chemical and biological properties of the soil. As a result of these improvements, the soil becomes more resistant to stresses such as drought, diseases and toxicity; it also helps the crop in improved uptake of plant nutrients; and possesses an active nutrient cycling capacity because of vigorous microbial activity.

iii. Vermicomposting

Earthworms have been on the Earth for over 20 million years. In this time they have faithfully done their part to keep the cycle of life continuously moving. Their purpose is simple but very important. *Vermicomposting* is the process of turning organic debris into worm castings. The worm castings are very important to the fertility of the soil. Vermicomposting can be done on small scale on farm and large scale commercial level.

The species of earthworms are used in vermicomposting include *Eisenia foetida; E. andrae; Eudrillus eugeneae* and *Perionix excavates* by most of organic growers in India. The worms should be carefully maintained and checked for health. The selection of feed is very important. The feed should not have any chemical toxic for earthworms.

The procurement of organic waste should be checked for seepage and contamination. For the initial multiplication of earthworm mother culture best feed substrate is cow dung manure at advance stage of decomposition and free from insect pests and pathogens. All the biodegradable and decomposable organic waste can be used in vermicomposting. Waste material such as cattle dung; crop refuge; weeds; vegetable waste, sugarcane trash and orchard leaf litter; poultry droppings etc. is used in vermicomposting.

a. Vermicomposting method:

Depending upon the nature and quantum of organic waste, facilities/ space available , there are different methods of vermicomposting i.e. Surface bed heap method; tank method, vermin-bin method, hanging out door worm system, large iron basket method etc. However for the large scale or commercial production of vermicompost is most done via surface bed method with the help of *Eisenia* and *Eudrillus* species of earthworms. Step wise process involved in this method is as follows:

1. Separate non bio-degradable materials i.e. plastics, stones, ceramics, glass and metals from the waste.
2. Leaf litter, plant parts, sugarcane trash etc like coarse organic waste material is threshed/ chopped in to small pieces of about2-4 inch size. This reduces the composting time.
3. Collected organic waste is spread in a layer of about 1 foot and subjected to exposure to Sun for a day or two for removing the foul smell and killing unwanted organisms.
4. This organic waste is mixed with the cattle dung and transferred in pits for pre-treatment for about 25-30 days. To maintain the proper moisture watering is done on daily basis. When this material is

partially decomposed it is taken out of the pit and spread in floor for a day or two to remove the foul odour and the insects etc from it.

5. Vermi bed is prepared by putting 1- 1½ inch layer of sand on the floor, above it a 3-4 inch thick layer of coarse biomass/ crop residue is prepared followed by 18-19 inch thick layer of pre-treated biomass making the width of bed about 40-45 inches. The length of vermin bed is kept according to the available space in the shed. A 10 feet long bed can accommodate about 5000 kg of organic waste. After preparation of bed watering is done to maintain the required temperature and it is left for 2-3 days as such.
6. When there is no bad smell and even temperature on the bed, the bed is inoculated with earthworms @ about 8-10 kg earthworms/ 120-140 cubic ft. vermin-bed, along with the cocoons, mixer of some preformed compost and raw material in a manner that it cover one side of the bed lengthwise.
7. The Vermi-bed is completely covered with 34 inch thick layer of chopped/ fine biomass and routinely watered to maintain desired moisture in bed. Under the favourable conditions the earthworms spread in whole bed themselves. Most of the earthworm live at upper 6 inch area of the bed, eat organic waste and excrete casting.
8. After 25-30 days under proper moisture, temperature and aeration the fully prepared vermicast will be deposited on upper 6 inch depth of bed, which is separated from the vermi-bed by removing the covering layer of vermi-bed at one side, in this process the earthworms migrate deep in to the vermi-bed due to exposure of light and vermicasting is removed easily from the bed at other end of vermi-bed. The vermi-bed is covered againwith the fine raw materialand watered daily to maintain proper moisture and temperature in the vermi-bed. After 5-7 days another 4-6 inch thick layer of vermicast will be formed again. This layer of vermicast is also removed like the previous time and the vermin-bed is covered again.
9. Subsequently after every 5-7 days 4 - 6-inch-thick layers of vermicast will be formed and removed as earlier ones. By this way about 80-85% vermicomost can be collected within 45-50 days. At the end some vermicast along with earthworms, cocoons, young earthworms will be left in form of small heap, which can be used as earthworm inoculum for the next cycle.
10. The same process is to be repeated to continue the production of vermicompost. The collected vermicompost is sieved to separate the unfed material, cocoons and young earthworms, with the help of 3-4 mm size sieve.
11. The sieved vermicompost is spread in cemented platform to remove excess moisture, when the moisture level reaches 20-25 % it is collected in form of a heap. This vermicompost is packed in plastic/ HDPE bags in a manner that further it should not loose moisture.

Fig. . Surface bed Method of Vermicomposting

Fig. Earth worms (*Eudrillus euguneae*)used in Vermicomposting

b. Precautions :

Vermicomposting is a simple technique to operate, however following precautions to be taken for production of good quality vermicompost :

1. The raw material should be chopped in to small pieces and partially-decomposed before putting in to the bed. Never add fresh waste in to the bed it will lead to rise in temperature of vermin-bed.
2. Moisture level in the vermin-bed should be around 30-40%, excess moisture in bed will lead to un-aerobic conditions and change the pH of vermin-bed. If moisture is excess in the vermin-bed, dry cattle dung manure or leaf litter should be mixed with the substrate.
3. The optimum moisture level in vermicompost is 20-25 %, the low or excess moisture in vermicompost depletes the quality of vermicompost.
4. Optimum temperature requirement is 20-30 ^{0}C in the vermibed. However, the survival of earthworms is even at lower and higher up to 45^{0}C air temperature. Obviously with little provision of shade, temperature in vermibed can be reduced.
5. The earthworm population is adversely affected with very low or high pH of substrate. For effiective results the pH of vermibed/ feeding material should around neutral.
6. Earthworms are sensitive to light, which may cause injury or kill them. Therefore, they should be protected from exposure to light.
7. Earthworms should be protected from birds, rats and snakes.
8. The packaging material of vermicompost should be of good quality to keep moisture preserved during storage.
9. Unfed material in the vermicompost decomposes in the storage and result in heating of vermicompost during storage, which ultimately degrades the quality of vermicompost. There should be no unfed material in the vermicompost,

b. Methods of Application :

Vermicompost is an excellent source of plant nutrients which results in improvement of yield on an average of 10-15 %; improves quality of produce and maintains the natural taste of fruits, vegetables and cereals. Dose of application of vermicompost for different crops in generalis as follows :

1. Cereals and Pulses- 2.0 tonnes/ ha
2. Oil seeds – 3-5 tonnes/ ha
3. Spices – 2-10 kg / plant
4. Vegetables- 4-6 tonnes/ ha
5. Cash crop- 5 tonnes/ ha
6. Plantation crop – 5.0 kg/ plant
7. Ornamental plants – 4.0 tonnes/ ha

The application of vermicompost is very popular in ornamental horticulture, floriculture, vegetable cultivation as it gives excellent results. It not only provides the nutrients to the plants but also reduces the disease and pest attack. Studies in potato field revealed that application of vermicompost reduced the attack of diseases to the potato crop (G.Chattopadhaya Personnel communication). Field application procedure of vermicompost is very simple, it is broadcasted uniformly in the field at the time of sowing @ 5.0 -7.5 tonnes/ ha, depending upon the type of crop. In standing crop the vermicompost is placed in the root feeder zone area before irrigation. In fruit trees / plantation crops a circular furrow around the canopy cover of the plant in circular furrow of about 6 inch deep is digged and vermicompost is applied in it @ 5.0 kg per plant and the furrow is covered with the soil.Vermicompost enriched with *Azotobacter, Azospirilllium* and PSB biofertilisers @1 kg/ 40 -50 kg of vermicompost improves the response on the growth and yield of different crops.

iv. Vermiwash

Vermiwash, a liquid fertilizer collected after the passage of water through a column of worm activation is very useful as a foliar spray. It contains plant growth hormones like auxins and cytokinins

apart from nitrogen, phosphorus, potash and other micro nutrients. It contains nitrogen fixing bacteria like Azotobacter sp., Arobactericum sp. and some phosphate solublizing bacteria. It acts as a plant tonic and helps to reduce many plant diseases. Vermiwash acts as a plant tonic and helps to reduce many plant diseases A mixture of Vermiwash (1litre) with cow urine (1litre) in 10 liters of water acts as bio-pesticides and liquid manure. Increases the rate of photo synthesis in crop / plant.Increases the number of micro-organisms in the soil.Increases the crop yield.Increases the resistance to pest and diseases.Increases the rate of decomposition of compost.

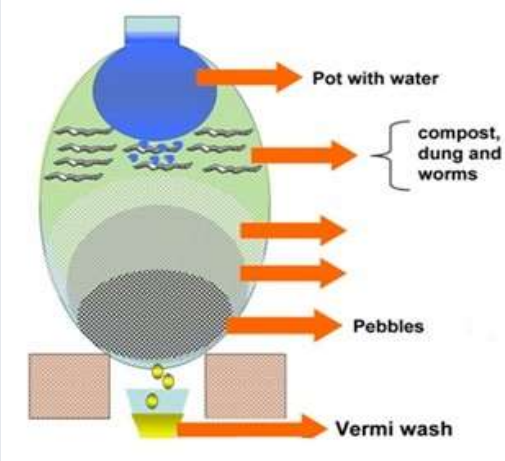


Fig . : Methodology of Vermi-wash Production

The basic principle of Vermi wash preparation is simple. The system consists of an earthen pot of 10 kg capacity, which is filled, with pieces of stone up to 10 cm height from the bottom. above this, a plastic net is placed and spread out. then a thick layer of coir fiber along with humus containing 1500-2000 worms of species eudrillus euginae or eisenia foetidae is laid down. the hole situated at the bottom of the pot is fixed with a water tap through which vermiwash is collected. every day, the kitchen waste is put into the container. allow the composting process to continue for one week or more till brownish black mask of compost is obtained. occasionally, two or three tablespoons of fresh cow-dung slurry is poured on the humus as feed for the worms. after the formation of compost, soak the entire mask with two liters of water. after 24 hours, about 1.5 liter of vermin-wash can be collected. this process can be continued for one or two weeks till the brown colour of wash disappears. the less enriched compost that remains in the pot can be collected and used as fertilizer. later, the pot can be emptied and set up again to continue the process.

Vermi-wash units can be set up either in barrels or in buckets or even in small earthen pots (Fig 14).Vermi-wash acts as a plant tonic and helps to reduce many plant diseases A mixture of Vermi-wash (1litre) with cow urine (1litre) in 10 litres of water acts as bio-pesticides and liquid manure. Ii increases the rate of photo synthesis in crop / plant and also increases the number of micro-organisms in the soil. Vermi-wash increases the crop yield and the resistance to pest and diseases. The rate of decomposition of compost is also enhanced by vvermi-wash. Vermi-wash is collected after the passage of water through a column of worm action in liquid form and is very useful as a foliar spray. It is a collection of excretory products and mucus secretion of earthworms along with micronutrients from the soil organic molecules. These are transported to the leaf, shoots and other parts of the plants in the natural ecosystem. Vermi-wash, if collected properly, is a clear and transparent, pale yellow coloured fluid.

v. EM – Technology: -

EM or Effective Microorganisms is a consortium culture of different effective microbes commonly occurring in nature. Most important among them are : N_2-fixers, P-solubilizers, photosynthetic microorganisms, lactic acid bacteria, yeasts, plant growth promoting rhizobacteria and various fungi and actinomycetes. In this consortium, each microorganism has its own beneficial role in nutrient cycling, plant protection and soil health and fertility enrichment.

Depending upon the requirement and its end use, various EM formulations have been developed. Even among one formulation depending upon the place and climatic conditions some variations have

been incorporated and recommended by promoting institutes and agencies. Some of the widely used and popular formulations are described below. Water used in all formulations should be either rain water or fresh tube-well water. Tap water is not to be used.

a. EM-1 formulation- This formulation is used for seed treatment, soil enrichment and for spray in field after the emergence of seedlings. To prepare it dissolve 5 kg jaggary (chemical free) in about 100 lit of water. Add 5 lit of EM and mix thoroughly and pour into a plastic barrel. Seal the barrel and allow fermenting for 7 days. Dilute this solution in a ratio of 1:1000 and spray over soil or crop residue. For seed treatment soak the seeds in this diluted solution.

b. EM-5 for control of insects and pests – To prepare this formulation dissolve 100gm of jaggary in 600 ml of water and add 100 ml each of natural vinegar, wine or brandy and EM. Mix thoroughly and transfer the contents in a plastic bottle or barrel and seal the container. To increase the potency few cloves of garlic and chilly paste can also be added to this suspension before sealing the container. Allow the contents to ferment for 5-10 days under shade, while releasing the gas daily. Within 10 days the EM solution will be ready for use. This can be stored up to 3 months at normal room temperature in a cool and dry place. Dilute the contents in a ratio of 1 : 1000 and apply as foliar spray with the help of a sprayer.

c. Fermented Plant Extract (FPE) – In this formulation fresh green weeds are fermented with EM to obtain a fermented plant extract. To prepare FPE grind 2.3 kg of fresh green weeds to a coarse paste. Dilute with 14 lit of water and dissolve 42 g of jaggary in some water and mix with weed suspension adding 420 ml of EM. Transfer the contents to a plastic drum and with the help of a thick plastic sheet cover the drum and tie with a rope. The drum should be filled up to the top, leaving very little space for air. Fermentation and gas formation process will start slowly. Mix the contents at repeated intervals. Finished FPE having a pH of 3.5 with pleasing smell will be ready in 5-10 days' time. Filter the solution through a cloth and collect the filtrate. For spraying on soil dilute the FPE in a ratio of 1 : 1000 with fresh water. For spraying on crops dilute FPE in a ratio of 1 : 500. Spraying should be done after germination of seeds in early morning hours once or twice a week.

d. EM-Bokashi – Bokashi is a type of compost prepared by fermentation of waste organic matter with the help of EM. Bokashi is mainly used for improving the fertility status of soil and for enhancing the degradation of crop residue. Collect sufficient quantity of different organic matter (such as rice bran, fish meal, animal waste etc) equivalent to 150 lit drum volume. Mix 150gm of jaggary and 50 ml of EM in 15 lit of water. Mix this solution with organic waste thoroughly in such a way that entire contents get uniformly moistened. Transfer the contents in a plastic bag and seal the bag. To ensure the anaerobic conditions put this bag into another polythene bag and seal. Allow the contents to ferment for 3-4 days in a cool shade place. Bokashi will be ready after 4 days, which can be used immediately or can be stored in plastic air tight bags up to 6 months.

Bokashi can be used directly as compost in poor fertility soils. It can also be used along with the crop residues. For 0.1 ha mix 100-150 kg Bokashi with sufficient quantity of finely chopped crop residue. Spread this mixture over 0.1 ha area and mixed with soil a day before sowing. Spraying of 5-10 lit of 1:500 diluted simple EM-solution over this mixture can further boost the degradation process. By using Bokashi+crop residue+EM-solution the requirement of compost can be dispensed with. This can save lot of labour, time and space required for compost process.

<u>Doses of EM formulations</u>

a. At the time of land preparation – Dilute 5-10 lit of simple EM solution in 50-100 lit of water and sprinkle/spray over 0.1 ha of land, when soil is wet a day before sowing.
b. For seed treatment – Soak seeds for 5-6 hrs in 1 : 100 fold diluted EM solution and sow immediately.
c. As foliar/ soil spray – After seedling emergence, 1 : 1000 diluted EM solution or FPE should be sprayed at the rate of 500 lit per ha, 4-5 times at an interval of 7-10 days. In fast growing crops such as vegetables, spraying should be done twice a week. In transplanted crops 1 : 500 diluted FPE can be sprayed after 5 days of transplanting @ 750-1000 lit per ha.
d. For soil enrichment – For every 0.1 ha mix 100-150 kg Bokashi with crop residue and mix with soil just before sowing. Simple EM solution @ 5-10 lit can also be used as spray over

this residue-Bokashi mix. Spraying the soil with 5-10 lit of FPE mixed in 500-1000 lit of water per ha also add to the fertility of the soil.

vi. Some Popular formulations for soil enrichment: -

Many variants of liquid manures are being used by farmers of different states. Few important and widely used formulations are given below:

a. Sanjivak – Mix 100 kg cow dung, 100 lit cow urine and 500 gm jaggary in 300 lit of water in a 500-lit closed drum. Ferment for 10 days. Dilute with 20 times water and sprinkle in one acre either as soil spray or along with irrigation water.
b. Jivamrut – Jivamruta has been found to be rich in various beneficial microorganisms. It is prepared by mixing cow dung 10 kg, cow urine 10 lit, Jaggary 2 kg, any pulse grain flour 2 kg and Live forest soil 1 kg in 200 lit water. Ferment for 5 to 7 days. Stir the solution regularly three times a day. Use in one acre with irrigation water. About 200 lits of jivamruta is needed for one application in one acre. It can be applied through irrigation water by flow, by drip or sprinkler or even by drenching of mulches spread over the field or under the tree basin.
c. Amritpani - Mix 10 kg cow dung with 500 gm honey and mix thoroughly to form a creamy paste. Add 250 gm of cow desi ghee and mix at high speed. Dilute with 200 lit water. Sprinkle this suspension in one acre over soil or with irrigation water. After 30 days, apply second dose in between the row of plants or through irrigation water.
d. Panchgavya – Panchgavya is used by some farmers as bio-enhencer prepared from five products obtained from cow; dung, uine, milk, curd and ghee. It can be prepared by mixing fresh cow dung 5 kg, cow urine 3 lit, cow milk 2 lit, curd 2 lit, cow butter oil 1 kg and ferment for 7 days with twice stirring per day. Dilute 3 lit of Panchgavya in 100 lit water and spray over soil. 20 lit panchgavya is needed per acre for soil application along with irrigation water. Panchgavya contains many useful microorganisms such as fungi, bacteria, actinomycetes and various micronutrients. The formulation act as tonic to enrich the soil, induce plant vigour with quality production. Panchgavya has also been found to be reducing nematode problem in terms of gall index and soil nematode population. As due to application of panchgavya a thin oily film is formed on the leaves and stem, it reduces evaporation losses and ensures better utilization of applied water.
e. Enriched Panchgavya:- It is made from cow dung 5 kg, cow urine 3 lit, cow milk 2 lit, curd 2 lit, cow deshi ghee 1 kg, sugarcane juice 3 lit, tender coconut water 3 lit, banana paste of 12 fruits and toddy or grape juice 2 lit. Mix cow dung and ghee in a container and ferment for 3 days with intermittent stirring. Add rest of the ingredients on the fourth day and ferment for 15 days with stirring twice daily. The formulation will be ready in 18 days. Sugarcane juice can be replaced wit 500 g jaggery in 3 lits water. In case of non-availability of toddy or grape juice 100g yeast powder mixed with 100 g jaggery and 2 lit of warm water can also be used. For foliar spray 3-4 lit panchgavya is diluted with 100lit water. For soil application 50 lit panchagavya is sufficient for one ha. It can also be used for seed treatment.

Epilogue:-

Nutrient management on organic farms requires long-term planning and a diverse combination of cultural practices and inputs. There are an increasing number of commercially-available organic fertilizers and biofertilizers, but the most profitable organic farms typically source nutrients on or very near the farm by using organic wastes, scavenging residual soil nutrients, and biological fixation of nitrogen. When off-farm or manufactured fertilizer inputs are necessary, it is essential to verify that the production Standard norms are being compiled with.

The major aim of organic agriculture is to maintain a productive and biologically-active healthy soil, wherein the nutrient levels are maintained at optimum levels across the whole rotation. These levels are determined by regular soil tests and field by field nutrient budgets. The optimum levels are similar to, and based on the guidelines of Organic standards being followed. Soil tests and nutrient budgets provide the information to establish the best fields on which to use farm produced manures and, where ever necessary to use bought-in biological and mineral fertilizers (off farm inputs) to replace soil nutrients exported in crops and livestock or lost to water or the atmosphere. This gap can be fulfilled by all possible natural /permitted means available.

Pest and Disease Management

Organic pest management is a component of Organic Farm Management, has been developed as a farming system to meet the requirements of long term sustainability. Success of pest management in organic farming requires three basic areas which includes; prevention, monitoring and timely intervention with need based use of botanical and microbial pesticides (bio-pesticides) as the chemicals are not at all permissible in organic farming system. It is based on cordial principles of Natural Pest Management with respect to environment, in ways which suits local site, climatic and economic conditions and safeguards farm's natural assets in long term. It includes practices that avoid waste, enhance energy efficiency and minimize pollution.

Avoidance Techniques: -

To manage pests effectively, producers need to understand the biology and growth habits of both pest and crop. The type and concentration of pests are often responses to previous crop history, pest life cycles, soil conditions and local weather patterns.

A. Prevention:-

This technique is based on the principle of *"Prevention is better than cure"*. It is the most important indirect method which aim to reduce initial severity of pest infestation by way of removing primary indicators. Many aspects of farm agronomy and crop management prevent the initial build-up of pest infestations and its secondary spread to surrounding crop area and adjoining cropped areas. Common options are to prefer growing crops and varieties in appropriate locations where they fit to climate, soil and topography. Local conditions provide the crop with optimal growth conditions from the seedling, which makes them strong enough to bear the injury to tolerable level. For small temporary benefits raising of non-local and off-season crops are avoided in this practice.

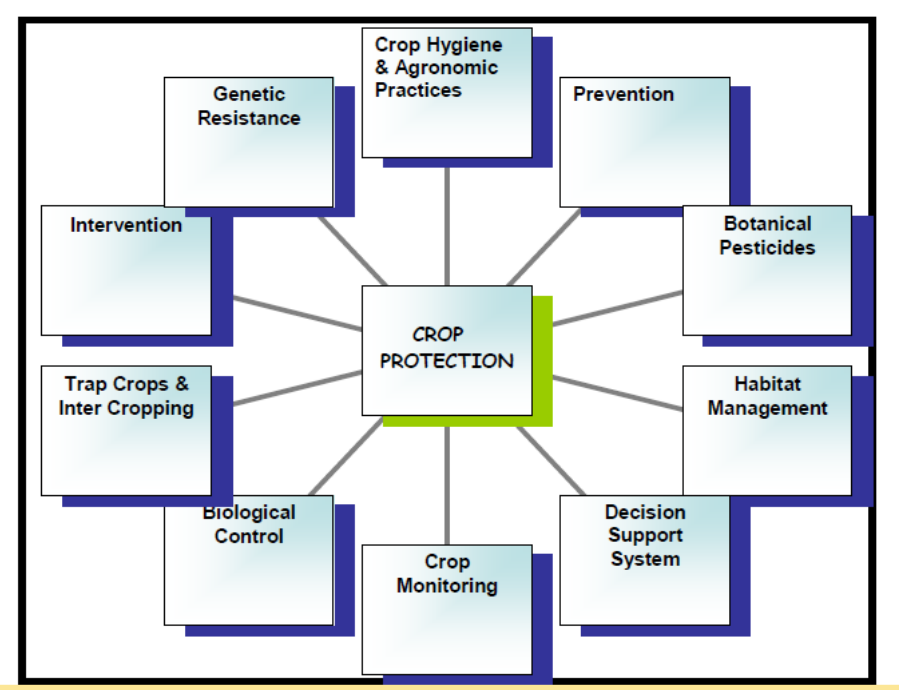


Fig. : Components of Pest Management in Organic Farming

B. Crop Hygiene and Agronomic Practices:

In Organic farming system physical and mechanical crop protection methods are important for promoting good crop development and minimizing weed, disease and insect infestation. Traditional ploughing inverts the soil and buries up crop residue and weeds before the preparation of a seed bed for the succeeding crop, which can also lead to increased erosion, therefore, it should be combined with other conservation techniques such as use of contour ploughing and ridging. Changes

in soil disturbance, location of plant residue and weed ecology all influences the incidence of diseases and pests, thus it should be taken into account in designing pest management programme. Good field hygiene is also important in reducing the build-up and carry- over of pest population from one crop to another. Removal of crop residue which contains aggregated egg masses and larvae provides an essentially effective way of reducing survival of some pests to the next season e.g. in cotton, carry-over of pink bollworm from one crop to another can be reduced by preventing ratoon cropping and removal as well as removal of cotton trash well advance in sowing.

Flooding of some crops, particularly low land paddy, is important in checking weeds and diseases e.g. Panama Disease of Banana. However, flood irrigation can also adversely affect the survival of some soil-inhibiting natural enemies hence needs caution in implementation. In case of vegetable crops this can be reduced by growing crop on ridges or raised beds and should be taken into account in designing pest management system in organic farms.

C. Genetic resistance:

Selection of crop variety has always been on top priority in organic farming system, especially disease and pest resistant varieties. These may reduce the need for use of botanical or bio-pesticide. This also encourages survival of beneficial microbes and insects. Growing different crops in a rotation helps in reducing the build-up of certain pests, especially those in the soil, such as root feeders, fungal pathogens affecting the root system and nematodes. Plant of inter as well as cover crops increases bio-diversity and helps in conservation and promotion of bio-agents in the field. In case of certain pest problems such as cotton leaf curl Virus, alternative host crops (cucurbits, solanaceous vegetables and citrus orchards) should be avoided, if possible.

D. Habitat Management:

Many natural enemy species require food sources in the form of pollen, nectar or innocuous arthropods that are not present in particular crop habitat. These food requirements may be provided to support natural enemy populations by encouraging or deliberate development of certain wild vegetation habitat near the crop field, especially on the borders. Protection of natural habitats within the farm environment is recognized as a mean of conserving many of the natural enemies of pests which either difficult to rear in laboratory or not economical. Careful management of the margins of farmland as well as growing tree crops or hedges are particularly important because they provide habitat, cover and refuge for beneficial insects and other animals. It is established fact that in Paddy field bunds provide important refuges for predatory spiders which help in controlling several paddy pests by predation; and for snakes which helps in controlling rodents; in case of cotton growing of maize and cowpea on border increases population of coccinellids which migrates to cotton in search of aphids and jassids.

E. Trap crops and Inter-cropping:

Sometimes a pest can be attracted away from a valuable sensitive cash crop by another crop which suffers less damage if attacked (e.g. coriander and linseed is sown in rows every 10-15 m across chickpea fields to attract ball worms during critical periods of crop development, scattered tobacco and pigeon-pea crop attracts *Helicoverpa* on their growing shoots which can be either shaken off or nipped away. Traditionally, some farmers may show different crops in alternative rows, or under sow a crop (e.g. Maize) with a legume (e.g. beans) to help improve soil fertility and conserve beneficial bio-agents. Growing of Ragi as 10 rows, serve as live bird perch which attract the birds to predate on ball worms.

F. Crop Monitoring: -

The aim is to determine WHEN and WHAT action is to be taken to protect the crop, therefore, regular monitoring is crucial to effective pest management. An efficient monitoring programme can pay big dividends in lowering pest control costs. By detecting and assessing problems early, one can initiate the biological control practices well in time and also limit crop protection input cost by targeting the primary inoculum at site. The monitoring could be done by using standardized sampling methods such as use of pheromone, sticky yellow traps in the representative area to gain enough

information to guide decisions for an entire field or farm, as it is not desirable or possible to examine every plant or square inch of ground. Management of any crop needs routine inspections to assess how well plants are growing and what action needs to be taken on cultivations, pest and disease control. Monitoring of pests is important part of the need to Walk through a crop. Various tools, such as pheromone traps (*Helicoverpa* and *Pink Bollworm*-PBM), diagnostics and forecasting systems (against Late blight of potato and apple scab) are available and in operation assisting in timing of management operations. This can also be achieved by the following: -

i. Forecasting: - Producers should pay attention to the forecasts for various pest and disease infestations for each crop year. Maps of these forecasts are usually available for many of the major destructive insects such as grasshoppers and wheat midge, as well as some diseases. Agro meteorological warning and forecast can help in this way.

ii. Record-Keeping: - Keeping diligent field records can provide very useful information. A complete history of each field should include any insect or disease infestations, which management methods worked and which did not, and a list of management techniques to try in the future. A well-kept field record book is a great help in remembering which crop has in the past been grown in a particular plot within the field or farm. This is useful especially if the records also show past incidents of plant pests or diseases in each plot in the farm.

For example, soil diseases and pests can build up during the life of a susceptible crop. If the same crop or a similar type belonging to the same family is grown in the same field, it will suffer from the accumulated pests and diseases from the previous crop(s) and may not grow well. This can be avoided if the soil is left fallow (not cropped) for a while, or a different crop is planted which is tolerant or resistant to the particular pest or disease. Better still is to plant a crop from a different family which will not share a same complex of pests and diseases. This will result in decline of soil problems and the original crop can be grown successfully again.

G. Intervention:

The aim is to reduce the effects of economically damaging pest population to acceptable levels. Mechanical/ cultural and biological management measures may be applied in combination taking in to consideration costs/ benefits, timing available manpower, tools and control agents based on ecological and environmental considerations. Some of the basic intervention measures available for organic farmers for reducing the damage caused by pests include the followings:

1. Cultural and Physical Management:

The aim is to get healthy crop by sanitation; CLEAN CULTIVATION, which is most important in organic farming. A number of cultural or physical techniques continues to be used in agriculture since the origin of agriculture together with our civilization. These methods include:

i) Weed/ Disease management by manual methods (roughing).

ii) Insect management control by hand picking of egg masses or larvae

iii) Disease management by removing infected plant/ crop debris and burying in compost pits for destruction of infectious pests/ larvae/ eggs during composting.

2. Crop Rotation

The practice of alternating the species or families of annual and/or biennial crops grown on a specific field in a planned pattern or sequence so as to break weed/pest and disease cycles and to improve soil fertility and organic matter is called crop rotation. Planting the same crop in the same location time after time (mono cropping) encourages the build-up of diseases and pests that plague that particular crop. Crop rotation helps in overcoming this problem without the use of any chemicals.

3. Pheromones: -

Besides selective trapping techniques to monitor the movement of pests or changes in pest population during the season, pheromones are also used in “lure and kill” strategies to attract the pest to localized insect deposits and killing them by mechanical / biological means. Mating disruption

to delay or reduce the need for management treatment offers new possibilities for organic farmers.

H. Biological Control: -

This practice is used for a specially chosen living organism to control a particular pest. This chosen organism can be a predator, parasite, or disease which will manage the harmful insect. It is a form of manipulating conditions for bio-control agent population to get the desired effect.

Table - Biological agents to control pests of different crops

S. No.	Biological Agents	Pest	Crop
1.	Trichogramma brassiliensis - 1.0 cc/ac. once in 10 days, (Egg parasitoid)	Lepidopteran pests, *Heliothis sp*	Tomato, Cotton
2.	Trichogramma chilonis - 2 cc/ac once in 15 days	Borers	Sugarcane, paddy, pulses, Vegetables
3.	Nuclear Polyhedrosis Virus (NPV) 100-200 LE/ac	*Spodoptera sp*& *Heliothis sp*	Vegetables
4.	Chrysoperla Sp 5000 - 10000 eggs /ha, 3 – 4 Times in 15 days, (Green lace wing)	Prudenia, Caterpillars, White flies, thrips, aphids	Vegetables
5.	*Beauveria bassiana* - 1.0% Affects the young stage	Helicoperva, Spodoptera, borers, hairy caterpillars, mites, scales, etc	Vegetables, Cereals & fruits
6.	Metarhizium (Nomuraea) rileti	Lepidopteran pests; white grub and noctuid pests	Tomato, Cotton, vegetables
7.	*Metarhizium anisopliae* - 0.5 - 1.0 % affects all stages	White grubs, Beetle grubs, caterpillars, Semi-loopers, mealy bugs and BPH	Sugarcane, groundnut, rice, potato, cotton,
8.	Verticillium lecanii - 0.5 - 1.0 %, affects all stages	All sucking soft bodies insects	Sugarcane, groundnut, rice, potato, cotton, cereals
9.	Paecilomyces sp.	Nematodes	All crops
10.	*Bacillus thuringiensis var kustaki* 0.3 - 0.4 %	Helicoperva, spodoptera, borers, hairy caterpillars, mites, scales, etc	Vegetables, cereals, Fruits
11.	NPV - Nuclear Polyhedrosis Virus of *Spodotera litura* 250 – 500 ml/ ha 2 - 3 time at 10 days interval	*Spodotera litura*	Cotton, groundnut, pulses, cabbage & chilly
12.	NPV - Nuclear Polyhedrosis *Helicoverpa* Cotton, Virus of *Helicoverpaarmigera* 250-500 ml/ ha, 2 – 3 time at 10 days interval	*Helicoverpa armigera*	groundnut, pulses, cabbage, chillies

A complete biological control programme may range from preparation of field to raising and releasing one insect to have it attack the pest almost like a living insecticide. Cost effective techniques for a number of bio-agents, such as egg parasitoids *Trichogramma chilonis, T. japonicum,* larval parasitoids *Bracon hebetor, B. brevicornis, Goniozus*sp., *Brachymeria* sp. and predators viz. *Chrysoperla carnea, Chrysoperla incarnate, Coccinella septumpunctata, Menochilus sexmaculatus* are available commercially and being used in organic farming.

Viral bio-agents such as Nucleo Polyhydrosis Virus (NPV) and Gemini Virus (Gv) are commercially available for management of key pests such as *Spilosoma oblique, Amsacta albistriga, Spodoptera litura* and *Helicoverpa armigera.*

Application of *Bacillus thuringiensis* is very popular in management of *Plutella xylostella* and *Helicoverpa armigera* in organic farming system.

Table:- Bio-pesticides products for various crops

Crop	Pest/Diseases	Biopesticides
Cotton	Bollworms	Traps, lures, BT, NPV, Trichogramma
	Whitefly, jassids, thrips	Neem 1500 ppm
	Mites	*Chrysoperla sp.* , *Verticillium* sp., *Baeuveria sp.*
	Leaf spot & wilt	*Trichoderma, Pseudomonas sp.*
Paddy	Yellow stem borer, leaf folder	Traps, lures, BT, Trichogramma
	Hoppers	Neem 1500 ppm, Baeuveria
	Sheath blight and leaf spots	Trichoderma, Pseudomonas
Pulses	Bollworms or cutworms	Traps, lures, BT, NPV, Trichogramma
	Wilts	*Trichoderma, Pseudomonas sp.*
Tomato And Capsicum	Heliothis	Traps, lures, BT, NPV, Trichogramma
	Mites	Trichoderma, Pseudomonas
Okra & Brinjal	Fruit and shoot borer	Traps, lures, BT, NPV, *Trichogramma*
	Mites	Neem 1500 ppm, *Verticillium*

I. Botanical Pesticides:

Botanical Sources of Secondary metabolites or allele-chemicals that provide for the fundamental or physiological or biochemical process of the plant. As many as 2121 plant species have been reported to possess pest control properties, 1005 species have insecticidal, 384 anti-feedants, 297 repellents, 27 attractants and 31 growth inhibiting properties but not many could find their way to commercialization. Insecticides formed the key tools for management of pests and diseases in organic farming system. The products like Azadirectin from Neem and Lentin from *Lantana camera* are already quite popular in organic farming practices. Some commonly available plants for preparing botanicals are as follows: -

Table - Commonly available plants that can be used for making Botanicals

S. No.	Common Name	Botanical Name	Plant Parts Used
1.	Neem	Azadirachta indica	Laeves, Seed, Kernel, Oil, de-oiled cake
2.	Pungam	*Pongamia glabra* *Pongamia pinnata*	Leaf & flower
3.	Notchi	*Vitex nugunda*	Leaf & flower
4.	Nithia Kalyani	*Catharanus rosea*	Whole plant
5.	Lantana	*Lantana camera*	Leaf & flower
6.	Dhatura (Devils Trumpet)	*Datura metal*	Leaf, fruit, flower
7.	Yellow Nelliam (Kaner)	*Nerium thevetifolia*	Flower, fruit, root
8.	Aruku	*Calatropis gigantea*	Leaf, tender stem, flower

9.	Siria Nangai	Andrographis paniculata	Whole plant
10.	Parthenium (Congress weed)	Parthenium sp	Plant before flowering
11.	Adathoda	*Adathoda vasica*	Leaf
12.	Tobacco	*Nicotiana tobaccum*	Dried leaf, plant waste, stem waste
13.	Crysanthemum (Guldaudi)	*Crysanthemum cinerrifolia*	Flower
14.	Chhota halkusa (Thumba)	*Lucus aspera*	Flower, leaf, tender stem
15.	Wild Tobacco	*Lobilia sp*	Whole plan
16.	Ginger	*Zingiber officinale*	Rhizome
17.	Bailewa (Nux Vomica)	*Strychnos nuvomica*	Seeds
18.	Turmeric	*Curcuma longa*	Rhizome
19.	Nagdona (Mugwort)	Artemesia vulgaris	Tender shoots & leaves

J. Decision Support and Area Wise Management System:

Farmers need assistance in interpreting pest monitoring data. Simple "expert systems" can be designed and made available to farmers in a range of ways, including simple pegboards or charts, special booklets, radio and television programmes or more advanced aids such as prediction models and computer based system (available for cotton, paddy, wheat and potato in USA). Development and provision of up to date information is a key factor enabling farmers to implement Organic Pest Management programmes.

Epilogue: -

Organic farming is a system approach utilizing the natural cycles and biological interactions for crop production and protection. Organic techniques have been developed from an understanding of and research into soil science, crop breeding, animal husbandry and ecology. The maintenance of soil fertility relies principally on the use of legumes, crop rotations, the application of composted animal manures and ground rock minerals. Weeds are controlled by mechanical methods while pests and diseases tend not to be a problem due to the inherent biodiversity in the system. Artificial fertilizers, pesticides, growth regulators and livestock feed additives are prohibited.

Weed Management

Introduction to Weed Management

In India, weeds are responsible for about 33% of total yield losses caused by pests, whereas insects and diseases are responsible for 26% and 20%, respectively. Weeds interfere with crops by competing for light, water, nutrients and space resulting in reduction of crop yield and quality. The yield reduction in any crop through weed competition depends on several factors such as weed flora and density, duration of competition, management practices and climatic conditions. Therefore, timely weed management is crucial for attaining optimal grain yield of a crop. However, none of the single weed control methods are effective for all weeds and to manage weeds effectively and sustainably in the long run, it is essential to develop and deploy flexible integrated weed management (IWM) practices for organic farm. IWM consists of physical, cultural, bio-herbicides, and biological means developed on knowledge of weed ecology and biology.

Weeds are an important factor in the management of all land and water resources, but its effect is greatest on agriculture. The losses caused by weeds exceed the losses caused by any other category of agricultural pests. Of the total annual loss in agriculture produce, weeds account for 45%, insect 30%, disease 20% and other pests 5%.

Identification of Weeds. Correct identification is the foremost step in working out strategy for controlling weeds. Knowledge of morphology is most important in the identification of weeds. There are approximately 250,000 species of plants in the world. However, less than250 plant species, about 0.1% are troublesome enough to be called universally throughout the world. Monocots: Plants whose seedlings bear only one cotyledon. Monocots are typified by parallel venation and flower parts in three or multiples of three. Most monocot weeds are found in only two groups, grasses and sedges, although other groups exist.

Grasses: Leaves usually have a ligule or at times an auricle. Leaves are narrow, arranged in sets of two. The leaf sheaths are split around the stem, with the stem round or flattened in cross section with hollow internodes.

Sedges: Leaves lack ligule and auricles, and the leaf sheaths are continuous around the stem. Leaves are narrow, arranged in sets of three. In many species the stem is triangular in cross section with solid internodes.

Dicots: Plants whose seedlings produce two cotyledons or seed leaves. Dicots are usually typified by netted leaf venation and flowering parts in fours, fives, or multiples thereof. Leaves are wide. They are commonly called broadleaved plants. Examples include mustards, nightshades and morningglory.

WEED CONTROL:

Weed management has been identified in many surveys of organic growers and farmers as being their number one problem, often by over 80% of respondents. Good weed management is essential for a successful organic enterprise. However, the amount of detailed information on organic weed management is often sparse and more often covers 'what' needs to be done rather than 'how' to do it. This aims to address that gap with information on both what needs to be done and how to do it.

An organic system that aims for the total eradication of weeds is likely to run into difficulties, and vice versa, abandonment of weed management will lead to severe crop losses. A balance is therefore needed. Organic systems need to have a diverse range of plants in field margins, and while managing crop weeds, total elimination would be counterproductive.

Methods of weed control

Weed management is the combination of the techniques of prevention, eradication, and control to manage weeds in a crop, cropping system, or environment. Weed managers recognize that a field's or area's cropping history, the grower's management objectives, the available technology, financial

resources, and a host of other factors must be combined to make good management decisions. Complete weed control in a crop may be the best decision in some cases, but it is not automatically assumed to be the goal. Maintenance of a weed population at some level in a cropping system may be the most easily achievable and financially wise goal for a weed management program. Weed prevention, control, eradication, and management are different concepts, and each uses and combines technologies differently. Controlling weeds in cropped and non-cropped lands may involve a wide range of techniques. Nevertheless, virtually all weed control methods may be classified into one or more of five main categories viz. preventive, cultural, mechanical, biological and chemical.

Preventative Weed Control

Prevention of invasion is the best strategy to combat weeds. Preventative weed control refers to any control method that aims to prevent weeds from being established in a cultivated crop, a pasture, or a greenhouse. A good weed management program includes vigilance or watchfulness. The good weed manager can identify weed seeds, seedlings, and mature plants, and has a management program for each crop and field and appropriate follow-up programs. The good manager is ever watchful for new weeds that may become problems and whenever possible emphasizes prevention rather than control.

Several preventive practices can be included in management programs:

1. Isolation of introduced livestock to prevent spread of weed seeds from their digestive tract.
2. Use of clean farm equipment and cleaning of internal equipment, including combines, cultivators, and grain trucks.
3. Cleaning irrigation water before it enters a field.
4. Mowing and other appropriate weed control practices to prevent seed production on irrigation ditch banks.
5. Inspection of imported nursery stock for weeds, seeds, and vegetative reproductive organs.
6. Inspection and cleaning of imported gravel, sand, and soil.
7. Special attention to fence lines, field edges, rights-of-way, railroads, and so on as sources of new weeds.
8. Seed dealers and grain handlers should clean crop seed and dispose of cleanings properly.
9. Cleanings should be heated or ground to prevent seed dispersal.
10. Fields should be surveyed regularly to identify new weeds.
11. When identified, small patches of new weeds should be treated to prevent growth and further dispersal.

The first rule for weed prevention and the first step of any good weed management program is the purchase and planting of clean seed. Each country regulates transport and sale of seeds in foreign and interstate (but not intrastate) commerce.

Manual weeding from standing crop. Cultural weed management techniques are of immense importance in crops where other weed management options are limited or not available. Cultural weed control refers to any technique that involves maintaining field conditions such that weeds are less likely to become established and/or increase in number. The techniques of cultural weed control are well known to farmers and weed scientists. In fact, they are employed regularly but often are not consciously attempted to manage weeds. Planting a crop is a sure way to reduce growth because the crop interferes with the weeds. It is a fundamental method of weed management, but most often cultural weed control just happens rather than occurring as a planned addition to weed management programs. Examples of cultural weed control would be crop rotation, optimum date of sowing, plant density, planting pattern/crop architecture, selection of quick growing varieties, avoiding overgrazing of pastures or rangeland, using well adapted competitive forage species, stale seed bed or dab system, proper water management, method of fertilizer application and maintaining good soil fertility.

Mechanical

Hand weeding :Removal of weeds either manually or by using tools like khurpi or sickle, when weeds grow upto some extent.

Effective against annuals and biennials and controls only upper portion of the perennial. In order to reduce soil seed bank, this method should be practiced before flowering and seed setting stage of

weeds. Higher labour is required and is tire some.

Hand hoeing: Hoe has been the most appropriate and widely used weeding tool for centuries. Taking out the weeds with the help of khurpi or hand hoes or wheel hoes is more time saving method than hand pulling. Hoeing by cutting the crown part gives proper control.
The time of hoeing is very critical and should not be too early or too late but crop should be kept weed free at the critical state of crop growth. Annuals and biennials can be effectively controlled. This method is very safe but labour intensive and very expensive. Hand hoeing can be done in all row-sown crops may be solid drill or widely sown.

Spudding
Hand weeding, hand hoeing added by a sharp edged sickle.

Sickling
Sickling is also done by hand with the help of sickle to remove the top growth of weeds to prevent seed production and to starve the underground parts. These methods are useful for control of tall growing grasses. Especially sickling is useful in irrigation channels, drainage channels and where undulating topography is present.

Mowing
It is cutting of uniform growth from the entire area up to the ground level. It is useful more in non-cropped areas than cropped areas. It is very effective method of cutting excess iv e. growth of undesirable plants from lawns, playgrounds , roadsides , orchards and from non -cultivated areas . Mowing improves aesthetic value of an area. This method is effective against erect and herbaceous annual weeds. However, perennials re-sprout from rootstock and needs repeated cutting to exhaust the food reserve. This method apart from controlling weeds, enriches the soil by adding organic matter.

Digging
Digging is useful for patch or spot control of obnoxious / perennial weeds. Digging is very useful in the case of perennial weeds to remove the underground propagating parts of weeds from the deeper layer of the soil. They can be eliminated by digging with crowbar or Pick axe etc. For large areas, it is not desirable because it is costly and labour oriented

Cutting
Cutting is the topping/cutting of the weeds little above ground level. It is done with help of axes and saws.
It is mostly practiced against brushes and trees. In aquatics under water weed cutters are used.

Dredging
This is used to control aquatic weeds growing in shallow ditches. Dredging refers to mechanical pulling of aquatic weeds along with their roots & rhizomes from the mud.

Chaining
Very big & heavy chain is pulled over the bottom of a ditch with tractors along with embankments of ditch.

With rubbing action of chain weeds can be fragmented & collected by nets and hooks.

Burning
It is cheapest method to eliminate the mature unwanted vegetation in non-cropped areas and range lands.
Coagulation of protoplasm occurs with which plant dies.

Flaming

It is the momentary exposure of green weeds to as high as 1000oC from flame throwers to control in row weeds. Sometime weeds are desiccated with high pressure steam. Flaming and steaming are used in western countries for selective weed control in wider row sown crops like cotton, soybean and fruit orchards. Dodder is also controlled by flaming in lucerne.

Searing

Repeated application of flame to above ground parts destroyed the root system and plant dies.

Soil Solarization It is also called solar soil heating. It is effective against weeds which are produced from seeds. It doesn't involve any tillage of the field. Covering the soil with transparent, very thin plastic sheets of 20-25mm polyethylene (PE) film during hottest part of summer months for 2-4 weeks. This increases the temperature by 10-12 Cover unfiled control fields. Then weeds seeds are desiccated which are present at top 5 cm soil depth. Eg: *Phlaris minor, Avene* and broad leaved weeds controlled by Solarization. Where as *Melilotus* sp. Posses hard seed coat is resistant to Solarization treatment.

Cheeling

An implement called cheel (spade like implement with very long handle) with which weeds & soil can be racked up. Generally practiced in tea plantations.

Tillage

Tillage is done for preparing good seedbed ideal for the seeds to germinate, conservation of soil moisture & weed control. Tillage removes weeds from the soil resulting in their death. The rear different implements which can be used for this purposes as cultivation, disc harrows , mould board plough, deep chiseler etc. Tillage may weaken plants through injury of root and stem pruning, reducing their competitiveness or regenerative capacity: Pre plant tillage helps in burying the existing weeds. Bring the seeds to the soil surface for germination and their subsequent destruction by suitable secondary tillage implements. Incorporation of pre - plant herbicides. Post plant tillage (row cultivation) helps in mixing of manures and fertilizers & control of weeds, soil and water conservation.

Mulching

Principle is exclusion of sunlight from environment. Black or white polythene sheets and natural materials like paddy husk, ground nut shells, saw dust etc. are used as mulching material.. The thickness organic mul ch should be enough to cut off light (i.e. 10-15 cm).The efficiency of polythene sheet is more (more polythene) if it is applied in continuous sheet rather than in particle farm. It is effective against annual weeds and perennial weeds like *Cynodon dactylon* and *Sorghum halepense.* Mulching is used in high value crops like coffee tea plantations by using guatemala grass (*Tripsacum laxum*) and citronella grass
(*Cymbopogan sp*)

Flooding

Flooding kills weeds by excluding oxygen from their environment. It is a worldwide crop husbandry method ofcontrolling weeds in rice fields. Flooding is very effective method for controlling annual weeds requiring aerobic conditions and many perennials like *Cynodon dactylon* and *Sorghum halepense*.

Inter-cultivation

This method is very widely adopted in wider row sown crops such as maize, cotton, sugarcane and pigeonpea.

Inter-cultivation is done with bullocks or with tractor by adjusting the distance between tines. In rice intercultivation is performed in standing water. This method is effective for controlling later flushes of weeds in large area. To make the method effective the weeds near the vicinity of crop plants are removed manually.

However, the crops with lateral spread of roots suffer due to root injury. Even the spread of plant diseases may also takes place as in potato.

Use of Mulch

Mulches can be divided into organic, such as grass clippings, and inorganic, such as black plastic. Mulches can be the easiest and most effective way to control annual weeds in the garden. Mulches may also suppress perennial weeds. Mulches control weeds by preventing sunlight from reaching the soil surface. Light is required for the germination of certain weeds, and light is required for the growth of all green plants.

Organic Mulches: Organic mulches include grass clippings, pine bark, straw or similar materials. Organic mulches cool the soil surface, which is beneficial during hot summer days, but may reduce crop growth in the spring. Do not use grass clippings from a lawn that has been treated with a broadleaf herbicide such as 2,4-D. Tomatoes, peppers and most other vegetables are very sensitive to 2,4-D and could absorb residues of the compound from the treated grass clippings.

Avoid overmulching, which can reduce oxygen levels in the soil. Crop roots require oxygen for growth, so limit the mulch layer to a maximum of about 3 inches. Organic mulches provide good control of annual weeds, but perennial weeds may be able to push through the mulch layer. Also, annual weeds may germinate and grow in the mulch layer.

When using an organic mulch, make sure that the source is not contaminated with weed seed, rhizomes or tubers. Weeds are often spread by contaminated mulch, making weed control harder than if no mulch was used.

Inorganic Mulches: Inorganic mulches are synthetic and can be divided into black plastic and the newer geotextiles. Black plastic, a solid sheet of polyethylene, effectively controls annual weeds. The disadvantage of black plastic is that water and oxygen cannot pass through this material. The soil should be moist prior to laying this synthetic material. Check the soil under black plastic during the growing season to ensure that the soil contains adequate moisture. Black plastic warms the soil, which is an advantage in the spring but can be harmful in the summer.

Clear plastic, which increases soil temperature more than black plastic, will not control weeds since sunlight can reach the soil surface. Perennial weeds may be suppressed by black plastic, but plants like yellow nutsedge will push through the material in places.

The new geotextiles, also called weed barriers, are woven or spun-bonded fabrics containing polypropylene or polyester and may come in black or white. These fabrics are more expensive than black plastic, but they allow water and gases to pass through the fabric. Research generally indicates good control of annual weeds, but annual weeds may be able to germinate above the fabric and send their roots through the fabric. Certain weeds, such as large crabgrass, are able to germinate below these fabrics and push their shoots through holes in the material. Perennial weeds may also push through these fabrics.

Use of off-farm Bio-herbicides. Control of weeds through bioherbicides

A bioherbicide is a biologically based control agent for weeds. Bioherbicides may be compounds derived from microbes such as fungi, bacteria, viruses, or protozoa; or phytotoxic plant residues, extracts or single compounds derived from other plant species. In the industry, bio-herbicides and other bio-pesticides are often referred to as "naturals". When the active ingredient used is a fungus, the product is called a mycoherbicide.

Biological

Biological weed control refers to any technique that involves the use of natural enemies (insects, disease organisms, herbivorous fish, other animals and competitive plants) of weed plants to control the germination of weed seeds or the spread of established plants. This is a rapidly expanding area of weed control with many examples. Examples of biological weed control include sheep to control tansy ragwort or leafy.

Organic Farm Management

Growing Crops under Organic Management

Organic farming envisages a comprehensive management approach to improve soil health, the ecosystem of the region and the quality of produce living soil can be maintained by continuous incorporation of crop and weed biomass, use of animal dung, urine-based manures (FYM, NADEP, vermicompost), biofertilisers and bioenhancers, special liquid formulations (like vermiwash, compost tea etc) during a crop's duration.

As a thumb rule, crop residues and cattle excreta should be returned to the plot, directly or indirectly. As a strategy, the quantity of biomass removed for human food and fiber, cattle feed or firewood from an organic farm should be replaced with any other bio-waste on the farm. In phosphorous-deficient and acidic soils, some quantity of mineral grade rock phosphate and lime can also be added either by direct application to the field or through addition to compost. The compost can be further enriched by incorporation of biofertilisers, microbial inoculants, etc. Special composts like biodynamic compost, cowpat pit compost, biodynamic preparations such as BD-500 and BD-501, special formulations like Panchgavya, Dashgavya, Biosol etc are also useful and ensure optimum productivity. Use of EM formulation has also been found effective in soil enrichment and compost making. For high nutrient demanding crops and for intermittent soil enrichment use of oilcakes, poultry manure, concentrated manures (mixture of oil cakes, poultry manure and rock phosphate) can also be an ideal low-cost option of manuring.

Important steps

1. Enrichment of soil – Abandon use of chemicals, use crop residue as mulch, use organic and biological fertilizers, adopt crop rotation and multiple cropping, avoid excessive tilling and keep soil covered with green cover or biological mulch.
2. Management of temperature - Keep soil covered, Plant trees and bushes on bund
3. Conservation of soil and rain water – Dig percolation tanks, maintain contour bunds in sloppy land & adopt contour row cultivation, dig farm ponds, maintain low height plantation on bunds.
4. Harvesting of sun energy – Maintain green stand throughout the year through combination of different crops and plantation schedules.
5. Self reliance in inputs – develop your own seed, on-farm production of compost, vermicompost, vermiwash, liquid manures and botanical extracts.
6. Maintenance of life forms – Develop habitat for sustenance of life forms, never use pesticides and create enough diversity.
7. Integration of animals – Animals are important components of organic management and not only provide animal products but also provide enough dung and urine for use in soil.
8. Use of renewable energy – Use solar energy, bio-gas and bullock driven pumps, generator and other machine.

Steps of organic farm development

(i) Habitat development
(ii) On-farm facilities for input production
(iii) Cropping sequence and combination planning
(iv) 3-4 years rotation plan
(v) Growing of crops suiting to the region, soil and climate.

Development of farm facilities and habitat

Infrastructure – Reserve 3-5% of farm space for utilities, such as space for cattle, vermicompost bed, compost tank, Vermiwash/ compost tea unit etc. 5-7 trees should be planted only on this space, as all utility infrastructure need shade. Irrigation well, water pumping infrastructure etc can also be in this utility area. Dig some percolation tanks (7x3x3mt or of any other size depending upon the rainfall and run-off pattern) for rain water conservation (1 pit per ha) at appropriate places depending upon slope

and water flow. If possible, develop a farm pond of preferably 20x10 mt size. Keep few 200 lit tanks (1 per acre) for liquid manure preparation and few containers for botanicals. For 5-acre farm, develop 1-2 vermicompost beds, 1 NADEP tank, 2 biodynamic compost beds, 2-3 compost tea/ vermiwash units, 5 liquid manure tanks, five cowpat pits and one underground cattle-urine collection tank.

Habitat and biodiversity- Management of an appropriate habitat for sustenance of different life forms is an essential component of organic farming. This can be achieved by ensuring crop diversity and by maintaining a wide variety of trees and bushes as per climatic suitability. These trees and bushes will not only ensure the nutrients from air and deep soil layers to surface layer but also attract the birds and predators, friendly insects and also provide the food and shelter. There may be some loss of productivity due to shading effect but that loss can be compensated with reduced pest problems and natural biological pest control system. In the plains, for a 10-acre farm, plant at least five to six neem trees (*Azadirachta indica*), one to two tamarind (*Tamarindus indica*), two gular (*Ficus glumerata*), eight to ten ber (*Zizyphus* Sp) bushes, one to two aonla (*Emblica officinalis*), one to two drumstick and 10–15 wild bushes.

More specifically, if we classify areas into wet and dry farms, then on the wet farms there should be five to six neem trees, one to two wood apples, one to two star fruit, eight to ten guava or sour soap, three to four drumstick, one to two fig and 10–15 bushes of mulberry, star gooseberry, curry leaf etc, and on the dry farms there must be at least five to six neem, one to two bael fruit, eight to ten ber or custard apple, one to two aonla , one to two drumstick and 10–15 bushes of sasaka , nirgundi (*Vitex negundo*), *Cassia auriculata*, *C. tora*, etc.

In hilly areas, *Alnus nepalensis* is considered to be a wonder tree as it fixes good amount of nitrogen. It is being promoted in a cropping system mode particularly in northeastern India. Bushes of Prunus, oak (*Quercus glauca*), Pinus species along the farm boundary and yarrow (*Achillea millifolium*), buck wheat (*Fagopyrum esculentum*), lupin (*Lupinus sativus*), Himalayan stinging nettle (*Urtica parviflora*), marigold, etc., in between the plots invite a lot of predators and also attract a large number of pests. Fruit orchards also need to maintain adequate diversity with at least 3-5 types of fruit plants and few non-fruit trees (as listed above).

Major and minor plots should be separated by bunds about 1.5m wide and should be planted with Glyricidia, perennial Sesbania (jayanti), Leucaena leucocephala, cassia siamea, etc. The internal hedgerow should consist of perennial pigeon pea, Crotalaria , seasonal Sesbania, etc. Lops from these trees will provide enough quantity of biologically fixed nitrogen.

In between *Glyricidia/Sesbania* rows insert few plants of pesticidal value such as *Adathoda vesica, Vitax nigundo, Calotropis, Datura alba, Ipomea* (Besharam) etc. Surrounding the farm or garden, there should be hedgerows or a live fence of coppiced or pollarded, multipurpose, deep-rooted trees and shrubs and medicinal herbs such as Adathoda vasica, Vitex negundo, Jatropha curcas, etc. Ecological diversity is an essential component of any successful organic farming system.

Trees on utility space can be allowed to grow fully. Trees and bushes on farm bunds should be placed randomly at sufficient distance and pruned at repeated intervals. Glyricidia plants should be planted at close spacing on all major bunds and all around the farm. They will act not only as biological fence but also provide biologically fixed nitrogen to soil.

A 400 mt long Glyricidia strip can provide 22.5 kg N/ha per year from the year 3 and up to 77 Kg N/ha from year 7 under rainfed conditions. This can be 75-100% higher under irrigated conditions. Three to four harvests can be made under irrigated conditions and two harvests under unirrigated conditions. Never allow them to grow above 5.5 ft to avoid shading effect. Lopping is used as green leaf manure. Simply harvest them and incorporate in soil before sowing or use as mulch.

Conversion of soil to organic

Low input alternative - In first year simultaneously sow three different types of legumes in strips, first of 60 days (like moong), second of 90-120 days (Cow pea or soybean) and third of more than 120 days

(red gram) in strips. Apply mixture of Compost and vermicompost (2:1) @ 2.5 ton per acre enriched with 4 kg Azotobacter and 4 kg PSB biofertilizers or 4 kg consortia of customized cultures as basal dose at the time of sowing preferably in furrows below the seeds. Seeds of legumes should be treated with crop specific strains of Rhizobium biofertilizer. Mulch the entire surface with a thick layer of biological mulch and drench the biomass with Jivamrut @ 200 lit per acre. Seedlings will emerge from this layer. If soil is poor in phosphorus, then apply 300 kg of low grade mineral rock-phosphate along with the compost. Apply second dose of Jivamrut after 25-30 days of sowing with irrigation water or during rains.

To add to diversity 100 plants/ acre of marigold or Hibiscus subdarifa or any other suitable plant effective as trap crop/plant may be planted randomly through out the field. Few seedlings of vegetables such as chillies, tomato, brinjal, etc and rhizomes of turmeric, ginger etc can be planted randomly for home consumption.

Harvest the pods/ fruits and use remaining biomass for mulch. Collect the crop biomass at the end of strips in the form of heaps and drench with Jivamrut. Sow short duration leafy vegetables (such as fenugreek or spinach) in the space vacated by the first and second crop and mulch the surface with treated biomass. Harvest leafy vegetable and grains and incorporate remaining biomass in the soil at appropriate time.

In next season apply compost-vermicompost mixture @ 2.5 ton/ha and sow cereal crop with legume as inter or companion crop. After harvest use entire legume and remaining part of cereal crop as mulch. If irrigation facilities are there, take summer legume with some vegetable crop. Recycle entire residue as mulch. Use 3-4 application of liquid manure (such as Jivamruta) during each cropping season for soil application. Now the soil is ready for high value horticultural crops.

High input alternative – Incorporate 2.5-3.0 ton compost/ vermicompost or 1.5 ton of biodynamic compost, 500 kg crushed oil cakes, 500 kg rock phosphate, 100 kg neem cake, 5 kg Azotobacter and 5kg PSB biofertilizer or 4 kg consortia of customized cultures in soil through broadcasting or by drilling in furrows below the seeds. Sow 3-4 types of different crops in strips. 40% crop stand should be of legumes. Randomly plant 100-150 marigold and vegetable seedlings for increased diversity. After harvest incorporate entire residue in soil or use as mulch after sowing of the next crop. For second crop also use similar quantities of manures. Use liquid manure (Jivamruta) @ 200lit/acre 3-4 times during cropping season along with irrigation water. For increased productivity 2-3 sprays of vermiwash or vermiwash+cow urine or Panchgavya can also be provided.

In fruit orchards cultivate 3-4 types of legume mixtures as mixed or intercrop in inter spaces along with adequate quantity of manures (as specified above). After pod/ grain harvest mulch the entire soil surface with the left over biomass and drench the biomass with 2 applications of Jivamruta.
After about 12-18 months the soil will be ready for organic cultivation of any crop combination. For next two-three years, along with any crop incorporate legumes as inter or companion crops. Ensure that crop residue always have at least 30% residue from legumes. Also treat crop residue with liquid manure before incorporating into soil or using as mulch

Post-Harvest Management and Value Addition

Introduction

The final quantity and quality of the agricultural produce solely depends on the post harvest management practices being adopted by the farmers or other food handlers at the times of crop harvest. Some of these practices include handling, grading, pre-conditioning, curing, ripening, packaging, transient storage, transportation, distribution and also long term storage where possible. In countries like India, a significant portion of fruits, vegetables and other crop losses are reported every year due to the existence of poor infrastructure as well as improper post harvest operations. This has not only created a considerable gap in gross production and net availability i.e. from "farm to fork" availability of food but has simultaneously limited the processing of different food commodities both perishable and non-perishable as well as has lowered India's chances towards contributing to the global food basket on a large scale. As per the recent reports, Indian farmers have faced post-harvest losses amounting to Rs 93000 crores in 2019 which is actually one of the biggest constraints behind India's low share in agricultural exports on global basis. Presently, India is the 8th largest agri-exporter in the world following top exporting countries such as European Union, USA, Brazil, China, Canada etc. Despite of the existence of well-established postharvest institutions supported by the government as well as private sector, lack of awareness is still prevailing among the farmers regarding proper food handling and its storage which often attracts mechanical losses such as bruising, cracking, cuts, contamination by fungi and bacteria etc. as well as physiological losses that include changes in respiration, transpiration, pigments and flavors etc. All these losses result in lowering of market prices and also compromises consumer acceptance of such agricultural produce.

Important Sites of Post Harvest Losses

The following are the important sites of possible post harvest losses of different agricultural commodities grown in India:

1) Farmers' Field (15-20%)
2) Packaging (15-20%)
3) Transportation (30-40%)
4) Marketing (30-40%)

Post-Harvest Challenges

Post-harvest losses are mainly associated with the horticultural crops as they are highly perishable due to the presence of high moisture content and tender texture, thus if not handled properly post-harvest, these nutritious crops can deteriorate ranges between few hours to some days. The following are the types of post-harvest losses:

1) Metabolic loss:
   The natural process of respiration causes breakdown of food reserves and thus promotes aging of different agricultural produce.
2) Mechanical loss:
   Presence of high moisture content and tender texture of horticultural crops makes them highly susceptible towards mechanical injuries such as bruising, cutting, breaking etc. during transportation if packed improperly and in unsuitable containers.
3) Developmental loss:
   Processes such as sprouting, rooting or seed germination deteriorates quality as well as nutrition value thus limiting the market demand.
4) Parasitic Attacks:
   Fresh agricultural produce is always prone to attacks by rotting fungi, bacteria and other insect pests if not handled and stored properly post-harvest.

5) Physiological loss:
   Undesirable atmospheric conditions such as high humidity as well as spontaneous enzymatic actions are the major factors behind physiological post-harvest losses of perishable agricultural produce.
6) Lack of Post-Harvest Infrastructure & Marketing linkages:
   Inappropriate market information often leads to bumper production of certain food commodities which in turn bring down the market prices for that particular crop. This is quite common in those areas where post-harvest storage as well as transportation facilities are inadequate, thus exposing the produce to different insect pests and microbial attacks.

Good Post Harvest Practices for Organic Produce:

1. Harvesting should be done during the coolest time of the day so as to maintain low product respiration.
2. Avoid unnecessary wounding, bruising, crushing etc. caused by humans, agri-equipment or storage containers
3. Harvested product should be kept under shade in the field to prevent unnecessary water loss and premature senescence
4. Depending on the agricultural produce, the harvested product should be immediately moved to cold storage facility or subject to post harvest cooling treatment. Proper cooling helps in maintaining quality, taste and shelf life of organic produce.
5. Avoid mingling of damaged or decay prone organic agricultural produce with high quality organic produce during harvesting and at the time of packaging in bulk or smaller units.
6. Always store organic produce separately from the conventional or non-organic produce.
7. Processing of organic produce should be done separately in time and place (if possible) from the non-organic products.
8. Well cleaned and sanitized packing containers should always be used during transportation. Also keep in mind not to transport organic and non-organic products together till they are not properly labelled and physically separated.

Methods of Post Harvest Cooling:

Few methods are as follows:

1) Room Cooling: It is a method in which an insulated room or mobile container fitted with refrigeration units is used. It is a slower method and depending on the commodity, packing unit and stacking arrangement, an organic product may cool too slowly to prevent water loss, premature ripening and decaying.
2) Forced Air Cooling: This method employs use of fans in cooling rooms. However, speed of cooling depends on atmospheric temperature and on rate of air flow. This method is 75-90% faster than simple room cooling method.
3) Hydro-cooling: In this method, chilled disinfected water is showered over the agricultural produce to remove heat as well as to clean it. Although this method is not appropriate for all types of crops. It requires the use of waterproof containers or water-resistant wax corrugated cartons.

Some Special Technologies in Post-Harvest Management

Controlled Atmosphere: In this method, an artificial atmosphere is created in a storage room by increasing the concentration of CO_2 and lowering the concentration of O_2 as compared to its levels in normal atmospheric conditions. This method is very effective in reducing the rates of respiration and thus slows aging of organic agricultural produce. The method can be combined

with low temperature for prolonged storage of organic produce. For tolerant crops CO2 levels of ≥15% significantly suppresses decay and control insect pests.

Wax: Carnuba and wood extractable wax are acceptable sources for coating of organic produce and their use should be well indicated on the containers. These coatings can improve structural integrity by controlling the loss of moisture, oil, fats as well as other volatile flavoring compounds from organic agricultural produce.

Cleaners, Sanitizers and Disinfectants

A partial list is as follows:

1) Acetic Acid: Allowed as a sanitizer but must be from an organic source.
2) Ethyl Alcohol: Allowed as a disinfectant but must be from an organic source.
3) Bleach: All forms of chlorine such as liquid sodium hypochlorite, granular calcium hypochlorite etc. are allowed as sanitizers for water and food contact surfaces. In product wash water its Maximum Residual Disinfectant limit should not cross a value of 4 mg/L or 4 ppm expressed as Cl_2.
4) Detergents: Allowed as equipment cleaners.
5) Ozone: considered GRAS (Generally Regarded As Safe) for produce and equipment disinfection.

<u>Value Addition:</u>

It involves processing, packing and upgrading the quality of the product so that higher price can be realized for the same volume of a primary product. In other words, it is a way of increasing the economic value of an agricultural commodity that enhances its appeal and willingness of consumers to pay premium prices.

Need of Value Addition:

1) To augment profitability of farmers
2) To strengthen the farmers, especially women farmers by generating employment opportunities
3) To provide quality and safe branded food to consumers
4) It can play significant role in doubling of farmers' income

<u>Organic Food Processing:</u>

1) In order to avoid pest infestation, always maintain general cleanliness and hygiene while processing
2) Use of physical barriers such as lights/UV lights, sound/ultrasound, pheromone traps etc are allowed for pest control
3) Irradiations are prohibited
4) Ingredients used while processing of organic produce should be 100% organic except where it is not available in sufficient quantity or quality. Before using the non-organic ingredients, it must be certified by the concerned certification agency. Genetically engineered non organic raw material is strictly prohibited for use in processing.
5) The same ingredient within one product shall not be derived both from and organic and non-organic sources.
6) Microbial cultures commonly called as "starters" in food Industry and enzymatic preparations are allowed in organic food processing with the condition that medium used for producing these microbial starters and other microbiological products should be composed of organic ingredients only.
7) Use of water and salt in processing of organic food is allowed. Similarly, ethylene gas is permitted for ripening.
8) Use of minerals (including trace elements), vitamins and similar isolated ingredients are

allowed only after obtaining prior approval of the certification agency or where use is legally required to eliminate severe dietary and nutritional deficiency.

Processing Methods: The following methods can be used:

1) Mechanical and Physical
2) Biological
3) Smoking
4) Extraction
5) Precipitation
6) Filtration

For extraction purpose, water, ethanol, plant and animal oils, vinegar, carbon dioxide, nitrogen as well as carboxylic acid of food grade quality may be used.

Packaging

Eco-friendly packaging materials which are biodegradable and recyclable in nature should be used.

1) Packaging material should not contaminate food
2) Approval of the packaging material should be done by the certification agency prior its use.
3) Packaging should be done with proper sealing of packets so as to avoid any product manipulation later.

Labelling:

1) Always furnish accurate information about the organic status of the product while labelling.
2) Use PGS green logo for organic in-conversion products and PGS blue logo for organic products.
3) Always mention name and address of the manufacturing unit involved in production and processing of the product
4) Processing procedures should be mentioned on the product.
5) Information regarding ingredients, additives and processing aids should be also be mentioned.

Organic Certification and marketing

Participatory Organic Guarantee System for India (PGS-INDIA)

Introduction:

At present in India the growing demand for organic produce is gradually increasing and consumers are looking for the certified products for trusting quality of organic produce. At present in India two types of certification system exists namely 1. Third Party certification (NPOP) system which is governed by APEDA, Ministry of Commerce which is mainly focused for export purpose and 2. PGS-INDIA certification system.

PGS-India is governed by Ministry of Agriculture and Farmers Welfare mainly focused for local / domestic market purpose. The third partycertification bears high fees and more documentation as a result small andmarginal farmers are not able to offer for certification. To make it more easy, affordable and simplest system of certification which can be accessible by more number of small **and marginal farmers to adopt certification and further sale in domestic market, Participatory Guarantee System (PGS)-**INDIA organic certification system was launched in 2011 by Department of Agriculture andCooperation & Farmers Welfare, Government of India, it is an alternative to Third party (NPOP) certification system. The programme is implemented mainly through National Centre of Organic Farming (NCOF), Ghaziabad andits five Regional Centres (Ghaziabad (HQ), Bangalore, Nagpur, Bhubaneswar, Imphal, as

Zonal Councils. NCOF is a PGS-INDIA Secretariat of the PGS-INDIA System, and Director, NCOF as the Executive Secretary and has to play an important role in implementation of all activities of PGS- INDIA programme as per the PGS guidelines.

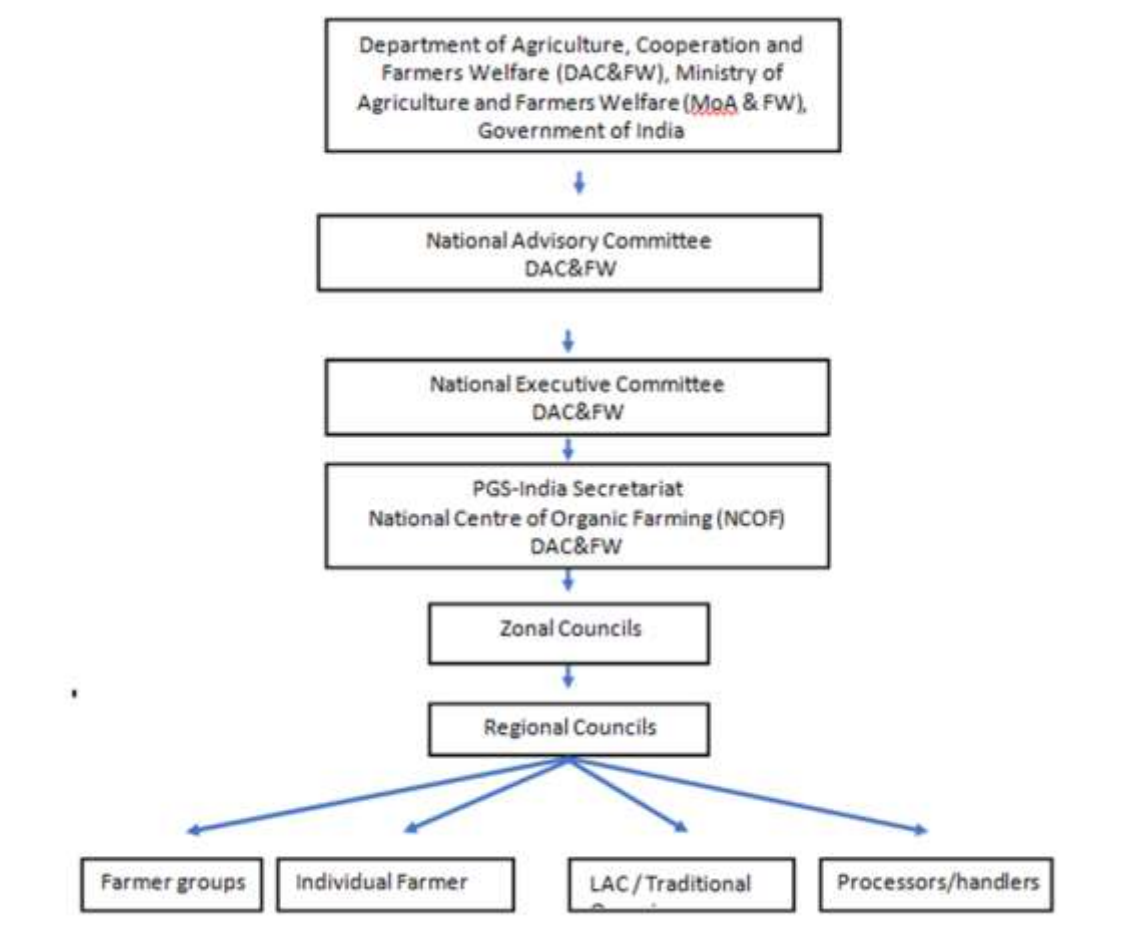
About PGS:

PGS are quality assurance initiatives that are locally relevant, emphasize the participation of stakeholders, including producers and consumers and operate outside the frame of third party certification. PGS is a process whereby people in similar situations (in this case small holder producers) in some way assess the production practices of their peers. This process can be formal or informal.

PGS-India Guiding Principles

In tune with the international trends and IFOAM's PGS Guidelines, PGS India system is also based on participatory approach, a shared vision, transparency, trust, Horizontality and networking. In addition, it gives PGS movement a National recognition and institutional structure without affecting the spirit of PGS. Participation is an essential and dynamic part of PGS. Key stakeholders (producers, consumers, retailers and traders and others such as NGOs) are engaged in the initial design, and then in the operation of the PGS. In the operation of a PGS, stakeholders (including producers) are involved in decision making and take essential decisions about the operation of the PGS itself. In addition, the producers are engaged in a structured ongoing learning process, which helps them to improve what they do. Thelearning process is usually 'hands-on' and might involve field days or workshops.

Institution Structure of PGS-India Programme (Fig.)



Scopes of PGS-INDIA organic certification system

To ensure entry of individual farm/Group/large area producers and PGS-India certified organic farm produce into organized processing and retail sales, PGS-India provides a system of continued verification of organic integrity for farms, on-farm and off-farm processing and handling and online marketingand traceability system. There are three types of module developed at present as given below

1) Crop Production Module

2) Processing and Handling Module

3) Live Stock Module and others

Crop Production module: The complete certification operation under PGS-INDIA web portal has been made functional at present. under crop production modules and there are three categories for which certificates will be issued by RC and the details as follows;

A. <u>Large Area Certification (LAC)</u>

India had been traditionally organic and many areas continue to remain organic. Due to complexities in documentation, physical verification and other requirements for standards compliance such areas could not be considered organic in spite of the fact that they are traditionally organic. PGS-India provides an opportunity to mainstream these areas to organic under the overall guiding principles of PGS-India with following additional features:

- Only large contiguous areas complying to PGS-India standards for several years are considered
- Local/ State administration assures that there is effective ban on usage of synthetic inputs and GMOs and no permissions have been granted for sale/ supply of prohibited substances.
- Such areas are geographically isolated from conventional area and are separated by hills, non-agricultural land, sea, rivers, forests or any other effective barrier.
- Adoptionof PGS-India organic farming policy and practices by all the farmers in the region and its corroboration by village councils or Gram Panchayats.

B. <u>Individual certification</u>

Who can register for Individual certification?

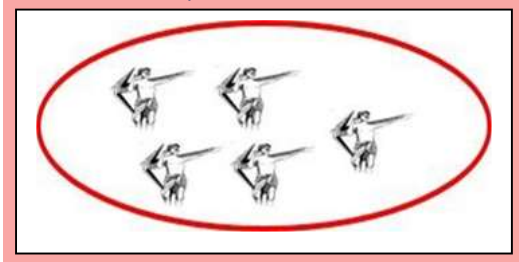
At the beginning where farmer is interested to undertakeorganic farming in a place in which other farmers are notready to join group or no local groups nearby villages present or isolated farmer away from other farmers, in that

case, any individual farmer have a scope to register under Individual certification system.

What is condition for Individual registered farmer?

Farmer should make all out efforts to create groups and become part of PGS- India groups as and when possible within two years. Failure which results him mandatory to join with other already existed PGS local groups nearest to him or his area / Village.

C. Local Group certification:



A Local/farmer Group formation is done comprising of minimum of 5 Members and maximum is any number as per group choice. People in similar situations (farmers) located in the same village or close by villages or adjacent land holding who can interact regularly with each other are facilitated to form a local group. Participation of women farmers shall be ensured and also ensured that at least a few (25%) members are well versed with the PGS/NPOP Standards or have undergone training on PGS guarantee Certification by RCOFS / NCOF / RC or part of the core team of other functional PGS group. It is compulsory that each farmer signed the PGS pledge and LG made agreement with RC on stamp paper. No restriction on the size of holding, one single member should not exceed 50% of the total land under the group. Parallel production and part conversion is not allowed, Entire farm with livestock should bring under organic management within 24 months, otherwise shall continue to remain under conversion

Steps involved in PGS-INDIA Organic certification:

a) Formation of local group (LG): A farmer group will be formed with Minimum 5 members and there is no maximum number limit. But an ideal group may be consisting of 20-25 farmer members which support for easy operation, understanding and effective in functioning.

b) Selection of Group leader /Lead Resource Person: One well educated farmer among the members of group will be selected upon all consent of members of whole group itself. The group leader should be keep rotating as and when required in Local Groups, and maintain harmony and promote growth of leadership.

c) Documents collection: Documents in a prescribed format (as per PGS Guidelines) are required to be collected for registration and approval from regional council. The documents collection is one-time exercise for life time certification process/registration process. All the documents collected will be uploaded in PGS webportal online and RC will approve online and activate thereby each local groups get Unique ID

d) Selection of Regional Council: The RC authorized by NEC-PGS India with whom local groups are interested / familiar / near to them can be chosen by the choice of farmers itself. Submit all the relevance document and get registered and activated by RC. Prior to registration, local groups must interact with RC and undergo proper training to understand PGS system and its operational requirements. LG can shift to an any RC at any time during certification process. Only if the RC is found non-functional or not performing their duties as per PGS guideline, and not guiding LGs for certification process and delaying issue of certificates. LG has to intimate to RC with reason for not continuing to with them before joining with other RC.

e) Registration with Regional Council: Each Individual farmers has to submit prescribed registration formats namely Application Form, Organic Pledge, Farm History Sheet, Identity proof, Identity card, Bank A/C details (Only if required) and land records/details (Pani/Patta/Naksha/GPS). Group leader on behalf of group members has to submit prescribed formats namely application Form, Agreement copy, Terms of Reference for Operation, Endorsement (LG/RC/State can endorse) of group to RC.

f) Endorsement: The authenticity of farmers belongs to village and their active engagement in agriculture activities will be endorsed by other Local Groups already registered under PGS/Regional Council / State Government officers. Under any government scheme if farmers registered/covered will be endorsed by State / District nodal officer.

g) Training: Its responsibility of each farmer registered under Local group have to compulsorily undergo

training to understand organic farming package and practices adopted in organic farming and PGS-India certification procedures, standards and documentation. Farmers should undergo training time to time organized by Regional Council / Service provider / State Government or other institute. Each local group should make sure atleast 50% of its farmer members attend training/ demonstrations programmes without fail. Atleast two such programs are to be compulsorily attended by each member of groups in a year

h) Meeting: Each group should organize time to time meetings and maintain attendance register. Participation of members in these meetings is a mandatory activity and is an indication of dedication of the member to the cause of group's guarantee scheme. There should be at least 2-4 times a year (2 for perennial crop group and 4 times a year for annual crop group) compulsory meetings at key times of the year depending on the season, the crops, etc. One/two meeting to decide for peer appraisal planning and one/two for certification decision making. Every member needs to attend at least 50% of the meetings conducted in a year and sign in attendance register.

i) Peer inspection and decision submission: Each and every season after 15 days of sowing crop and one month before harvest of crop a peer inspection of each individual farmer in a group has to be completed by each group /Individual/LAC as per
parameters set in PGS Standards. To perform peer inspection. A peer inspection team among the members of group will be constituted. It should have at least minimum 3 peer appraisers or more members, at least one member in the appraisal team must be literate and well versed in filling the appraisal forms. The peer inspection team formulated among the members of group will
perform evaluation of organic farming practices adopted by farmers based on ten-point standards of each farmer as given below. The peer appraisal team submit their decision to Local group leader which will be discussed in meeting with all LG members. A compliance and noncompliance of farmers will be prepared and final decision will be submitted to RC for issue of certificate. Noncompliance or sanctions on the farmers who violated rules/standards will be decided by farmers itself as per PGS guidelines. Standard peer appraisal points on which certification will be decided are as follows

1. Habitat management
2. Diversity
3. Integration of Livestock
4. Soil and water conservation
5. Contamination control*
6. Seed and planting material*
7. Fertilization*
8. Pest management*
9. Cleaning of equipment's / tools*
10. Storage and transport

Reciprocal review between two-member group farms is not allowed (i.e. A reviews the B and B reviews A). LG may invite other stakeholders to participate in peer appraisal team. Other stakeholders may include representatives of consumers/ traders or local State Agriculture Department officers / ZC / RCOFs etc., but their participation is not mandatory. This is promoted to increase the trust and credibility of the group guarantee and uphold transparency in PGS certification system. All peer appraisal sheets in respect of each group member needs to be maintained in hard copy or digitally by the local group for future supervision. These are to be made available in the public domain and provided to RC or statutory authority upon demand during physical supervision at any time.

a) Approval Group decision and certificate issue: completely filled peer appraisal form to be submitted to Regional Council and the same will be uploaded online by LG/RC in PGS-INDIA webportal. Regional Council verify and generate certificate and issue certificates to farmers.

PG-SIndia Green Certificate issued under conversion period (upto two years for seasonal crops and three years for perineal crops). PGS-India Organic certificate decision will be taken if farmers issued continuously PGS-India Green certificate and adopted all standards of organic farming as PGS guidelines. Its indicate complete organic status.

Updating Actual yield yield: After harvest of crop keeping 5% variation the actual yield per area of each farmer will be updated in the online PGS-INDIA webportal by LG/RC/FA/SP. Without updating actual yield farmers cannot perform the activity of online marketing through jaivikkheti web portal.

j) Online registration in Jaivikkheti webportal (https://www.jaivikkheti.in/) and Transactions/online marketing: Each registered and active farmer under PGS should also register online under Jaivikkheti webportal to perform online marketing. Farmershave freedom to decide their price for their product and sale to consumers. Farmers are provided an option to choose to sale product at their farm or deliver products through cornier to consumer.

Factors for success of PGS in India

In spite of tremendous investment and efforts in promotion of third party certification system, due to its prohibitively high cost, it is still beyond thereach of small farmers and is also unaffordable to even large farmers, if high premiums are not assured. In market there is growing awareness and consumers are inclined to accept organic foods, but high premiums deter them to buy organic products on regular basis. In such a scenario, it is essential that a farmer empowering system with consumer's participation based on mutual trust is developed and put in place with some credibility support from Government and institutions. Following are the determining factors for success of PGS in India

- Low cost
- Minimum Paperwork
- Regionally Appropriate
- Peer appraisals/inspection by team of farmers itself instead of Professional Third Party Inspections
- Farmers, Regional Groups, NGO's and other Support Organizations are ina Horizontal Network without hierarchies
- Building organic movement in the country
- Credible Organic Guarantee system based on complete trust
- Mutual Recognition and Support between Regional and PGS Groups

- Subtext of training and support built into the system
- Empowers the farmer with increased capacity building
- Empowers the farmer through increased marketing opportunities

Third Party Organic Certification system (NPOP)

India is among the first few developing countries to have developed and launched a credible third party certification system. The National Programme for Organic Production (NPOP) launched during 2001 was the first such quality assurance initiative by the Government of India under Ministry of Commerce and Industry. Accredited certification agencies authorized under the programme are certifying organic producers. NPOP Certification System (A third party certification) NPOP certification is a system of process certification wherein an independent organization reviews entire production, processing, handling, storage and transport etc. to ensure the compliance of organic standards. All such certified products bear the certification mark on their packaging to help consumers and other buyers make educated purchasing decisions.

Significance of Getting NPOP Certification

With the growing demand for organic food in national and international markets, it became necessary to ensure that the agricultural products labeled as "organic" comply the basic standards of organic production and entire production process is verified by independent certification agencies. The NPOP not only provided the institutional framework for accreditation of certification agencies and operationalization of certification programme through its accredited certification bodies but also ensures that the system effectively works and is monitored on regular basis. During 2004 the NPOP was brought under the ambit of Foreign Trade Development and Regulation (FTDR) Act wherein it was mandated that no organic products can be exported unless they are certified under NPOP.

Aims of NPOP

Providing with the methods to evaluate the certification programs for the organic agriculture and associated products including the wild harvest, aquaculture and livestock products as per the approved criteria

Accrediting certification programs of Certification Bodies who are seeking for recognition under this program

Facilitation of organic products certification in strict compliance with NSOP

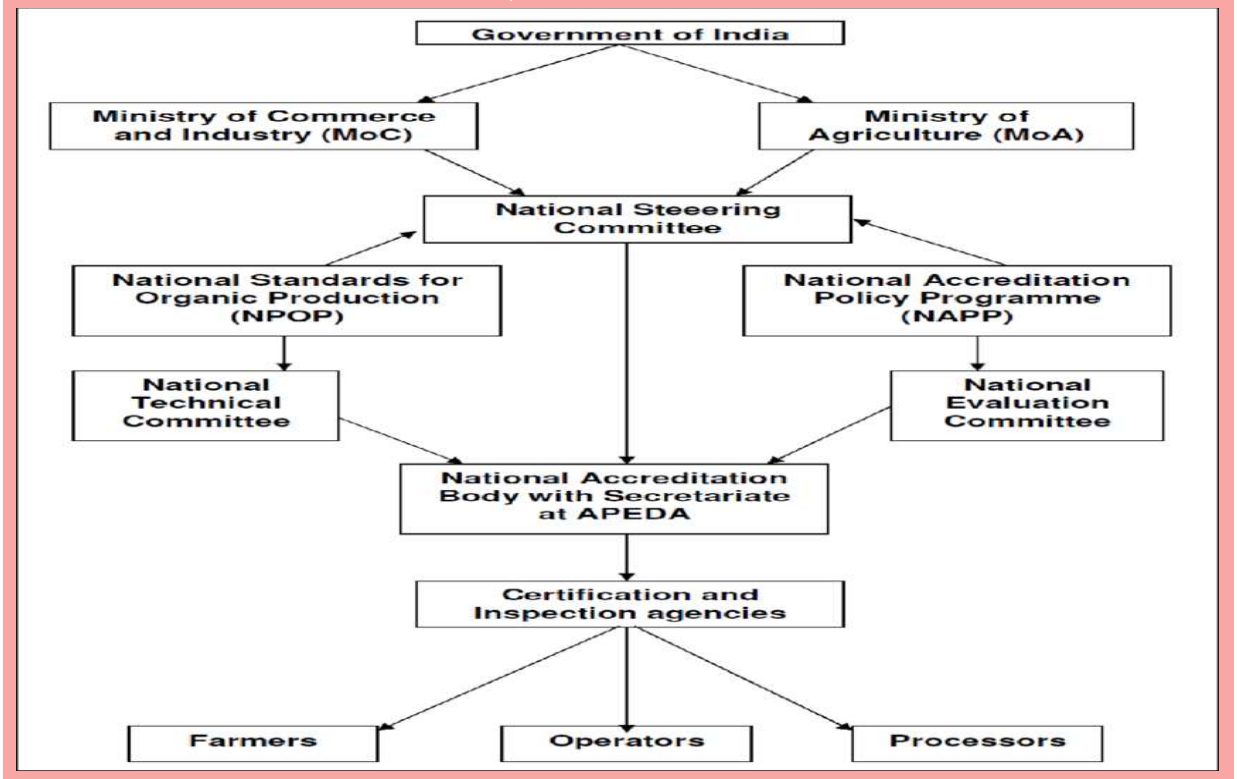
To facilitate certification of organic products in conformity with the importing countries organic standards as per equivalence agreement between the two countries or as per importing country requirements

Promotion of organic farming and organic processing

Scope categories:

a. Crop production and wild harvest
b. Livestock, Sericulture
c. Apiculture
d. Aquaculture
e. Organic Food processing and Handling
f. Organic Animal Feed Processing and Handling
g. Organic Mushroom
h. Seaweeds, Aquatic Plants and Green House Crop Production

Operational Structure



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Certification Procedure in brief

- Application to certification agency in the prescribed format
- Screening of application by certification agency
- Cost estimate of certification sent for acceptance
- Acceptance of cost by the grower/producer
- Signing of agreement between grower/producer and certification agency
- Certification agency seeks cropping/production/cultivation/processing plan and supply a copy of the standards to the grower/producer to follow
- Invoice generated and sent to the producer for payment of initial fee
- Fees paid by the Grower/producer
- Inspection is scheduled
- Inspection is carried out at one or more than one occasion
- If required unannounced inspection can also be done. In case of doubt, the inspection team can also draw plant/soil/raw material/input/product sample for laboratory analysis.
- Submission of Inspection report/(s) to the certification committee
- Certification agency asks for final payment
- Final payment is made
- Certification is granted
- On grant of scope certificate Producer/operator applies for license for use of India Organic Logo
- Certification body grants the license for use of India Organic Logo
- Grower/producer releases the stock for sale with Certification Mark

Marketing Strategies for Organic produce

Organic farmers offer promise of a future world where food and farms products were producing in an ecological and sustainable manner. Farmers approach direct marketing in a variety of ways using single or multiple channels. The goal generally is to develop a strategy to sell all the product they produce. This can be through one marketing channel or several. For instance, many farmers begin with selling through a farmers' market or a roadside stand. As the business grows they can add otherdirect channels such as a CSA, grocery or restaurant sales.

Following are the approaches for marketing strategies for organic products. Some have been around for decades others are have been developed more recently.

Community Supported Agriculture:

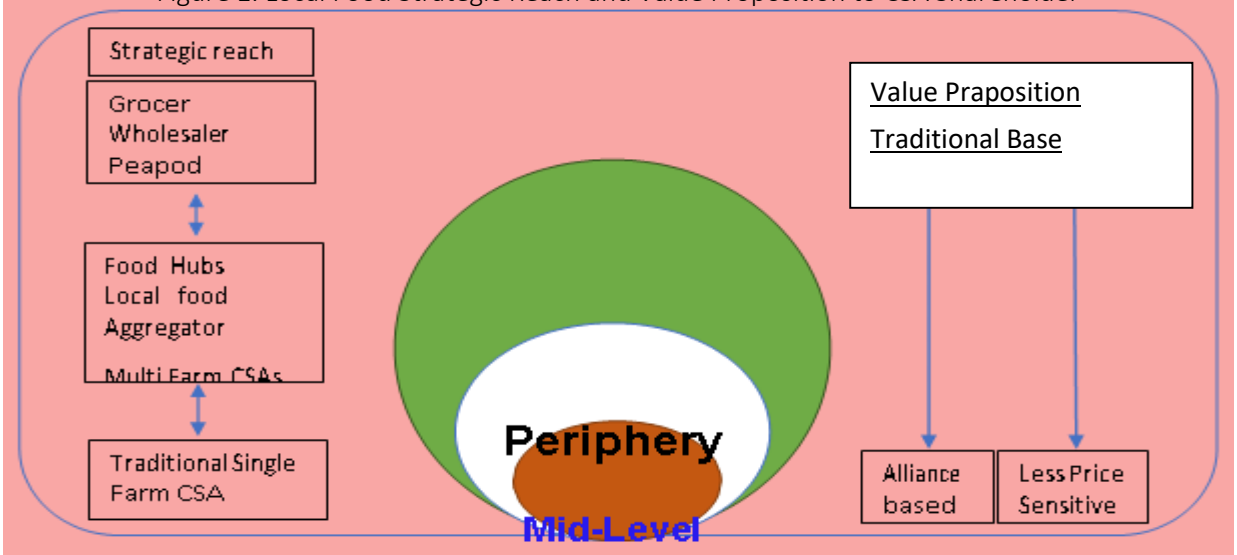
Community supported agriculture (CSA) is a relatively recent and innovative concept that is intended to create a relationship between farmers and consumers, wherein risks and bounties are shared. CSA customers buy shares for a season by paying a fee in advance. In return, they receive a regular (in most cases weekly) selection of food. Having cash in advance of the growing season and a regular customer following provide financial security for farmers. The regular supply of food grown on the farm provide nutritional security and a sense of community for customers In its purest form, customers share in the risk of low production and crop failures, as well as any abundance, by receiving less or more food. It has been an excellent start-up strategy for many small organic farms, providing crucial cash flow at the beginning of the growing season and allowing farmers to "boot strap"their way into farming.

CSA can be implemented by following way.

- Traditional single farm models,
- Cooperatives/multi-farm CSAs,
- Low-income consumer-targeted CSAs,
- Multi-farm innovations targeting unique consumer segments with a health and wellness marketing partner,
- CSAs associated with urban market innovations, and
- A for-profit food hub concept that utilized a CSA aggregation and distributionmodel.

The model is highly flexible to accommodate a variety of products– produce, meat, dairy, eggs, as well as value-added and processed products coming from the farm. The strategic reach of retailers and other aggregators is generally more mediated as they try to reach local consumers, but they are getting better at it. Figure 1 suggests a conceptual framework for considering the spectrum to local food marketers and their strategic reach against the local food consumer value proposition.

Figure 1. Local Food Strategic Reach and Value Proposition to CSA Shareholder



Farmers' Markets

A farmers' market is a place where a number of growers assemble on a particular day to sell farm products directly to consumers. The sites are often parking lots, streets closed during the market, parks, etc. Farmers at these markets sell their products from "stands" that may consist of the back of a farm truck or a simple tabletop to elaborate and attractive covered displays. Farmers generally receive retail prices or higher for their products. Startup costs for becoming involved in a farmers' market can be very inexpensive- just a stall fee in some instances. Farmers' markets also provide the opportunity to build a customer base. Some farms advertise other outlets for buying their products (other farm direct marketing methods, or retail stores for instance).

Picture 1: Ima Keithel Imphal (Mothers Market)

Ima Keithel (Mother's Market), also known as Ima Market or Nupi Keithel (Women's Market) is a market run exclusively by women in Imphal, India. It is a commercial center and a popular tourist attraction in the state of Manipur. It has shifted its location within the city of Imphal over the years and is currently located in Khawairaband Bazaar.

Developing markets like this in all over India, will help in women empowerment and strengthen the women farmer condition.

U-Pick Farms

U-Pick or Pick-Your-Own farms grow crops specifically to be harvested by customers. In this manner, the task of picking the crop, one of the higher costs of growing fruits and vegetables, is passed on to customers. U-Pick farms have traditionally appealed to families who do home canning. There continues to be an interest by families in picking produce for fresh use and, in some instances, having their children experience where their food comes from. As with many direct marketing techniques, U-Pick operations can be blended with other marketing techniques such as roadside markets, farmers' markets, and so on. This strategy is not unique and has probably been around as long as farmers have grown more than they can sell at wholesale or consume on the farm. U-pick operations serve as an alternative selling method that, depending on the type of produce a farmer grows and the farm's customer base, it can supplement other marketing strategies.

Following are the examples of U -Pick Farm in and around Bangalore, perfect for fruit & vegetable picking with the children.

The Farm, Bannerghatta Road. Bangalore, Karnataka

Chiguru Farm, Dodduru, Therubeedi Village, Maralawadi Hobli, KanakapuraTaluk, Karnataka

The Green Path – Sukrishi Farm, Chikmaranahalli, Karnataka

Aditi Farms, Off Kanakapura Road, Bangalore, Karnataka

Silver Oak Farms, Sultanpet Village, Nandi Post Office, Nandi Hills,Karnataka

Picture 2: Children in U-Pick Farm

Farm Stands

Farm stands or markets are structures of some type from which the farm's products are sold. They can range in sophistication from a stand with a coffee can for purchases by honor system to a building with refrigerated storage and several employees. They tend to be located on the farm, often on a well-traveled road with good access and parking. They can operate seasonally or all year and focus on one product or a full line of products. Roadside markets usually charge near retail prices. Given that farm stands or markets are structures, they are subject to local building codes and highway setback regulations.

Picture 3: Farm stand on road side

Restaurants

Many farms are now marketing directly to restaurants providing the specific products and the high quality that chefs are demanding. Many restaurants cultivate relationships with farms even noting the farm name and its product on their menu. These restaurants serve a niche of customers who find high quality food produced locally appealing. Supporting local farms is a philosophical goal for these restaurants. Similar opportunities for farm direct sales are to institutions that serve food to large or "captive" groups such as: Hospitals Retirement and nursing facilities.

Examples of Organic restaurants where farmers sell their organic products. (9)

Om Made Cafe: Serving selection of continental food like chicken burgers, chocolate crepes, wraps, garlic breads and amazing desserts like almond ice cream and brownies.

Rasa India: Serving all organic South Indian cuisine in Bangalore.

Spoonful of Sugar: Serving Organic desserts.

California Burrito: Serving organic American continental food.

Green Theory: serving Italian food and sizzlers.

Green path organic state: serving Indian food

Picture 4: The green path organic state restaurantFarm to School and Institutions Resources

Bring local food to local institutions: This provides farmers, school administrators,and institutional food-service planners with contact information and descriptions of existing programs that have made connections between local farmers and local school lunchrooms, college dining halls, or cafeterias in other institutions. To help communities initiate similar programs, this publication includes: resource lists of publications on how to initiate and manage local food programs, funding and technical assistance sources, and provisions of the 2002 Farm Bill that support farm-to-school and other community food programs.

Farm to School programs are popping up all over the world and same can be implemented in India. These programs connect schools with local farms with the objectives of serving healthy meals in school cafeterias, improving student nutrition, providing health and nutrition education opportunities that will last a lifetime, and supporting local small farmers. Unlike other guides, this one focuses on agricultural practices, because these practices are inseparable from nutrition and sustainability. This guide establishes best and worst practices in the field. It provides a list of questions you need to ask to get the very best product for your institution. It also offers helpful hints, so that you can learn from work that has been done.

For example, Washington State Department of Agriculture providing opportunities forsmall farms in Washington states in Farm-to-cafeteria connections. An extensive resource guide for those interested in starting farm-to-cafeteria programs at all levels, with information for food services, farmers and others. Includes case studies of programs and a list of resources. Similar type of program is Farm-to-college programs connect colleges and universities with producers in their area to provide local farm products for meals and special events on campus. These programs may be small and unofficial, mainly involving special dinners or other events, or they may be large and well-established, with many local products incorporated into cafeteria meals every day. Similar type of programme can be implemented in Farm to hospital which introduces interested farmers and hospital food service departments to the ins and outs of developing partnerships between hospitals and local farms. Included are examples of ways hospitals can improve the food they offer, issues for farmers to consider if they are interested in selling products to area hospitals, and specific case studies of successful programs.

Akshaya Patra has 55 centralized kitchens in 12 states and 2 Union Territories in India, andfeeds over 1.8 million children per day. The objectives behind this initiative are:

To ensure our beneficiary children continue to receive nutritious meals amid theprevailing crisis;

To boost immunity and health of children;

To ensure basic hygiene needs are met; and

Engage children in activities to support their continuous learning amid the lockdown.

These types of programs resulted in increased attendance and marked improvement instudent health and academic performance as well as financial condition of farmers.

Programme like Farm to Cafeteria, Farm to school (Akshaya Patra), Farm to college, Farm tohospital will help organic farmers to develop steady and sustainable market for long term.

Agritourism

Agritourism appeals to customers who have a desire to visit a farm and experience its activities. As Americans lose family ties with agriculture, many are interested in maintaining some sort of contact with farming; especially for their children. This is a theme with most types of direct marketing but is a key feature of agritourism. There are a variety of approaches. On-farm bed and breakfasts allow overnight stays to relax in a bucolic atmosphere or, in some instances, work on the farm. The concept of Agri tourism is very simple, whereby the urban tourists go the farmers home; stay like farmer, engage in farming activities, experience the bullock cart, tractor ride, fly kites, eat authentic food, wear traditional clothes, understand the local culture, enjoy the folk songs and dance, buy fresh farm produce and in turn the farmer maintains home and farm hygiene, greets new tourists, sells his farm produce at a better price, earns a livelihood all year round. The concept of "farm stays," popular in Europe, is catching on in the U.S. Hay rides to gather Halloween pumpkins or Christmas trees and other family-oriented activities are popular on farms. Other activities such as cattle drives attract customers who are willing to pay to experience a
celebrated part of our past and present. Agritourism and entertainment techniques can work in both urbanized areas and very rural areas. As with many direct marketing techniques, people skills are crucial. In India state like Maharashtra and Karnataka are pioneer in agro tourism.

Example: 1) Maharashtra is the pioneer state to develop and promote Agri-Tourism in the country. Agri Tourism Development Corporation incorporated in 2005 and owns the pilot Agri tourism project of 28 acres in Palshiwadi, tal Baramati Dist Pune, 70 kms from Pune city.

ATDC encourages individual farmers to be a part of Agriculture tourism for strengthening farmers financial health. Abhishek Mala Paryatan Krishi Kendra Pakani Maharashtra is an excellent example where farmers quitting farming due to problems like drought whereas this farm in 2003 started agriculture tourism for extra income and succeeded in it and started doing traditional farming (Parmparagat Krishi).

In Karnataka, Green path, Bangalore is a sustainable living movement with several eco-initiatives. Their aim is to inspire more people to adopt eco-friendly lifestyle through replicable models of sustainability. They also have a tour in organic farm & hands on experience with the farming.

Organic Seed Bank:

Marketing and skill development point of view farmers facing problem of certified organic seeds. availability of organic and indigenous seed is a hurdle in organic farming. Farmers perusing organic farming by preserving and maintaining good pedigree can develop high yield organic seeds. Community level organic seed cultivation is now popular and can be a major business for growers. Farmers also deposit their seeds directly in seed bank and in return they get direct money for their produce this is also a market as well as a businessmodel for farmers.

Farmers have an alternate business by developing seed bank on community level.

Seed bank work is to provide indigenous seeds to farmers with little money in return farmer has to deposit double seeds after cultivation. By this means both farmers and seed bank owner both are benefited. Development of seed bank not only provide farmers alternate option of income but also reduce his input cost of seed.

Some active community seed cultivators are given below.

Navadanya (https://www.navdanya.org/)

Green Foundation (http://www.greenfoundation.in/)

Sahaj Samrudha(https://www.sahajasamrudha.org/)

Online Marketing

Digitization and easy internet access have changed the face of farming forever and many in the industry are scrambling to keep up with the new methods available to keep them in touch with their customers. The time is ripe for agricultural suppliers to make the shift from traditional to digital marketing approaches and claim their full portion of sales available.

The internet provides a convenient method to advertise the farm business, sell products, and communicate with customers.

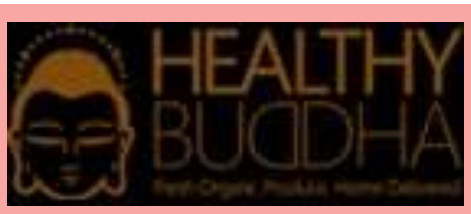
Jaivik kheti portal is a unique initiative of Ministry of Agriculture (MoA), Department of Agriculture (DAC) along with MSTC to promote organic farming globally. It is a one stop solution for facilitating organic farmers to sell their organic produce and promoting organic farming and its benefits. Jaivik Kheti portal provide various price discovery mechanisms to help farmers get the best prices for their products through forward auction, price-quantity bidding, book building and reverse auction mechanisms.

Following are the government and private portals where farmers sell their products.

Jaivik kheti portal (https://www.jaivikkheti.in/)

KisanMandi.com(https://www.kisanmandi.com/)

Healthy Buddha - Organic e.Store, Bangalore(https://healthybuddha.in/)



Farmers can develop and form their website for selling produce byindividually or by group or by geo tagging.

Move From 1-to-Many to 1-to-1 Marketing

The old approach to advertising (general ads placed in newspapers, directories, radio,TV etc.) spreads one message to many consumers - but in the modern world, this singular approach just doesn't cut it anymore. By combining traditional methods for quick-buys that don't require any really investment or thought and one-to-one relationship building digital marketing methods for those bigger purchases, you can have a winning formula.

Today's farmer spends hours (and we mean HOURS) researching the latest innovations in theindustry, the best rated products and the newest addition to their inventory.

Organic food producers must do more to position themselves as competitive alternatives to traditional food providers. This means implementing marketing strategies that present organic goods not simply as food, but as a way of improving your personal health andlifestyle.

Scope for Skill Development in Agriculture for Farmers and Rural Youth

Various new job opportunities are emerging in agriculture and allied sector due to increasing commercialisation of farming. Hence skill training can provide an edge to those who are seeking job opportunities in these sectors. The emerging job opportunities are in the following areas: - Agri Warehousing, Cold Chain, Logistics & Supply Chain - Commodity & Financial Markets - Digital Agriculture, Weather Forecasting - Dairy, Poultry, Meat, Fisheries, Horticulture, - Alternate energy (Solar, Biomass etc) - Farm Mechanization, Micro Irrigation etc - Protected Cultivation (Green House, Hydroponics etc) - Bamboo, Honey, Medicinal & Herbal, Organic etc - New requirements in Seeds, Pesticides, Fertilizers etc (Arya, 2015).

Marketing CareersWholesale Buyer

Wholesale buyers explore pricing and demand for particular products. For organic foods, this means determining ways of pricing higher quality foods in a competitive mannerto draw more consumers toward the product.

Consumer Marketing Manager

Because organic food is such a consumer-focused industry, companies must gain insight into what their customers think about certain products. Consumer marketing managers interview consumers about which organic foods they buy, why they buy them, and methods to educate more consumers about health benefits

Empowering Farmers with FPOs
(A Step Towards Atmnirbhar Krishi)

Farmer Producer Organization refers to farmer- producers' organization incorporated/ registered either under Part IXA of Companies Act or under Co-operative Societies Act of the concerned States and formed for the purpose of leveraging collectives through economies of scale in production and marketing of agricultural and allied sector. The concept behind Farmer Producer Organizations is that farmers, who are the producers of agricultural products, can form groups. To facilitate this process, the Small Farmers' Agribusiness Consortium (SFAC) was mandated by Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, to support the State Governments in the formation of Farmer Producer Organizations (FPOs)

The Government of India has approved and launched a Central Sector Scheme of "Formation and Promotion of 10,000 Farmer Producer Organizations (FPOs)" to form and promote 10,000 new FPOs till 2027-28.

Under the scheme, the formation and promotion of FPO is based on Produce Cluster Area approach and specialized commodity-based approach. While adopting cluster-based approach, formation of FPOs will be focused on "One District One Product" for development of product specialization.

Need of FPOs

Nearly 86 per cent of farmers are small and marginal with average land holdings in the country being less than 1.1 hectare.

These small, marginal and landless farmers face tremendous challenges during agriculture production phase such as for access to technology, quality seed, fertilizers and pesticides including requisite finances.

They also face tremendous challenges in marketing their produce due to lack of economic strength.

FPOs help in collectivization of such small, marginal and landless farmers in order to give them the collective strength to deal with such issues. Members of the FPO will manage their activities together in the organization to get better access to technology, input, finance and market for faster enhancement of their income.

Objectives of FPOs

To provide holistic and broad-based supportive ecosystem to form 10000 new FPOs to facilitate development of vibrant and sustainable income-oriented farming and for overall socio-economic development and wellbeing of agrarian communities.

To enhance productivity through efficient, cost-effective and sustainable resource use and realize higher returns through better liquidity and market linkages for their produce and become sustainable through collective action.

To provide handholding and support to new FPOs up to five years from the year of its creation in all aspects of management of FPO, inputs, production, processing and value addition, market linkages, credit linkages and use of technology etc.

To provide effective capacity building to FPOs to develop agriculture entrepreneurship skills to become economically viable and self-sustaining beyond the period of support from the government.

Implementation of the Scheme

Under this scheme, formation &promotion of FPOs are to be done through the Implementing Agencies (IAs). As of February 2021, nine IAs had been finalized for formation and promotion of FPOs viz.:

Small Farmers Agri-Business Consortium (SFAC)

National Cooperative Development Corporation (NCDC)

National Bank for Agriculture and Rural Development (NABARD)

National Agricultural Cooperative Marketing Federation of India (NAFED)

North Eastern Regional Agricultural Marketing Corporation Limited (NERAMAC)

Tamil Nadu-Small Farmers Agri-Business Consortium (TN-SFAC)

Small Farmers Agri-Business Consortium Haryana (SFACH)

Watershed Development Department (WDD)- Karnataka

Foundation for Development of Rural Value Chains (FDRVC)- Ministry of Rural Development (MoRD)

FPOs will be provided financial assistance upto Rs 18.00 lakh per FPO for a period of three years. In addition to this, provision has been made for matching equity grant upto Rs. 2000 per farmer member of FPO with a limit of Rs. 15.00 lakh per FPO and a credit guarantee facility upto Rs. 2.00 crore of project loan per FPO from eligible lending institution to ensure institutional credit accessibility to FPOs.

There are well defined training structures in the scheme and the institutions like Bankers Institute of Rural Development (BIRD), Lucknow and Laxmanrao Inamdar National Academy for Co-operative Research & Development (LINAC), Gurugram have been chosen as the lead training institutes for capacity development & trainings of FPOs. Training & skill development modules have been developed to further strengthen the FPOs.

Formation & promotion of FPOs is the first step for converting Krishi into Atmanirbhar Krishi. This will enhance cost effective production and productivity and higher net incomes to the member of the FPO. Also improve rural economy and create job opportunities for rural youths in villages itself. This was the major step towards improving farmers' income substantially.

Creation of FPOs/FPC under MOVCDNER

Background

Mission Organic Value Chain Development for North-East Region (MOVCDNER) is a Central Sector Scheme, a sub-mission under National Mission for Sustainable Agriculture (NMSA), launched by the Ministry of Agriculture and Farmers Welfare for implementation in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura, during the 12th plan period. It focusses on enhancing farmer's participation in agriculture value chain through promotion of organic farming and development of farmer institutions.

Its major objectives are:

- To develop crop commodity specific organic value chain and address gaps in organic crop production, wild crop harvesting, organic livestock management and processing handling and marketing of organic agricultural products
- To empower producers with program ownership by organizing them into FIGs with the final aim to federate into farmer producer organizations/ companies.
- To replace conventional farming/subsistence farming system into local resource based, self-sustainable, high value commercial organic enterprise.
- Developing commodity specific commercial organic value chain under integrated and concentrated approach with end-to-end facilities for production, processing, storage and marketing.
- Development of organic parks/zones with facilities for collection, aggregation, value addition, processing, storage and market-linkages for specific commodities requiring capital intensive technology.
- Develop NER products as brands/labels through brand building and facilitating stronger marketing access under the ownership of growers‟ organizations/ companies.
- Creating state specific lead agency (Organic Commodity Board or Organic Mission) for coordinating, monitoring, supporting and financing the development and operationalization of entire value chain.

Mission Goals

- The scheme revolves around its major goals which are:
- Installing institutional systems for developing and promoting Organic Farming

- Empowering 30-50 thousand farmers in North-East Region through creating 100+ FPC's
- Converting subsistence farming to commercial organic farming with end-to-end facilities.
- Making North-Eastern states as major suppliers of organic commodities for national and international markets.
- Improving production system to ensure higher productivity with better profitability.
- Enabling states to evolve their own brand

Major Components

MOVCDNER disseminates through various components of supply chain leading to meet its goals. Following are the major components that the scheme involves:

- Institution Development - Creation of FPO/FPCs
- Value Chain Production - Support for inputs, seeds, certification, and commodity specific production and setting up of custom hiring centres
- Value Chain Processing - Supporting FPO/FPCs for setting up of collection and aggregation centres, integrated processing units, pack houses, transportation vehicles and cold chain component
- Value Chain Marketing and Support services - Market facilitation, handholding, brand building, brand promotion and contract production

Value Delivered across Value Chain

Capacity Building

- More than 92 trainings on Production, Marketing, Packaging, Business Planning, Accounting, Input, Processing, and IT
- Business Planning for 9 FPOs and Industry mentorship for 7 FPOs
- 24 Model FPOs created

Values Unlocked:

- FPOs bidding to take on responsibilities of Service Provider
- FPOs forming federations for scale
- Towards self-sustainability

Team and trust building workshops in Meghalaya

Training on variety, sorting and grading, package of Kiwi in Nagaland

Pineapple harvesting training in Tripura by Big Basket

Post-Harvest Infrastructure

- 75 Small Processing Unit sanctioned/allocated
- 18 proposals sanctioned through NEDFi
- Rs. 84.79 Cr worth PPP investment facilitated
- 34 Collection Centres, 16 CHCs at FPO Level

Values Unlocked:

- **Value addition** at farm level
- Achieve **economies of scale**
- Protection against distress sale
- Estimated **Rs. 200 Crore** potential revenue generation

Marketing and Branding

- Rs. 73 Cr. Demand linked
- 11 brands/ institutional buyers engaged
- Contract cultivation initiated
- Upto 30% premium for organic

Values Unlocked:

- Segmented Marketing – Retail, Nutraceutical, Export
- Shortened supply chain
- Reduce transportation losses – Packaging + Train transport
- Transparency in Transaction generation

Innovation

- Tie up with Google and MOMA
- Agri – Tourism with Little-Local
- Packaging Designing for Fruits
- Wikipedia page for high Google Search rank

Values Unlocked:

- Creation of **Brand Equity**
- **Additional income** through tourism
- High **Google Search** ranking

Innovations in Marketing

- Branding collaterals created for scheme
- Innovative packaging for pineapples and linkages with 'Kisan Rail'
- Labelling through pineapple collars for NER
- Linked pineapple and ginger from Tripura to Big Basket
- Establishing supply chain for Kiwi from Nagaland and AP
- Contract Farming of Calendula & Red Clover in Manipur

6 Brands created

Achievements

- INR 737.36 crore of total funds have been released
- 170 FPO/FPCs created covering 1,55,495 ha area and 1,53,116 farmers
- Facilitation of 242 Collection, Aggregation, Grading units, Custom Hiring Centres
- 26 processing and pack house entities created under FPO/FPCs and private ownership
- Provision of 89 transport vehicles to FPOs/FPCs
- Brand development of 6 North-Eastern States

MOVCDNER in 15th Finance Commission

Targets	Way Forward

• Area – 85,000 ha (170 clusters)
• Farmers - 85,000
• FPO/ FPCs - 170 No
• All FPOs with basic post-harvest handling infra
  o Warehouse/ cold room
  o Collection & Agg Centre
  o Transport vehicle
• Support for advanced processing and handling
  o Packhouse
  o Integrated processing
  o Cold chain
• In-situ seed clusters – 170 No
	• Capacity building, soft skills and technical skills on business management, company management
	• Extended support for 5 years
	• Continuous in-situ seed supply
	• Linkages between FPCs & Exporters
	• Contract farming of MAPs
	• Further strengthening of postharvest facilities
	• Linking MOVCDNER FPOs with jaivikheti.in for e commerce
	• International and national exposure for marketing

Government Schemes for promotion of Organic Farming

Govt of India is committed to promote Organic Farming to ensure sustainable productivity, food and nutritional security, resource conservation and soil health. Organic farming is being promoted through various schemes as mentioned below:

1. Paramparagat Krishi Vikas Yojana (PKVY)

The PKVY Scheme is implemented through state Governments in cluster mode with minimum 20 ha area. To ensure collective approach and link the produce to market 25-50 such clusters are grouped to make 500 to 1000 ha cluster group. PGS-India certification is the basis for quality assurance. PKVY is a centrally sponsored scheme and funds are provided by central and state Governments in a ratio of 60:40 in plain states and 90:10 in hilly states. PKVY and its sub-schemes are implemented in all states except 8 North Eastern States

Objectives

1. To promote natural resource based integrated and climate resilient sustainable farming system emphasizing on-farm nutrient recycling and minimizing dependence on external inputs;
2. To reduce cost of cultivation
3. To sustainably produce chemical free and nutritious food
4. To protect environment from hazardous inorganic chemicals
5. To empower farmers through their own institutional development in the form of clusters and groups with capacity to manage production, processing, value addition and certification management;
6. To make farmers entrepreneurs through direct market linkages with local and national markets.

Component and pattern of assistance:

Component	Rs/ha for 3 years	Cost in Rs. per 20 ha cluster
Cluster formation and capacity building	3000	60,000/-
Deployment of manpower and management of implementation	4500	90,000/-
PGS Certification – Service charges to RC and residue analysis	2700	12,000
Incentive to farmers as DBT or as inputs	31,000	620,000
Marketing, packaging, space rent, transportation	1500/ha	30,000
Value addition infrastructure	2,000/ha	40,000
Brand building, trade fairs, publicity, marketing support	5300/ha	1,06,000
Total	50,000/ha	10,00,000

How to avail the benefits and join the scheme?

Farmers interested for adoption of organic farming as long term goal can contact Director of Agriculture at state level and District Agriculture office of at local level. Under Namami Gange programme, 5 km belt along the river Ganges is also targeted for organic conversion. Farmers in these area also can contact their District Agriculture office.

1.1 Bhartiya Prakritik Krishi Paddhti (BPKP):

BPKP, a sub-scheme of PKVY is aimed at promoting traditional indigenous practices which gives freedom to farmers from externally purchased inputs and largely based on on-farm biomass recycling with major stress on biomass mulching, use of cow dung-urine formulations; plant based preparations time to time working for soil aeration and exclusion of all synthetic chemical inputs directly or indirectly.

Components and pattern of assistance

Component	Rs/ha for 3 years	Cost per cluster of 20 ha Rs.
Deployment of manpower and management cost for 1000 ha block level	4,500	90,000
Cluster formation, capacity building and trainings	3,000	60,000
PGS Certification – Service charges to RC and residue analysis	2,700	54,000
Incentive to farmers as DBT or as inputs	2,000	40,000
Total	12,200/ha	2,44,000

1.2 Large Area Certification (LAC)

Under PKVY-LAC scheme states can transform their large contiguous traditional/ default organic areas (such as tribal areas, hill districts etc) into certified organic through PGS -certification. In this large contiguous areas with no agro-chemical input usage history can be transformed into certified using one village-one group concept. Under this component financial assistance is available only for certification facilitation @ Rs. 2700/ha for three years.

1.3 Individual and Small Farmer group Certification

Individual and small farmer groups (5-50 farmers) doing organic farming of their own and not part of any Government scheme can also avail the certification assistance. For this, farmers need to transform their farm into organic and get registered with state Agriculture Department and nearby Regional Council of PGS-India program. Necessary cost limited to Rs. 2700/ha for three years will be reimbursed directly to certification authority. For details please contact nearby Regional Council. Names and contact details of such RCs can be seen from https://pgsindia-ncof.gov.in/

2. Mission Organic Value Chain Development for North Eastern Region (MOVCDNER)

The scheme aims at promotion of commercial organic farming in value chain mode to link growers with consumers and to support the development of entire value chain starting from inputs, seeds, certification, to the creation of facilities for collection, aggregation, processing, marketing and brand building. Farmers in contiguous area are aggregated for 20 ha farmer interest groups and 25 such groups are aggregated into Farmer Producer Organization (FPO). Entire value chain is created under their FPO ownership.

MOVCDNER is a central sector scheme with 100% funding from central Govt. The scheme is being implemented by the respective state Governments through their state specific “Organic Missions”.

Components and pattern of assistance

Components	Rate for 3 years	Total per cluster of 500 ha /FPO
FPO formation	4075/farmer	20.37 lakh
Support for inputs to farmers	15000/ha	75.00 lakh
Seed supply	17500/ha	87.50 lakh
Custom Hiring centre		10 lakh/FPO
Training, handholding and certification	10,000/ha	10 lakh
Collection & aggregation centre for FPOs	11.25 lakh/FPO	11.25 lakh/ FPO
Transport vehicle to FPOs	6.0 lakh	6.00 lakh/FPO
Integrated processing units	1-2 per state	600 lakh
Pack house, cold chain	Need based	18.75 lakh
Marketing, branding, publicity,	State Govt.	19.00 lakh/FPO
Project management 5% to states and 0.5% at national level		

Postharvest component Eligibility and funding pattern : Assistance under postharvest handling and value addition components is open to FPOs created under the scheme or private entrepreneurs/ companies. Financial assistance limited to cost norm given below is provided as subsidy @ 75% to FPOs and 50% to private entities. Subsidy to private entities is credit linked.

Components	Total Financial outlay ceiling	Maximum amount of admissible subsidy
Integrated processing Unit	Rs. 800 lakh	600 lakh
Integrated pack house	Rs. 50 lakh	37.25 lakh
Refer van	Rs. 26 lakh	18.75 lakh
Cold room, cold chamber, ripening chamber etc	Rs. 25 lakh	18.75 lakh
Small processing units (TFO 25 lakh)	Rs. 25 lakh	18.75 lakh

How to avail the assistance :Farmers of NER states willing to join the scheme can contact their state Organic Mission. Information can also be obtained from District Agriculture and Horticulture Department offices.

Capital investment Subsidy Scheme (CISS) under Soil Health Management Scheme: 100% assistance is provided to State Government / Government agencies for setting up of mechanized fruit/vegetable market waste/ Agro waste compost production unit up to a maximum limit of Rs.190.00 Lakh /unit (3000 Total Per Annum TPA capacity). Similarly, for individuals/ private agencies assistance up to 33% of cost limit to Rs 63 lakh/unit as capital investment is provided. For setting up of Biofertilizer/ Biopesticides units, capital subsidy of 25% of the total project cost subject to a maximum of Rs. 40 lakhs per unit.

4. National Mission on Oilseeds and Oil Palm (NMOOP): Financial assistance@ 50% subsidy to the tune of Rs. 300/- per ha is being provided for different components including bio-fertilizers, supply of Rhizobium culture/Phosphate Solubilising Bacteria (PSB)/Zinc Solubilising Bacteria (ZSB)/ Azatobacter/ Mycorrhiza and vermi compost.

5. National Food Security Mission (NFSM): Financial assistance is provided for promotion of Bio-Fertilizer (Rhizobium/PSB) @50% of the cost limited to Rs.300 per ha.

Biofertilizers and Organic Fertilizers in Fertilizer (Control) Order, 1985

"Schedule III

[See clause 2(h) and (q)]

PART – A

Specification of Biofertilizers

1. Rhizobium

(i)	*Base*	*Carrier based* in form of moist/dry powder or granules, or liquid based*
(ii)	*Viable cell count*	*CFU minimum $5x10^7$ cell/g of powder, granules or carrier material or $1x10^8$ cell/ml of liquid.*
(iii)	*Contamination level*	*No contamination at 10^5 dilution*
(iv)	*pH*	*6.5-7.5*
(v)	*Particles size in case of carrier based material.*	*All material shall pass through 0.15-0.212mm IS sieve*
(vi)	*Moisture percent by weight, maximum in case of carrier based.*	*30-40%*
(vii)	*Efficiency character*	*Should show effective nodulation on all the species listed on the packet.*

**Type of carrier: The carrier materials such as peat, lignite, peat soil, humus, wood charcoal or similar material favouring growth of organism.*

2. Azotobacter

(i)	*Base*	*Carrier based* in form of moist/dry powder or granules, or liquid based*
(ii)	*Viable cell count*	*CFU minimum $5x10^7$ cell/g of powder, granules or carrier material or $1x10^8$ cell/ml of liquid.*
(iii)	*Contamination level*	*No contamination at 10^5 dilution*
(iv)	*pH*	*6.5-7.5*
(v)	*Particles size in case of carrier based material.*	*All material shall pass through 0.15-0.212mm IS sieve*
(vi)	*Moisture percent by weight, maximum in case of carrier based.*	*30-40%*
(vii)	*Efficiency character*	*The strain should be capable of fixing at least 10 mg of nitrogen per g of sucrose consumed.*

**Type of carrier: - The carrier material such as peat, lignite, peat soil, humus, wood charcoal or similar material favouring growth of the organism.*

3. Azospirillum

(i)	*Base*	*Carrier based* in form of moist/dry powder or granules, or liquid based*
(ii)	*Viable cell count*	*CFU minimum $5x10^7$ cell/g of powder, granules or carrier material or $1x10^8$ cell/ml of liquid.*
(iii)	*Contamination level*	*No contamination at 10^5 dilution*
(iv)	*pH*	*6.5-7.5*
(v)	*Particles size in case of carrier based material.*	*All material shall pass through 0.15-0.212mm IS sieve*
(vi)	*Moisture percent by weight, maximum in case of carrier based.*	*30-40%*
(vii)	*Efficiency character*	*Formation of white pellicle in semisolid N-free*

		bromothymol blue media.

**Type of carrier:- The carrier material such as peat, lignite, peat soil, humus, wood Charcoal or similar material favouring growth of the organism.*

4. Phosphate solubilising Bacteria

(i)	*Base*	*Carrier based* in form of moist/dry powder or granules, or liquid based*
(ii)	*Viable cell count*	*CFU minimum $5x10^7$ cell/g of powder, granules or carrier material or $1x10^8$ cell/ml of liquid.*
(iii)	*Contamination level*	*No contamination at 10^5 dilution*
(iv)	*pH*	*6.5-7.5 for moist/dry powder, granulated carrier based and 5.0 – 7.5 for liquid based*
(v)	*Particles size in case of carrier based material.*	*All material shall pass through 0.15-0.212mm IS sieve*
(vi)	*Moisture percent by weight, maximum in case of carrier based.*	*30-40%*
(vii)	*Efficiency character*	*The strain should have phosphate solubilizing capacity in the range of minimum 30%, when tested spectrophotometrically. In terms of zone formation, minimum 5mm solubilization zone in prescribed media having at least 3mm thickness.*

**Types of Carrier:- The carrier material such as peat, lignite, peat soil, humus, wood Charcoal or similar material favouring growth of the organism.*

5. Mycorrhizal Biofertilizers

i.	*Form/base*	*Fine Powder/ tablets/ granules/ root biomass mixed with growing substrate*
ii.	*Particle size for carrier based powder formulations*	*90% should pass through 250 micron IS sieve (60 BSS)*
iii.	*Moisture content percent maximum*	*8 -12*
iv.	*pH*	*6.0 to 7.5*
v.	*Total viable propagules/ gram of product*	*100 gm of finished product with minimum 60 spres per gram*
vi.	*Infectivity potential*	*Inoculum potential : 1200 IP/g {determined by MPN method with 10 fold dilution}*

6. Potassium Mobilizing Biofertilizers (KMB)

1.	*Base*	*Carrier based* in form of moist/dry powder or granules, or liquid based*
2.	*Viable cell count*	*CFU minimum $5x10^7$ cells/g of powder, granules, or carrier material on dry weight basis or $1x10^8$ cell/ml of liquid*
3.	*Contamination*	*No contamination at 10^5 dilution*
4.	*pH*	*6.5-7.5 for carrier based in form of powder or granules and 5.0-7.5 for liquid based*
5.	*Particle size in case of carrier based moist powder*	*Powder material shall pass through 0.15 to 0.212 mm IS sieve*
6.	*Moisture per cent, by weight,*	*30-40*

	maximum in case of powder based	
7.	*Efficiency character*	*Maximum 10 mm solubilization zone in prescribed media having at least 3mm thickness.*

**Type of carrier – The carrier material such as peat, lignite, peat soil, humus, talc or similar material favouring growth of microorganisms.*

7. Zinc Solubilizing Biofertilizers (ZSB)

1.	*Base*	*Carrier based in form of moist/dry powder or granules, or liquid based*
2.	*Viable cell count*	*CFU minimum $5x10^7$ cells/g of powder, granules, or carrier material on dry weight basis or $1x10^8$ cell/ml of liquid*
3.	*Contamination*	*No contamination at 10^5 dilution*
4.	*pH*	*6.5-7.5 for carrier based in form of powder or granules and 5.0-7.5 for liquid based*
5.	*Particle size in case of carrier based moist powder*	*Powder material shall pass through 0.15 to 0.212 mm IS sieve*
6.	*Moisture per cent, by weight, maximum in case of powder based*	*30-40*
7.	*Efficiency character*	*Maximum 10 mm solubilization zone in prescribed media having at least 3mm thickness.*

8. Acetobacter

1.	*Base*	*Carrier based in form of moist/dry powder or granules, or liquid based*
2.	*Viable cell count*	*CFU minimum $5x10^7$ cells/g of powder, granules, or carrier material or $1x10^8$ cells/ml of liquid*
3.	*Contamination level*	*No contamination at 10^5 dilution*
4.	*pH*	*5.5-6.0 moist/dry powder, granulated or carrier based and 3.5-6.0 for liquid*
5.	*Particle size in case of carrier based material*	*Al material shall pass through 0.15 to 0.212 mm IS sieve*
6.	*Moisture per cent, by weight, maximum in case of carrier based*	*30-40%*
7.	*Efficiency character*	*Formulation of yellowish pellicle in semisoilid medium N free medium*

**Type of carrier – The carrier material such as peat, lignite, peat soil, humus, wood charcoal or similar materials favouring growth of organism.*

9. Carrier Based Consortia

1.	*Base*	*Carrier based in form of moist powder or granules*
2.	*Viable cell count*	*CFU minimum in a mixture of any 2 or maximum three of following microorganisms :* *CFU minimum Rhizobium or Azotobacter or Azospirillum $1x10^7$ per g* *CFU minimum PSB $1x10^7$ per g* *CFU minimum KSB $1x10^7$ per g*
3.	*Particle size in case of carrier based moist powder*	*Al material shall pass through 0.15 to 0.212 mm IS sieve*
4.	*Total viable count of all the biofertiliser organisms in the product*	*CFU minimum – $5x10^7$ cells per gm of carrier/ powder*
5.	*Moisture per cent, by weight, maximum in case of carrier based*	*30-40%*
6.	*Contamination*	*No contamination at 10^{-4} dilution for carrier based /*

		granule based inoculants
7.	*Efficiency character :* *Azotobacter* *Azospirillum* *PSB* *KMB* *Rhizobium*	 *The strain should be capable of fixing at least 10 mg of Nitrogen fixation/g of C-source* *The strain should be capable of fixing at least 10 mg of N-fixation/g of malate applied* *Minimum 5mm zone of solubilization zone on PSB media having at least 3mm thickness* *Minimum 5mm zone of solubilization on KSB media having at least 3mm thickness* *Nodulation test positive*

10. Liquid Consortia

1.	*Individual Viable count in Liquid based*	*CFU minimum in a mixture of any 2 or more of following microorganisms :* *CFU minimum Rhizobium or Azotobacter or Azospirillum* *$1x10^8$ per ml* *CFU minimum PSB* *$1x10^8$ per ml* *CFU minimum KSB* *$1x10^8$ per ml*
2.	*Total viable count of all the biofertiliser organisms in the product*	*CFU minimum – $5x10^8$ cells per ml of liquid based*
3.	*Contamination*	*No contamination at any dilution*
4.	*pH*	*5.0-7.0*
5.	*Efficiency character :* *Azotobacter* *Azospirillum* *PSB* *KMB* *Rhizobium*	 *The strain should be capable of fixing at least 10 mg N-fixation/g of C-source* *The strain should be capable of fixing at least 10 mg of N-fixation/g of malate applied* *Minimum 5mm zone of solubilization zone on PSB media having at least 3mm thickness* *Minimum 5mm zone of solubilization on KSB media having at least 3mm thickness* *Nodulation test positive*

11. Phosphate Solubilizing Fungal Biofertilizer

1.	*Base*	*Carrier base in the form of moist/dry powder or granules or liquid based*
2	*Moisture percentage by weight maximum in case of carrier base*	*10*
3	*Spore count (per ml or gram)*	*Minimum $1x10^6$ spores/g*
4.	*contamination*	*Nil for liquid inoculums* *$1x10^3$ cells/gm for carrier base preparation*
5	*pH*	*Liquid: 3.5 to 5.5* *Carrier :6.0 to 7.0*
6.	*Efficiency Character*	*The strain should have phosphate solubilization capacity in the range of 30%, when tested spectrometrically.* *In terms of zone Formation Minimum 10 mm* *Solubilization zone in prescribed media having least 3 mm thickness.*

[See clause 2(h) and (q)]

Part – A

Specifications of Organic Fertilizers

1. City compost:

(i)	Moisture, per cent by weight	15.0-25.0
(ii)	Colour	Dark brown to black
(iii)	Odour	Absence of foul odour
(iv)	Particle size	Minimum 90% material should pass through 4.0 mm IS sieve
(v)	Bulk density (g/cm^3)	<1.0
(vi)	Total organic carbon, per cent by weight, minimum	12.0
(vii)	Total Nitrogen (as N), per cent by weight, minimum	0.8
(viii)	Total Phosphates (as P_2O_5), per cent by weight, minimum	0.4
(ix)	Total Potash (as K_2O), per cent by weight, minimum	0.4
(x)	C:N ratio	<20
(xi)	pH	6.5 - 7.5
(xii)	Conductivity (as dsm^{-1}), not more than	4.0
(xiii)	Pathogens	Nil
(xiv)	Heavy metal content, (as mg/Kg), maximum	
	Arsenic as (As_2O_3) Cadmium (as Cd) Chromium (as Cr) Copper (as Cu) Mercury (as Hg) Nickel (as Ni) Lead (as Pb) Zinc (as Zn)	10.00 5.00 50.00 300.00 0.15 50.00 100.00 1000.00

2. Vermicompost

(i)	Moisture, per cent by weight	15.0-25.0
(ii)	Colour	Dark brown to black
(iii)	Odour	Absence of foul odour
(iv)	Particle size	Minimum 90% material should pass through 4.0 mm IS sieve
(v)	Bulk density ($g/cm^{3)}$	0.7 -0.9
(vi)	Total organic carbon, per cent by weight, minimum	18.0
(vii)	Total Nitrogen (as N), per cent by weight, minimum	1.0
(viii)	Total Phosphate (as P_2O_5), per cent by weight, minimum	0.8
(ix)	Total Potassium (as K_2O), per cent by weight, minimum	0.8
(x)	Heavy metal content, (as mg/Kg), maximum	
	Cadmium (as Cd) Chromium (as Cr) Nickel (as Ni) Lead (as Pb)	5.0 50.00 50.00 100.00

3. Phosphate Rich Organic Manure (PROM)

(i)	Moisture per cent by weight, maximum	15.0-25.0
(ii)	Particle size-minimum 90% material should pass through 4.0 mm IS sieve	
(iii)	Bulk density (g/cm^2)	1.646
(iv)	Total organic carbon per cent by weight, minimum	7.87
(v)	Total nitrogen (as N) per cent by weight, minimum	0.42
(vi)	Total phosphates (as P_2O_5) per cent by weight, minimum	10.42
(vii)	Total potash (as K_2O) per cent by weight, minimum	-
(viii)	C:N ratio	18:73:1
(ix)	pH(1:5 solution) maximum	6.72
(x)	Conductivity (as dSm^{-1}) not more than	8.27
(xi)	Heavy metal content (as mg/kg), maximum	
	Arsenic (as As_2O_3)	10.0
	Cadmium (as Cd)	5.0
	Chromium (as Cr)	50.0
	Copper (as Cu)	300.0
	Mercury (as Hg)	0.15
	Nickel (as Ni)	50.0
	Lead (as Pb)	100.0
	Zinc (as Zn)	1000.0

4. Organic Manure

(i)	Moisture per cent by weight, maximum	25.0
(ii)	Particle size	Minimum 90% material should pass through 4.0 mm IS sieve
(iii)	Bulk density (g/cm^2)	<1.0
(iv)	Total organic carbon per cent by weight, minimum	14.0
(v)	Total nitrogen (as N) per cent by weight, minimum	0.5
(vi)	Total phosphates (as P_2O_5) per cent by weight, minimum	0.5
(vii)	Total potash (as K_2O) per cent by weight, minimum	0.5
(viii)	NPK nutrients – Total N, P_2O_5 and K_2O nutrient should not be less than 3%	
(ix)	C:N ratio	<20
(x)	pH	6.5-7.5
(xi)	Conductivity (as dSm^{-1}) not more than	4.0
(xii)	Pathogen	Nil
(xiii)	Heavy metal content, (as mg./kg), maximum	
	Arsenic (as As_2O_3)	10.0
	Cadmium (as Cd)	5.0
	Chromium (as Cr)	50.0
	Copper (as Cu)	300.0
	Mercury (as Hg)	0.15
	Nickel (as Ni)	50.0
	Zinc (as Zn)	1000.0

Note : The source of organic manure is any of the plant biomass/ animal biomass/ animal

Excreta)

5. Bio-enriched Organic Manure

1.	Moisture percent by weight, maximum	30-40
2.	Particle size	Minimum 90% material should pass through 4.0 mm IS sieve
3.	Bulk density (g/cm3)	< 1.0
4.	Total Viable count (N, P, K and Zn Bacteria) or (N and P bacteria) or (N and K Bacteria)	5.0 x10^6 (within 3 months from the date of manufacture)
5.	Total organic carbon, per cent by weight, minimum	14.0
6.	Total Nitrogen (as N) per cent by weight, minimum	0.8
7.	Total Phosphates (as P_2O_5) per cent. by weight minimum	0.5
8.	Total Potash (as K_2O) per cent by weight, minimum	0.8
9.	NPK nutrients - Total of N, P_2O_5 and K_2O nutrient should not be less than 3%	
10.	C:N Ratio	<18
11.	pH	6.5-8.0
12.	Conductivity (as dSm^{-1}) not more than	4.0
13.	Heavy metal content (as mg/kg), maximum • Arsenic (as As_2O_3) • Cadmium (as Cd) • Chromium (as Cr) • Copper (as Cu) • Mercury (as Hg) • Nickel (as Ni) • Lead (as Pb) • Zinc (as Zn)	 • 10.00 • 5.00 • 50.00 • 300.00 • 0.15 • 50.00 • 100.00 • 1000.00

6. Bone meal , raw

(i) Moisture per cent by weight, maximum	8.0
(ii) Acid insoluble matter per cent by weight, maximum	12.0
(iii) Total phosphorous (as P_2O_5) per cent by weight, minimum	20.0
(iv) 2 per cent citric acid soluble phosphorous (as P_2O_5) per cent by weight , minimum	8.0
(v) Nitrogen content of water insoluble portion per cent by weight ,minimum	3.0
(vi) Particle size –the material shall pass wholly through 2.36 mm IS sieve of which not more than 30 per cent shall be retained on 0.85 mm IS sieve.	

7. Bone meal, Steamed

(i) Moisture per cent by weight, maximum.	7.0
(ii) Total phosphorous (as P_2O_5) per cent by weight, minimum	22.0
(iii) 2 percent citric acid soluble phosphorous (as P_2O_5) per cent by weight ,minimum	16.0

Annexure-I

List of Regional Councils under PGS

S.No	Regional Council	Location
1	ICAR-CENTRAL ISLAND AGRICULTURAL RESEARCH INSTITUTE- KVK	A AND N ISLANDS
2	QMARK INTERNATIONAL CERTIFICATIONS PVT LTD	ASSAM
3	UNITED ORGANIC SMALL FARMERS AND PRODUCERS ASSAM	ASSAM
4	BIHAR STATE SEED AND ORGANIC CERTIFICATION AGENCY	BIHAR
5	CG ORGANIC CERTIFICATION RAIPUR	CHHATTISGARH
6	MS AGROLAND SERVICES PVT. LTD. (AGROCERT)	DELHI
7	PAN HIMALAYAN GRASSROOTS DEVELOPMENT FOUNDATION	DELHI
8	RURAL DEVELOPMENT COUNCIL	DELHI
9	AKHIL GUJARAT VIKAS TRUST	GUJARAT
10	SHRISHTI ORGANICS	GUJARAT
11	DAMDAAR MAATI JAIVIK PRASAAR SANSTHAN	HARYANA
12	GLOBAL CERTIFICATION SOCIETY	HIMACHAL PRADESH
13	HP STATE SEED AND ORGANIC PRODUCE CERTIFICATION AGENCY SHIMLA	HIMACHAL PRADESH
14	DIVISIONAL SEED CERTICATION AGENCY DEPARTMENT OF AGRICULTURE JAMMU	JAMMU AND KASHMIR
15	ADITI ORGANIC CERTIFICATIONS PVT LTD	KARNATAKA
16	APOF ORGANIC CERTIFICATION AGENCY	KARNATAKA
17	BELGAUM INTEGRATED RURAL DEVELOPMENT	KARNATAKA

	SOCIETY NAGANUR	
18	BHUMAATHA ORGANIC CERTIFICATION BUREAU (BOCB)	KARNATAKA
19	KARNATAKA STATE SEED AND ORGANIC CERTIFICATION AGENCY	KARNATAKA
20	PHALADAAYI FOUNDATION	KARNATAKA
21	RELIABLE ORGANIC CERTIFICATION ORGANIZATION	KARNATAKA
22	SIXTEEN DODDI TRUST	KARNATAKA
23	SRI SRI INSTITUTE OF AGRICULTURAL SCIENCES AND TECHNOLOGY, BANGLORE	KARNATAKA
24	BIOFARM NATURALS	KERALA
25	KERALA STATE SEED CERTIFICATION DEPARTMENT	KERALA
26	LACON QUALITY CERTIFICATION PRIVATE LIMITED	KERALA
27	MANARCADU SOCIAL SERVICE SOCIETY	KERALA
28	THANAL	KERALA
29	THIRUVALI RURAL COOPERATIVE SOCIETY	KERALA
30	KRISHI VIGYAN KENDRA LAKSHADWEEP, PROGRAMME COORDINATOR, KAVARATTI ISLAND	LAKSHADWEEP
31	FAIRCERT CERTIFICATION SERVICES PVT LTD	MADHYA PRADESH
32	AGSUN BIOSEEDS INDIA PRIVATE LIMITED MUMBAI	MAHARASHTRA
33	GOVARDHAN ECO VILLAGE TRUST	MAHARASHTRA
34	INSTITUTE FOR INTEGRATED RURAL DEVELOPMENT [IIRD]	MAHARASHTRA
35	NATURAL ORGANIC CERTIFICATION ASSOCATION	MAHARASHTRA
36	NEEM FOUNDATION	MAHARASHTRA
37	VP ORGANIC SERVICES	MAHARASHTRA
38	THE GREEN FOUNDATION	MANIPUR
39	BIO RESOURCES DEVELOPMENT CENTRE	MEGHALAYA
40	ODISHA STATE SEED AND ORGANIC PRODUCTS CERTIFICATION AGENCY	ODISHA
41	KHETI VIRASAT MISSION	PUNJAB
42	PUNJAB STATE SEED CERTIFICATION AUTHORITY	PUNJAB
43	RAJASTHAN STATE SEED & ORGANIC CERTIFICATION AGENCY	RAJASTHAN
44	RAMKRISHNA JAIDAYAL DALMIA SEVA SANSTHAN	RAJASTHAN
45	SIKKIM STATE ORGANIC CERTIFICATION AGENCY	SIKKIM
46	KEYSTONE FOUNDATION	TAMIL NADU
47	ORGANIC FARMING ORGANIZATION	TAMIL NADU
48	PRITHVI INDIGENOUS NATURAL FARMERS TRUST	TAMIL NADU
49	CENTRE FOR SUSTAINABLE AGRICULTURE (CSA)	TELANGANA
50	EKALAVYA FOUNDATION	TELANGANA
51	TELANGANA STATE ORGANIC CERTIFICATION AUTHORITY	TELANGANA
52	CHETNA VIKAS SWARAJYA TRUST	UTTAR PRADESH
53	PARTICIPATORY RURAL DEVELOPMENT FOUNDATION	UTTAR PRADESH
54	PRERANA	UTTAR PRADESH
55	RS EVENTTECH PVT LTD NOIDA	UTTAR PRADESH
56	SAMKALP SKILL DEVELOPMENT PRIVATE LIMITED	UTTAR PRADESH
57	UTTAR PRADESH STATE ORGANIC CERTIFICATION AGENCY	UTTAR PRADESH
58	DIVYA YOG MANDIR TRUST	UTTARAKHAND

59	HIMALAYAN ENVIRONMENT LIVELY HOOD PROMOTION SOCIETY	UTTARAKHAND
60	HIMALYAN BAHUUDDASYA SWAYATT SAHKARITA	UTTARAKHAND
61	SHIVALIK NATURAL RESOURCES MANAGEMENT SOCIETY	UTTARAKHAND
62	UTTARAKHAND STATE ORGANIC CERTIFICATION AGENCY	UTTARAKHAND
63	VIVEKANAND EDUCATIONAL SOCIETY	UTTARAKHAND
64	MASUM FOUNDATION HOWRAH	WEST BENGAL
65	PAUDYALS FARM CONSULTANCY	WEST BENGAL

Annexure-II

LIST OF ACCREDITED CERTIFICATION BODIES UNDER NPOP

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
1	**Bureau Veritas (India) Pvt. Limited**	**Contact Person**: Mr. Jagdheesh N Manian Head – Certification **Address:** 72 Business Park, Ground Floor Marol Industrial Area, MIDC Cross Road 'C', Andheri (East) Mumbai - 400 093, Maharashtra Email : kaushik.sengupta@in.bureauveritas.com Contact Number : Office : +91 22 62742905; Mobile :+91 22 8691874332; Direct : +91 22 62742932 Website : http://www.bureauveritas.co.in	NPOP/NAB/001	31.08.2022	NPOP USDA NOP	(***w.e.f: 17-01-2018***)
2	**ECOCERT India Pvt. Ltd**.	**Contact Person:** Mr. Anil Jadhav Chief Executive Officer **Address:** Unit number 801, 8th Floor, The Palm Square, Sector 66, Golf Course Extension Road, Gurgaon 122018 Haryana India Telephone: +91 7065505625/ 9319691632 Fax: +91 124 4313171 Email: anil.jadhav@ecocert.com Website :www.ecocert.in	NPOP/NAB/002	22.08.2023	NPOP USDA NOP Livestock w.e.f 01.06.2018 Animal feed Processing and Handing w.e.f 03.02.2020 Overseas Certification (European Union w.e.f 05.10.2021) Not eligible for Category A&F asper EU Regulation w.e.f 01.01.2022	

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
3	**IMO Control Pvt. Ltd.**	**Contact Person:** Mr. Umesh Chandrasekhar Director **Address:** No. 3627, 1st Floor, 7th Cross, 13th 'G' Main, H.A.L. 2nd Stage, Bangalore-560 008. Tel. No: +91-80-25285883, 25201546, 25215780 Fax:0091-80-25272185 Email:imo@imocontrol.in Website:www.imocontrol.in	NPOP/NAB/003	28.09.2022	NPOP USDA NOP	
4	**Indian Organic Certification Agency (INDOCERT)**	**Contact Person:** Mr. Mathew Sebastian Executive Director **Address:** Kuttamassery, Thottumugham P.O Aluva – 5, Ernakulam District Kerala Telefax: 0484 2922400, 2630908Email: info@indocert.org Website: www.indocert.org	NPOP/NAB/004	24.09.2023	NPOP USDANOP Mushroom w.e.f 15.04.2019 Animal Feed Processingand Handling w.e.f 16.07.2020 Not eligible for CategoryA&F as per EU Regulationw.e.f01.01.2022	
5	**Lacon Quality Certification Pvt. Ltd.**	**Contact Person:** Mr. Bobby Issac Director **Address:** Chenathra, Theepany, Thiruvalla -689 101 (Kerala) Tel. No: 0469 2606447 Fax: 0469 2631902 Email:info@laconindia.comWebsite:www.laconindia.com	NPOP/NAB/006	30.09.2023	NPOUSDA NOP Livestock w.e.f 15.04.2019 Animal Feed Processing& Handlingw.e.f 03.02.2020 Not eligible for Category A&F asper EU Regulationw.e.f 01.01.2022	

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
6	**OneCert International Private Limited.**	**Contact Person:** Mr. Sandeep Bhargava Director **Address:** H-08, Mansarovar Industrial Area, Mansarovar Jaipur-302020, Rajasthan Phone & Fax- 0141-2395481,6541882, 6541883(Direct) Email: info@onecertinternational.com, sandeep@onecertinternational.com Website: www.onecertinternational.com	NPOP/NAB/008	20.10.2021	NPOP USDA NOP Livestock w.e.f 08.04.2016 Animal Feed Processing & Handling w.e.f 20.06.2017 Aquaculture w.e.f 01.06.2018 Mushroom w.e.f 15.04.2019 Seaweed, Aquatic Plants & Green House Crop Production w.e.f 15.04.2019 Not eligible for Category A&F as per EU Regulation w.e.f 01.01.2022 Accreditation has been suspended (NPOP & NOP) for 1 year w.e.f 20.10.2021	(***w.e.f: 23-01-2015***)

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
7	**SGS India Pvt. Ltd.**	**Contact Person:** Mr. Soumik Mondal National Certification Manager **Address:** SGS India Pvt Ltd 226,Udyog Vihar, Phase-I Gurgaon-122016 Haryana Tel: +91 124 6776300 Ext 6379 91 124 6776379 (Direct) Fax: +911246776403/04 Mobile: +91 8860117818 Email: Soumik.Mondal@sgs.com Website: www.sgsgroup.in	NPOP/NAB/009	01.05.2023	NPOP USDA NOP	
8	**CU Inspections India Pvt Ltd. (w.e.f. 19/12/2018)**	Contact Person: Dr. Binay Kumar Choudhury Chairman Address: 22nd & 23rd Floor, B Wing Arihant Aura, Plot No. 13/1, TTC, Opp, Turbhe Railway Station, Thane Belapur Road, MIDC Side, Navi Mumbai - 400705, Maharashtra Tel: +91-22-61294300 Fax:+91-22-61294217 Mobile: 9969002860 Email: cuorganic@controlunion.combkchoudhury@controlunion.com Website: www.controlunion.com	NPOP/NAB/0010	28.05.2023	NPOP USDA NOP Livestock w.e.f 21.04.2016 Seaweed, Aquatic Plants & GreenHouse Crop Production w.e.f 15.04.2019 Aquaculture w.e.f 15.04.2019 Not eligible for Category A&Fas per EU Regulation w.e.f 01.01.2022	(***w.e.f: 01-07-2013***)

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
9	**Uttarakhand State Organic Certification Agency (USOCA)**	**Contact Person:** Sh. Gauri Shankar Director **Address:** Third Floor, Krishak Bhavan Mussoorie By Pass Ring Road Nehru Gram, Dehradun, Uttarakhand Tel : 0135 2671734 Email: info@usoca.org Website: www.usoca.org	NPOP/NAB/0011	13.11.2024	NPOP USDA NOP Livestock w.e.f 08.06.2016 Seaweed, Aquatic plants and Greenhouse Crop Production w.e.f 01.06.2018	USOCA NPOP/NAB/0011
10	**APOF Organic Certification Agency (AOCA)**	**Contact Person :** Mr. Himanand Semwal Director **Address:** Row House No A, Shroff Suhana, Veerbhadra Nagar, Baner, Pune, Maharashtra (Pincode -411045) Landmark- Opp. to Maruti Nexa & Skoda Showroom, (Pashan Highway Side Road)Phone: 7720073202, 8806230301 Email: info@aoca.in Website: www.aoca.in	NPOP/NAB/0012	28.03.2022	NPOP Accreditation has not been renewed since 28.03.2022	aoca
11	**Rajasthan State Organic Certification Agency (RSOCA)** (***w.e.f: 24-01-2019***)	**Contact Person:** Mr. Surendra Kumar JainDirector **Address:** 3rd Floor, Pant Krishi Bhawan, Janpath, Jaipur 302 005Rajasthan Tel. No.: 0141-2227104,Tele Fax:0141-2227456 Email: rsoca.admn@gmail.com Website:www.agriculture.rajasthan.gov.in	NPOP/NAB/0013	09.10.2022	NPOP USDA NOP (w.e.f 01.07.2015) Livestock w.e.f 26.07.2018	RSOCA (***w.e.f: 24-01-2019***)

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
12	**ISCOP (Indian Society for Certification of Organic Products)**	**Contact Person:** Prof: Dr. S.R. Sree Rangasamy President **Address:** VCS Enclave, No.2/1, Nehru Street B. R. Puram Peelamedu, Coimbatore - 641004, Tamil Nadu Tel: 0422-2575566; Mobile: +91 94432 95403 Email: iscopcbe@gmail.com Website:www.iscop.org	NPOP/NAB/0015	30.09.2023	NPOP Accreditation has been reinstated w.e.f. 05.10.2021	
13	**TQ Cert Services Private Limited (formerly FoodCert India Private Limited)**	**Contact person:** Mr. Tenny Koshy Cherian Director **Address:** A Wholly Owned Subsidiary of Tata Projects Limited 4th floor, Mithona Towers-I 1-7-80 to 87 Prenderghast Road, Secunderabad Telangana - 500003 Mob : +91 9848335693; 9654803362 Email: tq@tqcert.in;tennycherian@tataprojects.com Website: www.tqcert.in	NPOP/NAB/0016	30.11.2021	NPOP USDA NOP Accreditation has been suspended (NPOP & NOP) for 1 year w.e.f. 12.01.2022	(***w.e.f: 07-12-2017***)
14	**Aditi Organic Certifications Pvt. Ltd**	**Contact person:** Mr. Narayana Upadhyaya Director **Address:** Aditi Organic Certifications Pvt. Ltd. No. 38, 1st Floor, 20th Main Road, FirstBlock, Rajajinagar,Bengaluru-560010 Tel.: +91-08023328134/35/36 Fax: +91-80-23373083 Mobile: +91-9845064286 Email: aditiorganic@gmail.com Website:www.aditicert.net	NPOP/NAB/0017	30.09.2023	NPOP USDA NOP (w.e.f 1.6.2010) Livestock w.e.f 15.04.2019 Overseas Certification (Middle East, NW Asia and neighboring countries) w.e.f 16.07.2020 & Africa w.e.f 15.03.2021	(***w.e.f: 22-10-2014***)

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
15	**Chhattisgarh Certification Society, India (CGCERT)**	**Contact person:** Shri Atul Kumar Shukla(IFS) Chief Executive Officer **Address:** Campus SFRTI Near Vidhan Sabha Zero point, Baloda Bazar Road, Raipur, Chhattisgarh 493 111 Tel: +91-771-2283249 Fax : +91-771-2283249 Email: cgcert@gmail.com Website: www.cgcert.com	NPOP/NAB/0018	15.09.2024	NPOP	
16	**Tamil Nadu Organic Certification Department (TNOCD)**	**Contact person:** Mr. A. Mathialagan Director **Address:** 1424 A, Thadagam Road G.C.T Post, Coimbatore – 641013 Tamil Nadu Tel.: 04222435080 Fax: 04222457554 Email: tnocdcbe@gmail.com Website: www.tnocd.net	NPOP/NAB/0019	30.09.2024	NPOP	
17	**Intertek India Pvt. Ltd.**	**ContactPerson**: Mr. NeerajGupta (Head – Certification, Food Services) **Address:** E-20, Block B-1 Mohan Cooperative Industrial Estate Mathura Road New Delhi - 110 044 Ph : +91-11-4159 5430/ +91 9971656236 Fax : +91-11-4159 5475 E-mail : neeraj.gupta@intertek.com Website : www.intertek.com	NPOP/NAB/0020	19.05.2022	NPOP Accreditation has been re-instated w.e.f. 05.10.2021	intertek Total Quality. Assured. (***w.e.f: 02-01-2019***)

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
18	**Madhya Pradesh State Organic CertificationAgency**	**Contact Person :** Mr. K.S. Tekam Managing Director **Address:** Vasundhara, B-II Office Complex Gautam Nagar Bhopal 462 023 Madhya Pradesh Tel : 0755 2600609 E-mail: md.mpsoca@gmail.com Website: www.mpsoca.org	NPOP/NAB/0022	30.09.2023	NPOP (w.e.f 01.10.2011)	
19	**Odisha State Organic Certification Agency (OSOCA)**	**Contact Person:** Mr.Subrat Kumar Mishra CEO **Address:** Plot No.-326, Baramunda, Bhubaneswar, Dist. Khordha, Orissa-751003 Phone-(0674) 2563639/2561783 Fax.-(0674)2562078 Mobile No.- 9437211001 Email: ceoosoca@gmail.com directorossca@rediffmail.com Website: www.ossopca.nic.in/osoca.aspx	NPOP/NAB/0025	30.05.2024	NPOP	
20	**Natural Organic Certification Agro Pvt. Ltd.**	**Contact Person:** Mr. Sanjay Deshmukh Managing Director **Address:** Flat No. A-6, 3rd Floor, Pol Heights, Above LodhaHospital, Mumbai-Bangalore Highway, Warhe,Pune-411058 Tel-91-20-65218063 Cell no. 09822006586, 8888810492 Email: nocaindia@gmail.com, nocaagro@gmail.com Website: www.nocaagro.com	NPOP/NAB/0026	14.02.2023	NPOP	(***w.e.f:1-12-2011***)

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
21	**Fair Cert Certification Services Pvt.Ltd.**	**Contact Person:** Dr. Pushkar Kulshrestha CEO **Address:** 5th F. 504 3rd Eye Vision, Opposite Shivalik Plaza, Panjarapole, IIM Road, Ahmedabad, Gujarat, India, 380015 Tel : +91-7282-231271/203017 Fax : +91-7282-231271 E-mail: cert.fair@gmail.com Website: www.faircert.com	NPOP/NAB/0027	14.02.2023	NPOP Accreditation for Processor and Trader has been suspended w.e.f. 08.04.2022	
22	**Gujarat Organic Products Certification Agency (GOPCA)**	**Contact Person:** Mr. Mahebub Keshubhai Kureshi Director **Address:** Beej Pramanan Bhavan Opp. Gokul Row House, Nr. Shyamal Cross Satellite, Ahmedabad 380 015 Gujarat Mob: +919825500813 Tel : +079-26740031 Fax : +079-26740031 E-mail: dirgopca@gmail.com Website: www.gopca.in	NPOP/NAB/0028	19.06.2023	NPOP (w.e.f 20.06.2014)	
23	**Uttar Pradesh State Organic Certification Agency**	**Contact Person:** Dr. A.P. Srivastava Director **Address:** Government Garden Campus Kariyappa Road, Alambagh Lucknow 226 005 Uttar Pradesh Tel : +91 – 0522 – 2451639 Mobile : +917991202001 E-mail: upsoca.org@gmail.com Website: www.upsoca.org	NPOP/NAB/0029	19.06.2023	NPOP (w.e.f 20.06.2014)	

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
24	**Karnataka State Organic Certification Agency**	**Contact Person:** Mrs. M.H. Banthanal Director **Address:** K.A.I.C Premises, Opp. Baptist Hospital Bellary Road, Hebbal Bangalore, Karnataka-560024 Tel : +91 –9448990379 Mobile: 9448990350 E-mail: ksocabng@gmail.com Website: https://kssoca.karnataka.gov.in	NPOP/NAB/0030	16.02.2022	NPOP (w.e.f 17.08.2015) Accreditation has not been renewed since 16.02.2022	
25	**Sikkim State Organic Certification Agency (SSOCA)**	**Contact Person:** Shri Sudhir Giri CEO **Address:** Ground Floor, Soil Testing Lab Building, ICAR Complex, Tadong, Gangtok, Sikkim 737102 Tel : +91 – 03592-232494 Fax : +91 – 03592-232495 E-mail: ssoca2016@gmail.com Website: www.ssoca.in	NPOP/NAB/0031	02.10.2022	NPOP (w.e.f 03.10.2016)	
26	**Global Certification Society**	**Contact Person:** Shri Prasanta Chowdhury Chairman **Address:** Kesar Bagh Colony, Mohal Nihang (Tika Nihang),near Dr. Chaudhary Hospital, Palampur, Himachal 176 061. Tel : 01894-234230 Fax:01894-230131 E-mail: chairman@glocert.org Website: www.glocert.org	NPOP/NAB/0032	02.10.2022	NPOP (w.e.f 03.10.2016)	

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
27	**GreenCert Biosolutions Pvt. Ltd**	**Contact Person:** Mr. Sujit Raghunath Kaisare CEO **Address:** B13, Anandmayi Apt, Karve Road Erandwane, Pune-411004 Tel : +91 – 9850914230 E-mail: ceo@greencertindia.in,contactus @greencertindia.in Website: www.greencertindia.in	NPOP/NAB/0033	02.10.2022	NPOP (w.e.f 03.10.2016)	
28	**Telangana State Organic Certification Authority**	**Contact Person:** Dr. K Keshavulu Director **Address:** HACA Bhawan, 1st Floor. 5-10-193, Opp. Public Garden Hyderabad 500 004 Tel : 040-23237016, 040-23235939 E-mail: tsscadir@gmail.com Website: www.tssoca.telangana.gov.in	NPOP/NAB/0034	31.05.2024	NPOP (w.e.f 01.06.2018)	
29	**Bihar State Seed and Organic Certification Agency (BSSOCA)**	**Contact Person:** Mr. Ashok Prasad Director **Address:** Bihar Pramanan Bhawan, Mithapur Farm, Patna 800 001 Tel : 9431818706, 8177954352 E-mail: sca.patna@rediffmail.com Website: www.bssca.co.in	NPOP/NAB/0035	02.02.2023	NPOP (w.e.f 03.02.2020)	

Sr. No	Name of the Certification Agency	Contact Person & Address	Accreditation No.	Validity of Current Accreditation	Scope of Accreditation	Certification Mark
30	**Reliable Organic Certification Organization**	**Contact Person:** Mr.Girish,N.M. Chief Executive Officer **Address:**#59,8th A Street, 4th Cross, 1st Main, MaruthiNagar,Yelahanha, Bengaluru -560064 **Tel :** 7026243618 **E-mail:** reliableoco@gmail.com **Website:** www.rococert.com	NPOP/NAB/0036	15.07.2023	NPOP (w.e.f 16.07.2020)	
31	**Bhumaatha Organic Certification Bureau (BOCB)**	**Contact Person:** Mr.Suresh,K.T. Chief Executive Officer **Address:** # 366, 5th cross, 7th main, 2nd stage, kumaraswamylayout,bengaluru 560078, karnataka, india **Tel :** 08026665434,91 9342349255 **E-mail:** agricertbocb@gamil.com	NPOP/NAB/0037	15.07.2023	NPOP (w.e.f 16.07.2020)	
32	**Baltic Testing India Pvt. Ltd.**	**Contact Person:** Mr. Surangan Bhattacharya Director **Address:** Hubtown Viva Building, Suite No. 313-314, 3rd Floor, Shankarwadi, Western Express Highway, Jogeshwari (East), Mumbai-400060 **Phone:** +91 22 6695 4185 / 6725 0540, **Telefax:** +91 22 6725 0540 **Email:** certification@balticcontrolindia.com / office@balticcontrolindia.com **Website:** https://balticcontrol.co.in	NPOP/NAB/038	05.04.2024	NPOP (w.e.f. 06.04.2021)	

Source: https://apeda.gov.in Last Updated on:31-05-2022

Annexure-III

Products for Use in Fertilising and Soil Conditioning (NPOP Standards) "restricted" means that the conditions and the procedure for use shall be subjected to condition. Factors such as contamination, risk of nutritional imbalances and depletion of natural resources shall be taken into consideration.

Inputs	Condition for use
Matter Produced on an Organic Farm Unit	
Farmyard & poultry manure, slurry, cow urine	Permitted
Crop residues and green manure	Permitted
Straw and other mulches	Permitted
Matter Produced Outside the Organic Farm Unit	
Blood meal, meat meal, bone meal and feather meal without preservatives	Restricted
Compost made from any carbon based residues (animal excrement including poultry)	Restricted
Farmyard manure, slurry, cow urine (preferably after control fermentation and/or appropriate dilution) "factory" farming sources not permitted	Restricted
Fish and fish products without preservatives	Restricted
Guano	Restricted
Human excrement	Prohibited
By-products from the food and textile industries of biodegradable material of microbial, plant or animal origin without any synthetic additives	Restricted
Peat without synthetic additives	Prohibited for soil conditioning
Sawdust, wood shavings, wood provided it comes from untreated wood	Permitted
Seaweed and seaweed products obtained by physical processes extraction with water or aqueous acid and/or alkaline solution	Restricted
Sewage sludge and urban composts from separated sources which are monitored for contamination	Restricted
Straw	Restricted
Vermicasts	Restricted
Animal charcoal	Restricted
Compost and spent mushroom and vermiculate substances	Restricted
Compost from organic household reference	Restricted
Compost from plant residues	Permitted
By products from oil palm, coconut and cocoa (including empty fruit bunch, palm oil mill effluent (pome), cocoa peat and empty cocoa pods)	Restricted
By products of industries processing ingredients from organic agriculture	Restricted
Minerals	
Basic slag	Restricted
Calcareous and magnesium rock	Restricted
Calcified seaweed	Permitted
Calcium chloride	Permitted
Calcium carbonate of natural origin (chalk, limestone, gypsum and phosphate chalk)	Permitted
Mineral potassium with low chlorine content (e.g. sulphate of	Restricted

potash, kainite, sylvinite, patenkali)	
Natural phosphates (e.g. Rock phosphates)	Restricted
Pulverised rock	Restricted
Sodium chloride	Permitted
Trace elements (Boron, Ferrous, Manganese, Molybdenum, Zinc)	Restricted
Wood ash from untreated wood	Restricted
Potassium sulphate	Restricted
Magnesium sulphate (Epson salt)	Permitted
Gypsum (Calcium sulphate)	Permitted
Silage and silage extract	Permitted excluding Ammonium silage
Aluminum calcium phosphate	Restricted
Sulphur	Restricted
Stone meal	Restricted
Clay ((bentonite, perlite, zeolite)	Permitted
Microbiological Preparations	
Bacterial preparations (biofertilizers)	Permitted
Biodynamic preparations	Permitted
Plant preparations and botanical extracts	Permitted
Vermiculate	Permitted
Peat	Permitted

Source: https://pgsindia-ncof.gov.in

Annexure-IV

Products for Plant Pest and Disease Control "restricted" means that the conditions and the procedure for use shall be subjected to conditions.

Inputs	Condition for use
Substances from plant and animal origin	
Azadiracta indica (neem preparations)	Permitted
Neem oil	Restricted
Preparation of rotenone from Derris elliptica Lonchocarpus, Thephrosia spp	Restricted
Gelatine	Permitted
Propolis	Restricted
Plant based extracts – garlic, pongamia etc	Permitted
Preparation on basis of pyrethrins extracted from Chrysanthemum cinerariaefolium, containing possibly a synergist Pyrethrum cinerafolium	Restricted
Preparation from Quassia amara	Restricted
Release of parasite predators of insect pests	Restricted
Preparation from Ryania species	Restricted
Inputs	Condition for use
Tobacco tea	Prohibited
Lecithin	Restricted
Casein	Permitted
Sea weeds, sea weed meal, sea weed extracts, sea salt and salty water	Restricted
Extract from mushroom (Shitake fungus)	Permitted
Extract from Chlorella	Permitted
Fermented product from Aspergillus	Restricted
Natural acids (vinegar)	Restricted
Minerals	
Chloride of lime/soda	Restricted
Clay (e.g. bentonite, perlite, vermiculite, zeolite)	Permitted
Copper salts / inorganic salts (Bordeaux mix, copper hydroxide, copper oxychloride) used as a fungicide depending upon the crop and under the supervision of accredited Certification Body	Restricted
Mineral powders eg : stone meal	Prohibited
Diatomaceous earth	Restricted
Light mineral oils	Restricted
Permanganate of potash	Restricted
Lime sulphur (calcium polysulphide)	Restricted
Silicates, clay (Bentonite)	Restricted
Sodium bicarbonate	Restricted
Inputs	Condition for use
Sulphur (as a fungicide, acaricide, repellant)	Restricted
Microorganism used for biological pest control	
Viral preparation (eg. Granulosis virus, Nuclear Polyhedrosis Virus etc.	Permitted
Fungal preparations (Trichoderma spp.)	Permitted
Bacterial preparations (Bacillus spp)	Permitted
Parasites, Predators and sterilized insects	Permitted
Others	
Carbon dioxide and nitrogen gas	Restricted

Soft soap (potassium soap)	Permitted
Ethyl alcohol	Prohibited
Homeopathic and Ayurvedic preparations	Permitted
Herbal and biodynamic preparations	Permitted
Traps	
Physical methods (Chromatic traps, Mechanical traps, sticky traps and Pheromones	Permitted

https://pgsindia-ncof.gov.in

Map of NCONF & Its Regional Centers

National Centre for Organic and Natural Farming, Ghaziabad (Uttar Pradesh)

Regional Centre for Organic and Natural Farming, Imphal (Manipur)

Regional Centre for Organic and Natural Farming, Nagpur (Maharashtra)

Regional Centre for Organic and Natural Farming, Bhubaneshwar (Odisha)

Regional Centre for Organic and Natural Farming, Bengaluru (Karnataka)

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