

Seed systems in natural farming

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Organic Agriculture

- Modern intensive agriculture is heavily dependent - chemical fertilizers - meeting the nutrient demand.
- Fertilizer consumption : 15.4 lakh MT (1967-1968)
431.66 lakh MT (2020-2021)

Why Organic Agriculture ?

- Consumers awareness on health, food security and safety.
- Adoption of organic farming as a remedy to cure the ill-effects of modern chemical agriculture.
- Increasing market demand

Organic agriculture

Organic farming system rely upon crop rotation, crop residues, animal manures, off-farm organic wastes, mineral bearing rocks and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control pest and diseases.

Organic agriculture is based on minimizing the use of external inputs, totally avoiding the use of synthetic fertilizers and pesticides.

Organic agricultural methods are used to minimize pollution of air, soil and water.

ORGANIC AGRICULTURE IS A PRODUCTION SYSTEM THAT

- Doesn't use synthetic pesticides and fertilizers
- Focuses on improving soil fertility through use of organic matter and cover crops
- Supports and enhances abundance of beneficial insects
- Must have 3 years with no prohibited material and be inspected on an annual basis by a accredited certifier.

Objectives

- **Creating a healthy soil**
- **Making nutrient and energy flow in the soil ecosystem**
- **Keeping the biological life in the cycle**
- **Providing sustainable yield in organic food production.**

Principles

- **Eco-farming**
- **Biodiversity conservation**
- **Suitable genetic resources and varieties**
- **Living soil**
- **Natural resource conservation**
- **Recycling**
- **Appropriate pest and disease management**

Issues

- The most often debated questions related to organic farming include
 - Its production potential,
 - Economic feasibility,
 - The possible environmental benefits like improved soil quality,
 - Health.

Area under organic farming

- **The largest area is in Australia (12 m ha) followed by Argentina (3.2 m ha)**
- **India ranks 10th (4.72 m ha) cultivable land under certification.**
- **Madhya Pradesh covered largest area (1.1 m ha).**
- **In Tamil Nadu, area is 12,018 ha**
- **India produced around 1.24 million MT of certified organic products.**
- **India exported 135 products with the total volume of 1,94,088 MT.**

“Organic”

- A product to be called and labelled “organic” it should have been produced from start (seed) until end (the produce the consumer is buying) in an organic way.

‘Organic seed’

- ‘Organic seed’ is defined as the seeds that are produced under an organic system of cultivation, preferably by certified system.

ORGANIC SEED

- Organic seeds are, basically, seeds used to grow organic grains, fruits and vegetables



Organic seed production

- ‘Organic seed’ is seed produced by a crop that is planted and raised organically for at least one generation in the case of annual crops and two generations in the case of biennial and perennial crops.
- The base seed material to be used for multiplication need to be organically produced by following organic certification procedures.
- Making the seed into organic produce is critical, because the amount of chemical inputs used for cultivating seed crop is proportionally higher than that of producing grain crops.

Breeding technique

It should be organic

- **Traditional breeding**
- **Conjugation**
- **Hybridization**

Advanced breeding tools

Varieties developed biotechnologically as

- cell fusion
- micro and macro encapsulation
- recombinant DNA methodology
 - gene deletion, gene doubling and gene transformation



Genetic engineering & contaminated with GMO



Not accepted as organic seed

or

Development of organic product

Advanced techniques

Protoplast fusion

**Cytoplasmic male sterile
(CMS) lines**

**Tissue culture applications
lead to damage the natural
environment**

**Not allowed
in organic
seed**

Traditional rice varieties

- **Varieties resistant to drought** : Kattu Samba, Sornavari, Puzhudikar, Puzhudi samba, Mattakkar, Vadan samba, Kullakkar, GEB - 24, Kuzhiyadichan.
- **Varieties resistant to water logging** : Neelan samba, Kudiraival Samba, Kaliyan Samba, Samba Mosanam, Perungar, Koomvazhai, Kudaivazhai.
- **Varieties resistant to both drought and water logging** : Kappakkar, Vaigunda, Pichavari, Kurangu samba.
- **Varieties suitable for saline soils** : Karuppu nel, Samba, Kuzhiyadichan.
- **Varieties resistant to pest and disease attack** : Kappa Samba, Vadan Samba, Kudirai Vali, Kaliyan Samba, Kurangu Samba, Kichali Samba, Muttakkar, Kullakkar, Sigappu Kuruvikkar, Thooyamalli, Sembalai, Kallimadyan, Pitchavari, Sadakar.
- **Variety resistant to brown plant hopper and ear head bug** : Neelansamba.
- **Variety resistant to weeds** : Vaigunda.

Traditional tomato varieties

Bangalore local, guli thakkali, periyakulam local,
pink thakkali, sirsi nattu thakkali and Nattu thakkali

Organic seed production

- **Organic seed production depends upon quality of seeds which can be enhanced by pre-sowing treatments like biopriming, nutrient management through organic sources and pest and disease management by organic biocides.**

FACTORS EFFECTING ORGANIC SEED PRODUCTIONS

- **Distance between plants**
 - **Temperature**
 - **Humidity**
 - **Wind direction**
- **Insects involved in pollination**
 - **Plant variety**

Organic seed treatment

- Eradicate seed borne pathogens or protect from soil borne pathogens.
- improve germination rates.

Pre-sowing seed management

- Density grading of seeds
- Pre-germination technique in seeds
- Dormancy breaking of seeds
- Seed bio-priming
- Seed colouring
- Seed pelleting



Seed treatments

- Soaking the seeds in water
- Soaking the seeds in cow dung solution
 - 0.5 kg of fresh cow dung in 2 lit of cow urine and dilute them with 5 lit of water
- Soaking the seeds in cow's urine solution
 - 500 ml of cow's urine in 2.5 lit of water
- Soaking in sweet flag extract
 - 1.25 kg of sweet flag rhizome powder in 6 lit of water
- Treatment of seed with amrut pani/panchagavya/cow pat pit manure/jeevamrut
- Seed treatment helps to improve germination potential, vigour and resistance to pests and disease.

Biofertilizer seed treatment

- Biofertilizers like *Azospirillum* / *Azotobacter* / *Pseudomonas* @ 1.25 kg/ha are first mixed in one litre of cooled rice gruel.
- Spread the sprouted seeds on a clean floor, add the biofertilizer slurry and mix well.
- The mixing of seed and biofertilizer slurry can be done in a pot as well.
- Dry the seeds in the shade for 30 minutes before sowing.

- **Priming**

- absorbed just enough water to dissolve germination inhibitors and activate the early stages of germination

- **Pelleting**

A seed pellet is a coating, usually of clay mixed with other inerts, that streamlines the size, shape, and uniformity of a small, non-round seed such as those of lettuce, carrots, onions, and many herbs and flowers

- **Plant extracts and oils**
- plant oils such as thyme, cinnamon, clove, lemongrass, oregano, savory, and garlic show some potential to suppress damping-off, and thyme oil is in use in Europe as a seed treatment

Seed Health Treatments

Hot water treatment

- warming the seed in 100°F water
- heating the seed for 20-25 minutes, depending on the crop species, in a 122°F water bath
- cooling the seed for 5 minutes in cold water.
- rapid drying
- Broccoli, 122 F, 20 min & tomato, 122 F, 25 min.

Nursery Management

- **Soil solarisation** of nursery plots by covering them with transparent polythene sheets of 200 guage for about 5-6 weeks,
- If the temperature is high ($>30^{\circ}\text{C}$), then the beds are covered by **green sheets**, about 1 m above the ground with suitable support.
- This reduces the intensity of the radiation hitting the ground surface and reduces seedling mortality
- **Agro-nets** are used especially for control of insects which spread viral disease.
- Dusting of **wood ash** on seedlings in the nursery acts as an insect repellent and protects the young plants from pest and disease attacks. It also serves as a good source of **mineral nutrients**.

Seedling treatment

- 100 g of **asafoetida** mixed with 5 litres of water can be used for treating the root portion of the seedlings.
- They should be soaked for 15 to 30 minutes in the solution before transplanting in the main field.
- This prevents **soil borne bacterial diseases**
- After uprooting from the nursery bed, the roots of seedlings can also be dipped in **cow dung and cow's urine slurry / cow pat pit / amrut pani / panchagavya** overnight before transplanting to the field.
- The **auxins and nitrogen** in the urine and dung help in better root growth and early establishment.

Soil management

- Plants need NPK, as well as micronutrients
- Intercropping
- Crop rotation and green manure
- Organic farmers also use animal manure, certain processed fertilizers such as seed meal and various mineral powders such as rock phosphate and greensand, a naturally occurring form of potash which provides potassium.

Organic Manures

Farm yard manure (FYM)

Green manures

Crop residues

Compost

Home compost

Concentrated organic manures

Green manure

- Cultivation of green manure plants between two cropping seasons prevents soil erosion from rain and wind.
- As the plants decompose, they convert unavailable forms of calcium, phosphorus and micronutrients present in the soil into a form that can be easily absorbed by the plants.
- In clayey soils, these plants help in increasing the soil's porosity by loosening its particles.

eg. Sunnhemp, daincha, sesbania

Main features

- Crop rotation.
- Appropriate Planting Dates, Soil Temperature and Moisture.
- Selecting Disease-Resistant Varieties.
- Cleaning and Processing Methods that Control Disease.

Weed management

- Tillage
- Cultivation
- Mowing and cutting
- Flame weeding and thermal weeding
- Mulching
- naturally-sourced chemicals are allowed for herbicidal use:
 - certain formulations of acetic acid,
 - corn gluten meal, and essential oils

Isolation for seed crop

- Organic field should be isolated from the production of any non-organic products.
- Organic seed fields required to avoid contact with non-organic crops, regardless of whether these crops are conventional or genetically modified (GM).
- Wind may transfer GM pollen, pesticides, or even smoke, thereby affecting the organic field present in adjacent lands
- Irrigation water could transfer pesticides and plant propagation materials.
- Also, it is necessary to consider involuntary transfers via humans, animals, vehicles, soil and admixture among others.

Plant growth regulators

Panchagavya

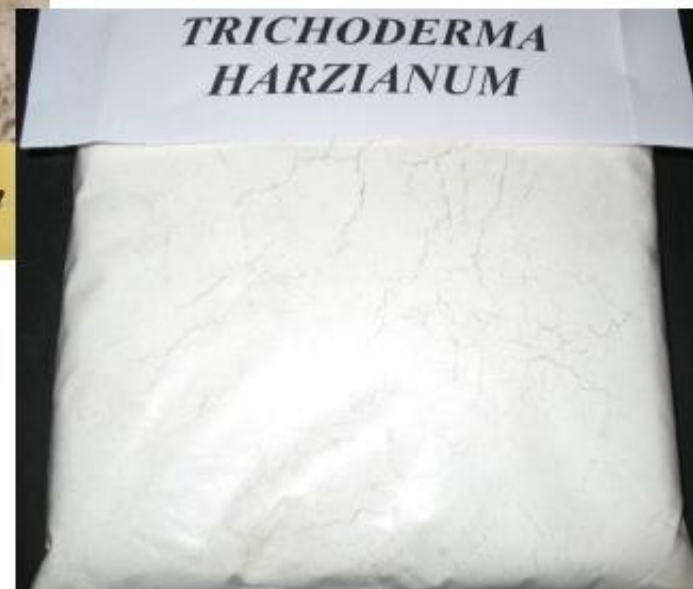
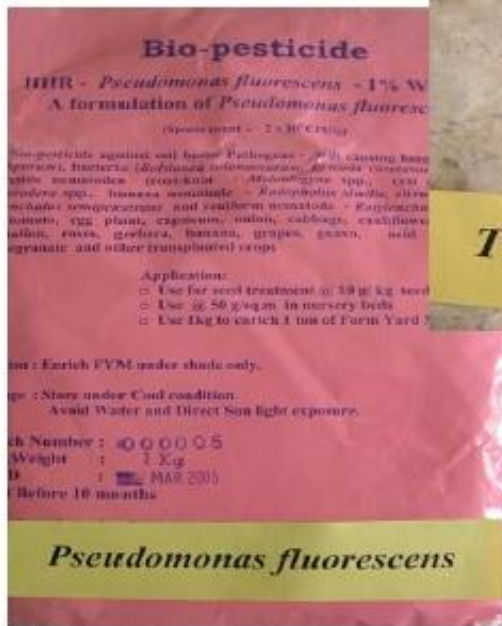
- This is a growth regulator produced from a combination of five products obtained from the cow and fermented along with a few other bio-products.
 - Eg. One spray of 3% panchagavya should be given during **tillering** and booting stage.

Plant protection

- Different plant protection materials used in organic farming include
- neem oil,
- fermented butter milk,
- jeevamrit,
- panchgavya,
- cow urine,
- plant extracts like *Aloe vera*, *datura*, *pongamia*, *cassia*, garlic, ginger, chilly
- bio-agents like *Trichoderma*, *Pseudomonas*, *Verticillium*, *Bacillus*.



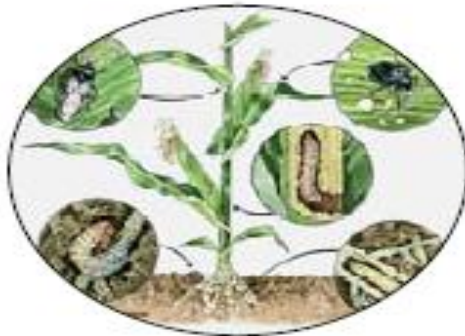
Botanicals and bio-pesticides for IPM



Modules in Organic Pest and Disease Management



Pheromone traps



Resistant varieties



Altered date of sowing



Predators



Botanicals



Light trap

Post harvest seed treatment

- Dry dressing (mixing) of seeds with botanicals
- Slurry treatment of pulses seeds with *Vitex negundo* or *Albizzia amara* leaf powder, turmeric or *Acorus calamus* rhizome powder @1:100 ratio
 - Eg. sweet flag rhizome powder @ 3 g kg⁻¹ of seed controls both bruchid infestation and seed deterioration and maintains seed viability up to 9 months of storage
 - Cashew Nut Shell Liquid (CNSL) had both a toxic and oviposition deterrence effect at a dosage of 4 ml kg⁻¹ of pulses seed.



INDIGENOUS SEED STORAGE STRUCTURE

- Storage methods range from mud structures to modern bins. The containers are made from a variety of locally available materials differing in design, shape, size and functions. The materials used include paddy straw, wheat straw, wood, bamboo, mud, bricks, cow dung etc.



Mudpots
Pulses Seed



A traditional seed storage structure made of straw



Fig.1 Kuthir



Fig.2 Kodambae



Fig.3 Thombarai



Fig. 4 Kalangiyam



Fig. 6 Paanai



Fig. 7 Orai



Fig.10 Vengaya pattarai

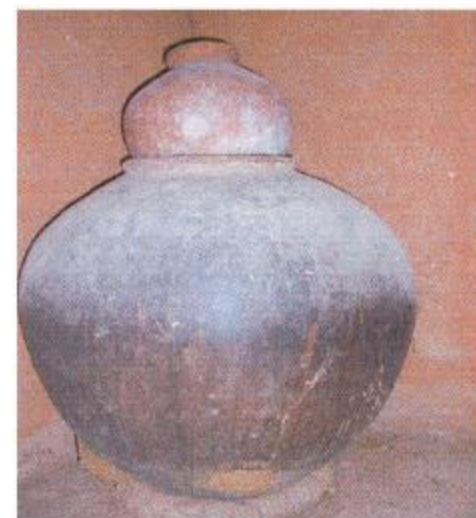


Fig.12 Saal



Fig. 9 Mara Thombai



Fig.11 Arisi petti

Seed cost

Generally, organic seeds are costlier than the conventional seeds since,

the seeds are produced with plant hygiene as no chemical nutrients or pest control systems are allowed.

Seeds should be produced only in those areas, which are free from the diseases.

Problems in organic seed production

It could be broadly placed within three categories,

- Technical

- Standards

- Marketing

- These problems can be overcome through education, training and discussion.

Constraints in organic seed production

- **Standardized agronomic protocols** and management practices for pest and disease control also be focused in organic seed production.
- **Seed standards** are yet to be set for organic seeds.
- In addition, **truthfully labelled seeds should also be certified** if processed through organic certification.
- **Shortage of organic seeds**
- **Lack of proper demand forecasting** for organic seed production
- Organic farmers have been depending on the **conventional seeds or own-saved seeds** or seeds produced inorganically by themselves or equivalent seeds

Basic recommendations

- Technology packages
- Organic standards
- Certification/regulatory mechanism
- Market network

Organic seed - scope

- About 251 different varieties of organic seed commercially available to organic farmers and growers, **98% of which are vegetable varieties** and 1% are cereal varieties.
- There are no grasses or herbage legumes available.
- In general view that **organic seed is in short supply**.
- Demand for organic cereal seed is **likely to double**, demand for vegetable seed will triple and demand for grassland seed will increase 7 or 8 times.

Organic Certification (TN)

Organic Certification is a labeling term with written assurance that denotes products that have been produced in accordance with organic production standards and certified by a duly constituted certification body or authority.

Tamil Nadu Organic Certification Department (TNOCD) was established in the year 2007-2008 to carry out inspection and certification of organic production system in accordance with NPOP (National Programme for Organic Production) norms.

Department of Seed and Organic Certification

TNOCD is accredited by Agricultural and Processed Food Products Exports Development Authority (APEDA), New Delhi.

The accreditation number allotted to TNOCD is **NPOP/NAB/0019.**

Organic certification carried out by this department is on par with **standards of European Union.**



- **PROCEDURE FOR REGISTRATION**

Prescribed application is available at our website (www.tnocd.net). The filled in applications can be submitted in triplicate along with the following documents:

1. Operators agreement with TNOCD
2. General details of the farm
3. Chitta copy
4. Annual Cropping Programme
5. Farm Map
6. Pan Card copy
7. Soil and Water test result copy

For registration and renewal fee should be remitted in the form of Demand Draft taken in favour of “Director of Organic Certification”, payable at Coimbatore

Thank you