



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 1070-1074
© 2022 TPI
www.thepharmajournal.com
Received: 20-07-2022
Accepted: 23-08-2022

Abdulgani Nabooji
Ph.D. Scholar, Department of
Agronomy, College of
Agriculture, UAHS,
Shivamogga, Karnataka, India

Veeranna HK
Professor, Department of
Agronomy, College of
Agriculture, KSNUAHS,
Shivamogga, Karnataka, India

Sadashiv V Nadukeri
Assistant Professor, Agricultural
and Horticulture Research
Station, KSNUAHS,
Shivamogga, Karnataka, India

Santosh
Ph.D. Scholar, Department of
Soil Science and Agricultural
Chemistry, UAHS, Shivamogga,
Karnataka, India

Shilpa ME
Research Associate, Natural
Farming Project, KSNUAHS,
Shivamogga, Karnataka, India

Shilpa HD
Research Associate, Natural
Farming Project, KSNUAHS,
Shivamogga, Karnataka, India

Corresponding Author:
Abdulgani Nabooji
Ph.D. Scholar, Department of
Agronomy, College of
Agriculture, UAHS,
Shivamogga, Karnataka, India

Organic seed production: Concept and practices

Abdulgani Nabooji, Veeranna HK, Sadashiv V Nadukeri, Santosh, Shilpa ME and Shilpa HD

Abstract

Organic seed production includes growing of seed crops by a set of guidelines that prohibit the use of synthetic products/chemicals. Growing seed crops requires a longer season since the crop must stay in the field twice as long as a conventional crop harvested for grain and also for increased monitoring to ensure high seed quality and purity. Standard production of seeds requires chemical herbicides, insecticides, fungicides, and fertilizers. The most compelling reason for using organic seed when growing organic crops is that seed produced organically causes less chemical impact on the environment. During organic seed production soil fertility and pest management is achieved through various sources like cropping patterns, organic manure, biofertilizers, cultural practices and bio pesticides, including plant derived products.

Keywords: Organic seed, herbicides, insecticides, fungicides, fertilizers

Introduction

The term “organic seed” means seed produced under an organic system, ideally one that is certified. Growing crops for seed requires a longer season since the crop must stay in the field twice as long as a conventional crop harvested for grain and also for increased monitoring to ensure high seed quality and purity. An increase in the amount of chemical products used on seed crops may occur due to the length of time the crops remain in the field. As a result, plant diseases and insects get more time to attack the crop during seed maturation. With these factors playing a role in conventional seed production, the challenges for organic seed production are increased. The most compelling reason for using organic seed when growing organic crops is that seed produced organically causes less chemical impact on the environment.

Back ground

Organic vs conventional

- Main difference between organic seeds and conventional ones in the absence of synthetic chemicals.
- Conventional vegetable seed crops rely on petroleum based synthetic pesticides and fertilizers.
- Organic seed production on the other hand only uses natural pesticides and fertilizers in lower amounts.

Organic agriculture is a production system that

- Doesn't use synthetic pesticide 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.

To farm in organic way, farmers should follow some principles:

- To produce food of high nutritional quality in sufficient quantity.
- To encourage and enhance biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals.
- To maintain and increase long term fertility of soils.
- To use, as far as possible, renewable resources in locally organised agricultural systems.
- To work with materials and substances which can be reused or recycled, either on the farm or elsewhere.

- To minimise all forms of pollution that may result from agricultural practices.

Suggested Organic Farming Techniques

Green manuring: Trees, shrubs, crops, grain legumes, grasses, weeds, ferns and algae provide green manure an inexpensive source of organic fertilizer to build up or maintain soil organic matter and fertility. The cumulative effects of continued use of green manures are important not only in terms of nitrogen supply, but also with regards to soil organic matter, phosphate and micro-nutrient which are mobilized, concentrated in the top soil and made available for plant growth.

Organic manure: FYM, sheep manure, crop residues, poultry manure, oil cakes, composts-coir pith compost and other farm wastage. The indigenous and biodynamic preparation such as compost preparation can be used in organic nutrition management.

Vermicompost: It is the compost prepared by earthworms. Biologically degradable and decomposable organic wastage are used as earthworm feed.

Biofertilizer: Microorganisms to fix atmospheric nitrogen, to release and mobilize phosphorous and other nutrients. Natural fertilizers containing carrier based micro-organisms *viz.*, Rhizobium, Azotobacter, Azospirillum, Blue Green Algae, Mycorrhizae and Phosphobacteria.

Plant products (botanicals): Seed hardening done with garlic extract, leaf extracts of Prosopis, Pungam, Acacia, Calotropis etc. The decayed plant extracts can be used as liquid manure for promoting plant growth.

Mulching: It is an important technique for improving soil microclimate, enhancing soil life, structure and fertility, conserving soil moisture and energy, reducing weed growth, preventing damage by impact from solar radiation and rainfall (erosion control) and reducing the need for tillage. Widely used traditional mulches include layers of dry grass, crop residues (straw, leaves etc.), fresh organic material from trees, bushes, grasses and household refuse green manures.

Panchmukhi: Five factors of agricultural treatments adopted by the natural farmers as seed treatment, soil treatment, water treatment, environmental treatment and crop treatment are cumulatively known as panchmukhi farming process for boosting agricultural yields.

Panchagavya: It is a foliar spray prepared by organic growers using the following ingredients and methodology: Biogas slurry/cow dung 5 kg, cow urine 3 litres, cow milk 2 litres, curd 2 litres, clarified butter/ghee 1 litres, sugarcane juice 3 litres, palm sugar 1 kg, tender coconut water 3 litres, banana are the ingredients. The ingredients are mixed in a mud pot after stirring them well. Then, it is kept in a shady place for one week for fermentation. Then 3 litres of Panchagavya are diluted in 100 litres of water. This mixture is sufficient for spraying four acres. The diluted mixture has to be thoroughly stirred for 20 minutes before spraying. It can be stored for one month. It reduces vegetative growth and enhances quick flowering and also gives resistance against pests and diseases.

Organic Seed Production Practices

Land selection

1. Land should be organically managed. Avoid the low lying area to restrict the runoff water contamination from conventional farming system.
2. To avoid contamination from wind, the organic farm shall be separated from conventional farm by live fence or manmade organically managed crop can be maintained as buffer zone.
3. A buffer zone of at least 3 meters shall be maintained between conventional and organic management land.
4. The equipment or implements used for org/anic management shall be cleaned before use.
5. Crops should be rotated to reduce pest problems and any potential for seed contamination by open pollination with similar species types.
6. The seed production field should not have known weed problems that are too difficult to control through organic means.

Land preparation

1. Soil should be tilled to ensure a fine seed bed, which is critical for germination, particularly with small-seeded crops.
2. The soil should have good water-holding capacity to allow for uniform germination and continued vegetative growth.
3. The beds should be raised and shaped depending on rainfall.
4. Uniformity of seedbeds is especially important because the seeds are often precision planted and uniform emergence and seedling developments are required for optimum management.

Soil fertilization

1. It is important that the fertility of the soil is improved when producing organically since chemical fertilizers cannot be used.
2. To ensure good soil fertility and fewer soil borne diseases, crop rotation, use of a cover crop, green manure crops, mulch, animal compost, and plant material compost can be used.
3. There are many commercial organic fertilizers available for organic crops; the major ones are listed below:
 - Composted manure used to increase nitrogen content.
 - Inoculates of beneficial fungi, which work with the plant's roots to help them fix nitrogen from the air.
 - Crop residues and green manures.
 - Straw and other mulches
 - Bio fertilizer (Bacterial preparation)
 - Wood ashes to increase potassium.
 - Rock phosphate, often crushed rock that contains elevated levels of phosphate.
 - Seaweed extract, which is not a fertilizer, but aids plant growth and resistance to pests and diseases.
 - Plant preparation and botanicals extract.
 - Vermiculate and Peat.

Choice of crop and varieties: Any crop of variety/hybrid except genetically modified organisms/crop which suits to the location shall be used or grown. Pest and disease resistant varieties are mostly preferred.

Seeds and planting material: Seeds/planting material shall

be used from organically certified source. In case of unavailability of organic seed, untreated seeds from conventional farm shall be used for first year and for subsequent years organic seeds shall be used. In case of growing other varieties which are not grown in the first year, chemically untreated conventional material shall be used. Genetically engineered seeds, pollen, transgenic plants or plant materials shall not be allowed.

Planting techniques: Seeds are generally planted directly by drilling in the field or transplanting from a greenhouse-grown seedling. These seed transplants should be organically produced. The seeds must be planted in such a way that proper vegetative development occurs that will support fruit and seed development with proper spacing and depth in the bed.

Row spacing and plant density must allow for maximum plant development of the flower and unrestricted access to inflorescences for pollinators to ensure proper seed set. Proper spacing will also allow for improved air movement, reducing pathogens and providing space for harvest operations at the end of the season.

Rouging: Rouging at periodical intervals to remove the off types from both in male and female lines during hybrid seed production.

Weed, pest and disease management: Management of weeds and pests is critical to ensure that organically produced seeds have high yield and quality. Weed can be managed through mulching with plant residues and other fully biodegradable materials, livestock grazing and hand weeding coupled with mechanical cultivation. The seed crop is in the field for a long period of time, there are many opportunities for multiple pathogens to interact with a single crop. To control these pathogens organically is complex and requires proper growing conditions.

1. **Biological pest control:** This practice is highly compatible with organic seed production. Biological control utilizes **three sources** of natural enemies that can be used to control harmful pests and reduce the use of organic pesticides.
 - a) The first group includes parasitoid insects, which lay their eggs inside another insect. An example is the wasp *Aphidius colemani* which lays its eggs in aphid adults.
 - b) The second group of beneficial insects is predators, which eat other insects. A common predator is the lady beetle, which preys on insects and mites.
 - c) The third group includes the weed feeders. Insects such as a weevil, *Hylobius transversovittatus* feed on certain weeds, including purple loosestrife.

To the brief biological methods include the following practices

- Biocontrol agent like *Pseudomonas*, *Trichoderma*.
- Viral, Fungal Bacterial and Protozoa.
- Introduction of predators or parasites of the pest.
- Natural enemies like spiders, insects, mites, nematodes and birds
- Non-synthetics control such as lures, traps and repellent.
- Mulches and nets.
- Sanitation to remove disease vectors, weed seeds and habitat for pest organism.
- Development of habit for natural enemy of the pest.
- Botanical pesticides.
- Crop rotation, trap crops and alternate host crop.
- Insect trap pheromones.

2. **Physical method:** In this method there is use of human effort to control insect pest and disease. The different physical method is listed below:

- Regulation of temperature: applicable for stored place
- Regulation of light: applicable for field crop
- Regulation of moisture: Use for stored insect pest control
- Use of sound waves

3. **Mechanical method:** Mechanical method: The mechanical method of insect pest management includes:

- Hand picking
- Sieving and winnowing
- Shaking and beating
- Netting
- Wrapping
- Painting
- Banding

Harvesting, threshing and drying: Parent's line should be done first. Method of harvesting depends on the type of seed being produced. When harvesting dry-seeded crops, seed shattering must be prevented because seed harvest generally occurs after the crop reaches physiological maturity. To reduce shattering, the stalks of the plant need to be cut while still green and field dried, allowing for uniform seed maturation.

Cleaning and Storage: Once seeds are harvested, threshed and extracted. They should be evaluated to determine the physical purity. All seeds should be single units and all should be stored according to their individual temperature/humidity requirements. Generally moisture content should be below 12% for storage.

Seed treatment: The organic seed are treated normally with materials from organic sources. They are:

Table 1: The organic seed are treated normally with materials from organic sources

Botanicals	Bio fertilizers	Cow's product	Biocontrol agent	Others
Neem leaf extract	<i>Rhizobium</i>	Panchagavya	<i>Pseudomonas</i> spp.	Coconut milk
Mint leaf extract	<i>Azotobacter</i>	Cow milk	<i>Trichoderma</i> spp.	Tender coconut
Sarani leaf extract	<i>Azospirillum</i>	Curd		Vermicompost
Prosopis leaf extract	Phosphobacteria	Cow urine		Vermiwash
Arappu leaf extract		Cow dung		

As it is often not possible to produce disease-free seed and as conventional effective seed treatment with synthetic

compounds is not possible, a lot of work on alternative seed treatments has been done and is still going on. The various

tested treatments can be classified in several categories:

- 1. Thermal treatment:** Hot water seed treatments are efficient on several crops but have to be applied with caution to avoid killing the seed. The limitation is that seed must be dried rapidly after the treatment and this is difficult at an industrial scale. To avoid that difficulty, an aerated steam method has been proposed. Because the seed is not immersed in water but exposed to hot moist air, drying is no longer a problem. The choice of temperature and its control is critical.
- 2. Use of antagonists:** Use of antagonists: Several antagonists have been tested and the list is long. Some no exhaustive results are as follows: - *Trichoderma* spp against collar rot (*Aspergillus niger*) on groundnut. - *Pseudomonas chlororaphis*, *Bacillus subtilis*, *Fusarium oxysporum*, *Streptomyces* spp against *Alternaria* spp on Brassica seed. *Bacillus subtilis* against *Tilletia caries* on wheat. - *Trichoderma viride* against *Fusarium* spp and *Bipolaris sorokiniana* on wheat and barley. - Several antagonists against *Rhizoctonia solani*.
- 3. Natural compounds:** Essential oils, sometimes with chelator and natural detergent have been tested. Thyme and oregano oils are reported to give good results against *Xanthomonas campestris* pv. *campestris*, *Clavibacter michiganensis* pv. *michiganensis*, *Botrytis aclara* and *Alternaria dauci*. A yellow mustard flour-based product, Tellecur, is reported to give good results against various pathogens, in particular *Tilletia caries* in wheat. Chitosan is reported to give good results against *Fusarium* spp. and *Bipolaris sorokiniana* on wheat and barley. A complex product, Biokal (57% of medicinal herb extracts, 38% bio-humus extracts, 5% volatile oil and metal and trace elements) is reported to give some good results against *Ascochyta pisi* on pea seed.
- 4. Other products:** Organic acids (lactic, acetic, citric, propionic and ascorbic) and antiseptic products such as $KMnO_4$ and $CuSO_4$ are also under tests at the moment.

Organic Seed Certification

- In simplified terms, the National Organic Program Standards require for crop farms: 3 years (36 months prior to harvest) with no application of prohibited materials (no synthetic fertilizers, pesticides, or GMOs) prior to certification.
- Distinct, defined boundaries for the operation.
- Proactive steps to prevent contamination from adjoining land uses.
- Implementation of an organic system plan, with proactive fertility management systems; conservation measures; and environmentally sound manure, weed, disease, and pest management practices.
- Monitoring of the operation's management practices to assure compliance.
- Use of natural inputs and/or approved synthetic substances on the National List, provided that proactive management practices are implemented prior to use of approved inputs.
- No use of prohibited substances.
- No use of genetically engineered organisms (GMOs), defined in the rule as "excluded methods".
- No use of sewage sludge or irradiation.
- Use of organic seeds, when commercially available (must not use seeds treated with prohibited synthetic materials,

such as fungicides).

- Use of organic seedlings for annual crops x.
- Restrictions on the use of raw manure and compost.
- Must maintain or improve the physical, chemical, and biological condition of the soil, minimize soil erosion, and implement soil building crop rotations.
- Fertility management must not contaminate crops, soil or water with plant nutrients, pathogens, heavy metals or prohibited substances.
- Maintenance of buffer zones depending on risk of contamination.
- Prevent commingling on split operations (the entire farm does not have to be converted to organic production, provided that sufficient measures are in place to segregate organic from non-organic crops and production inputs).
- No field burning to dispose of crop residues (may only burn to suppress disease or stimulate seed germination flame weeding is allowed).
- No residues of prohibited substances exceeding 5% of the EPA tolerance (certifier may require residue analysis if there is reason to believe that a crop has come in contact with prohibited substances or was produced using GMOs).

Why not all farmers use organic seed?

A situation where not all farmers use organic seed of good quality and there is no demand leads up two conclusions.

- 1) Organic farmers are in sufficiently educated in terms of seed quality importance.
- 2) Organic farmers are short in funds and cannot buy double certified organic seed.

Table 2: Advantages and disadvantages of organic seed production

Advantages	Disadvantages
Production of nutritious food	Lesser productivity
Poison-free produce	Cultivation practices are more
Increase long term fertility of soils	Time consuming
Food storability/longevity is high	Skills required

Conclusion

Organic agriculture with organic seed includes growing of crops by a set of guidelines that prohibit the use of synthetic products/ chemicals such as fertilizer, pesticides and herbicides. Therefore, soil fertility and pest management is achieved through cropping patterns (rotations, inter/mix-crops, pest and disease-resistant genotypes), manure (green manure, organic manures and compost), bio fertilizers, cultural practices (weeding, planting, conventional tillage) and bio pesticides, including plant derived products. At present this system seems to be an ideal and valid solution to produce seeds aside with the agriculture production. The overuse of plant growth regulator, pesticides and fertilizer for faster growth of agriculture produce is detrimental to human health and environment as a whole. Further, consumers are becoming conscious and critical about the quality of food and by-product that affect their health though the toxicity depends to some extent of the type of food consumed.

References

1. Agrawal RL. Seed Technology. Oxford and IBH Publishing Co. New Delhi; c1995. p. 1-772.
2. Agrawal PK. Principles of Seed Technology, ICAR, New Delhi; c2012. p. 1-107.
3. Anonymous. Seed Production and Technology. In:

- Handbook of Agriculture, ICAR, New Delhi; c2009. p. 1269-1297.
4. Bewley JD, Black M. Physiology of development and germination. New York: Plenum Press; c1994. p. 445.
 5. Dutta AC. Botany for Degree Students. Oxford University Press; 1980. p. 930.
 6. Roberts EH. (Ed). Viability of Seeds. London: Chapman and Hall. 1980 Jan 1;45(1):13-30.
 7. Kalaraju K. Response of finger millet genotypes to methods of planting under organic farming. M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Bengaluru.
 8. Kiran, Satyanarayana Rao, Rameshkumar C. Effect of nutrient management practices through organics on soil chemical property after harvest of chickpea (*Cicer arietinum* L.) under rainfed condition. Trends Bio Sci. 2015;8(12):3159-3162.
 9. ISTA. International Rules for Seed Testing. Seed Science and Technology. 1985;13:299-335.
 10. Jain VK. Fundamentals of Plant Physiology. S. Chand and Company Ltd., New Delhi; c2009. p. 474-480.
 11. Rahman MH, Islam MR, Jahiruddin M, Puteh AB, Mondal MMA. Influence of organic matter on nitrogen mineralization pattern in soils under different moisture regimes. Inter. J Agric. Bio. 2013, 15(1).
 12. Singh M, Singh M, Kumrawat B. Influence of nutrient supply systems on productivity of soybean-wheat and soil fertility of vertisol of Madhya Pradesh. J Indian Soc. Soil Sci. 2008;56(4):436-441.
 13. Singh BD. Plant Breeding. Kalyani Publishers, Ludhiana; c1993. p. 677.