



## Agronomical Practices for Production of Organic Groundnut

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Organic groundnut market is increasing because of farmers to sell their produce at high premium. Organic production systems can make important contributions to food supply and it combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. In addition to producing high quality crops, healthy and well balanced soil can help plants to develop natural resistance to insect pests and diseases.

### Introduction

Organic farming in recent years gaining importance due to realization of inherent advantages it confers in sustaining crop production in an eco-friendly pollution free environment. Organic farming is a method of farming system which primarily aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes to release nutrients to crops for increased production. Organic farming recorded lower productivity and yield losses but there was an overall improvement in soil quality parameters, indicating better soil health and sustainability of crop production. It is economically feasible to practice organic farming when farmers are able to get premium price for their produce and with reduced cost of cultivation by not depending upon the purchased off-farm inputs (Ramesh et al. 2010).

India is bestowed with lot of potential to produce all varieties of organic products due to its various agro climatic regions. In several parts of the country, the inherited tradition of organic farming is an added advantage. According to Agricultural and Processed Food Products Export Development Authority (APEDA), a nodal agency involved in promoting Indian organic agriculture, India ranks 33<sup>rd</sup> in terms of total land under organic cultivation and 88<sup>th</sup> position for agriculture land under organic crops to total farming area. The cultivated land under certification is around 4.43 million ha (2010-11). India produced around 3.88 million MT of certified organic products which includes all varieties of food products namely

basmati rice, pulses, honey, tea, spices, coffee, oil seeds, fruits, processed food, cereals, herbal medicines and there value added products.

### Organic Groundnut Cultivation

The cultivated groundnut (*Arachis hypogaea* L.) belongs to family *Fabaceae*, subfamily *Papilionaceae*. In India, it cultivated in 5.31million ha with production of 6.93 million tonne (Anonymous 2012a). In India, it is grown mainly in Gujarat, Maharashtra, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan, Karnatka and Madhya Pradesh. There are two major subspecies of groundnut that also differ in their branching patterns viz.,



*hypogaea* and *fastigiata*. However, most of the commercially cultivated varieties belong to the *hypogaea* (Virginia or runner), *fastigiata* (valencia), and *vulgaris* (Spanish) botanical variety groups. The groundnut contains high oil (46-52%) and protein (25-36%) content depending on the variety. Organic production of groundnut relies on management techniques that replenish and maintain long-term soil fertility by optimizing the soil's biological activity. This is achieved through crop rotation, cover cropping or composting and using organically accepted fertilizers that feed the soil and provide nutrients. Use of either farmyard manure (FYM) and vermicompost along with other organic amendments like neem seed cake; and biofertilizers and bio-pesticides etc., in rainfed groundnut, found advantageous for sustainable crop production. Groundnut being a legume leaves lot of residual fertility which in turn helps succeeding crop under rainfed farming situations. In groundnut, application of FYM at 10 to 15 t ha<sup>-1</sup> increased the pod and haulm yields and improved the yield parameters like shelling percentage, 100 seed weight and sound mature kernel compared to the recommended dose of fertilizers (Subrahmaniyan et al. 2000). The study indicates that the groundnut showed greater response to the application of organic manures (i.e., organic farming) under low rainfall situations with dry spell at the early growth stage (Malligawad, 2010). Organic farmers manage insects, diseases, weeds and other pests with an array of cultural, mechanical and biological options.

### Ecology and fertility requirement

Groundnut requires abundant sunshine and warm climate for normal development, but does not appear to be sensitive to day length, though it generally produces more flowers under long day conditions (Stalker, 1997). Temperature also significantly effects development and growth rate of groundnut, the optimum temperature between 25–30°C is good for vegetative and reproductive growth. Groundnut grows with an average rainfall from 500 mm to 1200 mm, but grows best when average rainfall is more than 500 mm throughout the crop season. Organic production field of groundnut should have good tilth, high organic matter, good drainage and airflow for roots and nitrifying bacteria. Groundnut grows well in slightly acidic soils with optimum pH ranged from 5.5–6.5. Organic groundnut growers need to get information of their soil fertility by obtaining a soil test report with recommendations for groundnuts. Gypsum, a by-product of dry wall is not allowed; only mined sources of gypsum are allowed in organic production. The importance of organic to groundnut plants was emphasized by Ahmed et al. (1997) who stated that the highest dry matter accumulation, kernel yield and oil content were achieved by fertilization with farmyard manure. Application of FYM @ 21.9 t ha<sup>-1</sup> produced the highest DMP, pod yield and haulm yield, and gave higher net return and BCR (Chandrasekaran et al. 2007). Application of *panchgavya* + neem leaf extract at branching and flowering is advantageous in increasing chlorophyll content, physiological growth, nutrient content and uptake, dry matter accumulation, yield and yield attributes and economics of groundnut (Kumawat et al. 2009). Application of FYM @ 7.5 t ha<sup>-1</sup> enriched with bio-fertilizers + bio-pesticide @ 2 kg ha<sup>-1</sup> and seed treatment with bio-fertilizers + bio-pesticide + PGPR + Trichoderma @ 200 g ha<sup>-1</sup> each + foliar application of *panchgavya* at 45 days was most productive and economic module for organic groundnut cultivation (Anonymous, 2012b). Poultry manure is excellent organic manure, as it contains high nitrogen, phosphorus, potassium and other essential nutrients. Bio-fertilizers are the source of microbial inoculants, which are also important component in organic groundnut production.

### Water management

Groundnut is a rainfed crop generally requires 500 mm rainfall throughout the crop season to raise a healthy groundnut crop. Excessive irrigation at different stages of crop growth may promote soil born diseases and iron chlorosis resulting losses in yield. If supplementary irrigation is available, it should be given at critical stages such as flowering, pegging and pod and seed development. Drought stress constitutes a serious threat for groundnut production because of the danger of aflatoxin. Aflatoxin is produced by two fungi such as *Aspergillus flavus* and *Aspergillus parasiticus*. Aflatoxin can cause financial losses for groundnut growers.

Many countries and export markets are setting stricter tolerance levels for aflatoxin. Drought and hot weather conditions have been associated with increased aflatoxin contamination. In general field studies demonstrate that reduction of drought stress by irrigation reduces aflatoxin contamination. Pre-harvest aflatoxin contamination can occur when groundnut pods with insect or mechanical damage. Various approaches have been suggested for control of pre-harvest aflatoxin contamination including the grow varieties with resistance to insects, resistance to plant stress (especially for tolerance to drought and high temperature).

### Weeds management

It is essential to keep groundnut fields weed free for up to 45 days after crop emergence. Weeds plants may act as alternative hosts of plant parasites allowing the pathogen to survive between seasons and providing a source of inoculum in the new growing season. Weed control in organic systems, especially in groundnut production, relies heavily on crop rotations, cover crops and cultivation. For cultivation to be successful, a straight, well prepared bed, as well as straight seeding lines in a conventional diamond pattern is necessary for cultivating implements to remove the most weeds while leaving the crop undisturbed. Hoeing between plants eliminates weeds in the planting row. Flame weeding and other thermal devices can reduce broadleaf weeds, but grasses still need to be mechanically removed. Polythene mulching has been found effective in controlling weeds.

### Diseases management

**Leaf spot:** Rainfall or irrigation followed by high humidity during the growing season can contribute to early leaf spot and late leaf spot. Cultural practices such as resistant varieties, crop rotation, deep ploughing, and removal of volunteer groundnut plants may alleviate the leaf spot, as could foliar inoculation of micro organisms with compost teas or commercial products that include *Bacillus subtilis* bacteria, like Serenade. The control of early leaf spot has been achieved by crop rotation with cotton, grain sorghum and corn. Biological control of early leafspot in groundnut using *Pseudomonas cepacia* and *Verticillium lecanii* has been reported as a parasite on several groundnut pathogens in India (Subrahmanyam et al. 1990). Host range of this pathogen is very limited to only groundnut so that groundnut is rotated with any other crop for one or two or three years reduces disease inoculum in soil.

**Rust:** Temperatures of 20-25°C and high relative humidity favours the rust epidemics in groundnut. Rust disease also prevalent throughout the groundnut growing areas. Groundnut should not follow groundnut, as infected pods and foliage stay behind in the soil with plant residues. Pathogen may over-winter on these materials and provide inoculum in the following crop. Crop rotation prevents the building up of pathogens in the soil. Planting of resistant

cultivars, deep ploughing, removal of groundnut residue, elimination of volunteer groundnut plants, crop rotation and manipulation of planting dates and careful handling of pods during harvesting and shelling could prevent disease development.

**Stem rot and collar rot:** Stem rot (*Sclerotium rolfsii* Sacc.) and collar rot (*Aspergillus niger* van Tieghem) are prevalent in almost all groundnut producing areas especially in sandy loam and medium black soils. These diseases cause severe seedling mortality. Soil solarization with polyethylene sheets for 3-4 weeks in the hot season before planting should prove useful in reducing stem rot and pod rot of groundnut. Deep ploughing to bury all undecayed organic matter and plant debris to at least 9 cm can greatly reduce stem rot infection and increase yield. Rotation of groundnut with wheat and corn is also effective against stem rot (Minton et al. 1991); this is a common practice in several parts of northern India and China. Rotating groundnut with crops belonging to the Liliaceae family such as onion and garlic has proved effective against stem rot (Asghari and Mayee 1991). Biological control has been proved to be a promising disease management technology especially against soil-borne plant pathogens. *Trichoderma viride* Tv1 was the most effective isolate against *S. rolfsii* with 69.40% growth inhibition followed by *P. fluorescens* resulting in 64.40% inhibition. Among the organic amendments tested in greenhouse, mahua cake with *T. viride* each @ 5 g/kg of soil resulted in 3.75% stem rot incidence as against 39.98% in control (Karthikeyan et al. 2006). Seed treatment with *Trichoderma viride* or *T. harzianum* @ 10 g kg<sup>-1</sup> seed also helps in managing seed and soil borne diseases.

### **Insect pest management**

Groundnut is attacked by several insect pests, among them defoliators viz., groundnut leaf miner, red hairy caterpillars, tobacco caterpillar, gram pod borer and sucking pests like Aphids, leaf hoppers and thrips etc. are the economic important in India. Biological and cultural methods can be used for controls of groundnut insect pest. Planting large expanses of a single, susceptible crop, or monocropping, encourages pest problems. A diverse farming involving many types of plants and animals considerably diminishes the likelihood of severe insect pest outbreaks. Farmers must create production methods that complement natural systems. The use of beneficial insect habitats with field borders increases the presence of beneficial insects. These habitats provide shelter, food and act as refuges that attract the natural enemies of pests. This would help in reducing pest populations. Some botanical insecticides, including neem products such as Agroneem and Neemix, act as repellents, anti-feedants and insect growth regulators should be used to management of insect pest in organic groundnut production.

### Harvesting and post-harvest management

Handling of organic groundnut is a complex issue. If organic groundnut is processed on farm in any way, a second certification as a handler or processor may be required. Following points should be considered for production of organic groundnut:

1. Equipment: Know what equipment is used for organic production, how to clean all parts of equipment, including planters, combines, wagons and trucks etc. Clean all the equipment's prior to use in organic fields and keep records of cleaning activities of the equipment.
2. Storage unit: All the storage units should be carefully inspected prior to use and thoroughly clean bins, dryers, cleaners and other storage units.
3. Transport facility: It should be making sure that transports units, including over-seas shipping containers are free of foreign matter. Keep records to document trucks, including clean transportation affidavits and bills of lading.
4. Farms records: Organic producers should maintain good records so that farmers will have a better chance of limiting the losses, identifying causes of problems and determining liability. The document with valid records of organic yields and sales may help to claims for losses due to contamination or by other means.

### Markets for Organic Groundnut

The marketing research on organic groundnut is very limited but demand of organic groundnut is increasing because of organic farmers enjoy high prices over conventionally grown groundnut. Some large organic food manufacturers seek dependable supplies of organic groundnut and willing to contract for organic production. The snack food industry, rather than the groundnut butter sector, may be the larger market for organic groundnut. This has implications for the type of groundnut desired and for the geographical area most suited to its production. However shellers and manufacturers are the principal contractors for groundnut production, a much different processing and marketing infrastructure may need to be developed to assist organic marketing system.

### Conclusion

Integrated agronomical management practices are to be more successful for production of organic groundnut. Cultural practices such as crop rotation, deep ploughing, and good seedbed preparation are the foundation of effective management of insect pest diseases of groundnut. Biological control is likely to be an integral part of production of organic groundnut for disease management strategy in the future. Development of pest and disease resistant varieties is crucial to any organic groundnut production on a scale comparable to that of conventional production.

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