

# Integration of Organic Farming Practices for Sustainable Production of Guava: A Case Study

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## Abstract

In India, four organic farming systems (Biodynamic, *Panchgavya*, *Rishi Krishi* and *Homa* farming) are prevalent in different parts of the country for production of horticultural and other crops. In Biodynamic farming system, maximum reliance is placed on self-regulatory agro-ecosystem locally or 'farm derived' renewable resources. Use of external inputs is as minimized as possible. Experiments were conducted on 3-yrs-old plant of guava cv. Allahabad Safeda using biodynamic preparations, biofertilizers and composts. Maximum number of fruits and yield (92 & 13.69 kg tree<sup>-1</sup> & 283 & 40.11kg tree<sup>-1</sup>) were consistently recorded for 2 years from the trees, applied with 20kg FYM inoculated with *Azotobacter* in comparison to 21.37kg tree<sup>-1</sup> fruit with recommended doses of fertilizer application. Fruit quality parameters, particularly TSS (16.20 Brix) were improved with application of 10kg FYM along with celrich. On the basis of these observations an experiment was further conducted by integrating four organic farming systems on guava. Fruit yield was maximum (38.88kg tree<sup>-1</sup>) in trees, which were exposed to *Homa* atmosphere followed by 29.28kg with *Homa+Rishi Krishi* and *Homa+Panchgavaya*. TSS was maximum (12.0 Brix) with *Homa + Rishi Krishi* and *Homa + Panchgavaya*, while ascorbic acid was more (165mg100g fruit<sup>-1</sup>) with FYM treated plants.

## INTRODUCTION

Organic farming in fruits crops can be defined as an approach to create integrated, humane, environmentally and economically sustainable agricultural production systems. Maximum reliance is placed on self-regulating agro-ecosystems, locally or farm-derived renewable resources and the management of ecological and biological processes and interactions. Reliance on external inputs, whether chemical or organic, to be reduced as far as possible. India had developed a vast and rich traditional agricultural knowledge since Vedic times and presently finding solution to problems created by over use of agrochemicals. Present day's modern farming is not sustainable in consonance with economics, ecology, equity, energy and socio-cultural dimensions. Indiscriminate use of chemical fertilizers, weedicides and pesticides has resulted in various environmental and health hazards along with socio-economic problems (Audus, 1970; Kakkar, 1981; Gupta, 1991; Joshi et al., 1995). Though agricultural production has continued to increase, but productivity rate per unit area has started to decline. The entire agricultural community is trying to find out an alternative sustainable farming system, which is ecologically sound and economically and socially acceptable. Sustainable agriculture is an unifying concept, which considers ecological, environmental, philosophical, ethical and social impacts and balanced with cost effectiveness. The answer to the problem probably lies in returning to our roots. Traditional agricultural practices, which are based on natural and organic methods of farming offers several effective, feasible and cost effective solutions to most of the basic problems being faced in conventional farming system. Among the various alternatives attempted, organic agriculture is gaining acceptance throughout the world with annual growth of 20 to 25 per cent in most of the European countries, including U.S.A., Australia, Japan, China etc. In India, sporadic attempts for organic production are

being attempted in horticultural and other crops like tea and coffee in certain pockets. Rupela et al. (2006) observed that yields are comparable to conventional agriculture by using biological approach.

## ORGANIC PRODUCTION SYSTEMS PREVALENT IN INDIA

### **Biodynamic Agriculture**

Among organic farming systems, Biodynamic agriculture, *Rishi Krishi*, *Panchgavya Krishi* and *Homa* Farming are prevalent in India. Biodynamic agriculture appears to be one of the sound alternatives. It is based on systematic and synergistic harnessing of energies from cosmos, earth, plant and cow (Steiner, 1920). Few of the preparations are used in minute quantities, viz. BD-500-508, Cow Pat Pit etc. show remarkable effect on growth, nutritive value of compost (Carpenter et al., 2000) metabolism, crop yield and quality (Pfeiffer, 1984). It is interesting to note that these practices do not require sophisticated facilities and most of them can be created at farm itself by simple effort. These are components of biological agriculture, capable of affording long-term sustainability to agriculture and particularly to the ecosystem. Emphasis is made to adopt an agriculture calendar for crop cultivation along with some specific preparations. Efforts are made to restore soil fertility in the form of humus, increase in living system of soil by skilful application of appropriate crop rotation (Edwards, 1965; Edwards and Thompson, 1973). Further Rupela et al. (2003) reported that BD preparations had  $3.24^{10}$  to  $6.90^{10}$  g<sup>-1</sup> of bacteria antagonistic to disease causing fungi. In any nutrient management programme, the appropriate use of the biodynamic preparations is of prime importance. After closely working for more than 5 years with the system an integrated system of Biodynamic Agriculture has been developed, which is capable of meeting the issues and could afford sustainable agriculture.

### ***Panchgavya***

It is a special preparation made from five by-products of cow along with certain other ingredients, incubated for specific duration in an earthen or wide mouth plastic container (Ramasamy et al., 2004). A medical practitioner in Erode district of Tamilnadu, India, has successfully tried its effects on various plants, animals and human beings. Brief account of this is enumerated in Table 1.

**1. Recommended Dosages.** In general, spray of 3 per cent (3kg/100<sup>l</sup> L of water) solution has been found most effective. It is advisable to filter the mixture with muslin cloth and spray with high volume sprayer.

**2. Flow System.** *Panchgavya* can be mixed with irrigation water at 50 L ha<sup>-1</sup> either through drips or with irrigation flow.

### ***Rishi Krishi***

This technology is being promoted and practiced by large number of farmers (Deshpandey, 2004) in Maharashtra and Rajasthan. In this system following aids are used to maintain soil fertility and crop productivity.

**1. Angara.** *Bhoomi Sanskar* is performed to make the soil fertile, where, 15 kg of rhizosphere soil of banyan tree "*Vatavriksh*" (*Ficus bengalensis*) is broadcasted over an acre of land. Mr. Pandey coined the name "*Angara*", application of this gradually increases the population of the living organisms in the soil.

**2. Amrit Pani.** It is prepared by mixing of cow dung (10kg), cow *ghee* (250g) and honey (500g). Ten kg of fresh cow dung is stirred for 2 hours with 250 g cow *ghee*, after proper mixing 500g honey is mixed stirred thoroughly and diluted to the tune of 200 liters. This preparation is known as *Amrit Pani*. Preparation is ready for use after one week of incubation. This is used for number of operations such as:

*Bhoomi Sanskar (Soil Treatment).* After incubation for 2-3 days, *Amrit Pani* is sprayed at 500 l ha on field ready for sowing/transplanting.

*Beej Sanskar (Seed Treatment).* Soak the seed in *Amrit Pani* and dry in shade before

sowing. For hard coat seed, Soaking in gomutra (cow urine) is beneficial for hard seed coat seed before treating with *Amrit Pani* for 12 hrs.

*Vanaspati Sasnkar (Spraying on the Crop)*. *Vanaspati Sanskar* is done on the crop for maintaining health and yield, where 10 liters cow urine of indigenous cow is mixed with 2 liters of neem oil and 200 liters of water for one hectare of land.

### **Use of *Amrit Pani***

- Dressing of seeds with hard coat - one kilogram of *Angara* mixed with sufficient quantity of *Amrit Pani* to make a thick paste or muck. Mix a small quantity of paste with seeds in a sifting pan and keep it rotating till seeds are covered with muck. Dry the seeds in shade, store and use as per need.
- In case of soft or thin coat seeds, the muck should be lightly sprinkled and seeds should be sown immediately.
- Sugarcane cuttings, turmeric rhizome etc. should be transplanted after dipping into *Amrit Pani*
- Seedlings before transplanting should be dipped (rice, vegetables) in *Amrit Pani*.
- *Amrit Pani* can be mixed with irrigation water through flow or drip system.

### ***Homa* Farming (*Agnihotra* Therapy)**

In organic production systems, it is presumed that 80 to 90 per cent nutrition can be derived from Cosmos, provided pollution free atmosphere is available for crop production (Bourguignon, 2005). *Homa* therapy is practiced in different European (Austria, Germany, Poland) and south American (Peru, Venezuela) countries, which has shown spectacular response with respect to crop production, animal, human health and creation of pollution free atmosphere. Paranjpe (2004) has strongly propelled that this therapy can safely be integrated with other organic production systems. Brief account of *Homa* therapy is enumerated below:

'*Homa*' is a Sanskrit word used synonymously with *Homa* therapy. It is a technical term from Vedic science of bio-energy, medicinal and climatic engineering denoting the process of removing the toxic conditions of the atmosphere through the agency of fire tuned to the specific bio-rhythm of sunrise and sunset. It is simply based on the principle that you heal the atmosphere and the healed atmosphere will heal you. It replenishes the nutrients that pollution robs from the environment. The simplest and widely acceptable is *Agnihotra*, which need to be integrated with other organic production systems to device package of *Jaivik* (organic) production. Resonance points with pyramids are established at four places surrounding the farm to spread the healing effects to wider areas of 40 to 50 hectare. By performing *Agnihotra* and other *Homa* on a farm, an atmosphere is created that is conducive to growing and therefore attracts nutrients, insects, microorganisms and animals that would thrive well with pollution free environment (Paranjpe, 2004). *Agnihotra* therapy is being popularized by Sri Vasant Paranjpe and others internationally and is used to improve environment and crop production with minimum expenditure. *Homa* farming is a totally revealed science. *Agnihotra* was regularly performed to purify the atmosphere since ancient time. Technical term, the *Homa* or *Yagna* can be described as describing the process of purification of the house and atmosphere through fire, which is tuned to rhythm of nature, radiation effects of astrological combinations and "*Mantras*" leads to better capture of cosmic energies from Sun and Moon and it helps to reset the energy cycle of the planet in natural harmony benefiting all concerns. The basic process used in *Homa* farming is *Agnihotra*. A copper pyramid shape container is used in the process.

### **CASE STUDY**

Biodynamic agriculture is a holistic system wherein the individual farm is considered as a unit itself. It is a farming system approach in which agriculture including horticulture, livestock, forestry etc. is addressed as a single component. Major emphasis is given to improve the humus content in the soil, through incorporation of enriched

compost (NADEP, Vermi/BD compost), Cow Pat Pit (CPP), BD-500, appropriate crop rotation, inclusion of legume in the system (green manure, inter/cover crop), mulching and harnessing cosmic energies by adapting agriculture calendar. In the system micronutrient are also taken into consideration, through biodynamic preparations (BD 502-507). In fertile soil, in general plants are vigorous, healthy and are less prone to pest and disease infection. In case of poor plant vigour, spray of vermi wash and BD liquid manures are occasionally done. Insect and diseases are managed through timely spray of BD liquid pesticides, BD-501 and by adapting other Organic Pest Management (OPM) techniques. Scientists associated with biodynamic system and interaction with other organizations clearly showed that this system is capable of meeting the desired issues as evidenced from the following experimental results, which were obtained from 4-yrs-old guava cv. Allahabad Safeda. Even after five year of close association with Biodynamic farming at CISH, Lucknow, it was difficult to prepare BD-502-507. Hence the question was asked: what is the strength of other organic production systems (Pathak and Ram, 2004) prevalent in India, and can these be integrated to develop a *Jaivik* package (organic)? A separate experiment was carried out on guava by integrating aforesaid four farming systems.

### YIELD AND QUALITY

Improvements in fruit yield and quality were noticed with application of different levels of organic and inorganic sources of nutrients (Fig. 1). Average maximum fruit yield (40.11 kg tree<sup>-1</sup>) was with FYM 20 kg + 250 g *Azotobacter* followed by (34.18 kg tree<sup>-1</sup>) with vermi compost application, whereas, it was 21.37 kg fruit tree<sup>-1</sup> harvested from the trees applied with recommended dose of fertilizers. However, variations among the treatments were non-significant. Similar results were reported with application of FYM + *Azotobacter* by Ram and Rajput (1998). Quality parameters were improved with application of different organic sources (Basker, 1992; Dlouhy, 1977) compared to inorganic. In present study, maximum TSS (14.13°Brix) was with application of FYM 10 kg + BD-500 spray followed by 14.0°Brix with FYM 10 kg + CPP 500 g. Ascorbic acid content varied from 156.94 to 112.43 mg 100<sup>-1</sup> fruit. It was maximum (156.94 mg 100<sup>-1</sup>) with vermi compost and minimum (112.43 mg 100<sup>-1</sup>) with 350 g N<sub>2</sub>O + 200 g P<sub>2</sub>O<sub>5</sub> + 350 g K<sub>2</sub>O. Reducing sugar was highest (5.32 %) with FYM 10 kg + BD-500 spray and minimum (4.73%) recorded with application of fertilizers but variations among the treatments were non-significant. Acidity content in fruits varied from 0.29 to 0.47 per cent due to application of different treatments but variations among the treatments did not differ significantly. On the basis of above observations an experiment was further laid out by integrating four organic farming systems on guava. Maximum fruit yield (38.88 kg tree<sup>-1</sup>) was in trees, which were exposed in *Homa* atmosphere followed by 29.28 kg with *Homa+Rishi Krishi* and *Homa+Panchgavaya*. Maximum TSS was (12.0 Brix) with *Homa + Rishi Krishi* and *Homa + Panchgavaya*, while ascorbic acid was more (165 mg 100 g fruit<sup>-1</sup>) with FYM treated plants. In an integration of organic farming systems (as discussed above) experiment was carried out and maximum fruit yield (38.88 kg tree<sup>-1</sup>) was recorded in tree which were exposed in *Homa* atmosphere followed by 29.28 kg trees<sup>-1</sup> with *Homa+Rishi Krishi* and *Homa+Panchgavaya* (Fig. 2). TSS was (12.0 Brix) with *Homa + Rishi Krishi* and *Homa + Panchgavaya* and maximum ascorbic acid (165 mg 100 g fruit<sup>-1</sup>) was with FYM treated plants. Ram and Rajput (1998) also reported improvement in fruit quality parameters with application of organic manures and biofertilizers. Linder (1973) noticed quality improvement in organically grown guava fruits.

### CONCLUSION

The interest in organic agriculture in developing countries is growing because it requires less financial inputs and places more reliance on natural and human resource available. Organic farming on small land holdings, especially under rain fed zones, tribal areas and North West to North East Himalayas still will go a long way in promoting

organic farming in India. In order to address the aforesaid challenges in a better way, integration of these systems and develop package of *Jaivik Krishi* (JK), which can be promoted in different parts of the country by the common Indian farmers, which has been depicted in Fig. 3. It is interesting to record that in all four systems “COW” particularly those with hump (indigenous breed) is one of the key components, hence provision of at least one cow per hectare need to be promoted for *Jaivik Krishi* activities in organic farming.

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## Tables

Table 1. Ingredients required for preparation of *Panchgavya*.

Ingredients	Quantity
Cow dung	5 kg
Cow urine	10 l
Cow milk	3 l
Cow curd	2 l
Cow ghee	1 kg
Sugarcane juice*	3 l
Tender coconut water**	3 l
Ripe banana	12
Toddy (if available)***	2 l

## Figures

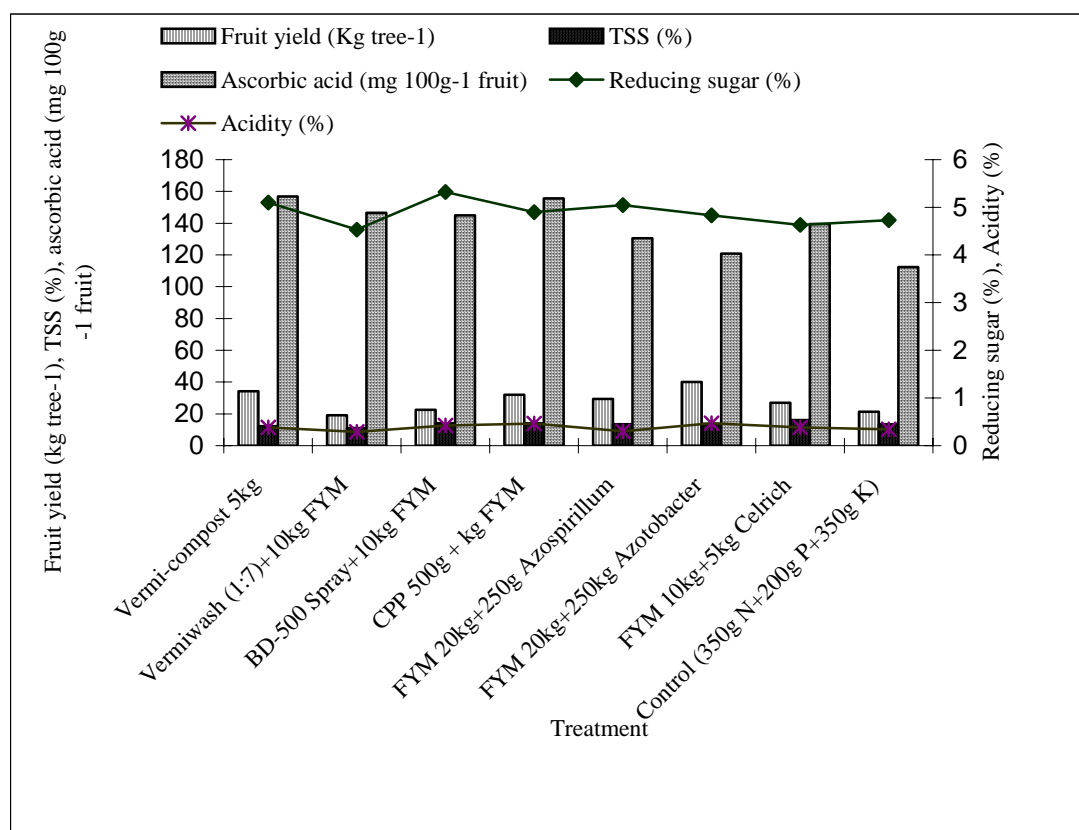


Fig. 1. Effect of different organic/biodynamic treatments on yield and fruit quality parameters of guava cv. Allahabad Safeda.

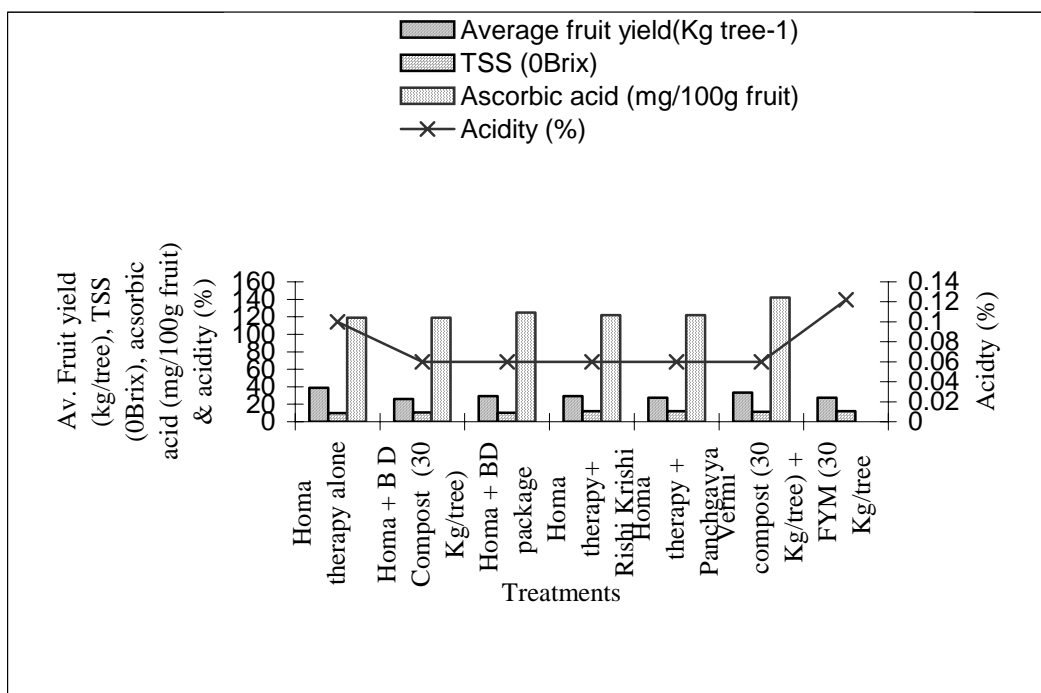


Fig. 2. Effect of integration of organic farming practices on yield and quality of guava cv. Allahabad Safeda.

