Effect of Organic Manure and Biofertilizers on the Growth, Yield and Productivity of Guava under Meadow Orcharding

ABSTRACT:

The study was conducted to investigate the effect of organic manure and biofertilizers on the growth, yield and productivity of guava under meadow orcharding at Horticulture Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. In this experiment, various organic sources (Farm yard manure (30 kg/plant/y), vermicompost (30 kg/plant/y) and neem cake (3 kg/plant/y) along with various biofertilizer combinations (*Azotobacter*, *Azospirillum*, PSB) were tested on five-year-old guava cultivar 'Allahabad Safeda' to study its effect on growth, fruiting and yield. The results obtained showed higher fruit weight (218.00 g),fruit length (7.60 cm),fruit diameter (7.42 cm), maximum number of fruits produced per plant (26.64 fruits/plant), maximum yield per plant of 5.81 kg/plant and maximum yield per ha (23.12 t/ha) with the application of T_9. The highest total soluble solids (12°Brix) and total sugar content of fruit (8.26%) with the application of T_9. Application of nutrients through organic along with biofertilizers improve soil health in terms of mean microbial population in the rhizosphere of root zone soil as compared to control. From the present study, the application of biofertilizers with the combination of organic manures has a beneficial effect on the availability of major nutrients in the soil to help in maintaining of the soilfertility and plantgrowth of the fruits at a desired level. It can be concluded that, for better growth, yield and quality guava fruits, the guava trees should be fertilized with (FYM (30kg/plant) +*Azospirillum* @250g/tree +PSB @250g/tree +Neem cake @3kg/tree) per year with treatment T_9.

Keywords: Guava,Bio fertilizer, *Azotobactor*, PSB,*Azospirillum*, vermicompost, Neem cake

1. INTRODUCTION:

Guava (*Psidiumguajava* L.) is the apple of the tropics and is one of the popular fruits

grown in tropical, sub-tropical and some parts of arid regions of India. Guava fruit belongs to the family Myrtaceae**.** Guava is the 5th most important fruit of India based on acreage and production after mango, banana, apple and citrus. Guava has become more popular in our country due to its prolific and precocious bearing habit, and wider adaptability under various agro-climatic conditions (**Mishra*et al.*, 2017).**

Guava is available at a cheap rate and is popularly known as the 'apple of plains and poor man's apple'. In north India agro-climate conditions guavaflowers twice a year-first in April-May for the rainy season crop and then, in September-October for the winter season crop. Generally, fruit yield is more in rainy season crops compared to the winter season **(Shrama*et al.*, 2018).**

Guava is the fifth most important fruit crop from the production point of view after the banana, citrus, papaya. The total area of production and productivity of guava in India is about 0.244 million hectares, 33,18000 million tonnes, and 13.5 mt/ha, respectively. It is grown in several parts of India but according to productivity Uttar Pradesh, Bihar and Andhra Pradesh are on the top. The popular varieties are Allahabad Safeda, Allahabad Surkha, Shweta, Sardar (Lucknow-49), Pant Prabhat, Lalit. In Madhya Pradesh total area and production of guava is about 7 mt/ha. Madhya Pradesh ranks 1st in production of the guava it shares about 3.5 % area of production in India. Major guava-producing districts in Madhya Pradesh are Jabalpur, Ujjain, Ratlam, Rajah, and Mandsaur. Guava fruit becomes fully ripe between 3-5 days at room temperature**(Rani*et al.*, 2021).**

Guava fruit of variety Locknow-49 is a selection from open pollination of Allahabad Safeda cultivar form Ganeshkhind, Pune (M.H) and is also called Sardar Guava. Trees are vigorous. The leaves are elliptical-ovate to oblong in shape. Fruits are roundish ovate in shape. Skin colour is primrose - yellow, the pulp is whitish, very sweet and tasty with a TSS of 9.5^{o}B and vitamin C content 130mg/100g. It has been observed that pectin content is higher in winter season guava than the monsoon fruits **(Mishra *et al.*, 2017).**

The Meadow Orchard is a modem method of fruit cultivation using small or dwarf tree with modified canopy. Better light distribution within tree canopy increases the well number of well illuminated leaves. It also promotes rate of photosynthesis that leads to high yield per unit area. This system of guava planting is going to revolutionize the guava industry by enhancing productivity coupled with reduction in production costs. The meadow orchard system of guava

accommodates 5000 plants / ha, planted at 2.0 x 1.0m spacing and managed with regular topping and hedging, especially during initial stages. Topping and hedging in guava are helpful in controlling tree size and extending fruit availability. A comparison between meadow orchard system and the traditional system of fruit growing is necessary to evaluate the potentiality of this technique**.(Jamwal*et al.,* 2018)**

Meadow orchard system is a new concept of guava planting which has been developed for the first time in India at Central Institute for Subtropical Horticulture, Lucknow. The planting is done at 2.0 m (row to row) x 1.0 m (plant to plant), which gives a density of 5000 plants ha^{-1}. Initially, the trees are pruned and trained to allow maximum production of quality fruits during the first year. A single trunk tree with no interfering branches up to 30 - 40 cm from the ground level is desirable to make dwarf tree architecture. After a period of 1-2 months of planting, all the trees are topped at a uniform height of 30-40 cm from the ground level for initiation of new growth below the cut ends. No side shoot or branch should remain after topping. This is done to make a single trunk straight up to 40 cm height. After 15-20 days of topping, new shoots emerge. In general, 3 - 4 shoots are retained from below the cut point after topping. As shoots mature generally after a period of 3-4 months, they are reduced by 50 per cent of their total length so that new shoots emerge below the cut point. This is done to attain the desired tree canopy architecture and strong framework. The emerged shoots are allowed to grow for 3 – 4 months before they are again pruned by 50 per cent. After pruning, new shoots emerge on which flowering takes place.At present, guava is cultivated largely through a traditional cultural practices and systems under which it is difficult to achieve desired level of production, because large tree provides low production per unit area and needs higher labour inputs. Moreover, some times this plant does not flower and fruits for longer time, which could further increase the overall cost of production. An overriding need exists either to improve the traditional system of cultivation or to develop new and modem system of cultivating guava to overcome the problems inherent with this tree.**Jamwal*et al.,* (2021)**

2. MATERIALSANDMETHODS:

2.1 Geographical location of the experimental site

The experimental site is located at a latitude of 25.41º North and longitude of 81.84

ºEast,with an altitudeof98meters abovethemean sealevel(MSL).

2.2 Climatic conditions of the experimental area

The area of Prayagraj comes under humid sub-tropical climate, which experiences warm humid monsoon, hot dry summer and cold dry winter. The annual mean temperature is 26.1ºC while monthly mean temperatures are 18-29ºC. The daily average maximum temperature is about 22ºC and the minimum temperature is 9ºC. The average annual rainfall received is 1042.2 mm. At this location, the temperature reaches upto 46ºC-48ºC and the minimum temperature recorded is 4ºC-5ºC. The relative humidity ranges in this location ranges between 20-94%.

2.3 Experimental details

Table 1 TreatmentDetails

Treatment	Treatment content
T_1	Control (Recommended dose of inorganic fertilizers)
T_2	VC (30kg/plant) +*Azotobacter* @150g/tree +PSB @150g/tree +NC@3kg/tree
T_3	VC (30kg/plant) +*Azotobacter* @250g/tree +PSB @250g/tree +NC@3kg/tree
T_4	VC (30kg/plant) +*Azospirillum* @150g/tree +PSB @150g/tree +NC@3kg/tree
T_5	VC (30kg/plant) +*Azospirillum* @250 g/tree +PSB @250 g/tree +NC@3kg/tree
T_6	FYM (30kg/plant) +*Azotobacter* @150g/tree +PSB @150g/tree +NC@3kg/tree
T_7	FYM (30kg/plant) +*Azotobacter* @250g/tree +PSB @250g/tree +NC@3kg/tree
T_8	FYM (30kg/plant) +*Azospirillum* @150g/tree +PSB @150g/tree +NC@3kg/tree
T_9	FYM (30kg/plant) +*Azospirillum* @250g/tree +PSB @250g/tree +NC@3kg/tree

Note: VC – Vermicompost

NC – Neem Cake

RESULTSANDDISCUSSION

The different levels of organic manure in combination with bio fertilizers showed positive response on physical (including qualitative and quantitative) and chemical quality

attributes of guava fruits. The maximum values of physical quality characters of guava fruits like fruit weight (218) fruit length (7.6cm), fruit diameter (7.42 cm), fruit volume (213.86 cm^3), were recorded in T_9 (FYM (30kg/plant) +*Azospirillum* @250g/tree +PSB @250g/tree +Neem cake @3kg/tree) while, minimum values of these characters maximum value of physical parameter were recorded in control treatment (T_o). The maximum values of chemical quality attributes like titrable acidity (0.48), in treatment T_o and ascorbic acid content (198), T.S.S (12.0%), reducing sugar (4.24), Non reducing sugar (4.02), Total sugar (8.26). The minimum value of acidity (0.41%) was recorded in T_0. While, the minimum values for these parameters of physical quality characters.

The minimum values of chemical quality attributes like ascorbic acid content (160), TSS (9.61%), reducing sugar (3.67), non-reducing sugar (3.72), total sugar (7.39) and minimum value of acidity (0.47%) were recorded in T_1. and highest acidity (0.41) was recorded in control treatment T_9.

The maximum number of fruits per plant (26.64) was produced by the treatment T_9. and. The minimum number of fruits per plant (17.26) was recorded in control T_o. The highest, yield per plant (5.81kg) was recorded in the treatment T_9. and the lowest yield per plant (2.96kg) was recorded in control T_1. The highest yield/ ha, (23.23 ton.) was recorded in the treatment T_9 and While, the lowest yield (11.95 ton.) was recorded in control T_1.

Table-2 Effect of different fruit bagging treatments on maturity, Fruit drop, Polar diameter of fruit and Radial diameter of fruit and fruit weight

Table-2 Effect of different fruit bagging treatments on different quantitative and qualitative parameters of guava plant.

Treatment	Fruits length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit volume (cm^3)	Number of fruits per plant	Yield per plant (kg)	Yield (t/ha)
T_1	6.20	4.98	173	64.66	17.26	2.99	11.95
T_2	6.30	5.50	182	87.10	20.36	3.71	14.68
T_3	7.00	6.19	195	124.16	22.29	4.35	17.36
T_4	6.10	6.27	204	129.04	23.54	4.80	19.23
T_5	6.20	6.36	206	134.68	24.09	4.96	19.79
T_6	6.30	6.66	209	154.65	24.34	5.09	20.36

T_7	6.70	7.26	211	200.32	25.28	5.33	21.31
T_8	7.30	7.33	214	206.17	26.05	5.57	21.93
T_9	7.60	7.42	218	213.86	26.64	5.81	23.12
Ftest	S	S	S	S	S	S	S
SE	0.18	0.28	5.05	17.57	0.99	0.32	1.2
CD at 5 %	0.08	0.13	2.27	7.91	0.45	0.16	0.54
CV	8.26	12.97	7.6	36.09	12.97	18.12	19.15

Table 3.Effect of different bagging treatment on quality parameter of guava fruit.

Treatment	TSS	Titrable acidity (%)	Ascorbic acid	Reducing sugar	Non reducing sugar	Total sugar
T_1	9.61	0.47	160	3.67	3.72	7.39
T_2	9.8	0.46	161	3.62	3.64	7.26
T_3	10	0.46	161	3.68	3.74	7.42
T_4	10.1	0.46	167	4.2	3.9	8.1
T_5	10.2	0.45	170	4.21	3.93	8.14
T_6	10.5	0.45	171	4.22	3.94	8.16
T_7	10.7	0.44	198	4.23	4.01	8.24
T_8	10.8	0.44	198	4.24	4.01	8.25
T_9	12	0.41	198	4.24	4.02	8.26
Ftest	S	S	S	S	S	S
SE	0.24	0.01	5.65	0.09	0.05	0.14
CD at 5 %	0.11	0	2.54	0.04	0.02	0.06
CV	7	3.93	9.79	7.04	3.68	5.35

Table 4.Economics of different bagging treatment of guava fruit.

Treatment	Cost of cultivation(Rs.)	Gross return(Rs.)	Net returns (Rs.)	Benefits cost ratio
T_1	84900	103600	18700	1.22
T_2	92400	120500	28100	1.3
T_3	94000	175200	81200	1.86
T_4	97400	192400	95000	1.98
T_5	97500	197900	100400	2.03
T_6	97500	203600	106100	2.09
T_7	102000	213000	111000	2.09
T_8	102500	219800	117300	2.14

T_9	102500	232400	129900	2.27

Conclusion:

The application of bio fertilizers and organic manures has a beneficial effect on the availability of major nutrients in the soil and increase the soil fertility that helps in maintaining the plant growth for the fruits at a desired level. It can be concluded that, for better growth, yield and for better productivity, the guava trees should be fertilized with (FYM (30kg/plant) +*Azospirillum* @250g/tree +PSB @250g/tree +Neem cake @3kg/tree) per year with treatment T_9.

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