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Effect of different organic sources and biofertilizers on yield and quality production in mango cv. Alphonso

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Abstract
An investigation was conducted at Regional Fruit Research Station, Vengurla of Maharashtra, India during 2017-18 to standardize the organic nutrient with biofertilizers management protocol for mango. In this experiment, various organic sources along with various biofertilizers combinations were tested on thirty year old mango cultivar Alphonso to study the effect on fruiting and yield. The maximum number of fruits (52.00 fruits/tree) and while minimum yield (14.70 kg/tree) was recorded with T_2 while minimum number of fruits (35.00 fruits/tree) and yield (9.40 kg/tree) with T_1. High average weight of fruits (317.40 g) and minimum acidity (0.12%) was recorded with T_7, while less average weight of fruit (263.63 g) and maximum acidity (0.23%) was recorded with T_4. Based on the results, it may be concluded that application of FYM (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree was more remunerative in comparison to other treatments.

Keywords: Biofertilizers, mango, yield, quality, alphonso

Introduction
Mango *(Mangifera indica* L.), the King of fruits, is the most important fruit in the tropical and subtropical region of the world. The nutritional and economic importance makes mango very popular over the world. Alphonso is one of the most popular varieties of India. The fruits are very attractive, large in size having a prominent ventral shoulder and attractive pinkish flush toward the basal end. The taste is superb with an excellent sugar: acid blend and captivating flavour besides being a Table cultivar, much in demand it is a favoured fruits of the processing industry because it remains its characteristics flavour even during processing. Indiscriminate use of inorganic chemical fertilizers resulted in high amount of chemical residues in field as well as in the crop produces leading to various environmental and health hazards along with socio-economic problem. Again the increasing cost of fertilizer and global concern of ground water pollution through leaching from the soil are discounting the use of fertilizers. So, it is necessary, to maintain the soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner (Chundawat, 2001) [2].
Biofertilizers are living organism which add, conserve and mobilize the plant nutrients in the soil. Biofertilizer based on renewable energy source are cost effective supplement to chemical fertilizers and can help to economize on the high investment needed for fertilizer use (Motsara *et al.*, 1995) [4]. Use of organic manures has also been recommended in Mango (Munniswami, 1970) [8]. The beneficial effect of bio-fertilizers is now well established in fruit crops like papaya (Sukhade *et al.*, 1995) [14] and (Gogoi *et al.*, 2004 [3] in banana). However, very little work has been done on the use of biofertilizers in mango. With these backgrounds the present experiment was designed with the objective to supplement the use of ever organic sources with the incorporation of biofertilizers that could ensure ecofriendly environment.

Materials and Methods
The various inputs along with biofertilizers, vermi compost, farmyard manure were applied in 35 years old trees of mango cv. Alphonso during 2017-2018 in a field experiment designed in randomized block design with three replications at Regional Fruit Research Station, Vengurla, Dr. B.S.K.K.V., Dapoli 416 516, Maharashtra. In order to assess the effect of various treatments, all trees were managed with uniform cultural practices as per the standard recommendations with respect to irrigation and plant protection measures. The treatment details are as follows.

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Tr. No.	Treatment details
T_1	FYM (50 kg/plant)
T_2	FYM (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree
T_3	FYM (50 kg/plant) + *Azotobactor* (250 g/tree) + PSB @ 250 g/tree
T_4	Vermicompost (50 kg/plant)
T_5	Vermicompost (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree
T_6	Vermicompost (50 kg/plant) + *Azatobactor* (250 g/tree) + PSB @ 250 g/tree
T_7	Vermicompost (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree + Vermi wash foliar spray

The observations on number of fruits per plant, fruit weight, and yield per plant were recorded at harvest stage. Quality parameters like total soluble solid (TSS) and titrable acidity content of ripen fruits were analyzed following the methods described by A.O.A.C. (1984). Experimental data were statistically analyzed following the analysis of variance method (Panse and Sukhatme, 1978).

Result and Discussion

Number of fruits per tree

The data on number of fruits are presented in Table 1. Maximum number of fruits (52.00 fruits/ tree) was recorded by T_2 treatment with application of FYM (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree, however treatment T_3 and T_5 were found at par while, the minimum number of fruits were recorded with application of FYM (50 kg/plant) FYM favoured mineralization of organic sources of nitrogen in the soil and also due to increased microbial activity which could have stimulated the nitrification process. A buildup of nitrogen and organic carbon in soil with different organic sources and levels combined with bio-fertilizers has also been reported by Mishra *et al.* (2011) [7] in ber. Similar types of results were also obtained by Pereira and Mitra (1999) [11] in guava. Higher fruit number was mainly due to better vegetative growth and improvement in the physiological condition which caused higher percentage of flowering, fruit set and retention.

Average fruit weight (g)

The results revealed that the among different combinations treatment T_7 organic and biofertilizers, Vermicompost (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree + Vermi wash foliar spray (dilution with water @ 1:1) produced maximum average fruit weight (317.40 g/fruit) whereas T_6 is at par with this treatment and minimum in treatment T_4 Vermicompost (50 kg/plant). The increase in average fruit weight due to the integration of organic sources of nutrients occurred due to accelerated mobility of photosynthates from source to sink as influenced by the growth hormones, released or synthesized due to organic sources of nutrients. Similar results were also observed by Yadav *et al*. (2011) [15] in mango.

Application of organic manures with different biofertilizers significantly added as well as native phosphorus making more available to fruits result to increase the fruit weight. These results are in accordance with Patidar and Mali (2004) [10] in sorghum and Dey *et al*. (2005) [5] in guava.

Yield (Kg/tree)

Improvement in fruit yield was recorded with application of different treatments. The data on fruit yield presented in Table 1. Maximum fruit yield (14.70 kg/tree, 1.47 t/ha) was recorded by treatment T_2 (application of FYM (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree) treatment T_3, T_6 and T_7 are at par with this. Minimum in application of FYM (50 kg/tree). Similar results were showed with respect to yield (t/ha). Improvement in fruit yield and quality was recorded with application of various organic inputs. This may be due to the balance nutrient management, as organic inputs contained major, micro nutrients and plant growth promoting microbes. Results of present study is in support with the study of Ram and Rajput (2000) [12] in mango, Jeeva *et al*. (1988) [6] and Ram *et al*. (2017) [13] in guava cv. Allahabad safeda. Similar types of results were also obtained by Pereira and Mitra (1999) [11]. Higher fruit yield was mainly due to better vegetative growth and improvement in the physiological condition which caused higher percentage of flowering, fruit set and retention.

Total Soluble Solid (^{O} Brix) and acidity (%)

Regarding TSS showed non-significant relation among different treatments. However, the total soluble solids (TSS) was the highest (18.27 ^{O} Brix) in the fruit juice from by plant treated with FYM (50 kg/plant). Minimum acidity (0.12 %) was recorded with the application of Vermicompost (50 kg/plant) + *Azospirillum culture* (250 g/tree) + PSB @ 250 g/tree + Vermi wash foliar spray, while the maximum (0.27 %) in FYM (50 kg/plant). Ram *et al.* (2017) [13] have also reported improvement in fruit quality parameters with application of organic amendments. It was observed that nitrogen stimulates the functioning of enzymes in the physiological processes, which have improved the total soluble solids content of the fruits.

These studies thus concluded that organic source along with biofertilizer when applied in integrated manner can be replaced with chemical fertilizers for increasing the yield, quality and nutrient status of mango.

Table 1: Effect of organic package on fruit yield and quality of mango

Sr. No.	Treatments	Average fruit weight (g)	No. of fruits (fruits/tree)	Yield (kg/tree)	Yield (t/ha)	TSS (^{O}B)	Acidity (%)
1	T_1	268.57	35.00	9.40	0.94	18.27	0.27
2	T_2	282.69	52.00	14.70	1.47	18.10	0.17
3	T_3	268.75	48.00	12.90	1.29	17.60	0.20
4	T_4	263.63	44.00	11.60	1.16	17.67	0.23
5	T_5	266.60	42.00	11.20	1.12	18.07	0.20
6	T_6	300.00	46.00	13.80	1.38	17.57	0.23
7	T_7	317.40	43.00	13.65	1.37	17.63	0.12
SEm±		9.89	2.0	0.60	0.06	0.92	0.02
CD at 5%		30.48	6.43	1.85	0.18	NS	0.07

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