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***Short communication***

# Effect of integrated nutrient management on the quality of Ganesh pomegranate

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## ABSTRACT

**A field experiment was conducted to find out the effect of integrated nutrient management in pomegranate under Marwar agro-climatic conditions of Rajasthan. The results revealed that among the different treatments used, the application of vermicompost @ 10 kg + 25% recommended dose of NPK + 5 kg *neem* cake + *PSB* 20 per plant significantly increased the quality components of pomegranate. Further, this treatment also improved fruit quality in terms of TSS (14.91%) , TSS: acid ratio (41.62), ascorbic acid (14.39 mg/100 g aril), total sugars (14.24%) and organoleptic score (8.51) as well as leaf and soil nutrient status as compared to recommended dose of NPK (500 : 200 : 500 g). The leaf nitrogen (2.75%), phosphorus (0.47%) and potassium (1.76%) contents at harvest were significantly increased by the application of vermicompost @ 10 kg + 25% recommended dose of NPK + 5 kg *neem* cake + *PSB* 20 per plant.**

**Key words:** *Punica granatum*, farm yard manure, biofertilizers, quality parameters, TSS, vermicompost.

Pomegranate (*Punica* granatum L.) is one of the important fruit crops of tropical and sub-tropical world. The characteristic ability of the fruit to withstand harsh climatic condition makes it able to grow in hot arid region. It is grown for its cool and refreshing juice. The ripe fruit of pomegranate contain 12-16 per cent sugars and 1.5-2.5 per cent acid. Infect, it contains more sugars than apricots, plums, peaches and oranges. Besides being commercially important, it has some medicinal value, and is considered beneficial for the patients of leprosy, dysentery and diarrhea. The rind of the fruit contains about 30 per cent tannin, which can be used for tanning leather. India ranks first in pomegranate production (26.13 lakh metric tonnes) in the world, contributing 60-70% to the international pomegranate trade by exporting 2.81 per cent of the production (Anon., 3).

In India, pomegranate is commercially cultivated in Maharashtra, Andhra Pradesh, Uttar Pradesh, Gujarat, Rajasthan, Tamil Nadu and parts of Karnataka where good quality fruits are produced due to dry and hot climatic conditions. In India, more than 70% of the total production is used as table purpose, and pomegranate is in great demand of fresh fruits both in domestic and international markets. For higher production of quality fruits in a sustainable manner, application of nutrients at proper doses is very important. It is a reality that proper dose of nutrients to be standardized for a set of agro-climatic conditions, which in turn to be economically acceptable, viable and eco-friendly suitable. In India, most of the fertilizer recommendations in pomegranate on the basis of higher quantity of inorganic fertilizers like 500-1000 g N, 500 g $P_2O_5$ and 250-500 g $K_2O$ plant/ year (Saraf *et al*.,18). The INM have been recognized to influence fruit quality of pomegranate. Therefore, an investigation was conducted to study the effect of INM on fruit quality of pomegranate cv. Ganesh.

The study was under taken at Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan). The Experimental Block is located at 24° 34′ N latitude and 7° 42′ E longitudes at an elevation of 582.17 m above mean sea level. The soil of the experimental site was clay loam having soil pH of about 8.0 with electrical conductivity of 0.94 $dSm^{-1}$ and 0.71 per cent organic carbon. The available N, P and K were 282.1, 23.0 and 305.94 kg $ha^{-1}$ respectively. In fact, in arid and semi arid areas, low precipitation, extremes of temperature, high wind velocity, poor soil fertility, soil salinity etc. are the major constraints of farming. The guava, though, it is a hardy plant to various biotic and abiotic stresses but needs proper management with respect to nutrition, moisture management and plant canopy architecture for obtaining higher yield per unit area. In eastern Rajasthan, *Mrig Bahar* crop is taken by withholding the irrigation in the month of May.

In present investigation, 5-years-old pomegranate orchard of a 'Ganesh' planted at distance of 4 m × 6 m was selected for the study. The manure and fertilizer treatments were applied in middle of June during both the years of experimentation. The first light irrigation was given immediately after application of treatment,

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and thereafter one or two light irrigations were given before the onset of rains. The trees started growth by July with onset of rains, flowers in August-September and produced fruits during winter season (December-January).

The experiment was laid out in Randomized Block Design (RBD) with four replications, considering four plants as treatment unit. The INM treatments comprised of inorganic fertilizers (NPK), organic manures (vermi-compost and farm yard manure) and biofertilizers (*Azotobacter, Azospirillum* and PSB). The total treatment combinations were 17 *viz*., Recommended dose of NPK, *i.e.* 500 : 200: 500 g NPK/plant without organic manure (T1), Organic manure, *i.e.* vermicompost (10 kg / plant) + *Neem* cake (5 kg / plant) + *Karanj* cake (5 kg / plant) without inorganic fertilizer (T2), Vermicompost (10 kg / plant) + 50% rec. dose of NPK (T3), Vermicompost (10 kg / plant) + 50% rec. dose of NPK + *PSB* (20 g/plant) (T4), (Vermicompost (10 kg / plant) + 50% rec. dose of NPK + *Azotobacter* (20 g/plant) (T5), *Neem* cake (5 kg/ plant) + 50% rec. dose of NPK (T6), *Neem* cake 5 kg + 50% rec. dose of NPK + *PSB* (20 g/ plant) (T7), (*Neem* cake 5 kg + 50% rec. dose of NPK + *Azotobacter* (20 g/plant) (T8), *Karanj* cake (5 kg / plant) + 50 rec. dose of NPK) (T9), *Karanj* cake (5 kg / plant) + 50% rec. dose of NPK + *PSB* (20 g/plant) (T10), *Karanj* cake (5 kg / plant) + 50% rec. dose of NPK + *Azotobacter* (20 g/plant) (T11), Vermicompost 10 kg + *Neem* cake 5 kg + 25% rec. dose of NPK) (T12), Vermicompost 10 kg + *Neem* cake 5 kg + 25% rec. dose of NPK + *PSB* (20 g/plant) (T13), vermicompost 10 kg + *Neem* cake 5 kg + 25% rec. dose of NPK + *Azotobacter* (20 g/plant) (T14), Vermicompost 10 kg + *Karanj* cake (5 kg / plant) + 25% rec. dose of NPK) (T15), vermicompost 10 kg + *Karanj* cake (5 kg / plant) + 25% rec. dose of NPK + *PSB* (20 g/plant) (T16) and vermicompost 10 kg + *Karanj* cake (5 kg / plant) + 25% rec. dose of NPK + *Azotobacter* (20 g/plant) (T17). Observations on quality characters were recorded and subjected to statistical analysis. The fully ripe fruits were selected for analysis of quality parameters TSS Brix$^0$, TSS: Acid, ascorbic acid (A.O.A.C., 1) total sugar (Dubois *et al*., 6) and organoleptic score (Amerine *et al*., 2) as well as leaf and soil nutrient (Jackson (7) and Richards (17) status at harvest. The data on various parameters were analyzed with M-STAT statistical package to test the significance of the treatments.

Application of inorganic fertilizers, organic manures and biofertilizers significantly improved the nutritional quality of pomegranate fruits in terms of TSS, acidity, TSS/acid ratio, ascorbic acid and sugar content as compared to control (Table .1). It is further evident from the data that application of organic manures and biofertilizers proved significantly superior over inorganic fertilizers treatment. However, among various treatments, the application of 10 kg VCM + 5 kg *neem* cake + 25% recommended dose of NPK + 20 g PSB ($T_{12}$) was found to be the best treatment with respect to nutritional quality parameters of the fruit. The maximum TSS content of 16.95°Brix, minimum acidity of 0.41%, highest TSS/acid ratio of 41.62, ascorbic acid content (14.39 mg/100 g), reducing sugars (12.82%), non-reducing sugar (1.35%), and total sugars (14.24%) (Table 1). These are in accordance with those of Yadav and Rathore (20) in *ber* and Ram *et al*. (13) in guava.

It is well documented fact that incorporation of organic manures in the soils not only acts as store house of major and micro-nutrients but also favorably improve physical, chemical and biological properties of the soils. These results are in agreement with Ranjan and Ghosh (16). Thus, the potential role of organic fertilization on various aspects of crop growth can be ascribed due to its direct effect on availability of vital nutrients along with physico-chemical and biological properties of soils and indirectly *via* release of growth hormones, vitamins and augmenting microbial population *etc*. during its process of decomposition (Naik and Haribabu, 11; Ram and Rajput, 13). Similarly, the beneficial effect of *PSB* on fruit quality with respect to TSS and acidity might be due to phosphate solubilising bacteria that solubilise the insoluble forms of phosphorus and make them available to the plants. The mechanism of stabilization appears to be acid metal reaction and thus dissolution and chelation of metal and release of P. These are also known to produce acids, vitamins, growth promoting substances like IAA, $GA_3$, etc. which might improve the quality of fruits (Kashyap *et al*., 8).

The results of the experiment revealed that leaf nutrient status with respect to nitrogen; phosphorus and potassium content were increased over control after the termination of the trial due to various treatments (Fig. 1). The combined application of 10 kg VCM + 5 kg *neem* cake + 25 % recommended dose of NPK + 20 g *PSB* was found to be significantly superior over 100 % recommended dose of NPK.

The leaf nutrient status was also significantly influenced by combined application of organic, inorganic and biofertilizers. The results of the present investigation are in conformity with the finding of Aseri *et al*. (4), who reported importance of vermicompost in the crop production. The results of the present investigation are in close agreement with the finding of Kumar *et al*. (9) who also reported that the different levels of N, P and K fertilizers significantly influenced

**Table 1.** Effect of INM treatments on quality parameters of pomegranate cv. Ganesh.

| Treatment | Organoleptic rating | Juice (%) | TSS (°B) | Acidity (%) | TSS / acid ratio | Ascorbic acid (mg/100 ml juice) | Reducing sugar (%) | Non-reducing sugar (%) | Total sugars (%) |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 6.25 | 64.95 | 15.05 | 0.61 | 24.75 | 10.76 | 10.85 | 1.15 | 12.06 |
| T2 | 5.95 | 64.85 | 14.75 | 0.59 | 25.08 | 10.52 | 10.82 | 1.14 | 12.03 |
| T3 | 6.55 | 65.50 | 15.30 | 0.57 | 27.07 | 11.13 | 10.87 | 1.21 | 12.14 |
| T4 | 7.75 | 72.26 | 16.16 | 0.46 | 35.25 | 13.72 | 12.27 | 1.32 | 13.66 |
| T5 | 7.75 | 71.80 | 16.11 | 0.48 | 33.85 | 13.60 | 12.11 | 1.31 | 13.49 |
| T6 | 6.91 | 67.85 | 15.66 | 0.52 | 30.37 | 12.66 | 11.52 | 1.27 | 12.85 |
| T7 | 7.41 | 69.46 | 15.85 | 0.50 | 32.16 | 13.21 | 11.86 | 1.30 | 13.23 |
| T8 | 7.01 | 69.03 | 15.73 | 0.50 | 31.29 | 12.76 | 11.77 | 1.29 | 13.13 |
| T9 | 6.44 | 66.43 | 15.29 | 0.54 | 28.14 | 11.86 | 11.02 | 1.21 | 12.30 |
| T10 | 6.79 | 67.31 | 15.41 | 0.53 | 29.45 | 12.29 | 11.49 | 1.23 | 12.79 |
| T11 | 6.69 | 66.90 | 15.52 | 0.54 | 29.03 | 12.18 | 11.32 | 1.24 | 12.62 |
| T12 | 8.01 | 73.54 | 16.40 | 0.53 | 29.45 | 12.29 | 12.40 | 1.32 | 13.78 |
| T13 | 8.51 | 76.60 | 16.95 | 0.54 | 29.03 | 12.18 | 12.82 | 1.35 | 14.24 |
| T14 | 8.34 | 76.26 | 16.87 | 0.45 | 36.59 | 13.84 | 12.71 | 1.34 | 14.12 |
| T15 | 7.41 | 70.96 | 16.01 | 0.41 | 41.62 | 14.39 | 11.97 | 1.31 | 13.35 |
| T16 | 8.11 | 76.30 | 16.71 | 0.42 | 40.75 | 14.30 | 12.62 | 1.34 | 14.03 |
| T17 | 7.93 | 75.76 | 16.68 | 0.49 | 32.85 | 13.42 | 12.56 | 1.33 | 13.96 |
| $CD_{0.05}$ | 0.46 | 4.23 | 0.56 | 0.02 | 1.78 | 0.56 | 0.50 | 0.11 | 0.49 |

leaf nutrient status. Similarly, the application of *PSB* @ 20 g per plant significantly increased N and P status of leaf at harvest, whereas, the K content of leaf was non-significant. Our results are in close agreement with the findings of Ram *et al*. (15) and Naik and Babu (11) in guava.

The results of soil analysis at harvesting revealed that available nitrogen, phosphorus and potash content of soil significantly increased due to different treatments as compared to control (Fig. 2). The application of organic manures and biofertilizers were found to be significantly superior over 100% recommended dose of NPK with respect to N and P.

The data further reveal that application of different levels of NPK treatment significantly increased the available NPK content of soil. Among the different treatments combined application of 10 kg VCM + 5 kg *neem* cake + 25% recommended dose of NPK + 20 g *PSB* showed higher fertility status of the soil in terms of NPK content of soil. It may be improvement in following use of VCM and NC. The results of the present investigation are in close agreement with the finding of Dey *et al*. (5), who stated that the availability of phosphorus gets released from fixed phosphorus in the soil by the application of phosphate solubilising bacteria.

From the discussion undergone it becomes quite clear that different nutritional treatments in pomegranate significantly affected the growth, yield and quality of fruit. Among the different organic manure, the investigation revealed that the vermicompost was superior over the other organic manures in improving vegetative growth, flowering fruiting, yield and yield attributes and fruit quality. Further, the organic manures improved the soil fertility and leaf nutrient status of guava plant .The conformity with finding of Shukla *et al.* (19). Similarly, among the different levels of inorganic fertilizer, the application of 25% recommended dose of NPK was found to be superior with respect to growth, flowering, fruiting and yield of pomegranate. The application of *PSB* @ 20 g per plant also improved the growth and yield of pomegranate. These treatments were also found most economic in terms of net return and benefit cost ratio. Therefore, based on the findings Vermicompost @ 10 kg per plant, 25% recommended dose of NPK and *PSB* @ 20 g per plant in the month of June may be applied in pomegranate to obtain higher yield and quality fruits in pomegranate. The maximum net return (Rs. 1,78,843.20/ha) and B:C ratio (3.72) recorded at $T_{12}$ treatment *i.e.* 10 kg VCM + 5 kg *neem* cake + 25 % recommended dose of NPK + *PSB* @ 20 g/ plant.

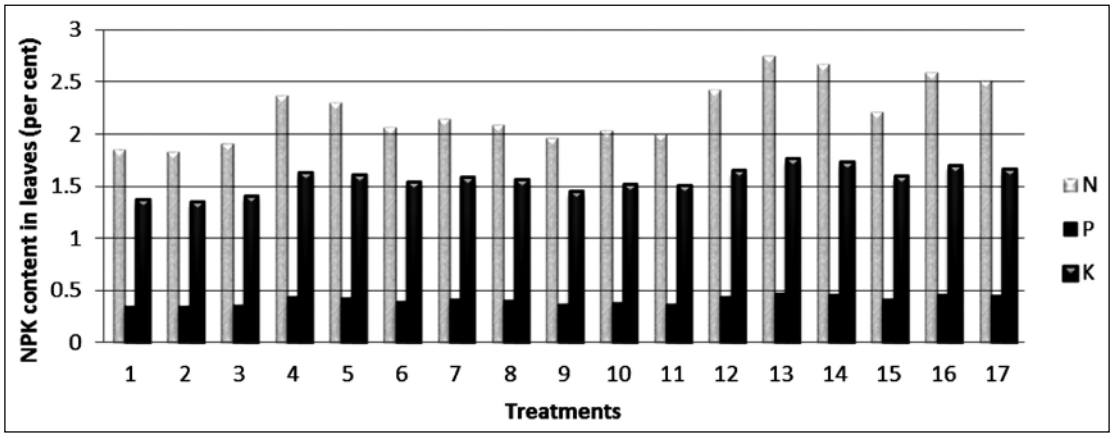


**Fig. 1.** Effect of INM on leaf nutrient status of pomegranate cv. Ganesh.

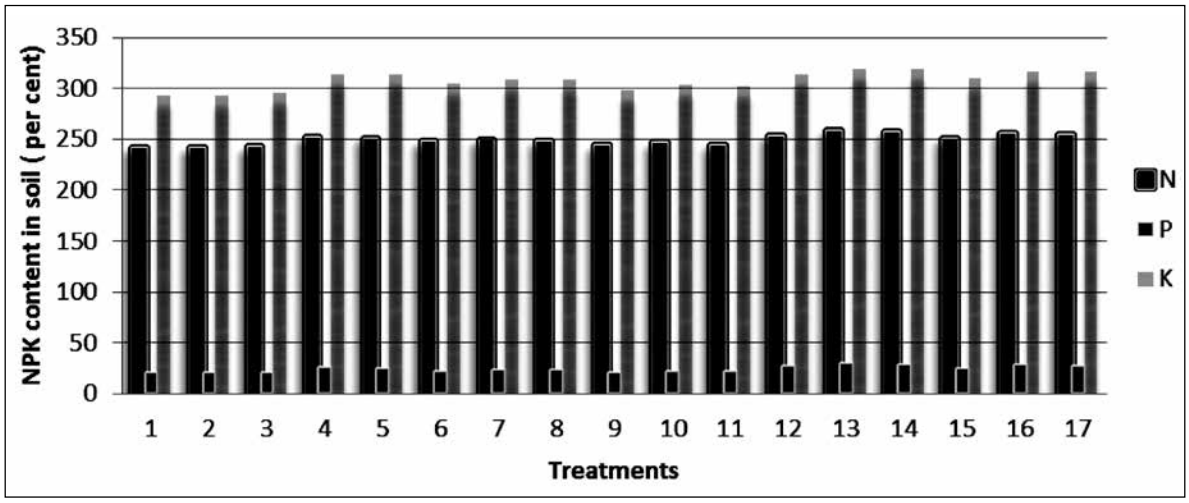


**Fig. 2.** Effect of INM on soil nutrient status of pomegranate cv. Ganesh.

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