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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(6): 920-924

www.thepharmajournal.com
Received: 08-02-2022
Accepted: 17-05-2022

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Study the effect of nutrient application in split doses on yield characters under high density planting of mango (*Mangifera indica* L.) cv. Kesar

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Abstract
This paper presents, research results on effect of nutrient application in split doses on yield characters under high density planting of mango (*Mangifera indica* L.) cv. Kesar was undertaken at Instructional cum Research farm, Department of Horticulture, MPKV., Rahuri Dist. Ahmednagar during the year 2019-20 and 2020-21. The experiment was laid out in the Randomised block Design (RBD) with five treatments and four replications and three plant served as a treatment unit (plant/replication). The application of nutrients in split doses (F_1 -F_5) significantly influence the yield parameters in high density planting of mango. Maximum fruit weight (241.28 g), number of fruit (61.05), fruit yield (14.73 kg/plant and 12.27 t/ha), length (11.10 cm) and diameter (7.08 cm) were observed at F_4 (50% NPK at initial stage, 50% P at one month before flowering, 20% N and K at Peanut stage, 20% N and K at Marble stage, 10% N and K at Egg stage) whereas minimum was observed at control F_5 (Control- Recommended dose of fertilizers- 50% N and 100% P & K at initial stage and 50% N at one month before flowering).

Keywords: Yield character, nutrients, split doses, high density planting, mango

Introduction
Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae, is the oldest and choicest fruit of the world. Mango is believed to be originated to South East Asia, Indo Burma region, in the foot hills of the Himalayas (Bose, 1985 & Mukherjee, 1951) [3, 14]. Mango is cultivated in an area of 2.32 million hectares with a production of 20.90 million tonnes and a productivity of 9.7 MT/ha and in Maharashtra area under mango cultivation is 0.167 million hectares with a production of 0.791 million tonnes (Anon., 2021) [1].

Kesar is the most popular mango variety in Maharashtra and has good export potential. In recent years, high density planting system of mango is getting popularity. Adoption of High-Density Planting (HDP) system with proper canopy management practices coupled with drip-fertigation system is highly essential to increase the productivity (Kumar, 2013) [12]. Fruit plant removes large amount of essential nutrient reserves in the soil. Over the time, continues depletion of nutrients decreases fruit yield and soil fertility and lead to soil degradation. On the other hand, excess or continuous use of inorganic fertilizers as source of nutrient in imbalance proportion creates problems, causing economic inefficiency, threaten the environment and human beings. Among the factors that influence crop production, fertilizer is the most important one, Mango trees mostly in the homestead and the trees in the orchard hardly receive any fertilizer (Hossain, 1989) [8]. Nutrient management in mango is one of the important practices for improving yield and quality of fruits. Fertilizer must supply and maintain an optimum level of nutrients within the root zone. The fertilizers are becoming costly input day by day. Hence, it is felt necessary to study the efficient use of this input. This can be achieved by adopting efficient use of drip system of irrigation. In addition to that, mango plants are biannual (Avilan, 1971) [2], that is a high yield in a year is followed by a low yield in the subsequent year and this fact may complicate the establishment of an adequate fertilization strategy. In the past, researchers have paid more attention on the use of proper amount of fertilizer to increase the yields in mango, but very little work has been done on the split and continuous application of fertilizers on regular basis. The present study was therefore undertaken to find out the effects of fertilizer and its instalment of application at different stages of plant growth on yield and quality of mango.

Material and Method

An investigation on "Study the effect of nutrient application in split doses on yield characters under high density planting of mango (*Mangifera indica* L.) cv. Kesar" was undertaken at Instructional cum Research farm, Department of Horticulture, MPKV., Rahuri, Dist. Ahmednagar during the year 2019-2021. The experiment was conducted in Randomised Block Design (RBD) with five treatment of split nutrient application, four replication and three plant served as a treatment unit (plant/replication). The nutrients was applied in split doses (F_1 – 50% NPK at initial stage and 50% NPK at one month before flowering, F_2 – 50% NPK at initial stage, 50% P and 25% K at one month before flowering, 25% N at Peanut stage and 25% N at Marble stage, F_3 – 50% NPK at initial stage, 50% P at one month before flowering, 50% N and 25% K at Peanut stage and 25% K at Marble stage, F_4 – 50% NPK at initial stage, 50% P at one month before flowering, 20% N and K at Peanut stage, 20% N and K at Marble stage, 10% N and K at Egg stage, F_5 – (control) Recommended dose of fertilizers 50% N and 100% P & K at initial stage and 50% N at one month before flowering). The number of fruit borne on the tree at the commencement of first harvest was counted and expressed as number of fruit per tree. Individual fruit was weighed on electronic balance and the average weight was expressed in grams, yield per hectare was obtained by multiplying average weight of fruit by total number of fruit per tree and expressed in kilograms per plant and ton per hectare. Fruit length and diameter was determined at harvest stage with the help of Vernier caliper and expressed in centimeters.

Result and Discussion

Weight of Fruit (g)

The effect of nutrient application was found significant on fruit weight in both the years and in pooled (Table 1 and Fig. 1). The maximum fruit weight was recorded in first year, second year and pooled were 238.85, 243.70 and 241.28 g in F_4 and it was at par with F_3 (233.00 g) in first year, F_2 (237.80 g) F_3 and F_5 (234.60 g) in second year and F_2 (233.96 g) and F_3 (235.60 g) in pooled, respectively. The minimum fruit weight 227.13 at F_5, 226.30 and 228.15 g was recorded at F_1 in first year, second year and pooled, respectively.

This increase in weight at F_4 is might be due to increased synthesis of metabolism to fruit and due to accumulation of sugars and high pulp percentage in plants treated with continuous dose of N, P and K. Another probable cause could be greater mobility of these major nutrients to the developing fruit which acted as strong metabolic sink and it stimulates the synthesis of chlorophyll and increased photosynthetic activity which results in increased stored food material in the tissue (Singh and Rajput, 1977) [19]. Similar results were also obtained by Chandrakumar *et al*. (2001) [12] in banana and Sharma *et al.* (2005) [18] in papaya.

Number of fruit per plant

The effect of nutrient application was found significant in second year and non-significant in first year and pooled on number of fruit per plant (Table 1 and Fig. 2). The maximum number of fruit per plant was 58.40 at F_4 in first year and was non-significant, 63.70 at F_4 in second year it was at par with F_2 (56.30) and 61.05 was recorded for F_4 in pooled and it was non-significant, respectively. The minimum number of fruit per plant 53.90 at F_2 in first year, 50.79 at F_1 in second year and 53.20 at F_5 in pooled, respectively. This increasing the number of fruit per plant at F_4 is due to irrigation at the time of nutrients application provides appropriate moisture at field capacity, better root development in terms of number and spread of roots, which facilitated luxuriant growth of plant due to better nutrient uptake resulting better fruit growth and development, ultimately achieving higher number of fruit per plant (Singh *et al.*, 2012) [20]. The increased number of fruit due to frequent fertilizer application was also reported by Feungchan *et al.* (1989) [6] and Makhmale *et al.* (2016) [13] in mango. Dheware *et al*. (2020) [5] found that, increasing the number of fruit per plant by application of fertilizers in split doses at fruit development stages in mango.

Yield (kg/plant)

The effect of nutrient application was found non-significant on fruit yield kg/plant in first year and significant in second year and pooled (Table 1 and Fig. 3). The maximum fruit yield 13.94 kg/plant was recorded at F_4 in first year and it was non-significant, 15.52 kg/plant at F_4 in second year and it was significantly superior among rest of the treatment and 14.73 kg/plant was also recorded at F_4 in pooled and it was at par with F_2 (12.89 kg/plant) and F_3 (13.05 kg/plant) respectively. The minimum fruit yield 12.27 kg/plant at F_5 in first year, 11.51 and 12.22 kg/plant were recorded at F_1 in second year and pooled, respectively. The increased fruit yield might be due to combine effect of these major nutrients supplied at different critical stages as compared to other treatments. Muriate of potash (MoP) applied in splits doses resulted in maximum yield due to availability of K for long time has been supported by Kanwar *et al*. (1987) [11] who opined that K was highly beneficial with regard to yield.

Yield (t/ha)

The effect of nutrient application was found non-significant on fruit yield t/ha in first year and significant in second year and pooled (table 1 and Fig. 3). The maximum fruit yield 11.62, 12.93 and 12.27 t/ha were recorded at F_4 in both the years as well as in pooled, respectively. In first year, it was found non-significant, in second year F_4 (12.93 t/ha) was significantly superior whereas in pooled F_4 (12.27 t/ha) was at par with F_2 (10.74 t/ha) and F_3 (10.87 t/ha). The minimum fruit yield 10.22 t/ha at F_5 in first year, 9.58 ton at F_1 and 10.18 ton at F_1 was recorded in second year and in pooled, respectively. This increased fruit yield (t/ha) at treatment F_4 might be due to regular supply of nitrogen to the plants increased yield and yield attributing characters because it is directly related to the synthesis of protein through amino acids (Hussain, 1970) [9]. Potassium absorption rates increased remarkably during the marble and egg stage of fruit growth which coincides with greater increases in dry matter accumulation which leads to increase in yield contributing parameters (Ghanem and Mimoun, 2010) [7].

Table 1: Effect of nutrient application in split doses on weight of fruit (g), number of fruit per tree and yield (kg/plant and t/ha) under high density planting of mango (*Mangifera indica* L.) cv. Kesar

Treatment	Weight of Fruit (g)			Number of fruit per plant			Yield (kg/plant)			Yield (t/ha)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
F_1	230.00	226.30	228.15	56.20	50.79	53.50	12.93	11.51	12.22	10.77	9.58	10.18
F_2	230.13	237.80	233.96	53.90	56.30	55.10	12.39	13.39	12.89	10.32	11.16	10.74
F_3	233.00	238.20	235.60	57.68	53.20	55.44	13.43	12.67	13.05	11.19	10.56	10.87
F_4	238.85	243.70	241.28	58.40	63.70	61.05	13.94	15.52	14.73	11.62	12.93	12.27
F_5	227.13	234.60	230.86	54.00	52.40	53.20	12.27	12.26	12.27	10.22	10.22	10.22
SE(m)±	2.44	3.19	2.88	2.89	2.60	3.10	0.68	0.61	0.75	0.57	0.51	0.63
CD @5%	7.51	9.83	8.42	NS	8.01	NS	NS	1.88	2.20	NS	1.56	1.84

Length of Fruit (cm): The effect of nutrient application was found significant on length of fruit (cm) in first year, second year and pooled (Table 2 and Fig. 4). The maximum length of fruit 11.12, 11.09 and 11.10 cm was recorded at F_4 in first year, second year and in pooled, respectively and it was at par with F_3 (10.90, 10.91 and 10.90 cm) in both the years as well as in pooled, respectively. The minimum fruit length 10.11, 9.97 and 10.04 cm was recorded for T_5 in first year, second year and in pooled, respectively. This increasing length of fruit at F_4 is might be due to better utilization of nutrients within the plant as well as translocation of more nitrogen to the top (Muthulakshmi *et al.* 2007) [15].

Diameter of Fruit (cm)

The effect of nutrient application was found significant on diameter of fruit in both the years as well as pooled (Table 2 and Fig. 4). The maximum diameter of fruit 7.03, 7.13 and 7.08 cm was recorded at F_4 and it was significantly superior among the treatments in first year, second year and pooled, respectively. The minimum diameter of fruit 6.31, 6.59 and 6.45 cm was recorded at F_5 during both the years as well as in pooled, respectively. This increasing diameter of fruit at F_4 is might be due the involvement of K which played major role for development of physical parameters of fruit as it can adjust plant's transpiration rates by affecting stomatal activities (Popsova and Goldback 2008) [16]. Similar results were also obtained by Rathore and Chandra (2002) [7] in Ber, Jat and Kacha (2014) [10] in guava and Makhmale *et al.* (2016) [13] in mango.

Table 2: Effect of nutrient application on length (cm) and diameter (cm) of fruit under high density planting of mango (*Mangifera indica* L.) cv. Kesar

Treatment	Length (cm)			Diameter (cm)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
F_1	10.16	10.11	10.13	6.46	6.84	6.65
F_2	10.32	10.70	10.51	6.74	6.88	6.81
F_3	10.90	10.91	10.90	6.78	6.88	6.83
F_4	11.12	11.09	11.10	7.03	7.13	7.08
F_5	10.11	9.97	10.04	6.31	6.59	6.45
SE(m)±	0.12	0.14	0.14	0.06	0.06	0.02
CD @5%	0.36	0.43	0.42	0.17	0.18	0.06

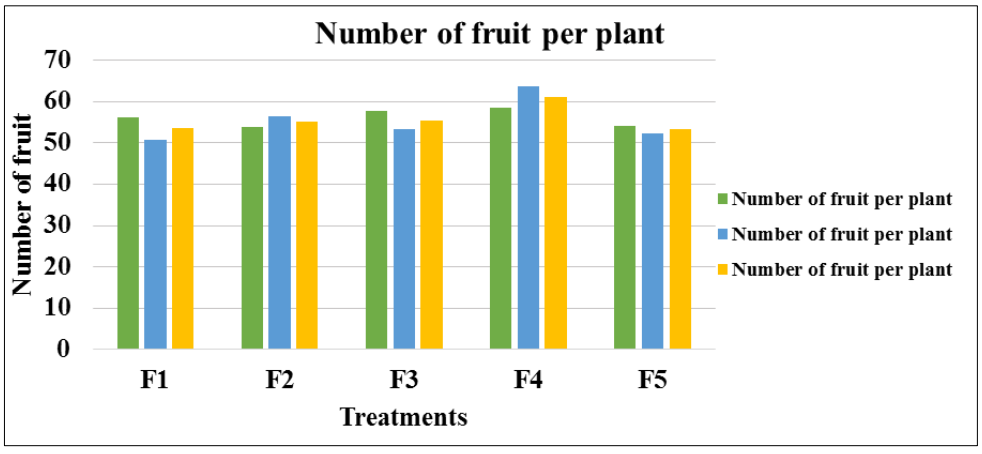

Fig 1: Effect of nutrient application in split doses on weight of fruit (g) of mango

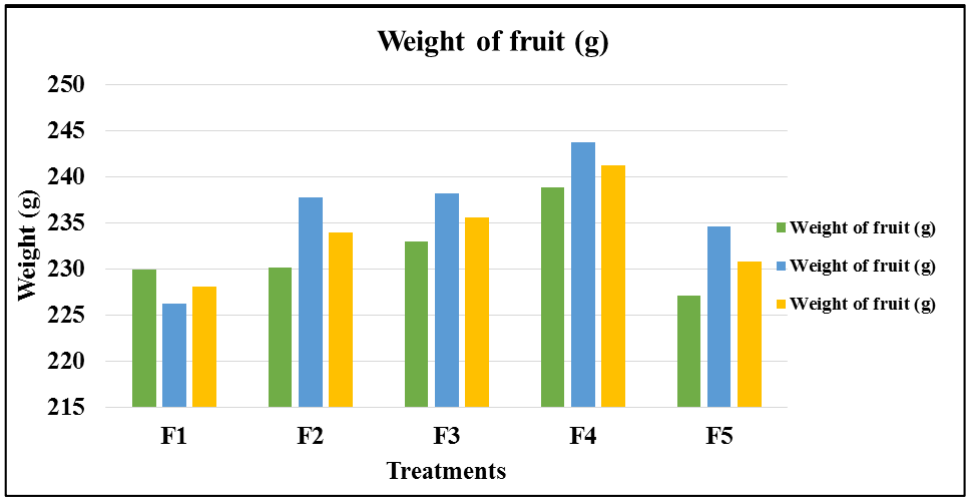

Fig 2: Effect of nutrient application in split doses on number of fruit per plant of mango

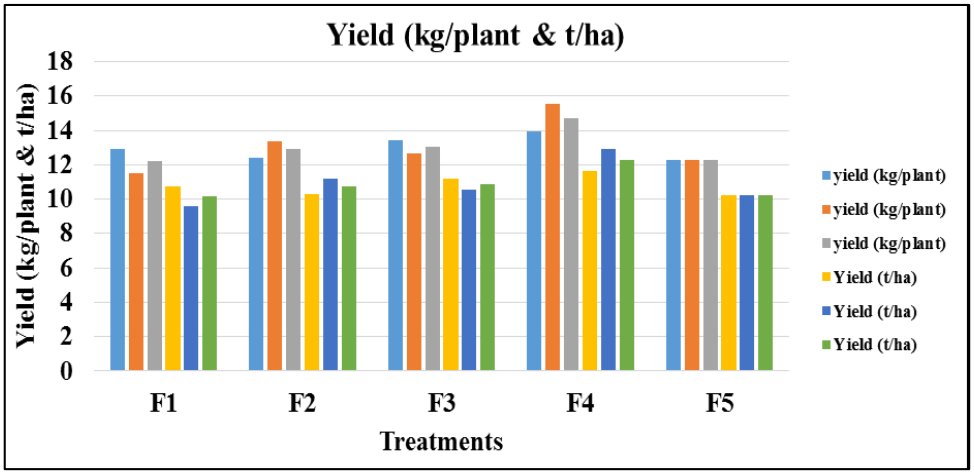

Fig 3: Effect of nutrient application in split doses on yield (kg/plant and t/ha) of mango

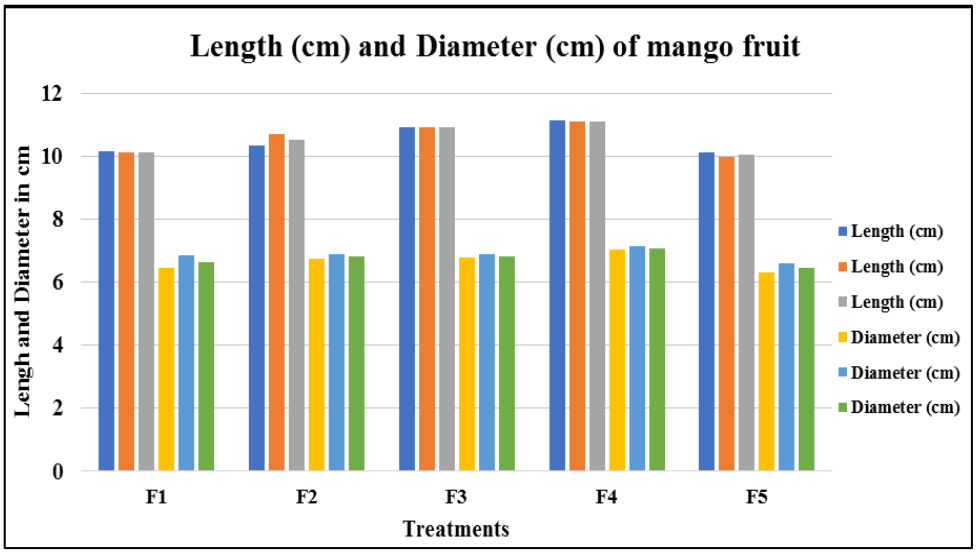

Fig 4: Effect of nutrient application in split doses on length (cm) and diameter (cm) of mango fruit

Conclusion

From the above findings it could be concluded that nutrient application F_4 (50% NPK at initial stage, 50% P at one month before flowering, 20% N and K at Peanut stage, 20% N and K at Marble stage, 10% N and K at Egg stage) was found to be the best split application for yield contributing character *viz.* number of fruit per plant, weight of fruit, yield (kg/plant and t/ha), length and diameter (cm) of fruit.

Acknowledgement

The authors are thankful to the Post Graduate Institute, MPKV., Rahuri, and Chhatrapati Shahu Maharaj National Research Institute (SARTHI) for facilitating guidance and funds, respectively to conduct the investigation.

References

1. Anonymous. Area, Production and productivity of mango in India. Indian Horticulture Database, 2021.
2. Avilan RL. Nitrogen, phosphorus, and potassium level variations in the leaf of mango (*Mangifera indica* L.) through plant production season. Agronomia Tropical. 1971;21:3-10.
3. Bose TK. Fruits of India Tropical and Subtropical, 1985, 69-123.
4. Chandrakumar SS, Thimmegowda S, Srinivas SK, Reddy BM, Devakumar N. Performance of Robusta banana under nitrogen and potassium fertigation. South Indian Hort. 2001;49(Special):92-94.
5. Dheware RM, Nalage NA, Sawant BN, Haldavanekar PC, Raut RA, Munj AY. Effect of fertigation on growth and yield of mango cv. Alphonso under Konkan agro climatic condition. J. Pharmacognosy and Phytochemistry. 2020;9(3):2001-2003.
6. Feungchan S, Yimsawat T, Chindaprasert S, Hongsbhanich N, Daito H. The effect of the fertilizer application interval on the mango. Kaen Kaset Khon Kaen Agril. J. 1989;17(2):100-105.
7. Ghanem M, Mimoun MB. Effects of potassium foliar sprays on Royal Glory peach trees. Acta Hort. 2010;868:261-265.
8. Hossain AKMA. Manual on Mango Cultivation in Bangladesh. Division of Horticulture, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, 1989;pp:40 & 82.
9. Hussain F. Effect of nitrogen application on growth, yield, and fruit composition of 'Solo' papaya (*Carica papaya* L.). U.A.R. Cairo U.A.R. Res. Bull. Fac. Agric. Aim. Shams Univ. 1970;624:11.
10. Jat G, Kacha HL. Response of guava to foliar application of urea and zinc on fruit set, yield and quality. J Agri. Search. 2014;1:86-91.
11. Kanwar JS, Nijjar GS, Kahlon GS. Effect of nitrogen, phosphorus and potassium fertilizers on growth and productivity of Dashehari mango (*Mangifera indica* L.). J. Res. 1987;24(3):411-422.
12. Kumar N. Drip-fertigation to increase the productivity of mango cv. Alphonso raised under Ultra High-Density Planting system. Paper presented at the XXII International Plant Nutrition Colloquium meeting (IPNC) held at Istanbul, Turkey from 19th to 22nd 2013 August.
13. Makhmale S, Makwana AN, Kore P, Barad AV. Effect of different fertigation treatments on yield and quality of mango cv. Kesar raised under ultra high density planting (UHDP) system. Int. J Farm Sci. 2016;6(4):1-7.
14. Mukherjee SK. The origin of mango, Indian J Genet; 1951;2:49.
15. Muthulakshmi S, Balmohan TN, Amutha R, Baby R. Fertigation studies in papaya. Res. J Agric. & Biol. Sci. 2007;3(12):260-263.
16. Popsova O, Goldback D. Sulphate of potash foliar spray effect on yield, quality and post harvest life of banana. Better crops. 2008;91:22-24.
17. Rathore RS, Chandra A. Effect of application of nitrogen on nutrient content, yield and quality of ber. Orrisa J. Hort. 2002;30(4):46-50.
18. Sharma HG, Dubey P, Agrawal N, Satpute P. Effect of fertigation through water soluble fertilizers on growth, yield and quality of papaya. *International Conference on Plasticulture and Precision Farming*. 2005, New Delhi, 2005 November 17-21, 250.
19. Singh NP, Rajput CBS. Chemical composition of guava fruits as influenced by nitrogen application. Progressive Hort. 1977;9(2):67-70.
20. Singh RM, Bhandarkar DM, Singh DK, Reddy KS, Rao KVR, Mathankar SK. Techno economic feasibility of drip fertigation in guava (*Psidium guajava* L.). Environment and Ecology. 2012;30(2):271-274.