The Pharma Innovation Journal 2022; 11(1): 124-128

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(1): 124-128

www.thepharmajournal.com
Received: 10-11-2021
Accepted: 30-12-2021

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Effect of fertilizer and chelated micronutrient on fruit set, retention, cracking and fruit drop of pomegranate (*Punica granatum* L.) Cv. Bhagwa

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Abstract
Experiment was carried out throughout two successive seasons of 2019-20 and 2020-21 on Bhagwa pomegranate trees grown under Mrig Bahar season at the Department of Horticulture, VNMKV Parbhani. The selected trees were applied with organic and inorganic fertilizer though soil application *i.e.* F_1: 100% RDF; F_2: 80% RDF + 20% RDF though FYM and F_3: 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and application of different concentration of chelated micronutrients though foliar application *i.e.* M_1: Chelated Mix formulation @ 3 gm/lit; M_2: Chelated Copper (Cu) @ 5 gm/lit; M_3: Chelated Manganese (Mn) @ 3 gm/lit; M_4: Chelated Zinc (Zn) @ 3 gm/lit; M_5: Liquid Boron (Solubor) @ 5 gm/lit and M_6: Chelated Iron (Fe) @ 5 gm/lit. Based on recorded observations maximum fruit set and fruit retention as well as minimum fruit cracking and fruit drop were recorded in F_3M_1 *i.e.* 60% RDF + 20% RDF though FYM + 20% RDF though neem cake + chelated mix formulation @ 3 gm/lit.

Keywords: Pomegranate**,** chelated micronutrients, fertilizer, neemcake, quality

Introduction

From an export point of view, pomegranate is one of the important crops of arid and semi-arid regions of India. The pomegranate (*Punica granatum* Linn) is one of the ancient fruit crop grown in tropical and subtropical regions of the world. It is claimed to have originated in the region extending from Iran to Northern India. Its domestication started 3000 - 4000 BC in the North of Iran and Turkey (Lye, 2008) from where it spread to other regions *i.e.* Mediterranean countries, India and China, possibly through ancient trade routes. It was introduced in the Indian peninsula from Iran during the first century AD.

In India commercial pomegranate orchards are found in rainfed areas, which characteristically have nutrient deficient soils, low in organic matter, irregular distribution of rainfall and generally experience water deficiency during plant growth period (Panwar and Tarafdar, 2006) [8]. Horticultural crops suffer widely by zinc deficiency followed by boron, manganese, copper, iron and molybdenum deficiencies. Cl, Cu, Fe and Mn are involved in various processes related to photosynthesis and Zn, Cu, Fe, and Mn are associated with various enzyme systems; Mo is specific for nitrate reductase only. B is the only micronutrient not specifically associated with either photosynthesis or enzyme function, but it is associated with the carbohydrate chemistry and reproductive system of the plant. The significance of micronutrients in grow the as well as physiological functions of horticultural crops such as iron, zinc, boron, molybdenum, copper and manganese is essential for different biological functions that might be attributed to tree yield and fruit quality. It also increases resistance to disease, insect pests and improves drought tolerance.

It is universally accepted that the use of chemical fertilizer is an integral part of package of practices for enhancing the agricultural production. Chemical fertilizer supplies NPK and other essential nutrients and micronutrients to plant for better growth and higher yields. The continuous use of high analysis chemical fertilizers leads to micronutrient deficiency in soil. Among the micronutrients, deficiency of Zn and Fe is wide spread in India and these soils are generally deficient in macronutrients like nitrogen and phosphorous.

Among the foliar application of various level of nutrients *viz*. zinc, copper, magnesium and boron have been found more effective in improving the flowering, fruit set, fruit size, fruit yield and fruit quality in number of fruit. Micronutrients are used in smaller quantities, but they are as important as macronutrients in respect of their functions in plants. Furthermore, they help to increase the use efficiency of macronutrients. They play an essential role in improving growth, yield and quality of many crops. Foliar application of micronutrients during crop growth was successfully used for correcting their deficits and improving the mineral status of plants as well as increasing the crop yield and quality (Kolota and Osinska, 2001) [4]

Materials and Methods

This experiment was executed through two successive seasons of seasons of 2019-20 and 2020-21 on six year old Bhagwa pomegranate plants grown on light soil having uniform growth and vigour were subjected to bahar treatment by withholding irrigation, so as to enable profuse flowering synchronously. All experimental plants were supplied with FYM @ 25 kg per plant after harvesting of previous crop and the dose of organic or inorganic fertilizers and micronutrient was given as per the treatment. The organic and inorganic fertilizer was given though soil application by ring method. Half dose of N was applied at the time of 1st irrigation after bahar treatment and remaining half dose of fertilizer applied after 4 week. Full dose of P & K was applied as single dose with 1st irrigation. Chelated micronutrients were applied through foliar application at flower initiation and fruit set with the fine sprayer. The required concentration of micronutrients solution was prepared by directly mixing them in required quantities of water and immediately used for spraying.The experiment consisted of eighteen treatment combinations and two replications laid out in Factorial Randomized Block Design (FRBD) and it consisted of two factor *i.e.* application of organic and inorganic fertilizer though soil application and application of different concentration of chelated micronutrients though foliar application. Three uniform and healthy trees were selected for each treatment combination. All the recommended cultural practices of pomegranate cultivation were undertaken as per the guidelines of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

Treatments		**Treatment Details**
Factor A	(F)	**Fertilizer levels**
	F_1	100% RDF
	F_2	80% RDF + 20% RDF though FYM
	F_3	60% RDF + 20% RDF though FYM + 20% RDF though Neem cake
Factor B	(M)	**Micronutrients levels**
	M_1	Chelated Mix formulation @ 3 gm/lit
	M_2	Chelated Copper (Cu) @ 5 gm/lit
	M_3	Chelated Manganese (Mn) @ 3 gm/lit
	M_4	Chelated Zinc (Zn) @ 3 gm/lit
	M_5	Liquid boron (Solubor) @ 5 gm/lit
	M_6	Chelated Iron (Fe) @ 5 gm/lit

Observations recorded

The trees were given uniform cultural operations during the course of investigation. Observations on fruit set, fruit retention, fruit drop and fruit cracking were recorded during experimentation.

Statistical analysis

The data were tabulated and statistical analysis was done by using method of analysis of variance (ANOVA) for Factorial Randomized Block Design (FRBD) as per the procedure given by Panse and Sukhatme (1989) [9].

Results and discussion

Total number of fruit set per plant

The maximum number of fruit set per plant (65.72) was recorded in treatment F_3 *i.e.* soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake, while minimum in treatment F_1 *i.e.* 100% RDF (60.85). Under chelated micronutrient levels on maximum number of fruit set per plant (70.56) was recorded in treatment M_1 *i.e.* foliar application of chelated mix formulation @ 3 gm/liter, while minimum in treatment M_3 *i.e.* foliar application of chelated manganese (Mn) @ 3 gm/liter (55.61). Further, interaction effect of F_3M_1 *i.e.* combination of soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/liter showed maximum number of fruit set per plant (74.58), while minimum (54.75) in treatment F_1M_3 *i.e.* combination of soil application of 100% RDF and foliar application of chelated manganese (Mn) @ 3 gm/liter (Table no.1)

Fruit set percentage (%)

The maximum fruit set percentage (87.17%) was recorded in treatment F_3 *i.e.* soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake, while minimum in treatment F_1 *i.e.* 100% RDF (83.98%). Under chelated micronutrient levels on maximum fruit set percentage (90.28%) was recorded in treatment M_1 *i.e.* foliar application of chelated mix formulation @ 3 gm/liter, while minimum in treatment M_3 *i.e.* foliar application of chelated manganese (Mn) @ 3 gm/liter (81.40%). Further, interaction effect of F_3M_1 *i.e.* combination of soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/liter showed maximum fruit set percentage (92.48%), while minimum (79.94%) in treatment F_2M_3 *i.e.* combination of soil application of 80% RDF + 20% RDF though FYM and foliar application of chelated manganese (Mn) @ 3 gm/liter. (Table no.1)

The increase in fruit set in pomegranate by application of chelated micronutrient treatments may be due to increased fruit set and reduced fruit drop as a result of zinc, boron and iron spray could give higher number of fruits and consequently the yield.

The increase in yield of pomegranate by spraying of micronutrients might be due to the direct or assimilation of nutrients by leaves leading to increased and metabolites synthesis for the growth and development of fruits. These activities improve fruit set thereby synergistically increased the total yield of pomegranate. The present results are in conformity with the findings of Abd-Allah (2006) [1] in Orange and Patil *et al*. (2014) [10] in Kinnow.

Fruit retention percentage (%)

The maximum fruit retention (95.73%) was recorded in treatment F_3 *i.e.* soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake, while minimum in treatment F_1 *i.e.* 100% RDF (94.45%). Under chelated micronutrient levels on maximum fruit retention (96.84%) was recorded in treatment M_1 *i.e.* foliar application of chelated mix formulation @ 3 gm/liter, while minimum in treatment M_3 *i.e.* foliar application of chelated manganese (Mn) @ 3 gm/liter (93.23%). Further, interaction effect of F_3M_1 *i.e.* combination of soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/liter showed maximum fruit retention (97.55%), while minimum (92.29%) in treatment F_1M_3 *i.e.* combination of soil application of 100% RDF and foliar application of chelated manganese (Mn) @ 3 gm/liter. (Table no.1)

Increase in fruit set and fruit retention per cent might be due to reduction in the fruit drop. The foliar application of zinc and boron which reduce fruit drop and increase fruit retention might be due to the fact that zinc play important role in biosynthesis of IAA (Alloway, 2008). Nijjar (1985) [2, 7] reported that Zn is required for preventing the abscission layer formation and consequently, the reduction in pre- harvest fruit drop.

Total number of fruit per plant at harvest

The maximum number of fruit per plant at harvest (62.99) was recorded in treatment F_3 *i.e.* soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake, while minimum in treatment F_1 *i.e.* 100% RDF (57.51). Under chelated micronutrient levels on maximum number of fruit per plant at harvest (68.33) was recorded in treatment M_1 *i.e.* foliar application of chelated mix formulation @ 3 gm/liter, while minimum in treatment M_3 *i.e.* foliar application of chelated manganese (Mn) @ 3 gm/liter (51.83). Further, interaction effect of F_3M_1 *i.e.* combination of soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/liter showed maximum number of fruit per plant at harvest (72.75), while minimum (50.50) in treatment F_1M_3 *i.e.* combination of soil application of 100% RDF and foliar application of chelated manganese (Mn) @ 3 gm/liter. (Table no. 2)

The production of more number of fruits in the treatments of application of organic fertilizers with chemical fertilizers at different combination could be a result of the improvement in soil physical and chemical properties which in turn provided required nutrition for the conversion of flowers to fruits resulting in higher fruit set ultimately, increasing the number of fruits per tree and yield of pomegranate.

The increase in total number fruit in pomegranate by application of micronutrient treatments may be due to increased fruit set and reduced fruit drop as a result of zinc, boron and iron spray could give higher number of fruits and consequently the yield. The beneficial effects of boron in increasing yield parameters appears to be due to application of boron which might have played important role in photosynthesis, translocation and therefore the accumulation of photosynthates in fruit might have been increased resulting in increase in number of fruits, weight and finally yield of pomegranate. These findings are in agreement with those of Bambal (1991) [3] in pomegranate who reported application of boron increased fruit yield in pomegranate.

Fruit cracking percentage (%)

The minimum fruit cracking (4.07%) was recorded in treatment F_3 *i.e.* soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake, while maximum in treatment F_1 *i.e.* 100% RDF (6.31%). Under chelated micronutrient levels on minimum fruit cracking (3.72%) was recorded in treatment M_1 *i.e.* foliar application of chelated mix formulation @ 3 gm/liter, while maximum in treatment M_3 *i.e.* foliar application of chelated manganese (Mn) @ 3 gm/liter (7.16%). Further, interaction effect of F_3M_1 *i.e.* combination of soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/liter showed minimum fruit cracking (2.07%), while maximum (8.42%) in treatment F_1M_3 *i.e.* combination of soil application of 100% RDF and foliar application of chelated manganese (Mn) @ 3 gm/liter. (Table no. 2)

The foliar application of boron on leaves may result in the translocation of sugars and production of cell wall material, which reduces the amount of fruit cracking. The substantial role of boron in the development of plant cell dividers through the functioning of pectins and water take-up has been attributed to its foliar application in lowering the influence on fruit cracking per cent. This may be because of helpful impact of boron by and large improvement and augmentation of plant cell wall through its relationship with cell wall pectins.

Fruit drop percentage (%)

The minimum fruit drop (4.16%) was recorded in treatment F_3 *i.e.* soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake, while maximum in treatment F_1 *i.e.* 100% RDF (5.39%). Under chelated micronutrient levels on minimum fruit drop (3.16%) was recorded in treatment M_1 *i.e.* foliar application of chelated mix formulation @ 3 gm/liter, while maximum in treatment M_3 *i.e.* foliar application of chelated manganese (Mn) @ 3 gm/liter (6.57%). Further, interaction effect of F_3M_1 *i.e.* combination of soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/liter showed minimum fruit drop (2.45%), while maximum (7.25%) in treatment F_1M_3 *i.e.* combination of soil application of 100% RDF and foliar application of chelated manganese (Mn) @ 3 gm/liter. (Table no. 2)

Minimum fruit drop percentage might be due to boron and calcium being main component of cell wall (middle lamella) of plant cell in the form of calcium pectate which play an important role in strengthening of pedicel attached to proximal end of fruits resulted that less fruit drop while zinc is also required for the synthesis of tryptophan a precursor of auxin thus helps in reducing fruit drop.

Foliar treatment of boron and zinc at greater level eventually stimulates the endogenous synthesis of auxins therefore decreasing fruit drop (Meena *et al.* 2014). Also, foliar boron and zinc treatment, which lowers fruit loss and increases fruit retention, might be owing to boron and zinc's key involvement in IAA production (Alloway, 2008) [2].

Furthermore, the borax reaction was more favourable owing to boron, which is crucial for carbohydrate translocation, auxin production to the sink and pollen viability and fertilization Vandana *et al*. (2017) [12]. Similar findings found by Sarkar *et al.* (1984) [11] in litchi, and Xu *et al.* (1984) [13] in litchi.

Table 1: Effect of fertilizer and chelated micronutrient on total number of fruit per plant, fruit set percentage and fruit retention percentage of pomegranate Cv. Bhagwa

Treatment	Total number of fruit set per plant	Fruit set percentage (%)	Fruit retention (%)
Factor A: Fertilizer levels (F)			
F_1	60.85	83.98	94.45
F_2	63.06	85.41	95.24
F_3	65.72	87.17	95.73
S.E. ±	0.32	0.34	0.12
C.D. at 5%	0.96	1.01	0.37
Factor B: Micronutrients levels (M)			
M_1	70.56	90.28	96.84
M_2	59.64	83.92	94.35
M_3	55.61	81.40	93.23
M_4	63.25	84.74	95.03
M_5	68.78	88.81	96.51
M_6	61.42	83.97	94.89
S.E ±	0.46	0.48	0.18
C.D. at 5%	1.36	1.42	0.52
Interaction A x B: Fertilizer levels x Micronutrients levels (F x M)			
F_1M_1	67.42	88.45	95.96
F_1M_2	57.42	82.87	93.90
F_1M_3	54.75	80.73	92.29
F_1M_4	61.42	83.34	94.44
F_1M_5	66.67	87.02	95.51
F_1M_6	57.42	81.45	94.63
F_2M_1	69.67	89.92	97.00
F_2M_2	59.08	83.39	94.36
F_2M_3	54.92	79.94	93.65
F_2M_4	63.17	85.24	95.00
F_2M_5	68.50	88.82	96.84
F_2M_6	63.00	85.18	94.59
F_3M_1	74.58	92.48	97.55
F_3M_2	62.42	85.51	94.79
F_3M_3	57.17	83.54	93.74
F_3M_4	65.17	85.65	95.65
F_3M_5	71.17	90.59	97.19
F_3M_6	63.83	85.28	95.47
S.E ±	0.79	0.83	0.30
C.D. at 5%	2.36	2.46	0.91

Table 2: Effect of fertilizer and chelated micronutrient on total number of fruit per plant at harvest, fruit cracking (%) and fruit drop (%) of pomegranate Cv. Bhagwa

Treatment	Total number of fruit per plant at harvest	Fruit cracking (%)	Fruit drop (%)
Factor A: Fertilizer levels (F)			
F_1	57.51	6.31	5.39
F_2	60.11	5.40	4.78
F_3	62.99	4.07	4.16
S.E. ±	0.33	0.05	0.04
C.D. at 5%	0.97	0.14	0.13
Factor B: Micronutrients levels (M)			
M_1	68.33	3.72	3.16
M_2	56.28	6.01	5.89
M_3	51.83	7.16	6.57
M_4	60.11	5.12	4.66
M_5	66.39	4.38	3.49
M_6	58.28	5.19	4.90
S.E ±	0.46	0.07	0.06
C.D. at 5%	1.38	0.20	0.19
Interaction A x B: Fertilizer levels x Micronutrients levels (F x M)			
F_1M_1	64.67	4.90	3.93
F_1M_2	53.92	7.12	6.39
F_1M_3	50.50	8.42	7.25

F_1M_4	58.00	5.76	5.15
F_1M_5	63.67	5.23	4.24
F_1M_6	54.33	6.44	5.37
F_2M_1	67.58	4.20	3.12
F_2M_2	55.75	5.98	6.06
F_2M_3	51.42	7.13	6.35
F_2M_4	60.00	5.84	4.60
F_2M_5	66.33	4.53	3.30
F_2M_6	59.58	4.75	5.29
F_3M_1	72.75	2.07	2.45
F_3M_2	59.17	4.93	5.21
F_3M_3	53.58	5.92	6.11
F_3M_4	62.33	3.74	4.24
F_3M_5	69.17	3.38	2.92
F_3M_6	60.92	4.39	4.03
S.E ±	0.80	0.12	0.11
C.D. at 5%	2.38	0.34	0.32

Conclusion
Considering the above result it may be concluded that, soil application of 60% RDF + 20% RDF though FYM + 20% RDF though neem cake and foliar application of chelated mix formulation @ 3 gm/lit was recorded maximum fruit set and fruit retention as well as minimum fruit cracking and fruit drop.

Reference

1. Abd-Allah ASE. Effect of spraying some macro and micro nutrients on fruit set, yield and fruit quality of Washington navel orange trees. J Appli. Sci. Res. 2006;2(11):1059-1063.
2. Alloway BJ. Zinc in soils and crop nutrition. *International Zinc Association Brussel*, Belgium. 2008.
3. Bambal SB, Wvhal KN, Nasalkar SD. Effect of foliar application of micronutrients on fruit quality and yield of pomegranate (*Punica granatum* L.) Cv. Ganesh. Maharashtra J Hort. 1991;5(2):32-36.
4. Kolota E, Osinska M. Efficiency of foliar nutrition of field vegetables grown at different nitrogen rates. Acta Horticulture. 2001;563:87-91.
5. Lye C. Preliminary assessment of the potential for an Australian industry. Rural Industries Research and Development Corporation of Australian government. RIRDC publication no. 08/153, 17. 2008.
6. Meena D, Tiwari R, Singh OP. Effect of nutrient spray on growth, fruit yield and quality of aonla. Ann. Plant and Soil Res. 2014;16(3):242-245.
7. Nijjar GS. Nutrition of fruit trees. New Delhi: Kalayani Publishers. 1985.
8. Panwar J, Tarafdar JC. Distribution of the endangered medicinal plant species and their colonization with *arbuscular mycorrhizal* fungi. J Arid Environ. 2006;65:337-350.
9. Panse VS, Sukhatme PV. Statistical Methods for Agricultural Workers, ICAR, New Delhi. 1989.
10. Patil MS, Shafeeq LB, Swamy GSK. Studies on the influence of micronutrient on growth, yield and quality of Kinnow mandarin. Trends in Bioscience. 2014;7(9):786-788.
11. Sarkar GK, Sinha MM, Mishra RS, Srivastava RP. Effect of foliar application of mineral elements on cracking of litchi fruit. Haryana J Hortic. Sci. 1984;13(1-2):18-21.
12. Vandana Waghmare GM, Shivendu Solanki. Influence of chelated calcium, Micronutrient and method of application on vegetative growth of pomegranate Cv. Bhagwa. Int. J of Curr. Microbiology and Applied Sci. 2017;6(11):135-147.
13. Xu RY, Chan RM, Chen JL, Wang KG, Kang ZL. A study on the effect of the micronutrient boron on litchi production. J Ful. Agri. Coll. 1984;13(4):305-11.