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Pruning intensity and micronutrients influence the growth and yield of guava (*Punica granatum* L.) cv. Allahabad Safeda under semi arid conditions of Rajasthan

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Abstract
A field experiment was conducted at International Horticulture Innovation and Training Center, Durgapura (Jaipur) during two successive years 2018-19 and 2020-21 to investigate the effect of pruning intensity and foliar spray of micronutrients on growth and yield of guava (*Punica granatum* L.) cv. Allahabad Safeda under semi-arid conditions of Rajasthan. The experiment included 24 treatment combinations comprising three levels of pruning intensity (0, 25 and 50%) and eight levels of micronutrients Zn, B and Fe (0.4% each) with laid out in Factorial Randomized Block Design with three replications. The results revealed that use off micronutrients (Zn, Fe and B) with pruning intensity significantly increase the plant growth (gain in plant and plant spread) and yield attributes (fruit equatorial and polar diameter, fruit weight, fruit volume and fruit yield per tree). Interactions of pruning intensity 25% (P_2) and micronutrient $ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4% (M_5) (P_2M_5) gave best results with respect to plant growth and yield of guava.

Keywords: Growth, guava, micronutrients, pruning, semi-arid, yield

Introduction

Guava (*Punica granatum* L.) is the known as poor man of apple due to its high nutritive value and high consumption fruit crop under tropical and sub-tropical area of India and belongs to family Myrtaceae (Bose and Mitra, 2001) [3]. It can be easily grown under different type of soil from sandy loam to clay loam and grown under wide areas of climatic conditions (Dhaliwal and Singla, 2002) [4]. Guava fruits are highly nutritionally, tasteful and lucrative fruit crop. Menzel (1985) [15] reported that the guava is highly economical and valuable over other fruits because it's nutritional and commercial values. It is a cheap and rich source of vitamin-C (over mandarin & orange fruit juice) and pectin (Agnihotri and Bhullar, 1962) [1]. In guava plants flowering and fruiting on the current season growth at terminal part flowers appear in axils of leaves, therefore, it responds well to pruning. In guava found three distinct bahar, First; *Ambe bahar* – flowering & fruiting is done February to March & July to August, Second; *Mrig bahar* - flowering & fruiting is done June-July & October-November and Third; *Haste bahar* - flowering & fruiting is done October-November & Feb-March, respectively (Shukla *et al.*, 2008) [22]. After 12-15 years of age, guava trees show a considerable decrease fruit yield and quality and overall increase total cost of production per unit area. The unproductive plants can be converted into profitable plants by judicious pruning. It is influence the growth, yield and quality attributes (Gadgil and Gadgil, 1933) [6]. Shoot pruning is helpful for maintain tree size and increase the fruit quality its give opportunity to the grower for increase the yield per plant per unit area (Lal *et al.*, 2000) [11].

Micronutrients play important role in guava in plant growth, development and quality. Severely deficiency of micronutrients in guava specially boron, iron, zinc, potassium and etc. reduce the plant growth & development, fruit quality and delay the fruit maturity. Fruits become tough with brown corky skin and cracked. Guava fruits are following the well reaction with zinc, boron, potassium and molybdenum applications (Singh and Chhonkar, 1983) [23]. Boron plays an important role in translocation of carbohydrates, synthesis of auxin, increase pollen viability and fertilization. Effect of Boron on pollen tube elongation, cell wall structure and root growth (Meena *et al.*, 2008) [14].

However, Zinc plays an important role either as metal component of enzymes or as a functional, structural or regulatory factor of a large number of enzymes. It is used in enzymatic activities, sugar metabolism, flowering, fruiting, maturity and fruit quality. Therefore, this investigation was undertaken to evaluate the response of pruning intensity and micronutrients on growth and yield of guava under the semi-arid condition of Rajasthan.

Materials and Methods

This field experiment was conducted at International Horticulture Innovation and Training Centre (IHITC), Durgapura (Jaipur) for two consecutive years during May to March months of 2018-19 and 2020-21. This location situated at 75º47' East longitude, 26º51' North latitude and at an altitude of 390 m MSL in Jaipur district of Rajasthan falls under Agro-climatic Zone IIIa (semi-arid Eastern plain zone). The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. The treatments consisted of three levels of pruning intensity (0%, 25% and 50%) and one levels of each micronutrient (Zn, Fe and B). Thus, there were 24 treatments combinations. The spraying of different micronutrients as per treatments was done 15 days before flowering and 20 days after fruit set at marble stage.

Observations related to plant growth and fruit yield i.e., gain in plant height (m), plant spread (m) NS and EW direction, fruit equatorial and polar diameter (m), fruit weight (g), fruit volume (cc) and fruit yield per tree (kg) were recorded during the experimentation. The experimental data was statistically analyzed as per the method suggested by Panse and Sukhatme (1985) [17]. The critical difference was worked out at 5 per cent (0.05) level of significance.

Results and Discussion

A. Growth parameters

Effect of pruning intensity

It is evident from the data (Table 1) clearly shows that there found a significant enhancement in vegetative growth parameters (gain in plant height and plant spread) with the medium pruning intensity in guava. The plant subjected to 25% pruning intensity observed maximum gain in plant height (0.59, 0.60 and 0.59 m) and plant spread EW (0.66, 0.67 and 0.66 m) and NS (0.58, 0.60 and 0.59 m) during both the years and pooled analysis. This is might be due to the pruned trees gave quick response to supply of food material absorbed by the roots and transmission of the same to the main trunk of such trees. Moreover, in such trees most of the carbohydrates and nitrogen were utilized for the vegetative growth, thereby, resulting in stimulated production of leader and lateral shoots, ultimately accounting for increased canopy volume. With an increase in severity of pruning the increase in plant height was less. Similar results were reported by Mahesh *et al*., 2016 [12] and Kohli *et al*., 2017 [8] in guava. However, increase in the canopy spread may be due to the increase in shoot length leading to increase in canopy spreading (Meena *et al*., 2016) [13].

Effect of micronutrients foliar spray

Data presented in Table 1 that various micronutrients combination (Zn, Fe & B) with their concentration of @ 0.4% each significantly increased the gain in plant height and plant spread (EW & NS). However, the highest gain in plant height was found with the treatment M_7 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%) *i.e*., 0.62, 0.65 & 0.64m which found at par with the treatment M_5 ($ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4%) under both the study years as well as pooled analysis, respectively. This maximum increase in growth attributes might be due to the favorable influence of application of micronutrients zinc sulphate @ 0.4%+ iron sulphate @ 0.4%+ borax @ 0.4% on growth characteristics because of their catalytic or stimulatory effect on most of the physiological and metabolic processes of plant. Thus, these findings are in line with earlier reports of Lal and Sen (2000) [10] and Kumawat *et al*. (2012) [9] that have shown that application of micronutrients alone or in combinations had significant effect on plant height and plant spread in guava plant.

B. Yield parameters

Effect of pruning intensity

Data presented in table 2 and 3 shows that the yield attributes. The yield of guava significantly influenced due pruning intensity. Results revealed that maximum equatorial and polar diameter (5.66, 5.72 & 5.69 cm and 6.04, 6.10 & 6.07 cm) recorded with the 50% pruning intensity during both the years of study and in pooled analysis, respectively. These results were similar to Sheikh and Rao (2002) [21] found that highest fruit diameter of pomegranate was noticed in severe pruning as compared to mild pruning and control. Fruit volume was significantly at par recorded with the pruning intensity at 25% of plant with the respective value (147.95, 150.89 and 149.42 cc) during study years and pooled analysis from the treatment pruning intensity 50%, respectively. It might be due to the fact that shoot pruning increases the photosynthesis activity due to more vegetative growth after pruning and induce the level of photosynthates in plant which ameliorate the overall fruit quality. However, the higher fruit weight was noted under treatment P_3 (Pruning intensity 50%) *i.e*., 149.53, 151.24 and 150.38 g during both the year of experiment and in pooled analysis, respectively. Which followed by the treatment P_2 (pruning intensity 25%). The metabolic activities have helped to increase the fruit size and fruit weight and thereby increase the fruit yield. The result was supported by Suleman *et al*., (2006) [25] in guava.

It is revealed that the pruning of guava plants at pruning intensity 25% (P_2) gave significantly at par yield per tree during both the years and in pooled analysis and the values were 35.28, 36.66 and 35.97 kg, respectively which found at par with the yield obtained in 50% pruning intensity. Results agreed with Pratap *et al*. (2003) [18] noticed that mango fruit yield was highest under moderate pruning, followed by severe and light pruning treatments.

Effect of micronutrients foliar spray

As is evidenced from the data presented in Table 2 to 3 that various micronutrients (Zn, Fe and B) with different concentration increased the value of the yield parameters of guava.

The results showed that the highest values for fruit weight (152.35, 154.22 and 153.29 g) fruit volume (149.98, 152.79 and 151.39 cc), equatorial diameter of fruits (5.87, 5.93 & 5.90 cm) and polar diameter (6.25, 6.33 & 6.29 cm) observed with the application of $ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4% while treatment M_5 significantly similar to treatment M_7 during both the years of study and pooled analysis, respectively.

This is due to cumulative effect of combined treatment of zinc, boron and iron might have resulted into higher fruit weight. The eventual reason for increase in fruit weight by the micronutrients might be due to faster loading and mobilization of photo assimilates to fruits and involvement in cell division and cell expansion which ultimately reflected into more weight of fruit in treated plants (Gurjar *et al*. 2015) [7] Similar results were also found by Banik *et al*. (1997) [2], Dutta (2004) [5] in mango and the increase in fruit length was possible due to accumulation of more food material in the tree that lead to efficient utilization for fruits development (Ram and Bose, 2000) [19]. Similar results have been reported by Singh *et al*. (2004) [24] and Pal *et al*. (2008) [16] in guava. They reported that zinc sulphate + borax spray increased fruit weight, size (length and width) and volume of fruits in guava.

The results revealed that the effect of foliar spray of different micronutrients alone and in combination influenced the overall yield. The application of treatment M_5 ($ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4%) significantly similar to treatment T_7 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%) found yield per tree (36.91, 37.94 & 37.42 kg) and (37.55, 38.60 and 38.08 kg), respectively as compared to other treatments. The yield significantly increase treatment M_5 and M_7 due to cumulative effect of zinc, iron and boron help to increase the fruit size, fruit weight and thereby increase the fruit yield. Similar result was also found by Sarolia *et al.* (2007) [20] in guava.

Table 1: Effect of pruning intensity and foliar spray of micronutrients on gain in plant height and spread

Treatments	Gain in plant height (m)			Gain in plant spread (E-W) (m)			Gain in plant spread (N-S) (m)		
	2018	2020	Pooled	2018	2020	Pooled	2018	2020	Pooled
Pruning intensity									
P_1 (Pruning intensity 0%)	0.53	0.56	0.54	0.54	0.57	0.56	0.47	0.49	0.48
P_2 (Pruning intensity 25%)	0.59	0.60	0.59	0.66	0.67	0.66	0.58	0.60	0.59
P_3 (Pruning intensity 50%)	0.57	0.58	0.57	0.62	0.65	0.64	0.56	0.58	0.57
S.Em$\pm$	0.003	0.003	0.002	0.008	0.008	0.006	0.007	0.006	0.005
CD (p=0.05)	0.008	0.010	0.006	0.023	0.022	0.016	0.019	0.018	0.014
Micronutrients									
M_0 (Control)	0.48	0.49	0.49	0.51	0.55	0.53	0.47	0.48	0.48
M_1 ($ZnSO_4$ @ 0.4%)	0.53	0.55	0.54	0.57	0.59	0.58	0.52	0.53	0.53
M_2 ($FeSO_4$ @ 0.4%)	0.51	0.53	0.52	0.57	0.59	0.58	0.50	0.52	0.51
M_3 (H_3BO_3 @ 0.4%)	0.56	0.57	0.56	0.58	0.60	0.59	0.51	0.55	0.53
M_4 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4%)	0.58	0.58	0.58	0.64	0.65	0.65	0.56	0.58	0.57
M_5 ($ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	0.61	0.63	0.62	0.66	0.68	0.67	0.58	0.59	0.58
M_6 ($FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	0.60	0.61	0.61	0.65	0.67	0.66	0.57	0.58	0.58
M_7 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	0.62	0.65	0.64	0.68	0.70	0.69	0.58	0.59	0.59
S.Em$\pm$	0.004	0.005	0.004	0.013	0.013	0.010	0.011	0.010	0.008
CD (p=0.05)	0.012	0.016	0.010	0.037	0.037	0.027	0.032	0.029	0.022

Table 2: Effect of pruning intensity and foliar spray of micronutrients on fruit equatorial and polar diameter

Treatments	Equatorial diameter (cm)			Polar diameter (cm)		
	2018-19	2020-21	Pooled	2018-19	2020-21	Pooled
Pruning intensity						
P_1 (Pruning intensity 0%)	5.00	5.03	5.01	5.37	5.42	5.40
P_2 (Pruning intensity 25%)	5.56	5.59	5.57	5.95	5.99	5.97
P_3 (Pruning intensity 50%)	5.66	5.72	5.69	6.04	6.10	6.07
S.Em$\pm$	0.08	0.09	0.06	0.07	0.08	0.06
CD (p=0.05)	0.24	0.26	0.17	0.21	0.24	0.18
Micronutrients						
M_0 (Control)	4.72	4.76	4.74	5.31	5.35	5.33
M_1 ($ZnSO_4$ @ 0.4%)	5.16	5.20	5.18	5.61	5.66	5.64
M_2 ($FeSO_4$ @ 0.4%)	5.10	5.14	5.12	5.53	5.58	5.56
M_3 (H_3BO_3 @ 0.4%)	5.26	5.29	5.28	5.70	5.76	5.73
M_4 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4%)	5.67	5.70	5.69	6.11	6.16	6.14
M_5 ($ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	5.79	5.83	5.81	6.21	6.29	6.25
M_6 ($FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	5.68	5.73	5.71	6.15	6.25	6.20
M_7 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	5.87	5.93	5.90	6.25	6.33	6.29
S.Em$\pm$	0.14	0.15	0.10	0.12	0.13	0.09
CD (p=0.05)	0.39	0.43	0.28	0.35	0.38	0.26

Table 3: Effect of pruning intensity and foliar spray of micronutrients on fruit weight, volume and yield

Treatments	Fruit weight (g)			Fruit volume (cc)			Fruit yield (kg tree^{-1})		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
Pruning intensity									
P_1 (Pruning intensity 0%)	119.09	121.36	120.22	122.14	123.76	122.95	27.50	28.27	27.88
P_2 (Pruning intensity 25%)	140.04	140.35	140.20	135.95	137.75	136.85	33.82	34.65	34.23
P_3 (Pruning intensity 50%)	143.09	144.01	143.55	139.63	141.48	140.55	33.60	34.10	33.85
S.Em±	1.65	1.74	1.20	0.70	0.71	0.54	0.18	0.17	0.12
CD (p=0.05)	4.69	4.96	3.38	2.01	2.02	1.55	0.50	0.50	0.35
Micronutrients									
M_0 (Control)	110.01	112.07	111.04	116.97	118.37	117.67	25.14	25.98	25.56
M_1 ($ZnSO_4$ @ 0.4%)	123.32	124.67	124.00	125.27	126.42	125.85	28.81	29.51	29.16
M_2 ($FeSO_4$ @ 0.4%)	120.74	121.74	121.24	123.59	125.46	124.53	27.94	28.58	28.26
M_3 (H_3BO_3 @ 0.4%)	137.21	135.10	136.15	132.61	134.28	133.44	32.24	32.16	32.20
M_4 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4%)	142.03	142.99	142.51	137.18	139.68	138.43	33.63	34.33	33.98
M_5 ($ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	146.14	148.00	147.07	141.69	144.07	142.88	34.98	35.87	35.43
M_6 ($FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	144.84	147.11	145.98	141.02	142.06	141.54	34.57	35.56	35.07
M_7 ($ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.4% + H_3BO_3 @ 0.4%)	148.28	150.23	149.26	142.27	144.28	143.27	35.80	36.73	36.27
S.Em±	2.69	2.84	1.97	1.15	1.15	0.88	0.29	0.28	0.20
CD (p=0.05)	7.66	8.10	5.52	3.28	3.30	2.52	0.81	0.82	0.57

Conclusion

On the basis of results obtained in the present investigation concluded the pruning intensity 25% with combined foliar spray of $ZnSO_4$ @ 0.4% + H_3BO_3 @ 0.4% recorded significantly superior result over the rest of the treatment in respect of plant growth and yield characteristics.

References

1. Agnihotri RP, Bhullar JS. Chemical deblossoming of guava cv. Allahabad Safeda. Hr. J. Hort. Sci. 1962;8:203-204.
2. Banik BC, Mitra SK, Sen SK, Bose TK. Interaction effects of zinc, iron, and boron sprays on flowering and fruiting of mango cv. [Title missing]. 1997.
3. Bose TK, Mitra SK. Guava Fruits: Tropical and subtropical. Kalyani Publication, New Delhi. 2001;1:609-653.
4. Dhaliwal GS, Singla R. Studies on the time of anthesis and dehiscence in different genotypes of guava in winter and rainy season crops. Indian J. Hort. 2002;59:157-161.
5. Dutta P. Effect of foliar boron application on panicle growth, fruit retention, and physico-chemical characters of mango cv. Himsagar. Indian J. Hort. 2004;61(3):265-266.
6. Gadgil DR, Gadgil VR. A survey of the marketing of fruit in Poona. Gokhale Inst. Politics and Economics Publi. 1933:3.
7. Gurjar MK, Kaushik RA, Baraily P. Effect of zinc and boron on the growth and yield of kinnow mandarin. Int. J Scientific Res. 2015;4(1):207-208.
8. Kohli K, Kumar R, Kumar A, Dubey MC. Effect of pruning height and planting distance on growth and yield of guava (*Punica granatum* L.) cv. Pant Prabhat. Bioscan. 2017;12(1):395-398.
9. Kumawat KL, Sarolia DK, Shukla AK. Growth, yield, and quality of rejuvenated guava as influenced by thinning-bending and micronutrients. Indian J Hort. 2012;69:478-483.
10. Lal G, Sen NL. Effect of nitrogen, zinc, and manganese fertilization on growth and yield of guava (*Punica granatum* L.) cv. Allahabad Safeda. Annals of Arid Zone. 2000;39:203-205.
11. Lal G, Sen NL, Jat RG. Yield and leaf nutrient composition of guava as influenced by nutrients. Indian J. Hort. 2000;57(2):130-132.
12. Mahesh RK, Jholgiker P, Mamatha NP, Ravi P, Shivanand MR, Kallappa SN. Effect of time and level of pruning on growth and yield of guava cv. Sardar under high-density planting. Res. Environ. Life Sci. 2016;9(7):849-853.
13. Meena KR, Maji S, Kumar S, Verma S. Influence of shoot pruning for crop regulation and improving fruit yield of guava. Bioscan. 2016;11(2):1355-1359.
14. Meena VS, Yadav PK, Meena PM. Yields attributes of ber (*Ziziphus mauritiana*) cv. Gola as influenced by foliar application of ferrous sulphate and borax. Agriculture Science Digest. 2008;28(3):219-221.
15. Menzel CM. Guava: An exotic fruit with potential in Queensland. Queensland Agricultural Journal. 1985;3:93-98.
16. Pal A, Pathak RK, Pal K, Tejbir S. Effect of foliar application of nutrients on yield and quality of guava (*Punica granatum* L.) fruits cv. Sardar. Prog. Res. 2008;3(1):89-90.
17. Panse VG, Sukhatme PV. Statistical methods for agriculture workers. ICAR, New Delhi. 1985:145-155.
18. Pratap B, Sharma HC, Goswami AM, Singh SK, Mishra LN. Effects of pruning on photosynthetic rate, canopy microclimate, and yield of mango cv. Amrapali under high-density planting. Indian Journal of Horticulture. 2003;60(4):339-342.
19. Ram RA, Bose TK. Effect of foliar application of magnesium and micronutrients on growth, yield, and fruit quality of mandarin orange (*Citrus reticulata* Blanco). Indian Journal of Horticulture. 2000;57:215-220.
20. Sarolia DK, Rathore NS, Rathore RS. Response of zinc sulphate and iron sulphate sprays on growth and productivity of guava cv. Sardar. Curr. Agric. 2007;31(1-2):73-77.
21. Sheikh MK, Rao MM. Effect of pruning and fruit load on yield and quality in pomegranate (*Punica granatum* L.) Var. Ganesh. Karnataka Journal of Agricultural Sciences. 2002;15(3):549-555.
22. Shukla AK, Kaushik RA, Pandey D, Sarolia DK. Guava. Published by Maharana Pratap University of Agriculture and Technology, Udaipur. 2008:7.

23. Singh PN, Chhonkar VS. Effect of zinc, boron, and molybdenum as foliar spray on chemical composition of guava fruit. Punjab J Hort. 1983;23(1-2):34-37.
24. Singh R, Chaturvedi OP, Singh R. Effect of pre-harvest spray of zinc, boron, and calcium on the physicochemical quality of guava fruit (*Punica granatum* L.). International Seminar on Recent Trend on Hi-Tech Hort. 2004;4(6):204.
25. Suleman M, Sharma JR, Kumar R, Gupta RB, Singh S. Effect of pruning on growth and cropping pattern in guava cv. Lucknow-49. Hariyana J Hort. Sci. 2006;35(3/4):211-212.