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Research Article

Effect of Foliar Spray of Urea and Zinc Sulphate on Physical and Chemical Parameters of Guava (*Psidium guajava* L.)

Jatav, R.[1*], Kanpure R. N.[2] and Prajapati, O. P.[3]

[1]Consultant, Department of Agriculture & Animal Husbandry,
PSS Central Institute of Vocational Education, Bhopal
[2]Department of Fruit Science, College of Horticulture, Mandsaur, 458001,
[3]Department of Horticulture, College of Agriculture, Gwalior, 474002,
Rajmata Vijayaraje Scindia Agricultural University, Gwalior, Madhya Pradesh, 474002, India
*Corresponding Author E-mail: rajeshjatavhorti@gmail.com
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ABSTRACT

The present study was conducted on seven year old tree of guava cv. Apple Colour at Instructional cum Research Fruit Orchard, Department of Fruit Science, College of Horticulture, Mandsaur, Rajmata Vijayaraje Scindia Agricultural University, Gwalior, Madhya Pradesh, 474002. The experiment was laid out in Randomized Block Design (RBD). There were forty eight uniform and healthy guava trees, planted at 6 x 6 m distance were selected under the present study. The experiment consisted of sixteen treatment combinations of nutrients (urea 1.0, 1.5 & 2.0% and zinc sulphate 0.3, 0.6 and 0.8%) with control. In this manuscript various physical and chemical parameters such as pulp thickness (cm), seed weight (gm), pulp weight (gm), seed/pulp ratio, pulp percentage, seed percentage and chlorophyll content in leaves (spad value) have discussed here in respect of foliar application of nutrients on guava.

Key words: *Guava, Foliar spray, Urea, Zinc sulphate, physical and Chemical.*

INTRODUCTION

Guava is one of the most common and important fruit crop of India, grown in tropical, sub-tropical and some parts of arid regions of India. It is indigenous to tropical America, where it occurs in wild as well as in cultivated forms. Guava belongs to the family Myrtaceae. It's classified under genus *Psidium*, which contains 150 species, but only (*Psidium guajava* L.) has been exploited commercially. It was introduced in India during 17th century and its commercial cultivation is done in Maharashtra, U.P., M.P. and Bihar. However, Maharashtra is the pioneer in guava cultivation and Allahabad district of Uttar Pradesh has the reputation of producing the best quality guava in the country as well as in the world[10]. The growth, yield and quality of guava fruit are greatly affected by temperature and humidity, because of these facts the fruit quality of winter season is far better than rainy season.

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One of the important factors urea which limits the production is nutrient and season of crop, which urea (nitrogen) plays a dominant role. Nutrient requirement of guava vary with varieties and agro climatic condition. For optimum growth and performance use of micronutrients also play an important role to avoid hidden nutrient hunger. Favorable effect of urea and zinc spray has been observed on vegetative growth and yield of fruit trees. It also increases fruit size as well as yield.

MATERIAL AND METHODS

The experiment comprised of 16 treatments laid in Randomized Block Design (Factorial) replicated three times consisting of foliar spray of urea and zinc sulphate and control (water spray). First foliar spray of urea and zinc sulphate on crop was done on 16 August 2012 and same spray is repeated after 30 days. Observations on various characters of plants *i.e.* physical and chemical parameters of guava fruits with different treatments application were recorded First treatment consists the three different level of urea and zinc sulphate *viz*. U_1 (urea @ 1.0%), U_2 (urea @ 1.5%) U_3 (urea @ 2.0%) and Z_1, (zinc sulphate @ 0.3%), Z_2 (zinc sulphate @ 0.6%) and Z_3 (zinc sulphate @ 0.8%) respectively and there interaction treatments were fifteen combinations and control *viz.* T_0, T_1, T_2……T_{15} of urea and zinc sulphate. For recording physical and chemical parameters various methods has used.

RESULT AND DISCUSSION

Effect of urea on physical parameters of fruits

The Physical parameters of guava fruits were significantly improved by the sprays of urea. It is evident from the data presented in [Table 1]. The maximum pulp thickness (1.94 cm) was recorded under treatment U_3 (urea @ 2.0%), followed by U_2 and U_1 (urea @ 1.5% and urea @ 1.0% respectively), whereas it was minimum (1.78 cm) found under control. Data regarding to effect of urea, it is evident from the [Table 1] revealed that the maximum pulp weight of fruit (171.43 gm) was obtained under treatment U_3 (urea @ 2.0%), followed by (168.29 gm) pulp weight was obtain by the foliar spray of (U_2) urea @ 1.5%, while the minimum pulp weight (149.16gm) of fruit was obtained under the control. Data presented in [Table 1] revealed that the seed weight was found to be significant due to the foliar spray of urea over the control. The minimum seed weight (5.61 gm) was recorded under control, followed by U_1 (urea @ 1.0%) which was at par with U_2 (urea @ 1.5%), while the maximum seed weight (7.57gm) was recorded under the U_3 (urea @ 2.0%). It is evident from the [Table 2] it was revealed that seed: pulp ratio was found to be significant due to the spray of urea over the control. The minimum seed: pulp ratio (0.037) was recorded under the control, followed by U_1 (urea @ 1.0%), which was at par with U_2 (urea @ 1.5%) whereas the maximum seed: pulp ration (0.044) was obtained under the U_3 (urea 2.0%). Data presented in [Table 2] the pulp percentage was found to be significant due to the foliar spray of urea over the control. The mean maximum pulp percentage (96.37) was recorded under treatment U_3 (urea 2.0%) followed by U_2 (urea @ 1.5%), whereas it was minimum pulp percentage (95.89) was recorded under the control. Effect of urea on Seed percentage was presented in table 2 the minimum seed percentage (3.63%) was recorded under U_3 (urea @ 2.0%), followed by U_2 (urea @ 1.5%) whereas it was maximum seed percentage (4.11), under the control.

The Physical parameters of guava fruits were significantly improved by the sprays of urea. The maximum pulp thickness, pulp weight and pulp percentage were recorded under the treatment U_3 (urea @ 2.0 %), whereas minimum pulp thickness, pulp weight and pulp percentage were recorded under the control. This might be due to adequate and balanced supply of nutrients and reduction in losses of the nutrients, which are indispensible for growth and development of plants. The findings of present investigation are in confirmation with the findings of Meena *et al*.[11], Ahmad *et al.*[1], and Pal *et al*[12].

Effect of urea on chemical parameter of fruits

It is evident from the [Table 2] chlorophyll content was found significant due to the foliar spray of urea over the control. The mean maximum chlorophyll content (45.87) was recorded under treatment U_3 (urea @ 2.0%) which was significantly superior to the other levels of U_1, and U_2 (urea @ 1.0%, and urea @ 1.5% 43.00 and 44.24 Spad value respectively), whereas it was minimum chlorophyll content (39.53) under control. It has also been observed that the development of green colour is associated with an increase nitrogen content of leaves. Similar finding were also reported in guava fruit by pal *et al*.[12], Prasad *et al*.[14], and Kumar. Decrease in acidity content by urea spray has previously been shown by Ahmadet *et al.*[1], Rajput and Chand[15], Singh and Chhonkar[16] and Sharma[17].

Effect of zinc sulphate on physical parameters of fruits

The data on effect of foliar spray of zinc sulphate are presented in [Table-1] revealed that the pulp thickness was significantly increased with the spray of zinc sulphate over the control. The maximum pulp thickness (1.91cm) was recorded under treatment Z_3 ($ZnSO_4$ @ 0.8%), whereas minimum pulp thickness (1.81cm) was recorded under the control. The data presented in [Table 1] revealed that the maximum pulp weight of per fruit (169.30gm) was recorded under the treatment Z_3 ($ZnSO_4$ @ 0.8%), which was superior to compare with Z_2 and Z_1 ($ZnSO_4$@ 0.6% and $ZnSO_4$@ 0.3% respectively). Whereas minimum pulp weight of per fruit (154.31gm) was found under the treatment control. Effect of zinc sulphate, it was clear from [Table 1] the seed weight had influenced significantly due to the foliar spray of zinc sulphate. The minimum seed weight (6.20gm) was recorded under the Z_3 ($ZnSO_4$ @ 0.8%), followed by Z_2 ($ZnSO_4$ @ 0.6%) and Z_1 ($ZnSO_4$ @ 0.3%) however, maximum weight of seed (7.19) per fruit was recorded under the control. Effect of zinc sulphate was clear from the data presented in [Table 2] that Seed: pulp ratio had influenced significantly due to the spray of zinc sulphate. The minimum seed: pulp ratio (0.036) was recorded under U_3 ($ZnSO_4$ @ 0.8%), followed by Z_2 ($ZnSO_4$ @ 0.6%) and Z_1 ($ZnSO_4$ @ 0.3%) while the maximum Seed: pulp ratio (0.046) was recorded under the control. Effect of zinc sulphate was clear from [Table 2], the pulp percentage had influenced significantly due to the foliar spray of zinc sulphate over the control. The maximum pulp percentage (96.63) was recorded under treatment Z_3 ($ZnSO_4$ @ 0.8%), followed by Z_2 ($ZnSO_4$ @ 0.6%) and Z_1 ($ZnSO_4$ @ 0.3%), whereas the minimum pulp percentage (95.55) was recorded under control. The data presented in [Table 2] reveal that seed percentage influenced significantly due to the foliar spray of zinc sulphate. The minimum seed percentage (3.37%) was recorded under Z_3 ($ZnSO_4$ @ 0.8%). whereas maximum seed percentage (4.45%) was found under control.

The physical parameters of guava fruits were also significantly improved by foliar feeding of different concentration of zinc sulphate. The conformity of similar findings was also reported by Arora and Singh[2]. Zinc was reported to regulate the semipermeability of cell wall thus mobilizing more water into the fruits, thereby increasing the size of fruit[3]. Meena *et al.*[11], and Yadav *et al*.[19], also reported the similar results in the guava.

Effect of zinc sulphate chemical parameter of fruits

The data presented in [Table 2] chlorophyll content had significantly influenced with the spray of zinc sulphate. The maximum chlorophyll content (44.80) was recorded under treatment Z_3 ($ZnSO_4$ @ 0.8%), followed by urea @ 0.6%, whereas minimum (41.45) under control. It is also important in oxi-dation–reduction reaction and is related to the formation of chlorophyll in some undetermined way. Similarly, zinc also increases the chlorophyll content of leaves and plays an important role in enzymic activies like catalase, peroxidase and cytochrome chlorophyll oxidase. These improvements in chlorophyll content of leaf of guava also support from Rajput and Chand[15], Pandey *et*

al.[13], Sharma[17], Prasad *et al*.[14], El-Sherif *et al*.[8], Das *et al*.[7], Singh *et al*.[16], Rawat *et al*., and Trivedi *et al*.[18], in guava.

Interaction effect of urea and zinc sulphate on physical parameters of guava

The data presented in [Table 1] reveal that the combined effect of urea and zinc sulphate on pulp thickness was found to be significant. The maximum pulp thickness (1.99cm) was recorded under treatment T_{15} (urea @ 2.0% & $ZnSO_4$ @ 0.8%). There were non-significant differences observed in the treatment of T_1, T_2, T_3, and T_{10} T_{11}, T_{14} and T_{15}, whereas the minimum pulp thickness (1.74) was found under control. Interaction effect of urea and zinc sulphate presented in [Table 1] reveals that the combined effect of urea and zinc sulphate on pulp weight of fruit was found to be significant. The mean maximum pulp weight of fruit (178gm) was recorded under treatment T_{15} (urea @ 2.0% & $ZnSO_4$ @.8 0%) which was at par with treatment T_{14} (urea @2.0% & $ZnSO_4$@ 0.6%) and T_{11} (urea@ 1.5% & $ZnSO_4$@ 0.8%). The performance of other treatment i.e. T_{10} (urea@ 1.5% x $ZnSO_4$@ 0.6%), and T_{13} (urea@ 2.0% & $ZnSO_4$@ 0.3%) and T_7 (urea @ 1% & $ZnSO_4$ @ 0.8% respectively) gave the best result followed by T_{15}, whereas the minimum pulp weight of per fruit (145.50) was found under control. Data presented in [Table 1] reveal that the combine effect of urea and zinc sulphate on seed weight was found to be significant. The minimum seed weight (4.01gm) was recorded under treatment T_3 (urea @ 0% & $ZnSO_4$ @ 0.8%) followed by T_2 (urea @ 0% & $ZnSO_4$@ 0.6%) and T_1 (urea@ 0% x $ZnSO_4$@ 0.3%) whereas the maximum seed weight (7.84 gm) was found under treatment T_{14} (urea @ 2.0 % & $ZnSO_4$ @. 0.6%) followed by treatment T_{15}, T_{12}, T_8, T_4, T_{13} and T_9 respectively. The interaction effect of urea and zinc sulphate was presented in [Table 1] reveals that the interaction affects of urea & zinc sulphate on seed: pulp ratio was found to be significant. The minimum seed: pulp ratio (0.026) was recorded under treatment T_3 ($ZnSO_4$ 0.8%), followed by T_2, T_{11} and T_7, whereas the maximum seed: pulp ratio (0.047) was recorded under the treatment T_{12} (urea @ 2.0% & $ZnSO_4$ @ 0%), which was at par with treatment T_{15}, T_3, T_8, T_6 and T_{14} was recorded. The maximum pulp percentage (96.63) was recorded under treatment Z_3 ($ZnSO_4$ @ 0.8%), followed by Z_2 ($ZnSO_4$ @ 0.6%) and Z_1 ($ZnSO_4$ @ 0.3%), whereas the minimum pulp percentage (95.55) was recorded under control. Interaction effect of urea and zinc sulphate was presented in [Table 2] reveal that the maximum pulp percentage (97.46) was recorded under treatment T_{15} (urea 2.0% & $ZnSO_4$ 0.8%). The performance of other treatments i.e. T_{14}, T_{13}, T_{11}, T_{10}, T_7, T_6, T_3 and T_2 gave the best result after T_{15}, whereas the minimum pulp percentage (95.45) was recorded under the control. Data presented in [Table 2] reveal that the interaction effect of urea & zinc sulphate on seed percentage was found to be significant. The mean minimum seed percentage (2.54%) was recorded under treatment T_{15} (urea 2.0% & $ZnSO_4$ 0.8%), followed by T_{14}, whereas the maximum seed percentage (4.55%) was found under the control.

The physical parameters of guava fruits were significantly improved by the combined sprays of urea and zinc sulphate over the control. The maximum pulp thickness, maximum pulp weight, minimum seed weight, the maximum seed: pulp ratio, the maximum pulp percentage and minimum pulp seed percentage was recorded under the (urea @ 2.0% & $ZnSO_4$ 0.8%), It may be attributed to more vegetative growth, which might have augmented photosynthesis, respiration and synthesis of more carbohydrates required for true growth. These result reported by Meena *et al.*[11], El-Sherif *et al.*[8], and Ghosh[9].

Interaction effect of urea and zinc sulphate on chemical parameter of guava

Interaction effect of urea and zinc sulphate presented in [Table 2] revealed that the interaction effect of urea & zinc sulphate on chlorophyll content was found to be significant over the control. The maximum chlorophyll content (47.10 spad value) was recorded under treatment T_{14} (urea 2.0% & $ZnSO_4$ @ 0.6%),

followed by T_{15} (urea 2.0% & $ZnSO_4$ @ 0.8%), whereas the minimum chlorophyll content (37.38) was recorded under control. The chemical parameters of guava fruits were significantly improved by the combined foliar sprays of urea and zinc sulphate over the control. The maximum chlorophyll content was recorded under the treatment (urea @ 2.0 & $ZnSO_4$ @ 0.6%). Different fractions of sugar under the influence of urea and zinc sulphate might be due to hydrolysis of complex polysaccharides into simple sugars, synthesis of metabolites and rapid translocation of photosynthetic products and minerals from other parts of plant to developing fruits. Several workers observed similar results as, Ghosh[9], Balakrishnan[4] and Balakrishnan[6] in guava. Results find supports from the work of Rajput and Chand[15] and Singh and Chonkar[16].

Table 1: Effect of foliar spray of urea, zinc sulphate and their interaction on pulp thickness, seed weight and No. of seed per fruit of guava cv. "Apple Colour"

Treatment		Pulp thickness (cm)	Pulp weight (gm)	Seed weight (gm)
Urea				
U_0 0.0%		1.78	149.16	5.61
U_1 1.0%		1.84	160.86	6.88
U_2 1.5%		1.90	168.29	6.96
U_3 2.0%		1.94	171.43	7.57
S.Em.±		0.007	0.58	0.007
C.D. at 5%		0.020	1.68	0.020
$ZnSO_4$				
Z_0 0.0%		1.81	154.31	7.19
Z_1 0.3%		1.85	160.07	6.93
Z_2 0.6%		1.89	166.07	6.70
Z_3 0.8%		1.91	169.30	6.20
S.Em.±		0.007	0.58	0.007
C.D. at 5%		0.020	1.68	0.020
Interaction (UXZ)				
$T_{(0)}$	U_0Z_0	1.74	145.50	6.50
$T_{(1)}$	U_0Z_1	1.79	147.54	6.46
$T_{(2)}$	U_0Z_2	1.80	149.59	5.49
$T_{(3)}$	U_0Z_3	1.81	153.99	4.01
$T_{(4)}$	U_1Z_0	1.81	153.67	7.33
$T_{(5)}$	U_1Z_1	1.82	156.13	6.87
$T_{(6)}$	U_1Z_2	1.85	164.31	6.69
$T_{(7)}$	U_1Z_3	1.89	169.35	6.65
$T_{(8)}$	U_2Z_0	1.83	157.65	7.35
$T_{(9)}$	U_2Z_1	1.87	165.85	7.15
$T_{(10)}$	U_2Z_2	1.94	174.20	6.80
$T_{(11)}$	U_2Z_3	1.95	175.45	6.55
$T_{(12)}$	U_3Z_0	1.84	160.43	7.57
$T_{(13)}$	U_3Z_1	1.93	170.75	7.25
$T_{(14)}$	U_3Z_2	1.98	176.16	7.84
$T_{(15)}$	U_3Z_3	1.99	178.39	7.61
S.Em.±		0.014	1.16	0.08
C.D. at 5%		0.040	3.36	0.24

Table 2: Effect of foliar spray of Urea, zinc sulphate and there interaction on pulp weight, seed/ pulp ratio, pulp percentage, seed percentage and chlorophyll content (spad value) of guava cv. "Apple Colour"

Treatment		Seed/pulp ratio	Pulp percentage	Seed percentage	Chlorophyll content (spad value)
Urea					
U_0 0.0%		0.037	95.89	4.11	39.53
U_1 1.0%		0.042	96.02	3.98	43.00
U_2 1.5%		0.042	96.03	3.97	44.24
U_3 2.0%		0.044	96.37	3.63	45.87
S.Em.±		0.0008	0.07	0.008	0.073
C.D. at 5%		0.0022	0.21	0.024	0.212
$ZnSO_4$					
Z_0 0.0%		0.046	95.55	4.45	41.45
Z_1 0.3%		0.043	95.85	4.15	42.34
Z_2 0.6%		0.040	96.27	3.73	44.05
Z_3 0.8%		0.036	96.63	3.37	44.80
S.Em.±		0.0008	0.07	0.008	0.073
C.D. at 5%		0.0022	0.21	0.024	0.212
Interaction (UXZ)					
$T_{(0)}$	U_0Z_0	0.044	95.45	4.55	37.38
$T_{(1)}$	U_0Z_1	0.043	95.79	4.21	38.42
$T_{(2)}$	U_0Z_2	0.036	96.08	3.92	40.18
$T_{(3)}$	U_0Z_3	0.026	96.23	3.77	42.15
$T_{(4)}$	U_1Z_0	0.047	95.55	4.45	41.69
$T_{(5)}$	U_1Z_1	0.044	95.87	4.13	42.38
$T_{(6)}$	U_1Z_2	0.040	96.25	3.75	43.36
$T_{(7)}$	U_1Z_3	0.039	96.41	3.59	44.58
$T_{(8)}$	U_2Z_0	0.046	95.50	4.50	42.57
$T_{(9)}$	U_2Z_1	0.043	95.93	4.07	42.69
$T_{(10)}$	U_2Z_2	0.039	96.27	3.73	45.55
$T_{(11)}$	U_2Z_3	0.037	96.43	3.57	46.13
$T_{(12)}$	U_3Z_0	0.047	95.72	4.28	44.17
$T_{(13)}$	U_3Z_1	0.042	95.80	4.20	45.86
$T_{(14)}$	U_3Z_2	0.044	96.48	3.52	47.10
$T_{(15)}$	U_3Z_3	0.042	97.46	2.54	46.35
S.Em.±		0.0015	0.15	0.016	0.147
C.D. at 5%		0.0044	0.42	0.047	0.424

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