Impact of Foliar Feeding of Borax, Zinc sulphate and their Intraction on Post harvest losses and economy of Guava (Psidium guajava L.) Cv. Gwalior 27

Abstract:

A field experiment entitled "Effect of foliar application of borax and zinc sulphate on growth, yield and quality of guava (*Psidium guajava* L.) cv. Gwalior-27" was carried out at Agrotechnology Park, Krishi Vigyan Kendra, College of Agriculture, Gwalior (M.P.) during 2016-2017**.** The experiment was consisting of 9 treatments having two levels of each Borax (0.2 per cent and 0.4 per cent) and Zinc sulphate (0.4 and 0.6 per cent). The experiment was laid out in Factorial randomized block design with three replications. Among different doses of foliar spray of nutrients, Zinc sulphate @ 0.6 (T_5) were found significantly superior over control with respect physiological loss in weight (g) and shelf life of guava. While the minimum spoilage % was recorded with treatment B_2Z_2 (Borax@ 0.4% + $ZnSo_4$@ 0.6%) at 5^{th}, 10^{th} and 15^{th} day of storage respectively.

Keywords: Zinc sulphate, Borax, Guava, Post harvest losses.

Introduction:

The most widespread but significant fruit crop in India is the guava. After mango, banana, and citrus, it ranked fourth in terms of acreage and output. It belongs to the Psidium genus, which has more than 150 species. Due to its hardiness and tolerance to a wider range of environments, Psidium guajava L. was more economically utilized. Even with little care, it is effectively cultivated in a variety of soil types and climatic environments. Attention must be paid to organised fruit production if we are to harvest field produce of higher quality. It is important to emphasise certain procedures and approaches for improving the fruit's post-harvest quality. It is believed that Mrigbahar is the best time to purchase high-quality guava fruits because fruit flies are no longer an issue. The guava tree blooms three times a year, in February, June-July, and October, in eastern and southern India. The corresponding bahars are known by the names "Ambe," "Mrig," and "Hasta" bahar. Among these three bahars, "Mrigbahar" fruits, which are better in quality, flavour, and vitamin C content, ripen in the winter, from November to January.

Plants can get micronutrient applications by foliar and soil applications. Micronutrient application to the foliage is more efficient than application to the soil. According to Keram et al. (2014) [1], one of the eight required trace elements or micronutrients for agricultural plants' typical, healthy development and reproduction is zinc. However, there is little research on the use of micronutrients to increase fruit size and overall fruit quality in India and other countries. In recent years, it has become increasingly clear how important micronutrients are to increasing the output and improving the quality of fruit harvests (Anonymous 2013) [2]. In light of this, a study was conducted to evaluate the potential effects of micronutrients on the guava fruit's development, yield, and sensory characteristics.

The need for micronutrients (zinc, boron, iron, copper, chloride, molybdenum, and manganese) is minimal and is only partially satisfied by soil, chemical fertilisers, and other sources. Intensified agricultural practises, uneven fertiliser applications, particularly NPK, restricted use of organic manures, nutrient depletion, and a lack of replenishment are the main causes of micronutrient deficiencies. According to Jeyakumar and Balamohan (2013) [3], boron, iron, and mo deficiencies are the most common deficiencies affecting horticultural crops. Additionally, these micronutrients aid in the absorption of significant nutrients and are actively involved in all aspects of plant metabolism, including respiration, photosynthesis, chlorophyll formation, enzyme activity, hormone synthesis, nitrogen fixation and reduction, among others (Das, 2003) [4]. However, micronutrients can significantly boost horticultural crop productivity, enhance product quality, and lengthen the life of horticulture food after harvest (Raja, 2009). [5]. By catalysing the effects of micronutrients, macronutrients are swiftly absorbed and used by plant tissue (Phillips, 2004) [6].

Method and material:

The 2016–2017 growing season was the focus of the current study, "Effect of foliar application of borax and zinc sulphate on growth, yield, and quality of guava (Psidium guajava L.) cv. Gwalior–27." The current study was carried out at the Krishi Vigyan Kendra, College of Agriculture, Agrotechnology Park, Gwalior (M.P.). Guava variety "Gwalior 27" is 7 years old and was planted using a square planting scheme, 6 m apart. Throughout the trial period, all the plants were treated to the same cultural procedures in order to evaluate the impacts of various treatments. A unit of one plant was used in each of the three replications of each treatment in the experiment's Randomised Block Design layout. The treatments included two separate chemicals, namely Borax and Zinc Sulphate, in two different concentrations. Controlled amounts of ordinary distilled water were sprayed on the plants. By dissolving the necessary quantity of zinc sulphate and boric acid in the necessary quantity of water, the stock solution of various concentrations of zinc sulphate (neutralised with hydrated lime) and borax was created. Fruits were picked when their skins became a pale yellow. For various observations, randomly chosen branches from each treatment were tagged in all directions of the tree. Observations recorded to be physiological loss in weight, Shelf life of fruits and spoilage %. The data so obtained were analysed statically.

Table 1. List of treatments used for the study

Treatments	**Details of the treatment**
T_1 (B_0Z_0)	Control (Water spray)
T_2 (B_1)	Borax (0.2%)
T_3 (B_2)	Borax (0.4%)
T_4 (Z_1)	$ZnSO_4$ (0.4%)
T_5 (Z_2)	$ZnSO_4$ (0.6%)

T_6 (B_1Z_1)	Borax (0.2%) + $ZnSO_4$ (0.4%)
T_7 (B_1Z_2)	Borax (0.2%) + $ZnSO_4$ (0.6%))
T_8 (B_2Z_1)	Borax (0.4%) + $ZnSO_4$ (0.4%)
T_9 (B_2Z_2)	Borax (0.4%) + $ZnSo_4$ (0.6%))

Result and discussion:

The PLW% is presented in Table 2 and the minimum physiological loss in weight was recorded 4.90 per cent at 4 days with foliar application of Zinc sulphate @ 0.6 (T_5). The maximum physiological loss in weight was recorded 7.10 per cent at 4 days under control (T_1). The maximum shelf life of fruit recorded 5.2 days with foliar spray of Zinc sulphate @ 0.6% (T_5) significantly superior to other treatments followed by T_3 and T_7. The minimum fruit storage stability is recorded 2.00 days under control (T_1).

The minimum weight loss in the fruits produced by the application of these treatments could be attributed to slower rate of respiration and transpiration from these fruits with reduced enzymatic activities and slower the biochemical changes occurring in the fruits obtained from the trees receiving these treatments. Kumar et al. (2017) [7, 8, 9] reported that, reduction in weight loss of guava fruits with foliar application of borax. The minimum PLW and prolonged shelf life of was observed due to foliar application of zinc sulphate (Goswami et al. 2012) [8]

Table 2.: Effect of foliar application of Borax, Zinc sulphate and their intraction on Physiological loss in weight (%) and Shelf life of guava.

Treatment	**Physiological loss in weight (%)**	**Shelf life of fruit**
T_1–control	7.10	2.00
T_2 -Borax (0.2%)	5.70	3.20
T_3 -Borax(0.4%)	5.30	4.00
T_4 -Zinc sulphate (0.4%)	5.10	3.50
T_5 -Zinc sulphate(0.6%)	**4.90**	**5.20**
T_6 -(Borax @0.2%+ZnSo4@0.4%)	6.00	3.00
T_7-(Borax @0.2%+ZnSo4@0.6%)	5.80	3.60
T_8 -(Borax @0.4%+ZnSo4@0.4%)	5.60	3.40
T_9-(Borax @0.4%+ZnSo4@0.6%)	5.50	3.30
SEm±	**0.077**	**0.120**
CD at 5%	**0.239**	**0.371**

The data pertaining to effect of spray of Borax, Zinc sulphate and their interaction on the fruit spoilage percentage are given in table 3.

The minimum spoilage % were observed (3.68%) and (3.23%) on the 5th day of storage, (11.43%) and (11.12%) on the 10th day of storage, (20.96%) and (20.56%) on the 15th day

storage were observed with treatments B_2(Borax @ 0.4%) and Z_2 (zinc sulphate @ 0.6%) respectively. however maximum decay per cent was recorded in the control.

The minimum spoilage % (4.11%), (11.11%) and (20.77%) was recorded with treatment B_2Z_2 (Borax@ 0.4% + $ZnSo_4$@ 0.6%) at 5^{th}, 10^{th} and 15^{th} day of storage respectively, However, the maximum spoilage % (7.72%), (16.89%) and (28.44%) was recorded under control at 5^{th}, 10^{th} and 15^{th} day of storage, respectively.

Table 3.: Effect of foliar application of Borax, Zinc sulphate and their intraction on fruit spoilage % of guava.

Treatments	Decay (%)		
	At 5^{th} day	At 10^{th} day	At 15^{th} day
Borax (H_3BO_3)			
B_0	5.74	14.65	24.64
B_1	4.92	12.37	22.46
B_2	3.68	11.43	20.96
S.Em±	0.360	0.540	0.435
CD at 5%	1.04	1.52	1.23
$ZnSO_4$			
Z_0	5.77	14.78	23.47
Z_1	4.52	13.34	22.14
Z_2	3.23	11.12	20.56
S.Em±	0.360	0.540	0.435
CD at 5%	1.04	1.52	1.23
B_0 Z_0	7.72	16.89	28.44
B_1 Z_1	5.33	12.68	24.34
B_1 Z_2	5.50	12.34	22.23
B_2 Z_1	4.44	13.23	22.33
B_2 Z_2	4.11	11.11	20.77
S.Em±	0.17	0.24	0.45
CD at 5%	0.55	0.62	1.25

A critical examination of data presented in the table 4 revealed that various treatments of Borax and Zinc sulphate increased the net return and B:C ratio. Maximum net returns (Rs 2, 43,280/ ha) was recorded in B_2Z_2 (Borax @ 0.4% & ZnSo4@ 0.6 %) and the minimum (Rs 192674/ ha) in control. Whereas, minimum B: C ratio (1:8.00) was recorded with B_0Z_0 (Borax @ 0.2 % @ & no ZnSo4), while maximum (1:9.97) was in B_2Z_2 (Borax @ 0.4% & ZnSo4 @ 0.6 %). The net income and B:C ratio was calculated taking sale price of fruits @ 20/kg.

Table 4.: Economics of the different treatments (per ha.)

Treatments	Common expenditure/ (ha)	Treat. Cost (Rs)	Total Expenditure / ha	Gross Income/ ha	Net Income/ ha	B:C Ratio
T_1	25000	0	25000.00	220200.00	192674.00	1:8.00
T_2	25000	1500	26500.00	223600.00	197100.00	1:8.44
T_3	25000	2155	27155.00	245000.00	217845.00	1:9.02
T_4	25000	2526	25726.00	210600.00	185600.00	1:8.42
T_5	25000	3830	28830.00	233400.00	204570.00	1:8.10
T_6	25000	5621	30621.00	254800.00	224179.00	1:8.32
T_7	25000	5100	30001.00	240600.00	210599.00	1:8.02
T_8	25000	5801	28600.00	256400.00	227800.00	1:8.97
T_9	25000	5675	27120.00	270400.00	243280.00	1:9.97

Conclusion:

The minimum physiological loss in weight and maximum shelf life of fruit recorded with foliar spray of Zinc sulphate @ 0.6% (T_5) significantly superior to other treatments. The minimum spoilage % were observed on the 5^{th} day of storage, 10^{th} day of storage, and the 15^{th} day storage were observed with treatments B_2 (Borax @ 0.4%) and Z_2 (zinc sulphate @ 0.6%) respectively. In the interaction effect of Borax and Zinc sulphate, the treatment B_2Z_2 (Borax @ 0.4% & Zinc sulphate @ 0.6 %) were found to be the best treatments for almost Maximum net returns and maximum B: C ratio.

References:

1. Keram K.S., Sharma B.L., Kewat M.L. and Sharma G.D. (2014). Effect of zinc fertilization on growth, yield and quality of wheat grown under agro-climatic condition of kymore plateau of madhyapradesh, India. *The BioScan*. 9 (4): 1479-1483.
2. Anonymous (2013). *http://www.cropnutrition.com/efu micronutrients#overview*
3. Jeyakumar P, Balamohan TN. Micronutrients for horticultural crop 2013. *http:agritech.tnau.ac.in*
4. Das DK. Micronutrients: Their behaviours in soils and plants, *Kalyani publ Ludhiana* 2003, 111-214.
5. Raja EM. Importance of micronutrients in the changing horticultural scenario. *J Hort Sci* 2009;4(1):1-27.

6. Phillips M. Economic benefits from using micronutrients for the farmer and the fertilizer producer. *Int Sym onmicr* New Delhi, India 2004, 23-25.
7. Kumar P, Singh AK, Shankhdhar SC. Efficacy of soil and foliar application of macro and micronutrients on yield and quality of Mango Cv. Dashehari. *Int j curr microbiol app Sci* 2017;6(10):1855-1861.
8. Goswami, A. K, Shukla HS, Kumar P, Mishard DS. Effect of preharvest application of micronutrients on quality of guava (Psidium guajava L.) Cv. Sardar. *Hort Flora Res Spectrum* 2012;1(1):60-63.
9. Shreekant RD, Kumar U. Effect of foliar application of micronutrients on fruit set, yield attributes and yield of winter season Guava (*Psidium guajava* L.) Cv. L-49. *Int J Pure App Biosci* 2017;5(5):1415-1419.