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Effect of different levels of boron and zinc on flowering, fruiting and growth parameter of winter season guava (*Psidium guajava* L.) cv. L-49

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ABSTRACT : The present investigation was undertaken to study the effect of different levels of boron and zinc on flowering, fruiting and growth parameter of winter season guava (*Psidium guajava* L.) cv. L-49 in the Fruit Research Farm, Horticulture Unit, B.H.U., Varanasi, U.P. during the year 2012-2013. A perusal of data revealed that maximum shoot length, number of leaves, leaf area, fruit set, fruit retention and number of fruits per tree was found in T_8 ($ZnSO_4$ 0.8% + borax 0.4%), while minimum results was recorded in all the attributes under control (no treatment is given), respectively. Treatment T_8 ($ZnSO_4$ 0.8% + borax 0.4%) shows minimum fruit drop, number of days taken for first flowering and number of days taken for 50% flowering, while in control the all attributes was maximum, respectively.

KEY WORDS : Boron, Flowering, Guava, Quality, Zinc, Boron

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Guava (*Psidium guajava* L.) is an important fruit crop of the subtropical and tropical regions in the world. Guava (*Psidium guajava* L.), the apple of the tropics, is one of the most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India. The fruit belongs to the family Myrtaceae, which has 140 genera and 3000 species widely distributed throughout the tropical and subtropical regions of the world. In India, it has been introduced in early seventeenth century and gradually became a crop of commercial significance all over the country.

Guava fruit are climacteric (Akamine and Goo, 1979; Brown and Wills, 1983), with a relatively short shelf life due to their rapid rate of ripening (Pantastico *et al*., 1975). It is a good source of ascorbic acid, pectin, sugars and certain minerals. Its skin and flesh colors vary from variety to variety depending on the amount and type of pigments. The fruit softens very rapidly during ripening (Wilson, 1980).

Guava has earned the popularity as "Poor man's apple" available in plenty to every person at very low price during the season. It is no inferior to apple for its nutritive value. It is pleasantly sweet and refreshingly acidic in flavor and emits sweet aroma. It is wholly edible along with the skin. The fruits outer layer is green and as it ripens turns into a pale yellow.

Guava is a rich source of ascorbic acid, sugars and pectin. The ascorbic acid content ranges from 75 to 260 mg/100g pulp which varies with cultivar, season, location and stage of maturity. The total soluble solid content in fruits varies from 8.2 to 10.5 ^{0}Brix.

The total sugars ranges between 4.9 to 10.1 per cent, out of which fructose (59%), glucose (36%) and sucrose (5%) are predominant sugar in ripe guava fruit. Fructose is the principle sugar in green ripe fruit while sucrose is the main one in fully ripe fruits. Fruits are fair source of vitamin A (about 250 IU/100 g) and contain appreciable quantities of thiamine, niacin and riboflavin. The pectin content in guava ranges between 0.5 to 1.8 per cent. The pectin content also varies with cultivars and stages of maturity and there is no specific trend in pectin content between pink and white fleshed cultivars/ hybrids.

RESEARCH METHODS

The present investigation entitled "effect of different levels of boron and zinc on flowering, fruiting and growth parameter of winter season guava (*Psidium guajava* L.) cv. L-49" was carried out in the Fruit Research Farm, Horticulture

Unit, Banaras Hindu University, Varanasi, U.P. during the year 2012-2013.

Selection of variety:

Guava variety L-49 also known as sardar guava was selected for the present study. This variety was evolved through selection from open pollinated seedlings of Allahabad safeda at Poona and also known as Sardar guava. It is Semi dwarf 2.3 to 3.4 meter in height, heavy branching type with flat crown, leaves are large 12.8 to 13.2 cm long, 6.8 cm broad, elliptic-ovate to oblong in shape. Fruit is roundish ovate in shape, skin colour promise yellow with occasional red rot on the skin. The taste is good and keeping quality is excellent.

The investigation was conducted on 6 years old guava plants planted at 6 x 6 m apart under square system of planting. In order to assess the effects of various treatments, all the plants were subjected to uniform cultural practice during the period of experimentation.

Experimental details:

The experiment was laid out in Randomized Block Design with three replications with a unit of one plant in each replication of a treatment.

Table A : Experimental details

Symbol	Details of the treatment
T_0	(Control)
T_1	(Zinc sulphate 0.4%)
T_2	(Zinc sulphate 0.8%)
T_3	(Borax 0.2%)
T_4	(Borax 0.4%)
T_5	(Borax 0.2%+ Zinc sulphate 0.4%)
T_6	(Borax 0.2%+ Zinc sulphate 0.8%)
T_7	(Borax 0.4%+ Zinc sulphate 0.4%)
T_8	(Borax 0.4%+ Zinc sulphate 0.8%)

Preparation and method of application of nutrient solution:

The requirement of spray liquid for spraying a tree was assessed to be two liters. The quantity of micronutrient at the rate of 1 g/liters was used to make the solution concentration of 0.1 per cent. Similarly Zinc sulphate at the rate of 4 g per liter and 8 g / liter make a solution of 0.4 per cent and 0.8 per cent, respectively.

Observations on various characters of plant *i.e.* growth, fruiting, yield, physical and chemical attributes of fruits and economics of different treatments applied were worked out as per standard procedures.

Observations recorded:

The observation will be recorded on length of terminal shoot (cm), number of leaves per shoot, leaf area per shoot (cm^2), flowering, fruiting, and yield characters, fruit setting (%), fruit drop (%), fruit retention (%), time taken for first flowering (days), time taken for 50 per cent flowering (days), number of fruits per tree and fruit yield (kg/tree).

Statistical analysis:

The statistical analysis of the data obtained in the different set of experiment were calculated as suggested by Panse and Sukhatme (1985). The critical difference (C.D.) was calculated to assess the significance of difference between treatments, whenever the results were found significant through 'F' test. CD at 5 per cent level of significance was determined.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Growth characters:

It is evident from the data presented in the Table 1 with different treatments had significant effect on vegetative growth characters *viz.*, terminal length of shoot, number of leaves per shoot and leaf area per shoot. A perusal of data revealed that the greatest length (38.12 cm) was recorded under T_8 ($ZnSO_4$ 0.8 % + borax 0.4%), while the minimum length of

Table 1 : Effect of boron and zinc on growth parameter of winter season guava

Treatments	Length of terminal shoot (cm)	Number of leaves per shoot	Leaf area (cm^2)
T_0 (Control)	28.02	15.95	528.88
T_1 (Zinc sulphate 0.4%)	29.23	17.25	540.79
T_2 (Zinc sulphate 0.8%)	31.02	19.06	558.55
T_3 (Borax 0.2%)	32.30	20.42	571.95
T_4 (Borax 0.4%)	34.78	22.83	595.05
T_5 (Borax 0.2%+ Zinc sulphate 0.4%)	34.00	22.11	585.45
T_6 (Borax 0.2%+ Zinc sulphate 0.8%)	35.98	23.96	602.86
T_7 (Borax 0.4%+ Zinc sulphate 0.4%)	36.78	24.68	612.18
T_8 (Borax 0.4%+ Zinc sulphate 0.8%)	38.12	26.23	628.21
S.E. ±	0.16	0.34	4.56
C.D. (P=0.05)	0.50	1.02	13.69

terminal shoot (28.02cm) was in control. The maximum (26.23) number of leaves was recorded under T_8 ($ZnSO_4$ 0.8 % + borax 0.4%) while the minimum (15.95) leaves per shoot was recorded in control. The greatest (628.21cm^2) leaf area was recorded with T_8 ($ZnSO_4$ 0.8% + borax 0.4%), while the lowest (528.88 cm^2) leaf area per shoot was noted in control.

The maximum value for terminal length of shoot, number of leaves per shoot and leaf area per shoot were reported with the foliar spray of $ZnSO_4$ 0.8 per cent + borax 0.4 per cent followed by $ZnSO_4$ 0.4 per cent + borax 0.4 per cent. These results are similar to the findings of Bangali *et al.* (1993); Balakrishnan (2001); Abdollahi *et al.* (2010); Kumar *et al.* (2010) and Khan *et al*. (2012). Zinc is essential for auxin and protein synthesis, Seed production and proper maturity of fruits. Increased vegetative growth might be due to residual effect of higher concentration of auxins in plant which produced high leaf to fruit ratio ultimate cause of higher amount of photosynthates. While boron has a key role in cell division and elongation, and there by increased vegetative growth. A notable characteristic of borax is that it directly effects photosynthesis activity of plants. The higher vegetative growth due to combined application of higher concentration of zinc and boron may be attributed to their stimulatory effect on plant metabolism.

Flowering and fruiting characters:

It is obvious from Table 2 that effect of different treatments was very striking on fruit set per cent. The maximum (78.57%) fruit set was recorded with T_8 ($ZnSO_4$ 0.8% + borax 0.4%) which was statistically at par with T_7 (78.46%), T_4 (78.37%), T_6 (78.13%) and T_5 (77.93%). The minimum (70.92%) fruit set was recorded in control. The minimum (39.77%) fruit drop was recorded with T_8 ($ZnSO_4$ 0.8% + Borax 0.4%), while maximum (56.53%) fruit drop was noted in control. However, high level of both the micronutrients was more effective in reducing the fruit drop. A perusal of data revealed that different levels of boron and zinc increased fruit retention as compared to control. The maximum fruit retention (62.10%) was recorded with T_8 ($ZnSO_4$ 0.8% + Borax 0.4%), while it was minimum (43.47%) in control.

It is evident from the data presented in Table 2 that different treatments had significant effect on reproductive characters of tree (fruit set, fruit retention and fruit drop percentage). Maximum fruit set, fruit retention and minimum fruit drop were recorded with foliar spray of $ZnSO_4$ 0.8 per cent + borax 0.4 per cent followed by $ZnSO_4$ 0.4 per cent + borax 0.4 per cent . These results are similar to the findings of Bagali *et al.* (1993); Balakrishnan (2001); Prasad *et al.* (2005); Shukla (2011) and Yadav *et al.* (2011) in guava. Dahiya *et al.* (1993) and EI-Sherif *et al.* (2000) also reported that fruit set percentage was increased by zinc spray. Wright (1956) suggested that primitive effect of growth substances in greater retention of fruit may be attributed to reduction in fruit drop.

Table 2 : Effect of boron and zincon fruiting character of winter season guava

Treatments	Time taken for first flowering (days)	Time taken for 50% flowering (days)	Fruit set (%)	Fruit drop (%)	Fruit retention (%)	No. of fruits per tree
T_0(Control)	41.00	50.00	70.92	56.53	43.47	172.00
T_1(Zinc sulphate 0.4%)	39.33	48.33	76.43	48.59	51.41	183.50
T_2(Zinc sulphate 0.8%)	38.67	47.67	77.78	44.27	55.73	196.83
T_3(Borax 0.2%)	37.67	46.67	77.43	47.91	52.09	191.17
T_4(Borax 0.4%)	36.67	45.67	78.37	43.04	56.93	204.33
T_5(Borax 0.2%+ Zinc sulphate 0.4%)	37.00	46.00	77.93	46.87	53.13	214.71
T_6(Borax 0.2%+ Zinc sulphate 0.8%)	37.33	46.33	78.13	42.72	57.26	221.81
T_7(Borax 0.4%+ Zinc sulphate 0.4%)	36.33	45.33	78.46	41.72	58.28	230.11
T_8(Borax 0.4%+ Zinc sulphate 0.8%)	35.00	44.00	78.57	39.77	60.23	241.84
S.E. ±	0.61	0.61	0.36	0.32	0.39	3.47
C.D. (P=0.05)	1.85	1.85	1.10	0.97	1.18	10.40

There is correlation between fruit drop and endogenous hormonal status, and existence of high level of internal auxin is useful for preventing fruit drop. Since high level of endogenous hormones might help in building up endogenous hormone at appropriate level that might be potent enough to reduce the fruit drop. The increased fruit retention due to zinc spray might be due prevention in fruit drop owing to increased auxin concentration to distal end of fruits. By the foliar application of boron the fruit drop is reduced because boron plays an important role in translocation of carbohydrate, synthesis of auxin and enhancing pollen viability and fertilization.

Data presented in Table 2 reveal that a considerable decreased number of days taken for first flowering as compared to control. The minimum (35 days) number of days taken for first flowering was recorded with T_8 ($ZnSO_4$ 0.8 % + Borax 0.4%), while the maximum number of days (41 days) taken for first flowering were noted in control. The minimum (44 days) number of days taken for 50% flowering was recorded with T_8 ($ZnSO_4$ 0.8% + Borax 0.4%), while maximum number of days (50 days) taken for 50% flowering was noted in control. It is obvious from data that effect of different treatments was very striking on number of fruits per tree. The maximum (241.84) number of fruits per tree was recorded with T_8 ($ZnSO_4$ 0.8% + borax 0.4%), while the minimum (172) number of fruits per tree was recorded in control. Time taken for 50% flowering was minimum with the foliar spray of $ZnSO_4$ 0.8% + borax 0.4% followed by $ZnSO_4$ 0.4% + borax 0.4%. These results collaborate the findings of Balakrishnan (2001) and Prasad *et al.* (2005).

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