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Influence of Diatomaceous Earth as a Source of Silicon on Growth Status of Guava cv. Sardar

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ABSTRACT

Diatomaceous earth (Silicon) has positive growth effect including increased dry mass and yield in plants, by knowing this benefit effect of diatomaceous earth (DE) on growth of guava has been studied. In this experiment among the different treatments, highest plant height (3.59 m) was recorded in T_9 (RDF + 3 kg/plant of DE) at first month and the same trend was seen after 2,3,4,5 month. Among the treatments for plant spread in North – South direction, T_4 Treatment showed highest value in the month of 1st(3.40m), 2nd(3.53m) 3rd(3.64)and5th(3.89m)month, respectively. In case of East-West direction, the maximum spread was observed in treatment T_5 (Half of RDF + 2 kg/ plant of DE).in during entire period and the values are 3.02, 3.15, 3.28, 3.43, 3.56 meters respectively.

Key words *Diatomaceous earth (DE), silicon, growth, plant height, Guava*

Guava *(Psidium guajava* L.) member of family Myrtaceae, popularly known as the "Apple of the Tropics", is one of the most common fruits grown in India. It claims to be the fourth most important fruit in area and production after mango, banana and citrus. Presently, it is widely grown all over the tropics and sub-tropics. Guava can be grown on diverse types of soil. Tree can also be grown in soils which are unsuitable for other fruit crops. Guava grows well in soils of low fertility, but yield and quality can be increased by application of manures, fertilizers and beneficial elements.

Although silicon is not considered as an essential plant nutrient because of its ubiquitous presence in the biosphere and most plants can be grown from seed to seed without its presence (Epstein, 1999). Among the plants silicon concentrations are found to be higher in monocotyledons than in dicotyledons and its level increased from legumes > fruit crops > vegetables > grasses > grain crops. Silicon is used as fertilizer for both agronomic and horticulture crops to improve yield and quality. The role of silicon in plant biology is to reduce multiple stresses including biotic and abiotic stresses. It is also known to increase drought tolerance in plants by maintaining plant water balance, photosynthetic activity, erectness of leaves and structure of xylem vessels under high transpiration rates (Melo *et al*., 2003). Improved water economy and dry matter yield by silicon application and it enhanced leaf water potential under water stress conditions, reduced incidence of micronutrient and metal toxicity (Matoh *et al*., 1991). The presence of Silicon has also been reported to affect the absorption and translocation of several macro- and micro-nutrients. More recently, silicon amendments were shown to reduce the leaching of phosphate, nitrate and potassium (NPK) (Matichenkov and Bocharnikova, 2010). Nutrient leaching also results in soil nutrient deficiencies that require additional fertilization. The leaching of NPK fertilizers poses a significant environmental and economic concern, Silicon -amendments that are able to mitigate these risks are worthy of further investigation. Numerous laboratory, greenhouse and field experiments have showed the benefits of silicon fertilizers for agriculture and horticulture crops and the importance of silicon fertilizers as a component in sustainable agriculture was reported by Ma and Takahashi, 2002. Realizing the beneficial effects of silicon in sustainable crop production and the response of several crops to silicon nutrition for sustained crop yields; it has become a component of integrated nutrient management in certain countries. With this background information and based on the possible benefits of silicon, the present study was carried out to know the Effect of Diatomaceous Earth (as a source of silicon) on growth of Guava.

MATERIAL AND METHODS

The present investigation on "Studies on effect of Diatomaceous earth (DE) as a source of silicon on growth of Guava was carried out at Kittur Rani Channamma College of Horticulture, Arabhavi (University of Horticulture Sciences, Bagalkot), Karnataka. The Sardar (L-49) variety of guava is used for experiment. The source of silicon used is Diatomaceous earth (DE), applied as basal dose to the respective treatment in this experiment. The dosage of DE used in this experiment was 1, 2 and 3 kg/plant. The inorganic nutrient *i.e.* nitrogen was applied in the form of urea (46% N), phosphorous in the form of single super phosphate and potassium in the form of muriate of potash (60% K). These nutrients were applied to the respective treatment according to the package of practice of UHS, Bagalkot. The design adopted for the experiment was Randomized Block Design (RBD) and the treatment details are T_1 - Absolute control, T_2 - Recommended dose of fertilizer (200:80:150 g NPK/plant) ,T_3 - Half of Recommended dose of fertilizer,T_4 - Half of RDF + 1 kg/plant of DE, T_5 - Half of RDF + 2 kg/plant of DE,T_6 - Half of RDF + 3 kg/plant of DE,T_7 - RDF + 1kg/plant of DE,T_8 - RDF + 2 kg/plant of DE,T_9 - RDF + 3 kg/plant of DE. Plants of uniform growth

Table 1. Effect of diatomaceous earth (DE) on plant height of guava

Treatments	Plant height (m)					
	Initial	One MAT	Second MAT	Third MAT	Fourth MAT	Fifth MAT
T_1 - Absolute control	1.91	2.91	2.74	2.82	3.16	3.24
T_2 - Recommended dose of fertilizer (RDF)	2.64	2.76	3.60	3.68	3.76	3.82
T_3 - Half of Recommended dose of fertilizer	2.02	3.10	3.57	3.64	3.73	3.83
T_4 - Half of RDF +1 kg/plant	2.82	3.40	3.64	3.71	3.82	3.89
T_5 - Half of RDF +2 kg/plant	2.48	3.48	3.81	3.90	3.98	4.07
T_6 - Half of RDF +3 kg/plant	2.43	3.17	3.57	3.65	3.78	3.86
T_7 - RDF +1kg/plant	2.18	3.06	3.61	3.70	3.80	3.87
T_8 - RDF + 2 kg/plant	2.28	3.45	3.86	3.72	3.79	3.88
T_9 - RDF +3 kg/plant	2.45	3.59	4.25	4.30	4.37	4.43
S.Em±		0.06	0.13	0.15	0.13	0.13
CD @ 5%	N.S	0.22	0.40	0.43	0.39	0.40

MAT- Month after treatment N.S- Non significant N-S-North -South

were selected for recording observations in each replication under each treatment. Vegetative growth parameters were recorded at monthly interval from initial to harvesting. The height of the plant was measured before imposing the treatments (initial value) and at monthly intervals, from the collar region to the top of the canopy using a measuring tape and expressed in m (meter). The plant spread in East-West and North- South directions was measured initially and at monthly intervals using a measuring tape and expressed in 'm'.

RESULT AND DISCUSSION

In case of plant height the data are presented in table 1 reveals that, in all the treatments, plant height increased linearly with the advancement of growth from the treatment imposition to harvesting. Initially in all the treatments, the plant height was non-significant. Significant difference was observed in all the treatment after one month of treatment imposition. At one month after treatment, the highest plant height (3.59 m) was recorded in T_9 (RDF + 3kg of DE per plant) which was on par with T_5(3.48m),T_8 (3.45m) T_4(3.40m) whereas, the least height (2.76 m) was recorded in T_2, which was on par with T_1(2.91m). At second month after treatment, maximum plant height (4.25m) was recorded in T_9, followed by treatment T_8(3.86m), where as minimum height (2.74 cm) was recorded in the T_1. At third month, maximum height (4.30m) was recorded in T_9, followed by the treatment T_5 (3.90 m) whereas, minimum height (2.82m) was recorded in the treatment T_1.After fourth month, maximum height (4.37m) was noticed in the treatment T_9, followed by the treatment T_5 (3.98m),T_4 (3.82m) and T_7 (3.80m), whereas, minimum plant height (3.16m) was recorded in the treatment

Table 2. Effect of diatomaceous earth (DE) on plant spread (N-S) of guava

Treatments	Plant spread (m)					
	Initial	One MAT	Second MAT	Third MAT	Fourth MAT	Fifth MAT
T_1 - Absolute control	2.12	2.22	2.35	2.48	2.59	2.70
T_2-Recommended dose of fertilizer (RDF)	2.33	2.37	2.50	2.63	2.75	2.88
T_3 - Half of Recommended dose of fertilizer	2.09	2.10	2.24	2.38	2.49	2.59
T_4 - Half of RDF +1 kg/plant	2.56	2.58	2.71	2.85	2.97	3.15
T_5 - Half of RDF + 2kg/plant	2.67	3.02	3.15	3.28	3.43	3.56
T_6 - Half of RDF +3 kg/plant	2.33	2.50	2.62	2.74	2.90	3.05
T_7 - RDF +1 kg/plant	2.42	2.49	2.61	2.76	2.90	3.04
T_8 - RDF + 2 kg/plant	2.62	2.71	2.82	2.95	3.13	3.23
T_9 - RDF +3kg/plant	2.38	2.49	2.64	2.77	2.92	3.05
S.Em±		0.13	0.12	0.12	0.12	0.11
CD @ 5%	N.S	0.35	0.36	0.36	0.36	0.37

MAT- Month after treatment N.S- Non significant N-S-North- South

Table 3. Effect of diatomaceous earth (DE) on plant spread (E – W) of guava

Treatments	Plant spread (m)					
	Initial	One MAT	Second MAT	Third MAT	Fourth MAT	Fifth MAT
T_1 - Absolute control	2.12	2.22	2.35	2.48	2.59	2.70
T_2-Recommended dose of fertilizer (RDF)	2.33	2.37	2.50	2.63	2.75	2.88
T_3 - Half of Recommended dose of fertilizer	2.09	2.10	2.24	2.38	2.49	2.59
T_4 - Half of RDF +1kg/plant	2.56	2.58	2.71	2.85	2.97	3.15
T_5 - Half of RDF +2 kg/plant	2.67	3.02	3.15	3.28	3.43	3.56
T_6 - Half of RDF +3kg/plant	2.33	2.50	2.62	2.74	2.90	3.05
T_7 - RDF +1kg/plant	2.42	2.49	2.61	2.76	2.90	3.04
T_8 - RDF + 2 kg/plant	2.62	2.71	2.82	2.95	3.13	3.23
T_9 - RDF +3 kg/plant	2.38	2.49	2.64	2.77	2.92	3.05
S.Em±		0.13	0.12	0.12	0.12	0.11
CD @ 5%	N.S	0.35	0.36	0.36	0.36	0.37

MAT- Month after treatment N.S- Non significant E-W-East- west

T_1. However at fifth month, maximum plant height (4.43m) was recorded in T_9, followed by the treatment T_5 (4.07m), whereas minimum height (3.24m) was recorded in the treatment T_1.

Among the treatments for plant spread in North – South direction,T_4 Treatment showed highest value in the month of 1st(3.40m), 2nd(3.53m) 3rd(3.64)and5th(3.89m)month, respectively(Table 2). But in the 4th month the highest value(3.46m)was found in T_9 treatment which was found on par with T_4 treatment (3.42 m).In case of East-West direction, the maximum spread was observed in treatment T_5 in during entire period and the values are 3.02, 3.15, 3.28, 3.43, 3.56 meters respectively(Table3). The increase in plant height and spread might be due to the fact that silicon induces the shoot height in crop plants, through its role in both cell division and cell expansion by its effect on RNA and DNA synthesis or due to altered levels of plant growth regulators. Similar results were observed by Kumbargire *et al* (2016) on Banana, Francico *et al*. (2015) on papaya, Manjunatha *et al*. (2014), Lalithya, *et al.* (2013) on Sapota, Milne *et al.* (2012) on Lettuce, Magno *et al.* (2012) on Banana, Neil and Roland (2010) in crossandra. Bhavya (2010) in Bangalore Blue grapes, Kammenidou *et al*. (2010) in gerbera, Kidane and Liang (2010) in banana, Pulz *et al*.(2008) in potato, Seome *et al*. (2008) in melon, Tesfagiorgis *et al*. (2008) in zucchini and zinnia, Aziz *et al*. (2001) in melon, , Henriet *et al*. (2006), Wang and Galleta (1998) in strawberry, Cia and Rian (1995) in apple.

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