INDIAN JOURNAL OF ARID HORTICULTURE
2010, Vol. 5 (1-2): 70-71

SHORT COMMUNICATION

Impact of bio-inoculants on seed germination and plant growth of guava (*Psidium guajava* Lamk.)

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Due to rising cost of chemical fertilizers and their adverse effects on soil health, the economically attractive and alternate potential sources of plant nutrients should be exploited. The excessive use of these chemical fertilizers adversely affects human health resulting in dreadful diseases like cancer, hypertension and other abnormalities. Further, to sustain the productivity, the bio-inoculants can supplement them to certain extent in various food crops. But it is not the common practice in various horticultural crops. The seed coat of most of the fruit crops is very hard. To break the seed dormancy, either some chemical treatment or long incubation period is required. These bio-inoculants can be helpful in breaking the seed dormancy by producing various plant growth substances. Hence the present investigations were undertaken to study the response of different bio-inoculants in combination with either FYM or vermicompost on seed germination and plant growth in guava (*Psidium guajava* Lamk.).

The experiment was conducted at the Experimental Farm, CCSHAU Regional Research Station, Bawal during the years 2007-08 and 2008-09. The experiment was laid out in randomized block design with six replications of each treatment both with vermicompost as well as farm yard manure. For filling up of polythene bags, the loamy sand soil and vermicompost/FYM were mixed together in 1:1 ratio. The different treatment combinations were- T_1: FYM alone; T_2: FYM+PGPR(*Pseudomonas maltophilia* PM4); T_3: FYM+VAM(vesicular arbuscular mycorrhizae); T_4: FYM+PSB(phosphate solubilizing bacteria); T_5: FYM+*Azotobacter chroococcum*; T_6:FYM+PSB +*Azotobacter*+PGPR; T_7: Vermicompost(VC) alone; T_8: VC+PGPR; T_9: VC+VAM; T_{10}: VC+PSB; T_{11}: VC+*Azotobacter*; T_{12}: VC+PSB+ *Azotobacter*+PGPR. In total there were twelve treatments; six each of vermicompost+soil and FYM+soil.

The seeds of guava were surface sterilized with 0.2% mercuric chloride solution for five minutes and then washed 2-3 times with sterilized distilled water, coated with charcoal based inoculants and then twenty seeds per replication for each treatment were impregnated into the polythene bags. The bio-inoculants used in the study were collected from Department of Microbiology, CCSHAU, Hisar and grown in their respective media under aseptic conditions.

Glomus fasciculatum, species of VAM fungi was used as VAM inoculants. The inoculums consisted of soil, spores and hyphae from chopped root fragments of pearl millet. Ten gram of the inoculums was mixed with the top soil in each polythene bag before sowing of guava seeds. The observations were recorded in terms of per cent seed germination at different time intervals up to 40 days of sowing. Then plant saplings were thinned down to one healthy sapling per bag and observed for plant height, number of leaves per plant and dry shoot weight at 150 days of sowing.

During the period 2007-08, maximum percent germination (34.2%) was observed in the treatment having FYM+ PSB+ *Azotobacter*+ PGPR; followed by FYM+VAM (29.2%). Per cent seed germination was slightly better in the treatments having FYM over their respective vermicompost treatments, however, the difference between them was non-significant. During 2008-09, the maximum germination (51.1%) was recorded in FYM + PGPR and FYM + *Azotobacter*; closely followed by FYM+ PSB+ *Azotobacter*+ PGPR and vermicompost+ *Azotobacter* (48.9 %) (Table 1). Plant height was also stimulated by different bio-inoculants in combination with farm yard manure as well as vermicompost during the period of investigation. However, PSB alone did not contribute much on different plant growth parameters.

VAM inoculation with FYM as well as with vermicompost positively affected number of leaves per plant during both the years (Table 2). The similar trends were followed when dry weight of shoot was recorded after 150 DAS. In general, VAM culture and co-inoculation of PSB, PGPR and *Azotobacter* stimulated plant growth parameters more positively as compared to single inoculation or untreated control. The response with FYM was slightly better over their respective vermicompost treatments.

Various reports in horticultural crops indicated that bio-inoculants either individually or in combination had synergistic effect on plant growth. The dual inoculation of *Azotobacter* and *Glomus fasciculatum* had more positive response in peach seedlings as compared to single inoculation or control (Godara *et al.*, 1998). Sharma and his associates (2002) reported that VAM fungi enhanced nutrient uptake and level of plant growth substances in apple seedlings. Subbiah (1990) also reported that when adequate amount of farmyard manure added to the soil with biofertilizers, it improved biofertilizer efficiency and ultimately nutrient status of the soil. Similar increase in growth of fruit plants with biofertilizers has also been reported by Sharma and Bhutani (1999). Increase in the

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growth of pecan seedlings could be attributed to the combined effect of biofertilizers on nutrient uptake and plant growth (Joolka *et al.*, 2004). The possible reason for better plant growth and germination can be attributed to maximum and early bacterization near root zone which induce germination by inducing root inducing substances (Wani *et al*; 1988). Similar reports have been made by Nath and Korla (2000) in ginger.

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Table 1. Effect of bio-inoculants on seed germination and plant height in guava

Treatments	Seed germination (%)		Plant height(cm)	
	2007-08	2008-09	2007-08	2008-09
T_1-FYM alone	20.8	37.7	18.8	27.5
T_2-FYM+PGPR	25.8	51.1	29.7	28.7
T_3-FYM+VAM	29.2	45.5	28.0	29.2
T_4-FYM+PSB	20.0	44.4	18.3	27.9
T_5-FYM+*Azotobacter*	24.0	51.1	22.3	28.2
T_6-FYM+PSB+ *Azotobacter*+PGPR	34.2	48.9	19.2	31.5
T_7- Vermicompost(VC) alone	21.0	23.3	15.5	20.3
T_8-VC+PGPR	22.5	46.6	27.7	25.0
T_9-VC+VAM	21.7	37.5	26.3	26.7
T_{10}-VC+PSB	26.3	37.7	16.3	23.3
T_{11}-VC+*Azotobacter*	25.2	48.9	18.0	27.4
T_{12}-VC+PSB+ *Azotobacter*+PGPR	26.7	28.9	25.2	28.4
Mean	24.8	41.8	22.1	27.0
CD at 5%	2.04	3.41	1.87	2.17

Table 2. Effect of bio-inoculants on other plant growth parameters in guava.

Treatments	No. of leaves/plant		Dry shoot wt. (g)	
	2007-08	2008-09	2007-08	2008-09
T_1-FYM alone	11.5	15.42	0.38	0.56
T_2-FYM+PGPR	21.8	17.17	1.17	0.77
T_3-FYM+VAM	22.5	18.80	0.95	0.83
T_4-FYM+PSB	15.5	15.75	0.53	0.79
T_5-FYM+*Azotobacter*	17.2	18.20	0.48	0.67
T_6-FYM+PSB+ *Azotobacter*+PGPR	14.8	17.75	0.95	0.92
T_7- Vermicompost(VC) alone	13.3	14.24	0.42	0.48
T_8-VC+PGPR	19.0	17.33	1.25	0.62
T_9-VC+VAM	20.5	15.67	1.08	0.68
T_{10}-VC+PSB	15.0	18.20	0.59	0.72
T_{11}-VC+*Azotobacter*	14.0	16.50	0.57	0.84
T_{12}-VC+PSB+ *Azotobacter*+PGPR	14.5	17.83	0.82	0.82
Mean	16.6	16.9	0.76	0.72
CD at 5%	1.49	1.35	0.12	0.17