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Effect of biofertilizers on growth of Rangpur lime seedlings

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ABSTRACT : The pot culture experiment was conducted to study the effect of biofertilizers on growth of the Rangpur lime seedlings. There were eleven treatments of inoculation of *Glomus fasciculatum* (50g and 100g), *Glomus mosseae* (50g and 100g), PSB 3 g and Neem cake 20g per seedling of Rangpur lime and its combination were given at the time of transplanting of Rangpur lime seedling in polythene bags and replicated trice. The experiment was laid out in Completely Ranzomized Design. The growth of Rangpur lime seedlings *i.e.* seedling height, stem diameter, number of leaves, leaf area, root growth, biomass accumulation, bud take percentage and final survival were found significantly superior under treatment *Gm*-50 g + *Gf*- 50 g+ PSB- 3g and *Gf*- 50 g+ PSB- 3g + Neem cake 20 g per pot against rest of the treatments.

KEY WORDS : Rangpur lime, Mycorrhiza, Neem cake, PSB

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Observing the prevailing situation about chemical fertilizers a term “chemophobia” is prevalent now a days in which fear with pesticide and fertilizer has been expressed. Environmentalists are of opinion that fertilizer and other agrochemicals used are imbalancing our environment and agro-system.

The large scale production through application of chemical fertilizers is base of green revolution. But application of higher quantity of fertilizer without considering the crop requirement has an adverse effect on microbial population and soil health. Use of cost-effective and eco-friendly biofertilizers aid in restoring soil health and productivity. It has been found that the use of biofertilizers is suitable for Indian conditions for improving the soil fertility and crop yield besides decreasing the input of cost. Biofertilizers are being promoted as an important component in supplementing plant nutrients need of the country (Arora and Das, 2010).

RESEARCH METHODS

The experiment was conducted under 50 per cent shade net conditions at Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Uniform, healthy Rangpur lime seedlings were transplanted in polythene bags. There were eleven treatments of inoculation of *Glomus fasciculatum* (50g and 100g), *Glomus mosseae* (50g and 100g), PSB 3 g and Neem cake 20g per seedling of Rangpur lime and its combination were given at the time of transplanting of uniform, healthy Rangpur lime seedling in polythene bags and replicated trice in the month of July. The experiment was laid out in Completely Randomized Design. The absolute growth rate was carried on the basis of total dry matter accumulation and period of accumulation.

$$AGR = \frac{W_2 - W_1}{T_2 - T_1}$$

where, W_2 and W_1 stand for the dry matter of the

seedling at T_2 and T_1 times, respectively. For root density, the seedlings were dipped in one litre measuring cylinder. Water displaced by the roots was measured in ml. Total chlorophyll content was estimated by the procedure given by Sadasivam and Manickam (1992).

RESEARCH FINDINGS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

Growth parameters :

Height of the seedling :

In general all the treatments improved the growth of the Rangpur lime seedlings (Table 1). The data recorded at 135 days after transplanting showed that maximum height (58.30 cm) recorded by *Gm*-50g+ *Gf*-50+PSB-3g/pot followed by *Gf*-50g+ PSB-3g+ NC-20g/pot (54.63 cm). Increase in seedling height of Rangpur lime might be due to mycorrhizal inoculation. Auxin, cytokine, gibberellins and vitamins are shown to be produced by mycorrhizal fungi (Slankis, 1976). It also attributed to the beneficial synthesis of these hormones and growth factors by AM fungi through increasing the cell multiplication and cell division (Azcon and Bago, 1994).

Stem diameter :

Treatment *Gm*-50g+ *Gf*-50+PSB-3g/pot showed significantly maximum stem diameter (0.70 cm) over rest of the treatments. Similar findings were reported by

Table 1 : Effect of bio-fertilizers and Neem cake on the growth of Rangpur lime seedlings

Treatments	Height (cm)	Stem diameter (mm)	AGR	Leaf area (cm^2)	Fresh weight (g)	Dry weight (g)
Gm-50g /pot	44.66	0.51	4.47	13.50	10.93	3.18
Gm-100g /pot	43.33	0.49	4.30	12.50	9.97	2.90
Gf-50g /pot	47.16	0.56	5.50	17.00	13.70	4.47
Gf-100g /pot	47.38	0.54	5.30	15.00	12.50	3.65
PSB-3g/pot	42.00	0.48	2.80	10.60	9.07	2.74
Gm-50g+ *Gf*-50g/pot	49.83	0.65	6.20	22.50	17.18	5.68
Gm-50g+ *Gf*-50+PSB-3g/pot	58.30	0.70	9.00	29.30	20.87	6.99
Gm-50g+ PSB-3g+ NC-20g/pot	51.83	0.66	6.90	24.00	19.20	6.34
Gf-50g+ PSB-3g+ NC-20g/pot	54.63	0.68	7.60	25.30	20.25	6.70
PSB-3g+NC-20g/pot	48.00	0.59	6.00	21.30	15.84	4.98
Control	35.30	0.31	2.30	8.60	6.67	3.04
S.E.±	1.50	0.05	0.46	0.15	0.16	0.026
C.D. (P=0.05)	4.38	0.14	1.42	0.43	0.45	0.077

Table 2 : Effect of bio-fertilizers and Neem cake on the root growth and bud-take per cent of Rangpur lime seedlings

Treatments	Root length (cm)	No. of fibrous roots	Root density (ml)	Bud-take (%)	Final survival (%)	Chlorophyll content (mg/g)
Gm-50g /pot	30.60	107.00	64.55	65.83 (54.21)	88.40 (70.09)	1.75
Gm-100g /pot	28.30	98.33	53.48	62.33 (52.12)	87.58 (69.30)	1.55
Gf-50g /pot	33.60	178.50	79.67	72.67 (58.50)	90.42 (71.95)	2.10
Gf-100g /pot	32.30	112.67	75.50	70.90 (57.35)	90.02 (71.76)	1.95
PSB-3g/pot	26.60	89.67	53.76	55.00 (47.87)	85.60 (67.70)	1.35
Gm-50g+ *Gf*-50g/pot	37.86	183.33	89.00	79.00 (62.72)	92.30 (73.89)	2.60
Gm-50g+ *Gf*-50+PSB-3g/pot	42.50	236.33	101.00	95.33 (77.48)	99.17 (84.87)	2.79
Gm-50g+ PSB-3g+ NC-20g/pot	39.30	210.30	94.51	87.20 (69.04)	94.20 (76.06)	2.66
Gf-50g+ PSB-3g+ NC-20g/pot	41.09	224.00	99.50	89.00 (70.63)	98.02 (81.87)	2.73
PSB-3g+NC-20g/pot	35.60	179.00	86.00	77.25 (61.48)	90.82 (72.34)	2.48
Control	21.30	65.33	40.18	45.33 (42.30)	72.58 (58.37)	1.15
S.E. ±	0.498	9.20	3.30	2.33	2.40	0.18
C.D. (P=0.05)	1.46	27.05	9.70	6.86	7.20	0.53

Chandrababu and Shanmugam (1983) in citrus, Shaban and Mohsen (2009) in sour orange. This could be attributed due to beneficial effect of microbes present in rhizosphere leading to higher mobilization of solute to the roots (Singh *et al.*, 2000).

AGR :

During 105-175 days after transplanting, maximum AGR (9.0) against (2.30) and leaf area(29.3 cm^2) against (8.6 cm^2) in control were recorded by *Gm*-50g+ *Gf*-50+PSB-3g/pot which was significantly superior over all the treatments except *Gm*-50g+ PSB-3g+ NC-20g/pot. These results are in accordance with Reena and Bhagyaraj (1990). The increase in AGR and leaf area might be due to significantly higher synthesis of total chlorophyll content as well as higher accumulation of various metabolites might have resulted from enhance plant growth and biomass production of combine treatment of organic and mycorrhizae (Kohler *et al.*, 2007).

Fresh and dry weight :

Maximum fresh (20.87g) and dry (6.99g) weight of the seedlings were recorded by *Gm*-50g+ *Gf*-50+PSB-3g/pot. This can be stated that increase in overall growth of seedlings had led to overall assimilation and redistribution of food material with seedling (Brian and Hemming, 1955) and hence, resulted in higher fresh and dry weight, thus increase is a consequence of increase dry matter accumulation.

Root growth :

Perusal of data in Table 2 revealed that maximum root length (42.50 cm), number of fibrous roots (236.33) and root density (101.0 ml) were observed in *Gm*-50g+ *Gf*-50+PSB-3g/pot treatment which was closely followed by *Gm*-50g+ PSB-3g+ NC-20g/pot and *Gf*-50g+ PSB-3g+ NC-20g/pot. The results are conformity with those of Onkarayya and Mohandas (1993) in citrus and Panja and Chaudhari (2007) in Darjeeling mandarin. Increase in root growth of seedlings in terms of root length and root density may be attributed to the beneficial synthesis of Auxin, gibberellins compounds by AMF, though increasing cell multiplication and cell division leading to overall increase in root growth (Azcon and Bago, 1994).

Chlorophyll content was also significantly higher (2.79 mg/g) in *Gm*-50g+ *Gf*-50+PSB-3g/pot which is closely followed by *Gf*-50g+ PSB-3g+ Neem Cake-20g/pot, while least chlorophyll content was recorded in control (1.15 mg/g). These observations are in accordance with Aseri *et al.* (2009) in Aonla. Increase in chlorophyll content in Rangpur lime seedlings might be due to Neem cake is a source of nitrogen and absorbed nitrogen plays an important role in pigment synthesis and hence was increase in chlorophyll content in Rangpur lime leaves.

Bud-take (%) and final survival :

An appraisal of data revealed that the highest bud-take (95.33%) and final survival (99.17%) of Nagpur mandarin on Rangpur lime were obtained in *Gm*-50g+ *Gf*-50+PSB-3g/pot which is closely followed by *Gf*-50g+ PSB-3g+ Neem Cake-20g/pot. These results are supported by Barman *et al.* (2007). It could be attributed to the fact that AMF increased nutrient concentration including phosphorus in citrus (Usha *et al.*, 2004), which increased photosynthetic rate, which might be an indirect effect of RuBP carboxylase activity (Barman *et al.*, 2007).

Conclusion :

The growth of Rangpur lime seedlings *i.e.* seedling height, stem diameter, number of leaves, leaf area, root growth, biomass accumulation, bud take percentage and final survival were found significantly superior under treatment *Gm*-50 g + *Gf*- 50 g+ PSB- 3g and *Gf*- 50 g+ PSB- 3g + Neem cake 20 g per pot against rest of the treatments.

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