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Research Note :

EFFECT OF BIOFERTILIZERS ON MORPHOLOGICAL CHARACTERISTICS IN GRAFTED PLANTS OF AONLA

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ABSTRACT : The current experiment on effect of biofertilizers on morphological characters of grafted aonla plants revealed that treatment of biofertilizers with different combinations showed their significant effects. The combination of AMF + *Azospirillum* enhanced higher morphological growth performance than other combinations. The AMF + *Azospirillum* applicated grafted plants produced more leaves and shoot length which could have increase the rate of photosynthesis. This combination also have more roots per plant than other combinations.

Keywords : *Biofertilizers, morphological growth, grafted aonla.*

The Indian gooseberry (*Emblica officinalis* Gaertn.) belonging to family Euphorbiacea, native to tropical South-East Asia, particularly Central and South India, is considered to be the second richest source of vitamin-C (600 mg/100g) next to Barbados cherry (Asenjo, 1) and it also contains high amount of minerals, i.e. iron, calcium and phosphorus. A number of value added processed fruit products and herbal and cosmetic products are manufactured from aonla fruits.

The cultivation of aonla is widely distributed all over the country varying from rainfed drought prone areas to arid and semi-arid tropical and subtropical regions. Besides India, it is widely grown in China and Srilanka. Aonla is considered to be high tolerance potential fruit species which is most suited to grow under salt-affected and waste/ravine lands and foothills with little investment and high economic returns. The maximum area under aonla cultivation is distributed in Uttar Pradesh, but a large area of aonla cultivation expanded during the last 10 years in different parts of country, particularly in Maharashtra, Madhya Pradesh , Chattishgarh, Rajasthan, Gujarat, Karnataka, Andhra Pradesh, Orissa, Himanchal Pradesh, Delhi, Haryana and Punjab.

Aonla seeds are shown in raised bed or polybags, subsequently, after10-12months, when seedling attains the lead pencil thickness then it is allowed for vegetative propagation. It takes more time for maturity of seedling for grafts. This time taking period may be shortened by treatment of AMF because AMF can help uptake of macro and micro nutrients; thereby improving vegetative growth.

In recent years, several studies have been conducted in different fruit plants regarding utilization of bio-fertilizers for improved plant growth and survival, particularly in nursery (Krishna *et al.*, 3). However, very meager information is available in aonla on exploitation of bio-fertilizer / AMF for increased seedling growth.

The two months old seedling planting material of uniform height and girth was selected from nursery. and grafted plants were used. These planting materials were healthy and free from insect pest and diseases. Besides, planting materials four bio-fertilizers AMF, *Trichoderma*, PSB and *Azospirillum* alone as well as in combination were used. In this experiment, containing eight treatment combinations, experimental unit was taken four and total ninety four seedlings were used in three replications. The soil media used in experiment was prepared by soil and FYM with the ratio of 1: 1.

The measured quantity of bio-fertilizers was mixed properly in soil media. The bio-fertilizers used in present experiment for filling in the pots was as 30 g in single bio-fertilizers and in combination of two bio-fertilizers was 60 g (30g each). The above bio-fertilizers in single or in combination was mixed with soil media and left over a night. In next day pots were filled with the mixture of soil media and bio-fertilizers and also in same day transplanting of seedling was done.

The plant height and shoot diameter was measured at the interval of 30, 60 and 90 days after transplanting by using the measuring tape. The root length, root numbers, root collar diameter, shoot biomass and root biomass were measured after 120 days. The experiment was laid out in factorial RBD with three replications. The data was analyzed as per

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Table 1: Effect of bio-fertilizers on plant height (cm) of aonla grafted plants.

Treatments	2011			2012		
	30 days	60 days	90 days	30 days	60 days	90 days
Control	33.33	39.13	41.43	33.56	38.80	45.33
AMF	49.56	51.00	51.23	49.93	51.30	54.56
Azospirillum	51.43	52.13	53.66	49.96	51.36	54.90
Trichoderma	43.30	45.10	48.06	39.53	44.63	46.20
PSB	61.66	63.10	71.16	57.70	60.60	80.70
AMF + *Azospirillum*	77.10	84.83	94.66	75.03	78.13	89.60
AMF + PSB	56.06	56.50	58.66	56.00	59.26	68.96
AMF + *Trichoderma*	53.86	54.46	55.23	51.90	54.10	55.53
Factor	A	B	A × B	A	B	A × B
CD (P=0.05)	3.2448	5.2987	9.178	4.8731	7.9578	13.783

Table 2: Effect of bio-fertilizers on shoot diameter (cm) of *aonla* grafted plants.

Treatments	2011			2011		
	30 days	60 days	90 days	30 days	60 days	90 days
Control	0.903	0.935	0.966	0.87	0.93	0.98
AMF	1.062	1.083	1.104	1.03	1.05	1.06
Azospirillum	1.126	1.146	1.170	1.11	1.12	1.13
Trichoderma	0.976	1.030	1.040	1.01	1.02	1.03
PSB	1.317	1.348	1.401	1.24	1.43	1.50
AMF + *Azospirillum*	1.443	1.518	1.688	1.70	2.62	4.10
AMF + PSB	1.263	1.277	1.292	1.22	1.27	1.29
AMF + *Trichoderma*	1.206	1.221	1.231	1.12	1.25	1.27
Factor	A	B	AXB	A	B	AXB
CD (P=0.05)	0.0657	0.1072	0.186	NS	NS	NS

Table 3: Effect of bio-fertilizers on morphological growth performance of aonla grafted plants.

Treatments	Root Length (cm)		Root Number		Root Collor diameter (cm)		Shoot Biomass (g)		Root Biomass (g)	
	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Control	11.700	11.600	15.000	14.000	0.668	0.689	4.833	4.900	5.367	5.467
AMF	14.367	14.167	22.000	22.667	0.881	0.880	6.467	6.700	6.200	6.300
Azospirillum	16.200	16.000	23.000	24.000	0.902	0.902	6.833	6.900	6.300	6.433
Trichoderma	14.133	14.133	20.333	20.000	0.743	0.753	5.467	6.333	5.900	5.967
PSB	23.667	23.433	44.667	46.000	1.157	1.146	9.433	9.533	7.233	7.267
AMF+Azospirillum	26.500	26.100	55.333	57.667	1.316	1.316	11.167	11.333	8.433	8.433
AMF+ PSB	22.967	22.867	41.000	42.333	1.093	1.093	8.800	8.800	6.833	6.900
AMF+ Trichoderma	17.633	17.267	27.000	27.333	0.934	0.912	7.100	7.233	6.500	6.567
CD (P=0.05)	3.026	2.850	4.276	4.674	0.103	0.105	0.875	0.757	0.609	0.668

method of Panse and Sukhatme (7). Least significant differences at 5% level was used for finding the significance difference among the treatments.

The results obtained from the experiment (Table 1 & 2) indicate that different combinations of bio-fertilizers were significant as compared to non treatments of plants. The highest grafted plant growth was recorded by using of AMF + *Azospirillum* followed by PSB and AMF + PSB, respectively. It could be due to enhanced inorganic nutrient absorption and greater rates of photosynthesis. The *Azospirillum* and AMF are know to affect both the uptake and accumulation of nutrients so it acts as an important biological factors that contribute to efficiency of both nutrient absorption and use.

A perusal of Table 3 revealed that different combination of bio-fertilizers used in aonla grafted plants for the observation of root length, root numbers, root collar diameters, shoot biomass, root biomass were recorded highest by using of AMF + *Azospirillum* than PSB and PSB + AMF, respectively. The root length and roots number increase might be due to absorption of more nutrient especially phosphorous. It increased the absorbing surface area. This turn could have enhanced a higher plant growth rate resulting to more roots per plant and higher length of roots. The similar results had also been reported by Kumar *et al.* (5) in cashew rootstock, Papaya cv. Sunset Solo (Manjunathan *et al*., 6) , Awasthi *et al.* (2) in peach seedlings and Kunj'u (4) in *Senna spectabilis*.

The mycorrhiza colonization also protect the roots from the soil pathogen so it could have lead to increase in not only root growth and numbers but also help in survival.

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