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Studies on the interaction effect of Azospirillum and phosphobacteria on the growth and yield of crossandra (crossandra infundibuliformis.I)

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Abstract

Crossandra in one of the important native flower crop in india and it can occupy the same soil for more than 2 years because of perennial nature and needs required amount of nutrient in the rhizosphere for the growth and development. Nutrition plays a vital role in the developmental processes which bring about differential growth characters in flower crops. Biofertilizers are nothing but the preparations containing live or latent cells of efficient strain of microorganisms recommended to improve the availability of nutrients to the crop plants. Based on the above trait, a research work has formulated to standardize the use of inorganic and biofertilizers to improve the growth and yield of crossandra cv Dindigul local with the following objectives. Isolation of *Azospirillum* from soil and roots of crossandra. Characterization of *Azospirillum*isolates. Inoculation effects of *Azospirillum* and phosphobacteria with graded levels of NPK fertilizers on the growth and yield of crossandra. In the present investigation, the plants receiving recommended dose of NPK fertilizers, *Azospirillum* and phosphobacteria recorded enhanced growth valves and flower yield. In contrast, the plants receiving 17 and 50% NPK fertilizers, *Azospirillum* and phosphobacteria also recorded same type of growth valves and flower yield. Hence, the treatments constitute 75 and 50% NPK fertilizers enhance growth valves resembles the recommended dose of NPK fertilizers.

Keywords: *Azospirillum*, Phosphobacteria,Graded level of NPK, Crossandra.

Introduction

Crossandra in one of the important native flower crop in India and it can occupy the same soil for more than 2 years because of perennial nature and needs required amount of nutrient in the rhizosphere for the growth and development. Nutrition plays a vital role in the developmental

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processes which bring about differential growth characters in flowers crops. Balanced and optimum input of nutrients is important for getting higher yield and quality produce. In recent years, the concept of integrated nutrient supply, involving combined use of organic and chemical fertilizers has been developed to overcome or to reduce pollution.

The cultivation of crossandra is being taken up by large number of farmers in south India, particularly Tamilnadu due to assured and regular income. Crossandra is an ornamental flowering plant, belonging to the family Acanthaceae. Though the genus crossandra contains 50 species, only a few like *crossandrainfundibuliformis, c. guinensis, c. mucronata* and *c. subacaulis* are cultivated in India, among the species *c. infundibuliformis* is the most commonly cultivated species and supposed to be native of southern India and Sri Lanka (Wilkin, 1985).

Bio-fertilizers are nothing but the preparation containing live or latent cells of efficient strain of microorganisms recommended to improve the availability of nutrients to the crop plants. *Azospirillum* is an important biofertilizer which not only aid in nitrogen fixation but also produce growth substances like auxin, gibberellins and cytokinins helping in saving the application of nitrogenous fertilizer to an extent of 20 to 25 percent. Phosphobacteria is another important biofertilizer used in different crops to enhance the availability of phosphorus by solubilizing calcium, aluminium and iron phosphates as well as rock phosphate present in the soil and making the phosphorus available to the crop plants.

Material and Methods

Biofertilizers:

The inoculants of *Azospirillum* isolates used in the field studies and phosphobacteria was obtained from the Department of Agricultural Microbiology, Faculty of Agriculture, Annamalai university, also used for field studies.

Inorganic Fertilizer:

Inorganic fertilization was done following the recommended dosage of 15:10:25 g of NPK per plot of $2m^2$ in the form of urea, super phosphate and muriate of potash. The following treatments were used in the present investigation.

Treatment details

T_0 : Absolute control

T_1 : *Azospirillum* only

T_2 : Phosphobacteria only

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T_3 : 100% NPK

T_4 : 100% NPK +*Azospirillum*

T_5 : 100% NPK + phosphobacteria

T_6 : 100% NPK +*Azospirillum*+ phosphobacteria

T_7 : 100% NPK + *Azospirillum*

T_8 : 100% NPK + phosphobacteria

T_9 : 100% NPK +*Azospirillum*+ phosphobacteria

T_{10} : 100% NPK + *Azospirillum*

T_{11} : 100% NPK + phosphobacteria

T_{12} : 100% NPK +*Azospirillum*+ phosphobacteria

Method Of Inoculation:

The recommended dose of *Azospirillum* and phosphobacteria (each @ 2 kg per hectare) were inoculated through seedlings dip for half an hour, as per the treatment schedule.

Observations:

Obserations were recorded in five plants tagged at random leaving boarder rows in each replication(fifteen plants in each treatment) at different stages on the following characters.

Plant Height:

Height of the plants from ground level to the tip of the main stem was measured twice at initial, and pack flowering period and was expressed in centimeters.

Number Of Branches Per Plant:

Number of branches were counted at the time of initial and peak flowering stage and was expressed as number per plant.

Days Of First Flowering:

Number of days taken from the date of transplanting to first flowering was recorded and expressed in days.

Number Of Spikes Per Plant:

Number of spikes were counted at the post flowering period and was expressed in number.

Number Of Flowers Per Spike:

Total number of flowers that were produced in each spike was counted.

Flower Yield Per Plant:

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Flowers picked at each harvest, per plant were weighed separately and add overall the harvests to arrive at flower yield per plant and was expressed in grams.

Results:

Gradual increase in plant height was observed in all the treatments combination at both the stages of observation. The highest plant height of 46.38 m at initial flowering and 60.62 cm at peak flowering stage was recorded in T_6 . The next value as observed in T_9 46.39 cm at initial flowering and 60.28 cm at peak flowering stage . Which exhibited statistically significant difference compared with control where as on par values were observed in treatment T_6 T_9 and $T_{12.}$ Least values were expressed by the plants in the treatment.(T_0)

Number of Branches Per Plant :

In both the stages of observation, highest number of branches was recorded in T_6 (7.52 at initial flowering and 12.47 at peak flowering stage). The least number of branches was recorded in T_0 (2.60 at initial flowering and 5.16 at peak flowering stage). The treatments T_9 and T_{12} recorded statistically insignificant difference among themselves.

Days Taken to First Flowereing:

The inoculation of *Azospirillum* and phosphobacteria altered the flowering nature crossandra. The earliness in flowering was noticed in T_6 (56.80 days) and T_{12} (56.33 days). A significant difference was noticed between control and other treatments receiving *Azospirillum* and phosphobacteria.

Number of spikes per Plant:

All the treatment was recorded significant values compared with control. The treatment T_6recorded the highest value (39.00) for number of spikes with the least was recorded by $T_{0.}$

Table 1

Effect of *Azospirillum* and Phosphobacteria with graded levels of NPK fertilizers on growth parameters in crossandra.

Treatments	Plant height		No. of branches		Days taken to first flowering
	Initial flowering	Peak flowering	Initial flowering	Peak flowering	

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T_0	24.32	25.63	2.60	5.16	86.18
T_1	29.51	30.10	3.81	7.18	81.91
T_2	26.42	28.23	3.54	6.71	82.36
T_3	37.21	40.21	4.80	9.26	66.18
T_4	41.40	51.40	5.80	10.47	60.31
T_5	39.53	47.63	5.41	10.04	63.54
T_6	46.38	60.26	7.52	12.47	56.00
T_7	36.82	41.70	5.05	9.47	67.81
T_8	34.74	36.42	4.28	8.49	70.26
T_{19}	46.39	60.28	7.49	12.45	56.28
T_{10}	32.91	34.80	4.06	8.21	74.21
T_{11}	30.30	31.21	3.93	7.63	76.42
T_{12}	46.20	60.24	7.38	12.44	56.33
SED	0.7807	0.9847	0.1646	0.2896	0.8838
CD(p=0.05)	1.5615	1.8792	0.3293	0.5793	1.7676

Number of Flower per Spike:

All the treatment exhibited significant differences when compared with control. The highest number of flowers per spike was recorded in T_6 (30.28). The next best value was recorded by T_9 (26.8) treatments, T_9 and T_{12} did not exhibit statistically significantly difference among themselves. The least number of flowers per spike was recorded in T_0 (17.0).

Table 2:

Effect of *Azospirillum* and Phosphobacteria with graded levels of NPK fertilizers on yield parameters in crossandra:

Treatments	No. of spikes per plant	No. of spikes per plant	Flower yield per plant (g)	Flower yield q/ha
T_0	14.25	17.0	19.30	10.60
T_1	18.49	21.30	27.10	14.98
T_2	17.80	20.10	25.69	14.14
T_3	26.54	25.46	37.13	20.44
T_4	32.43	27.24	39.46	21.75

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T_5	29.46	25.74	38.00	20.94
T_6	39.00	30.28	41.73	22.91
T_7	26.83	24.38	36.80	20.30
T_8	25.68	23.52	34.40	18.92
T_9	37.20	26.8	39.80	20.10
T_{10}	22.45	22.96	32.86	18.60
T_{11}	19.98	21.64	30.45	16.70
T_{12}	36.9	26.6	39.69	19.96
SED	0.489	0.489	0.990	0.221
CD(p=0.05)	0.979	0.979	1.991	0.461

Discussion:

Application of both *Azospirillum* and phosphobacteria in combination with the recommended dose of fertilizers had a significant effect in improving the plant height. The possible reason for the increase in plant height may be due to the inoculation of *Azospirillum* and phosphobacteria which enhanced the uptake of nitrogen, since N is the chief constituent of protein, essential for the formation of protoplasm, which leads to cell division and cell enlargement resulting in increased plant growth (Bakley,1974).

In the present investigation, early flowering was noticed in the treatment receiving recommended doses for fertilizer along with *Azospirillum* and phosphobacteria. It may be due to better nutritional status of the plants as influenced by the various treatments. Due to more photosynthetic effect, flowering was induced thus effecting early intitiation of flower bud formation. This finding is in line with Ravichandran (1991) in crossandra and Balasubramanian (1989) in French marigold.

Number of leaves per plant was found significantly higher in the treatment that received recommended dose of fertilizer along with *Azospirillum* and phosphobacteria. This increased number of leaves could be due to increased number of branches in the above said treatment. Higher leaf production at optimum level of fertilizer application was earlier reported by Ravichandran (1991) in crossandra, Karunakaran(1997) in gladiolus and Sundaravelu and Muthukrishnan (1993) in radish.

Influence on the Yield:

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The flower yield was found to be higher in treatments that recorded greater values for number of branches and spikes per plant. The present study were in according to the earlier findings on correlation analysis carried out by Reddy (2000) there existed positive and significant association among these characters in crossandra.

Combined of inorganic and biofertilizers exhibited the characteristic effect in spike length and number of flowers per spike were noticed in the treatment that received recommended dose of fertilizer along with biofertilizers. Similar results were reported earlier by Bavanisankar and Vanagamudi (2000_a) in crossandra, Karunakaran (1997) in gladiolus and Swaminathan *et al*. (2000) in tuberose.

The enhanced flower yield in terms of weight was observed to be maximum in the plants treated with recommended dose of fertilizer along with *Azospirillum* and phosphobacteria. The observations also revealed that the treatment receiving 75% recommended dose along with *Azospirillum* was comparable with treatment receiving 100% recommended dose NPK alone . This result seems to concede the reports of Ravichandra (1991) and Bhavanisankar and Vanagmudi (2000_a) in crossandra, Balasubramanian (1989) in French marigold , Preethi (1990) in Edward rose, Manonmani (1992) and Bavanisankar and Vanagamudi (2000_a) in jasmine and Wang *et al.* (1995) in tuberose.

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