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Influence of *Azosprillum* Isolates on Growth Parameters of Tuberose (*Polianthes tuberosa* L.) cv. Mexican Single

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A B S T R A C T

Tuberose is important ornamental crop grown in large scale for its flowers. A pot culture experiment was carried out using five efficient isolates of *Azospirillum* on tuberose to evaluate the influence of these isolates on growth of tuberose, which revealed that treatments inoculated with isolate ATR-39 was significantly improved the growth of tuberose.

Introduction

Tuberose (*Polianthes tuberosa* L.) is one of the bulbous ornamentals which belongs to the family *Amaryllidaceae* and had originated in Mexico before spreading to other countries in the world (Trueblood, 1973). In India, tuberose occupies a prime position in floriculture industry because of its beauty, fragrance, good keeping quality apart from its easy cultivation. The flower spikes are largely consumed for vase decoration and preparation of bouquets, while loose flowers are used for making garlands and floral ornaments. The flowers are used for extraction of essential oil which is having high commercial value nearly four times that of jasmine and eight times that of rose essential oil. The yield of concrete from fresh flowers ranges from 0.08 to 0.11 per cent.

The flower yield can also be increased by manipulation of cultural practices for the crop. In this direction, one of the common cultural practices *viz.*, nutrient application especially nitrogen, phosphorous and its management is of great importance for increasing the higher yield. The use of only inorganic fertilizers is also not sufficient to increase the flower yield. In order to improve deficient status of N in soil, the use of bio-fertilizer like *Azospirillum* is advocated, which fixes atmospheric nitrogen in the soil and thus maintaining the nutrient reserve of the soil and results in higher yield of flower. The use of *Azospirillum* also reduces inorganic fertilizers to an extent of 25 per cent. The studies conducted elsewhere on use of bio-fertilizers in tuberose is limited and sometimes pertains to the particular zone.

Azospirillum, a ubiquitous rhizosphere bacterium, representing the main group of microaerophilic free living/associative nitrogen fixing bacteria (Dobereiner and Day, 1976). They are isolated from the rhizosphere of many grasses and cereals all over world and their roles on plant growth and yield have been well established (Wani, 1990; James, 2000). Two species *viz., Azospirillum brasilense* and *Azosprillium lipoferum* have been found in soil of a temperate zone (Coninck *et al.,* 1988) and even in the cold climate of Finland (Haathella *et al.,* 1983). According to Reynders and Vlassak (1979) *Azospirillum* occurs in about 90% of tropical soil and in about 60% of soils in the temperate zone. *A. brasilense* is attributed to have affinity with plants with photosynthesis type C3 (wheat and chilli), whereas *A. lipoferum* with plants of C4 type (Maize and Sorghum). However, investigations of microorganisms isolated from different crops and grasses in the area of Poland and other countries have shown that this relationship is not unique, found the occurrence of *A. brasilennse* in maize rhizosphere, even showed that different plant species could be inhabited by the same strain of *A. brasilense* (Bashan *et al.,* 1989).

Materials and Methods

The pot culture experiment was carried out to study the effect of inoculation of efficient *Azospirillum* isolates on growth and yield of Tuberose (Mexican single) at the College of Agriculture, Raichur during 2015-16. Early sprouting variety Mexican single of Tuberose was collected from Horticulture department, UAS Raichur. Bulbs of Tuberose were completely dipped into different treatment conditions (5 efficient isolates of *Azospirillum viz.,* ATR-06, ATR-19, ATR-32, ATR-36 and ATR-39, one reference strain and control) for 1-2 minutes for uniform distribution of bioinoculant. The inoculated bulbs were transplanted in pots at the rate of 4 bulbs per pot. Each treatment was replicated thrice. Immediately after transplanting, the plots were irrigated. The irrigations were scheduled at regular interval. Irrigation was stopped when the crop attained physiological maturity. To check the growth of weeds and to keep the pots free from weeds during the cropping period hand weeding was undertaken at an interval of 15 days in the experimental pots to keep the pots free from weeds. The observations on plant growth parameters were recorded at periodical of intervals (30 DAP, 60 DAP and 90 DAP).

Results and Discussion

The plant height (Table 1) varied significantly due to different isolates of *Azospirillum* bulb treatment. The ATR-39 (25.33, 49.43 and 55.00 cm at 30, 60 and 90 DAP, respectively) recorded significantly more plant height at 30, 60 and 90 DAP than control indicating the beneficial effects efficient isolates *Azospirillum* inoculation that might have contributed more vegetative growth due to nitrogen in promoting metabolic transport for growth responsible for higher yield of flower (t/ha) (Figure 1). Hence, the higher flower yield in the ATR-39 treatment might be due to more plant height as ascertained by Bankar (1987) and Parthiban *et al.,* (1992) in tuberose; Rathore and Singh (2013) in tuberose. With regard to number of leaves (Table 2 and Figure 2) of the plant, which are the sites of photosynthesis and are responsible for variation in the yield, significantly higher numbers of leaves were recorded in the ATR-39 (10.33, 13.67 and 17.00 at 30, 60 and 90 DAP, respectively) at all stage of growth. Fewer number of leaves in control at all stages of growth and steady increase at ATR-39 denotes the beneficial effects of biofertilizer inoculation. The similar results were obtained by Mohanty *et al.*, (2002) in tuberose; Singh (2005) in rose. *Azospirillium* produces growth promoting substances *viz.*, IAA or GA like substances, Vitamin B_{12}, thiamine, riboflavin (B_2) etc, which might have helped to increase number of leaves. The tillers production was significantly influenced by the varying treatments of different isolates. The treatment ATR-39 recorded significantly more number of tillers (at 30, 60 and 90 DAP) than control. The increase in the number of tillers could be attributed to the beneficial effects of *Azospirillum* bulb treatment. The higher flower yield in ATR-39 might be due to higher number of tillers per plant. The results are in conformity with the findings of Gaikwad (2009) in tuberose and Ahmad *et al.*, (2014) in gladiolus (Table 3, Fig. 3 and 4).

Table.1 Influence of *Azospirillum* isolates on plant height of Tuberose at different growth stages

Treatments		Plant height (cm)		
		30 DAP	**60 DAP**	**90 DAP**
T_1	Control	25.33	45.00	51.00
T_2	ATR-06	27.67	49.33	54.33
T_3	ATR-19	26.83	48.93	53.67
T_4	ATR-32	26.83	49.00	54.00
T_5	ATR-36	26.50	48.67	53.33
T_6	ATR-39	28.67	49.43	55.00
T_7	Reference *Azospirillum* strain (ACD-15)	25.67	46.00	51.33
S. Em ±		**0.558**	**0.540**	**0.701**
C.D. @ 1.0 %		**1.739**	**1.654**	**2.148**

(Values are means of three replications)

Table.2 Influence of *Azospirillum* isolates on number of leaves of Tuberose at different growth stages

Treatments		Number of leaves		
		30 DAP	**60 DAP**	**90 DAP**
T_1	Control	7.67	10.67	14.00
T_2	ATR-06	9.33	13.00	16.33
T_3	ATR-19	8.67	12.00	15.33
T_4	ATR-32	9.00	12.33	15.67
T_5	ATR-36	8.33	11.33	14.67
T_6	ATR-39	10.33	13.67	17.00
T_7	Reference *Azospirillum* strain (ACD-15)	8.00	11.00	14.33
S. Em ±		**0.236**	**0.333**	**0.403**
C.D. @ 1.0 %		**0.722**	**1.021**	**1.235**

(Values are means of three replications)

Table.3 Influence of *Azospirillum* isolates on number of tillers in Tuberose at different growth stages

Treatments		Number of tillers		
		30 DAP	**60 DAP**	**90 DAP**
T_1	Control	0.33	2.00	9.00
T_2	ATR-06	2.00	3.67	10.33
T_3	ATR-19	1.33	3.00	10.67
T_4	ATR-32	1.67	3.33	12.00
T_5	ATR-36	1.00	2.67	11.67
T_6	ATR-39	2.33	4.00	12.00
T_7	Reference *Azospirillum* strain (ACD-15)	0.67	2.33	11.00
S. Em ±		**0.209**	**0.275**	**0.252**
C.D. @ 1.0 %		**0.640**	**0.841**	**0.772**

(Values are means of three replications)

Fig.1 Influence of efficient isolates of *Azospirillum* on plant height of Tuberose at different growth stages

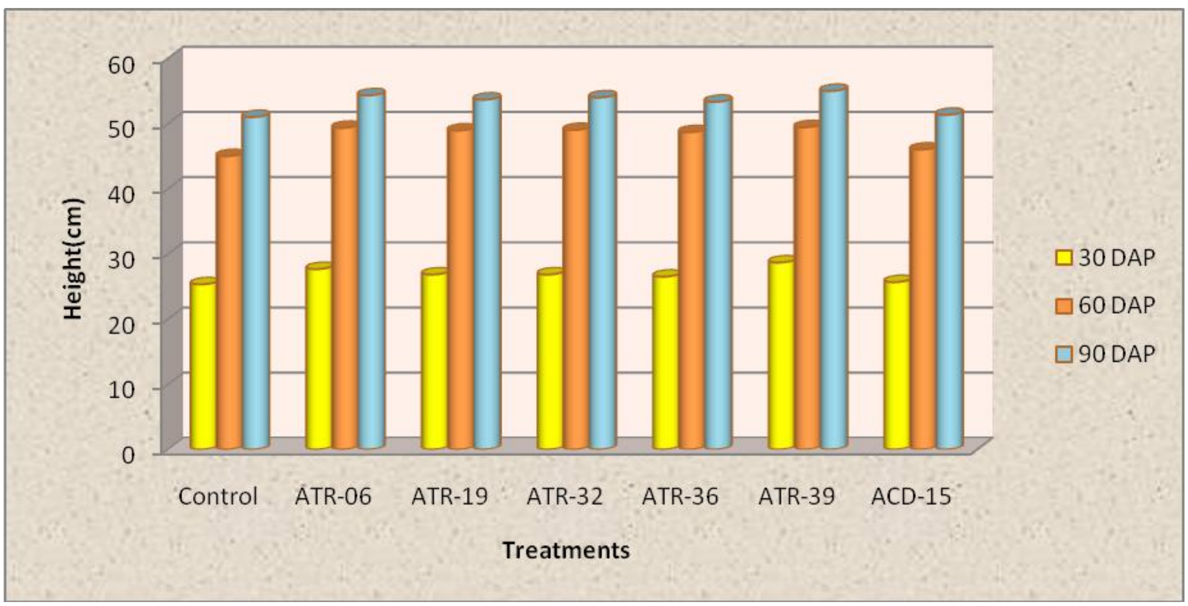


Fig.2 Influence of efficient isolates of *Azospirillum* on number of leaves of Tuberose at different growth stages

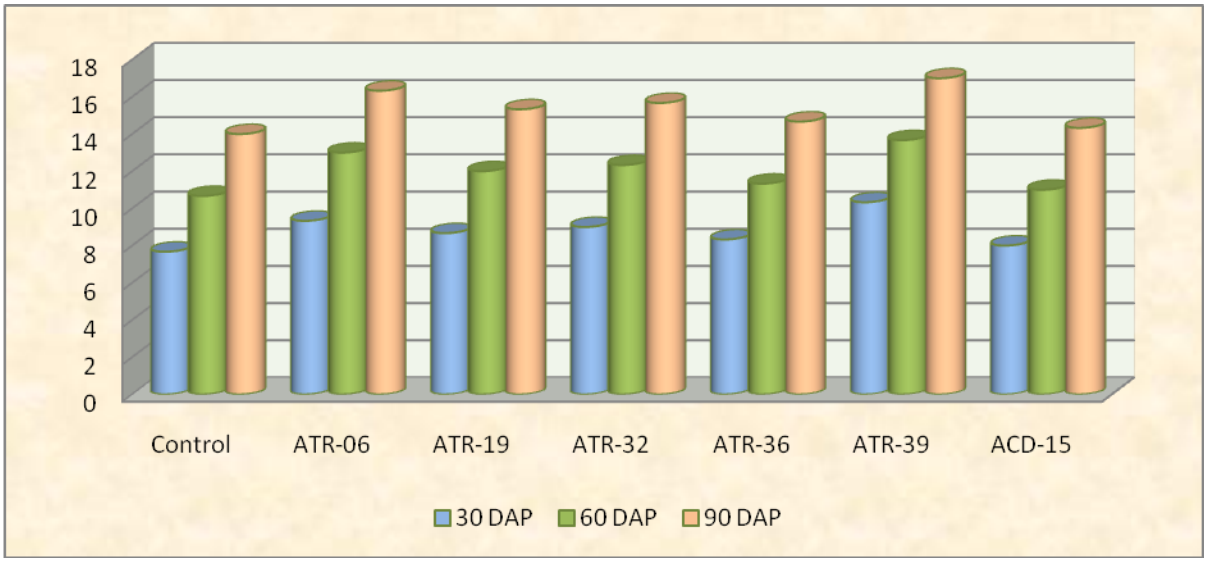


Fig.3 Influence of efficient isolates of *Azospirillum* on number of tillers in Tuberose at different growth stages

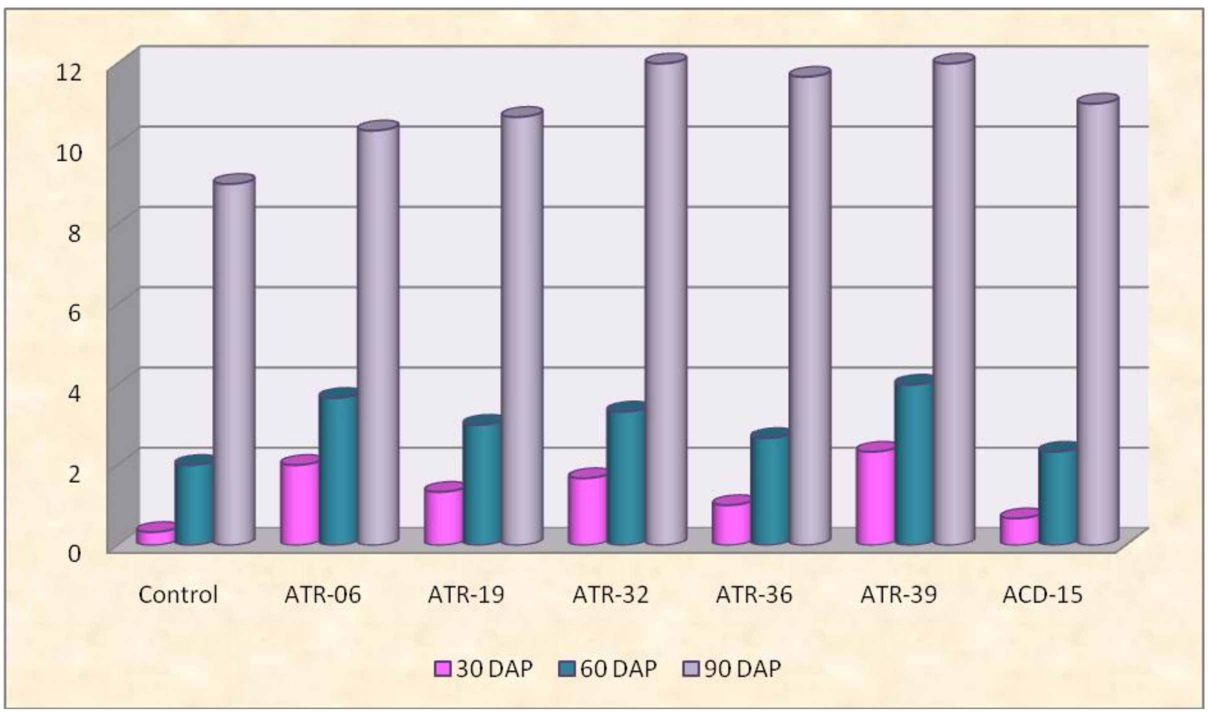
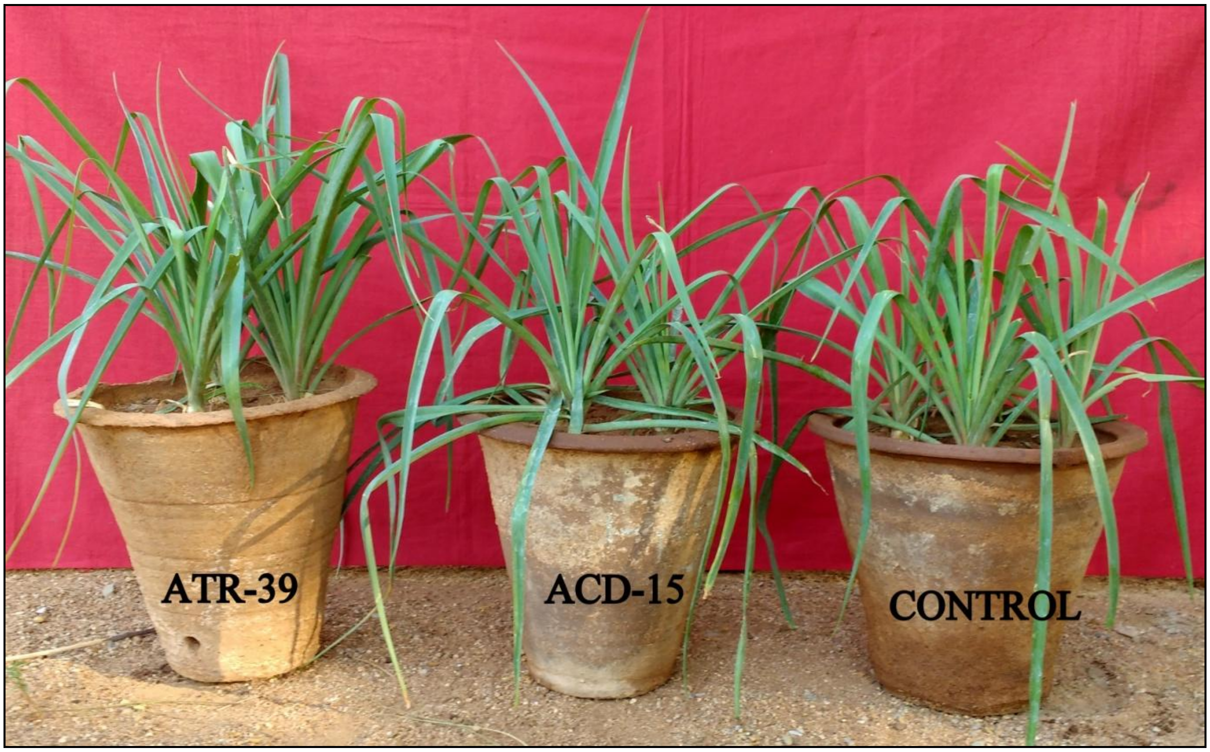


Fig.4 Influence of *Azospirillum* isolates on plant height of tuberose at 60 days after planting



Summary and Conclusions

In the present study five *Azospirillum* isolates were evaluated using Tuberose plant to check their ability to promote the plant growth with the production of plant growth promoting substances such as IAA, GA, siderophore production and many others. The results of this investigation revealed that *Azospirillum* isolate ATR-39 has shown significantly higher plant height, number of tillers and other growth parameters. The *Azospirillum* isolate ATR-39 adjusted well to the environment than other isolates and has proved that it is more potential than other isolates. So ATR-39 isolate can be used as bioinoculant for large scale production of biofertilizer.

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