



## IMPACT OF DIFFERENT LEVELS OF *Glomus aggregatum* ON GROWTH AND YIELD OF TOMATO (*Solanum lycopersicum*) IN AMBEDKARNAGAR DISTRICT OF U.P.

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### ABSTRACT

A Tomato is an important crop throughout the world and it is grown under a wide range of production system. The Tomato (*Solanum lycopersicum*) is very valuable from the perspective of nutritional value, for example it is a source of the different types of the antioxidants such as carotenoids, ascorbic acid, phenolic compounds and  $\alpha$ -tocopheral. VAM fungi have received considerable attention in recent years with regard to nutrition and development of host plants. VAM root colonization is the results of the interaction between the host soil and fungus. This study clearly brings out the impact of soil type of VAM development, i.e. the red soil type was found to be superior to the black clayey soil.

**KEYWORDS:** VAM Fungi, *Glomus aggregatum*, Tomato, Red and Black soil

A Tomato is an important crop throughout the World and it is grown under a wide range of production systems. The Tomato (*Solanum lycopersicum* L.) is very valuable from the perspective of nutritional value, for example it is a source of the different classes of the antioxidants such as carotenoid, ascorbic acid, phenolic compounds and  $\alpha$ -tocopherol (Becher, 1998; Sunil Kumar, 2019). This is the reason for searching of new opportunities to improve nutritional content in a Tomato under lower level of the fertilization. The use of the Vesicular Arbuscular Mycorrhizal fungi (VAMF) is one of the possibilities. VAMF is the most widespread root fungal symbiosis and it is associated with the vast majority of the higher plants. It represents a mutualistic Symbiosis between, VAMF and the roots of terrestrial plants (Smith and Read, 1997). The fungi colonize roots of approximately 90% of the Earth's land plant species (Gadkar *et al.*, 2001). VAMF improves the absorption of the several nutrients, such as Phosphorus (Formenti and Rasmann, 2019, Chandreshkara *et al.*, 1995), Nitrogen, Potassium, Calcium and Magnesium (Liu *et al.*, 2002), Copper (Gildon and Tinker, 1983) and Zinc (Faber *et al.*, 1990). VAMF can increase content of the antioxidant in inoculated plants (Huang *et al.*, 2011). Arbuscular symbiosis can improve a soil structure and protect host plants against the detrimental effects caused by the drought stress (Schreiner *et al.*, 1997).

Vascular arbuscular mycorrhizal (VAM) fungi have received considerable attention in recent years with regard to nutrition and development of host plants. The principal benefit from VAM fungi to plant growth is Phosphorus nutrition (Jeffries, 1987). The obligate

symbiotic nature of VAM fungi presently dictates that all VAM inoculum must be grown on the roots of an appropriate host plant (Screenivasa and Bhagyaraj, 1988). Due to major bottleneck, the application of this technology to commercial crop production has been minimal. Added to this, many ecological aspects of VAM fungi like the optimum quantity of inoculums, shelf life, etc., are yet to be worked out. It was the aim of present investigation to study the impact of different levels of an efficient local isolate of VAM fungus, *Glomus aggregatum* on the growth and yield of Tomato in two types- black clayey soil and red soil. This was done so that an optimum level of *Glomus aggregatum* inoculum could be selected for Tomato and the impact of soil factor on VAM activity could be verified.

### MATERIALS AND METHODS

District Ambedkarnagar (Akbarpur) situated in the eastern part of Uttar Pradesh. Ambedkarnagar district covers 2350 Square Km. Geographical area, lying between latitude 26° 09' N and 26° 40' and longitude 82° 13' N and 83° 09' N with its head quarters at Akbarpur. It was carved out as separate district from Faizabad district in 1995 and bounded in the south and south east by Faizabad and Sultanpur districts respectively. Ambedkar Nagar district is a district in the Ayodhya (Faizabad) division of Uttar Pradesh in India. This district was created on September 29, 1995 and was named in the memory of Dr. Bhimrao Ambedkar, who worked for the upliftment of the deprived classes, women and other weaker sections of the society. Ambedkarnagar district is located on the North-Eastern part of Uttar Pradesh. It lies

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between 26° 09' N to 26° 40' N latitudes and 82° 12' E to 83° 05' E longitudes. It is bounded on the north by Basti and Sant Kabir Nagar districts, on the north-east by Gorakhpur district, on the south by Sultanpur district, on the west by Ayodhya (Faizabad) district and on the east by Azamgarh district. The total area of the district is 2520 km<sup>2</sup>. The total length of the district from east to west is approximately 75 km and the breadth from north to south is about 42 km. The city of Akbarpur is situated on the bank of the River Tons (Tamasas), which divides the city into the two parts Akbarpur and Shahzadpur, with the latter being the main commercial center of the city.

Earthen pots of 12' diameter were filled with non sterile black clayey/red soil at 10 kg/pot. Pot cultures of an efficient local isolate of VAM fungus, *Glomus aggregatum* maintained in Rhodes grass (Sreenivasa, 1992) was tried at different levels, i.e. 25, 50, 75 and 100 g/10 kg soil. The inoculum was placed 2 cm below the soil surface as uniform thin layer. Thirty-day-old Tomato seedling, raised in nursery pots containing sterilized soil, were transplanted at three seedlings per pot. There were altogether 10 treatments with 9 replication each. The crop was maintained for 122 days after transplantation. After crop harvest, the plant dry weight, number of fruits, and fruit weight (fresh) were recorded. The percentage of mycorrhizal colonization in roots was determined by staining to roots with trypan blue (Phillips and Hayman 1970) and the mycorrhizal spore count in soil by the wet

sieving and decanting technique (Gerdemann and Nicolson 1963). The number of infective propagules in the pot ball, after chopping the roots to 1 cm bits, was determined by the Most Probable Number technique using sorghum as the test plant (Porter 1979). Shoot P concentration was estimated by the vanadomolybdate phosphoric yellow colour method (Jackson, 1967).

## RESULTS

The percentage of root colonization and the number of extrametrical chlamydospores increased with increases in the level of inoculum in both the soil types. However, the increase in the percentage of root colonization beyond 50 g inoculum level was not significant (Table 1). The number of infective propagules also increased in the level of inoculum up to 75 g/10 kg soil, beyond which they remained practically constant in both the soil types (Table 1). Mycorrhizal parameters were better in the red soil when compared to the black clayey soil (Table 1).

A similar trend was observed in plant characteristics-plant dry weight, number of Tomato fruits, fruit weight and shoot P concentration which increased with increases in the levels of inoculum in both the soil types. However, they were the highest in red soil when compared to the black clayey soil (Table 2). Increase in these parameters beyond 50 g inoculum level were not significant (Table 2).

**Table 1: Impact of different levels of *Glomus aggregatum* inoculum on the percentage of root colonization, spore count, and the number of infective propagules in Tomato (two soil types)**

Level of <i>Glomus aggregatum</i> inoculum (g/10 kg)	Root colonization (%)		Spore count (per 50 g soil)		Number of infective propagules/s pot ball (number × 10 <sup>4</sup> /g)	
	BCS	RS	BCS	RS	BCS	RS
0	43	41	122	130	0.074	0.074
25	78	79	165	174	0.090	0.092
50	92	91	350	391	0.100	0.100
75	93	93	382	422	0.120	0.120
100	94	93	446	460	0.120	0.120
VAM levels	0.80	2.30	10.20	28.50	-	-
Soil types	0.51	NS	6.50	18.00	-	-
Interaction	1.13	NS	04.50	NS	-	-

BCS-black clayey soil; RS-red soil; NS-not significant; SEM ± CD at 0.05

**Table 2: Impact of different levels of *Glomus aggregatum* on plant dry weight, number of fruits weight, and shoot P concentration, in Tomato (two soil types)**

Level of <i>Glomus aggregatum</i> inoculums (g/10 kg)	Plant dry weight (g/plant)		No. of Tomato fruits/plants		Fruits weight (g/plant)		Shoot P concentration (%)	
	BCS	RS	BCS	RS	BCS	RS	BCS	RS
0	13.5	16.6	28	28	61.0	61.0	0.06	0.09
25	20.6	27.1	36	39	90.0	92.0	0.17	0.22
50	27.0	30.7	48	51	110.0	118.0	0.22	0.29
75	28.3	32.4	49	52	111.0	119.0	0.23	0.29
100	28.7	32.5	50	53	112.0	119.0	0.24	0.29
VAM levels	1.32	3.88	1.67	4.92	0.80	2.35	0.01	0.038
Soil types	0.83	2.45	1.06	NS	0.50	1.48	0.01	0.024
Interaction	1.86	NS	2.36	NS	1.12	3.32	0.014	NS

BCS-black clayey soil; RS-red soil; NS-not significant; SEM ± CD at 0.05

**CONCLUSION**

VAM root colonization is the result of the interaction between the host, soil, and fungus. Few scientists earlier reported host preference to VAM endophytes. This study clearly brings out the impact of soil type on VAM development, i.e. the red soil type was found to be superior to the black clayey soil, and 50 g/10 kg of soil can be used an optimum level of *Glomus aggregatum* inoculums in Tomato.

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