Arbuscular Mycorrhizal Association for Growth and Nutrients Assimilation of Cotton (*Gossypium hirsutum* L.)

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ABSTRACT

A pot culture experiment was conducted in the Department of Microbiology, Faculty of Agriculture at Annamalai nagar to study the effect of *Glomus fasciculatum* on the growth and yield of MCU-7 cotton as influenced by different levels of N and P *viz*., 25, 50, 75 and 100 per cent recommended dose (RD) with Arbuscular – mycorrhizal fungi (AMF) and 100 per cent N and P without AM fungi (control) were maintained. Among the different treatments, 75 per cent P with 100 per cent N+ AM fungi was observed with better yield and P up take in cotton and maximum mycorrhizal colonization and spore number were recorded at 50 per cent P and 100 per cent N RD + AM fungi followed by application of 50 per cent P with 100 per cent N RD+AM fungi. Hence, this study revealed that 25 per cent of phosphatic fertilizer could be saved by the inoculation of *G. fasciculatum* in cotton.

Keywords: *Glomus fasciculatum,* AM fungi, cotton, recommended dose (RD)

INTRODUTION

Cotton is the king of fibers, which provides the basic material for the clothing of man. It is a vital and basic input for the textile industry and one of the world's most important industrial and commercial crops. India holds the maximum area (9. 16 m ha with a production of 17. 17 million bales) under cotton. To meet the future requirement the current production has to be increased in largely and this increase has to come from increased productivity alone by the way of sustainable agriculture. As the importance of sustainable agricultural practices and increased role of arbuscular mycorrhizal symbiosis in contributing to sustainability has also been recognized.

The symbiotic association established between plant roots and fungi belonging to the Endogonaceae , known as Arbuscular mycorrhizae fungi (AM fungi) can significantly improve the plant growth and development due to enhanced uptake of soil phosphorus and certain other nutrients. AM fungi are non-specialized host range, yet are apparently obligate endosymbionts. They depend on their host plants for by the energy source (carbohydrates). They could be recognized by the irregular coenocytic hyphae, which ramify within the cells of root cortex and form vesicles (storage pouches) and arbuscules (absorptive structures). The later are finely branched to help in the absorption of nutrients. The various mechanisms proposed to account for this increased nutrient uptake includes physical exploration of soil, increased translocation of P into mycorrhizal hyphae and modification of root environment.

MATERIALS AND METHODS

Cement pots (50 x45x30 cm sizes) were used to conduct the pot culture experiments. In the cement pots, clay loam soil of pH 7.3, available N 145Kg ha^{-1}, P_2O_5 16.5Kg ha^{-1} and K_2O 215 Kg ha^{-1} was filled @15Kg soil per pot. The dose of manures and fertilizers per pot were worked out on the soil weight basis keeping the base of their recommended doses *viz*., 60kg N, 30 kg P_2O_5, 30kg K_2O and 12.5 t of FYM ha^{-1} for MCU-7 cotton. The half dose of N and full dose P_2O_5 and K_2O were applied as basal application. Remaining N was top – dressed on 45^{th} days after sowing (DAS). The N, P_2O_5 and K_2O through urea, super phosphate and muriate of potash were used respectively. The method of inoculation of arbuscular - mycorrhizal fungal culture was by placement method @ 25 gram of soil inoculum per plant. The cotton (MCU -7) seeds were sown @ 4 seeds per pot and suitable control was also maintained. The experiment was laid out in completely randomized design (CRD) with three replications.

Plant roots were dugout, washed, cut into 1 cm length and stored in (FAA solution) Formalin: Acetic acid: Ethyl alcohol in the ratio of 90:5:5. Prior to staining rhizosphere soil samples of individual plants were used for the analysis of AM fungal spore enumeration. The fixed roots were stained with 0.05 per cent tryphan blue in lactophenol and AM funglspores were recovered by the wet sieving and decanting techniques following the method of Gerdemann and Nicolson(1963).The total phosphorus was determined by Vandomolybdate Method (Jackson,1973). The available N and P_2O_5 were estimated by Subbiah and Asija (1956) and Olsen's methods (1954) respectively. The soil pH was determined in Elico model Lt- 10T pH meter by preparing 1:25 soil: water suspension and stirring by means of glass rod.

RESULTS AND DISCUSSION

Application of P significantly increased the plant height and number of bolls up to 75 per cent recommended dose (RD) with Arbuscular – mycorrhizal fungi (AMF). Application of 'p' significantly increased the plant height and number of bolls up to 75 percent recommended dose (RD) with AM-fungi (Table). Thereafter, RD reduced proportionately to the application. The maximum plant height (106.37cm) and number of bolls per plant (22.3) were observed at 75 percent P with 100 percent N RD + AM-fungi followed by the application of N and P 100 percent RD + AMF at 120 DAS. This observation supports the earlier findings of Bagyaraj (1980). The principal function of mycorrhizal is to increase the soil volume explored for uptake of phosphorus, nitrogen and potassium and other minor nutrients *viz*.., Zn, Fe, Cu and Mn. This phenomenon would have increased the growth and yield of cotton.

The effect of different levels of N and P application on the root colonization by AM- fungi and spore population in the rhizosphere of cotton are presented in the table1. The percent root colonization and AM fungal spore population increased with increased in the application of P from 25 to 50 percent RD. On the other hand, the highest root colonization (91.81 per cent) and AM fungal spore population (188.6 per 100g of soil) were recorded at 120 DAS at 50 per cent P with 100 per cent N + AM fungi followed by 25 per cent with 100 per cent N+ AM fungi and minimum in the control (100 per cent N and P RD without AM fungi). This is probably because the soil p concentration was still below the critical concentration of P to inhibit the mycorrhizal colonization and AM fungal spore population. The study revealed that the 'p' application highly reduced the root colonization percent and AM fungal spore number than N application. The same findings from Champawat (1990) and Ryan (1994) in peanut.

CONCLUSION

This study revealed that 25 per cent of phosphatic fertilizer could be saved by the inoculation of *G. fasciculatum* in cotton and prevent the root knot nematode problem.

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Table1. Effect of *G. fasciculatum* inoculation on the growth, root colonization, spore population, P content and number of bolls of cotton as influenced by the application of various levels of N and P

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T. No.	Treatment	Plant height (cm)	Root colonization (%)	AM spore population (100 g^{-1} soil)	Phosphorus content	Available phosphorus kg ha^{-1}	No. of bolls per plant
		Sampling at 120th DAS					
		120	120	120	120	120	120
T_1	N 25 % + P100 % + AMF	86.80	55.91(48.39)	101.33	0.56(4.29)	115.68	12.33
T_2	N 50 % + P100 % + AMF	95.10	60.21(50.89)	117.33	0.64(4.59)	132.50	15.00
T_3	N 75 % + 100 % + AMF	102.40	62.69(5235)	122.00	0.74(4.93)	149.13	17.33
T_4	P 25 % + N 100 % + AMF	95.57	87.02(68.88)	176.00	0.46(3.89)	166.46	15.33
T_5	P 50 % + N 100 % + AMF	99.10	91.81(73.37)	188.670	0.96(4.76)	170.07	18.00
T_6	P 75 % + N 100 % + AMF	106.37	81.23(64.33)	167.00	0.96(5.62)	175.07	22.37
T_7	N and P 100% + AMF		58.91(50.13)	113.33	0.82(5.20)	182.47	20.33
T_8	Control (N and P 100% RDF)	104.20	23.05(28.69)	36.00	0.76(5.00)	185.41	18.67
	S. Ed.		**0.2448**	**0.8212**	**0.0355**	**11.466**	**0.3591**
	C.D.(P=0.05)		**0.6960**	**2.3343**	**0.0711**	**3.2594**	**1.0208**

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