also indicated in results. Similar reduction in content of Fe in grains of lintil, were observed by Sakal *et al.* (1980).

Copper and Managanese : Content of Cu tended to decrease while that of Mn remained unaffected by application of Zn. Varietal variations were observed for content of Cu and Mn in straw and these in grain did not very markedly. Interactive effects were also revealed except Cu content in second season.

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EFFECT OF VESI CULAR - ARBUSCULAR MYCORRHIZAL FUNGI ON GROWTH AND NUTRITION OF CHICKPEA

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ABSTRACT

Chickpea was inoculated with **Glomus fasciculatum, Glomus constrictum** and **Gigaspora calospora** in sterilized soil in pots. Plants inoculated with all the three mycorrhizal fungi showed an increased plant dry weight and total phosphorus uptake over uninoculated sterilized soil. Increase of growth was correlated with intensity of infection.

KEY WORDS : Mycorrhizal Fungi, Chickpea.

Chickpea *(Cicer arietinum* L.) is an important grain legume in India. Vesicular-arbuscular mycorrihizal (VAM) fungi occur on a wide range of crop plants, (Hayman, 1978). The role of VAM in plant growth and nutrient uptake is well established, (Tinker, 1982). A major part of the beneficial effect of VAM is attributed to their role in phosphorus uptake and translocations.

As the soil of this regionis sandy loam and is deficient in phosphorus, the present study was therefore undertaken to examine the usefulness of mycorrhizal fungi viz. *Glomus fasciculatum, Glomus constrictum* and *Gigaspora calospora* in chickpea.

MATERIALS AND METHODS

A pot culture experiment was conducted using phosphorus deficient (3 mg available phosphorus per kg of soil) sandy loam soil with pH 7.8. Soil was sterilized by autoclaving at 1.1 kg cm^{-2} pressure for 2h. Chickpea (CV RS-10) was grown in 30 cm pots, containing 5 kg of sterilized soil. Mycorrhizal inoculum contained extra matrical Chlamydospores (700 spores per 50 ml of soil) and root segments of *Panicum maximum* Jagg. infected with *Glomus fasciculatum* Gerdmann and Trappe, *Glomus constrictum* Trappe and *Gigaspora calospora* Becker and Hall and grown for 90 days. The inoculum (50 ml/pot) was placed (around the seeds) 2 cm below the soil surface to produce mycorrhizal plants. Plants without mycorrhizal inoculum in sterilized soil served as controls.

Plants were harvested after 60 days. Mycorrihizal infection in the root was determined by clearing the roots in 10% KOH and staining with trypan blue (Phollips and Hayman, 1970). Mycorrhizal spores in the soil were estimated using wet sieving and decanting technique (Gerdmann and Micolson, 1963). Plant dry weight was recorded. Phosphorus content was estimated by the vanadomolybdata yellow colour methods (Jackson, 1971). The results are based on five replications of each treatment.

RESULTS AND DISCUSSION

The shoot and root dry weight was significantly enhanced due to mycorrhizal inoculations and it was highest in *Glomus fasciculatum* followed by *Glomus constrictum* and *Gigaspora calospora* (Table 1). Plants raised in uninoculated non-sterile soil also exhibited higher shoot and root dry weight than plants raised in sterilized, uninoculated soil. Phosphorus content in shoot and root were significantly more in inoculated plants than uninoculated plants and the trend was similar to that of plant growth. In case of mycorrhiza treated plants, mean per cent root infection was 85.66, 82.00 and 76.33 in *Glomus fasciculatum, Glomus constrictum* and *Gigaspora calospora* respectively. Uninoculated plants in non-sterile soil also showed 77.33 percent mean root infection. Mycorrhizal root colonization in nuinoculated plants growh in non-sterile soil could be attributed to the presence of indigenous isolates of mycorrhizal fungi. Mycorrhizal treatments resulted in increase in number of spores in the root zone soil and it was maximum in *Glomus fasciculatum* followed by *Glomus constrictum* and *Gigaspora calospora*. The plants raised in uninoculated non- sterile soil also exhibited the presence of spores in the root zone soil.

VA mycorrhizal fungi differ greatly in their symbiotic effectiveness. Their effectiveness depends on their preferences for particular soils or host plants specificity (Mosse, 1973), direct ability to stimulate plant growth, rate of infection, competative ability and tolerance of applied chemicals. In this study, the effect of different mycorrhizal fungi inoculation on plant growth, phosphorus uptake, per cent root colonization and number of spores of

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Table 1. **Plant dry weight, phosphorus uptake, percentage mycorrhizal root infection and extramatrical chlamydospores in the root zone soil of chickpea as influenced by mycorrhozal inoculations.**

Treatments	Dry weight (mg/plant)		Total Phosphorus uptake (mg/plant)		% Root colonization.	Sporesper 100 ml soil
	Shoot	Root	Shoot	Root		
S+G.fascioulatum	3760	1001	8.14	1.18	85.66	235
S+G.constrictum	3642	960	7.44	1.03	82.00	205
S+G.Gigaspora calospora	3522	914	6.90	0.98	76.33	190
US+NM	2942	748	5.07	0.66	77.33	170
S+NM	2524	624	4.19	0.52	00.00	000
SEM±	41.48	24.28	0.26	0.04	3.43	8.98
CD at 5%	128.36	72.79	0.78	0.12	11.15	29.28

S=sterilized soil, US=unsterilized soil, NM=no mycorrhizal inoculation.

spores in root zone soil were more in sterilized soil than in non-sterile soil. This could be due to the presence or indigenous isolates of mycorrhizal fungi in non-sterile soil, which is well supported by the fact that uninoculated plants grown in non-sterile soil also recorded upto 77.33 per cent mycorrhizal infection. However it is obvious that the inoculated strain was more efficient than the native mycorrhizal fungi. This finding agrees with other experiments reporting differences in growth responses by different VAM fungi (Mosse, 1972; Sanders *et al*, 1977 and Jenson, 1982) and stresses the importance of evaluating the various endophytes. If differences are caused by variations in fungal adaptations to soil conditions and climate, differences in rate of spread of infection or in efficiency of nutrient uptake require further investigations.

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