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PERFORMANCE OF A VAM-FUNGUS (*GLOMUS FASCICULATUM*) ON GERMINATION AND GROWTH OF FOUR SUNFLOWER VARIETIES AT DIFFERENT SOIL MOISTURE REGIME

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ABSTRACT

Sunflower seedlings of 4 varieties grew better on inoculation with *Glomus fasciculatum* at 10% soil-water regime as against lesser growth in uninoculated series of seedlings. There was no difference in percent germination of seeds between inoculated and uninculated series. Mycorrhizal infection in sunflower roots was visible under microscope in 15 days old roots of sunflower seedlings. The growth of sunflower seedlings was better at 10% soil water regime than at 5% soil-water regime. The better growth of mycorrhiza infected sunflower seedlings is related to the entry of extramatrical mycorrhizal hyphae of the soil into the intramatrical region of roots than without inoculation at different soil moisture content. The VAM inoculated sunflower seedlings produced arbuscules in the cortical cells of roots whereas in uninoculated series of pots mycorrhizal hyphae and arbuscules was not seen in roots of sunflower seedlings. The VAM-inoculated sunflower seedlings showed better growth because of mycorrhization and thus could meet up water stress more efficiently than non-mycorrhiza sunflower seedlings at different soil-water regimes.

Key-words: VAM-fungus, *Glomus fasciculate*, sunflower, moisture levels.

INTRODUCTION

Water is a prerequisite for the growth of plants. The global warming causing climate change is causing serious repercussion on growth of plants. The impacts of climate change are being felt worldwide but acutely in dry areas. Dry lands are facing higher temperatures and disruptions in their hydrological cycles exacerbating already critical levels of water scarcity. Sindh is the southern province of Pakistan, is semi-arid to arid region, is very frequently subjected to drought causing loss in agricultural productivity. Low availability of water exerts a controlling influence on the growth and productivity of plants (Fisher and Turner, 1978). The adverse effect of water stress has been reported on nodulation (Sprent, 1971). The first examination of mycorrhizal influence on soil-water and plant was conducted by Safir *et al*. (1972). Sunflower is an important oilseed crop and is grown throughout Pakistan. The object of the research was to find out the performance of mycorrhizal inoculation in 4 sunflower varieties cultivated in Sindh at 3 levels of soil moisture content.

MATERIALS AND METHODS

Soil from Karachi University Campus was air dried and passed through 2 mm sieve. The soil was sandy-clay loam with moisture holding capacity of 30% as determined by the method of Keen and Rackowski (1921). The pH of the soil was determined electrometrically in a mixture of soil and distilled water (1 part soil and 2 parts of water, w/v). A series of earthenware pots (20 x 20 cm) were filled with soil up to 10 cm from the bottom. The soil was adjusted at different moisture levels following the method of Keen and Rackowski (1921). Seeds of 4 sunflower (*Halianthus annus* L.) varieties Hysun-33, Hysun-38, Helico-250 and S-270 cultivated in Sindh were tested for germination and growth at 5 and 10% soil water levels. The seeds sown in the pots were kept in laboratory near the window fitted with transparent glass facing at the sun. The soil based inocula of *Glomus fasciculatum* Thaxter sansu Gerd. @ 100 spores per 100g of soil was inoculated in series of 6 pots each for 21 days and another replicate series was left uninoculated. The data on the average germination and growth of sunflower seedlings were recorded at different soil water regimes. For determining mycorrhiza in roots of inoculated and uninoculated seedlings, the staining method of Phillips and Hayman (1970) was followed.

RESULTS AND DISCUSSION

The germination and growth of four sunflower varieties viz. Hysun-33, Hysun-38, Helico-250 and S-278 were tested at different soil water regimes with and without the inoculation of a VAM-fungus, *Glomus fasciculatum* Thaxter sensu Gerd. The effect of mycorrhizal inoculation had no influence on the percentage of germination of

sunflower seeds (Table 1). A little reduction in germination at 0.5% as compared to 10% soil moisture content may be due to the evaporation of water up to 3 cm depth below the soil surface where seeds are usually sown.

Table 1 Germination percentage of 4 sunflower varieties at different soil water regime.

Soil moisture content % _____ Sunflower vars.	Inoculated		Uninoculated	
	05	10	05	10
Hysun-33	96	100	95	100
Hysun-38	95	100	95	100
Helico-250	95	100	95	100
S-270	94	100	95	100

Table 2 Growth of seedling of 4 sunflower varieties (cm) at different soil water regime.

Soil moisture content % _____ Sunflower vars.	Inoculated		Uninoculated	
	05	10	05	10
Hysun-33	7.5	9.5	6.5	8.6
Hysun-38	7.5	9.4	6.5	8.5
Helico-250	7.4	9.5	6.4	8.3
S-270	7.3	9.3	6.4	8.3

Table 3 Mycorrhizal infection in roots of sunflower seedlings.

Soil moisture content _____ Sunflower vars.	Inoculated		Uninoculated	
	05	10	05	10
Hysun-33	+	++	00	00
Hysun-38	+	++	00	00
Helico-250	+	++	00	00
S-270	+	++	00	00

+ = 20% infection in roots; ++ = 40% infection in roots

Table 2 shows noticeable increase in growth of seedlings on inoculation with *G. fasciculatum* as compared to the result obtained without inoculation. On the average the maximum growth was at 10% soil water regime. Sunflower plants under farm field condition are not watered beyond 10% (soil-water regime) as heads of sunflower become gradually heavier and on maturity there is a fear of lodging of plants beyond 10% watering. The roots of 4 sunflower varieties were checked for VAM-fungal infection by the method of Phillips and Hayman (1970). It was found that 15 days old seedlings produced arbuscules in the cortical cells of roots (Fig. 1). This is an evidence of symbiotic association of mycorrhiza with plants. The symbiotic relationship assists plant to withstand high temperature (Marx and Bryan, 1971); promotes establishment of plants in wasteland (Marx and Artman, 1979). The VAM-fungi in symbiotic association produce mycelial network which extend in soil much more than few short root hairs and therefore absorb more nutrient elements dissolved in water (St. John, 1980). Sieverding and Toro (1988)

suggested improved water relationship of VAM-plants via improved plant nutrition. Sieverding, E. 1991 has placed importance of mycorrhizae in tropical agro-systems.

It is concluded that mycorrhizal sunflower seedlings performed better in growth and in withstanding water stress at different soil-water regimes than the nonmycorrhizal ones.

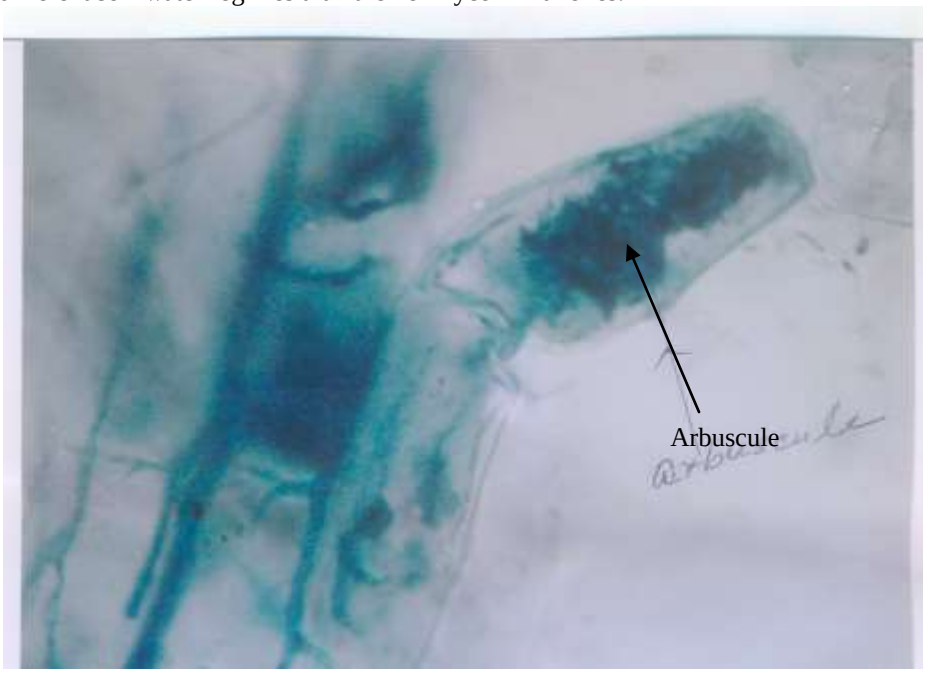

Fig. 1. Showing an arbuscule within the cortical cells of a root of an inoculated series of sunflower seedlings (× 400)

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