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Response to AM fungi and *Azospirillum* in growth of *Vigna radiata* L. Hub

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Abstract

Effect of AM fungi and *Azospirillum* application was studied on growth parameters in Green gram (*Vigna radiata* L.). The pot culture experiment was conducted by using AM fungi and *Azospirillum*. The result showed increased growth parameters (shoot, root length, number of leaves, fresh and dry weight). The AM fungi inoculated plants showed higher, when compared to the *Azospirillum* treated plants.

Keywords: AM fungi, *Azospirillum*, Green gram Plant, Growth parameters

INTRODUCTION

The mutualistic symbiosis occurring between soil-borne fungi and roots of higher plants is called mychorrhizal association. Endomychorrhiza are of the vesicular-arbuscular type occurring in almost all soils and on most of the plant species. This group of mutualistic symbionts now forms an integral part of many agricultural and horticultural. The significance of AM fungi in crop production is widely appreciated and therefore the necessity of using AM fungi as a bioinoculant for improving crop production is increasingly realized. The mychorrhizae are vital for uptake and accumulation of ions from soil and translocation to plants because of their high metabolic rate and strategic distribution in the upper soil layers. In fact the fungus serves as a highly efficient extension of the host root system. *Azospirillum* is a free-living, plant growth promoting bacterium capable of affecting growth and yield of numerous plant species, many of which have agronomic and ecological significance. The leading theory concerning its growth promotion capacity lies in its ability to produce various phytohormones that improve root growth, absorption of water and minerals that eventually yield larger and in many cases more productive plants (Dobbelare *et al.,* 2001). *Azospirillum* species are of ubiquitous distribution in many parts of the world having tropical, sub-tropical and temperate climatic conditions and also with various standing crops grown in a variety of soil types Green gram ranks high among the pulse crops of India. Mature seeds are rich in protein, and cooked seeds and dale from a valuable diet in our country. The most important among the variety of radiate with dark-green foliage, spreading pods and green seed.

MATERIALS AND METHODS

A field experiment was conducted for Botanical garden at the department of Botany, Annamalai University. The physico-chemical characteristics of the soil like pH, organic matter, macro - nutrients like N, P and micro –nutrients like Ca, Fe, Mn and Zn were analyzed at the Soil Testing Laboratory of Agriculture Institute, Vriddhachalam. Green gram is employed as a light diet during fever and is considered to have a cooling and astringent effect. The seeds of *Vigna radiata* L. were initially procured from TNAU, Coimbataore, and then subjected to treatment. The seeds were also subjected to chemical treatment by soaking them in concentration of 0.5 per cent $HgCl_2$ for 30 seconds. After treatments, the seeds were used for sowing in pots. The seed were then sown in soils in pot cultures and experiments were performed. Wetting of the filled pots were done for easy planting. Immediately after transplanting pot water was given to the plants for better establishment. Subsequent water was given every day or as and when required to keep the optimum moisture required in the soil. The growth parameter and photosynthetic pigments were measured on 30 days at pot culture experiment. The dry weight of plants was taken by using an electrical single pan balance after keeping the materials in a hot air oven at 80ºC for 24h. Chlorophyll (Arnon, 1949) and carotenoid (Kirk & Allen, 1965) were estimated.

RESULTS AND DISCUSSION

The physico-chemical characteristics of the study site are given in Table 1. The pH of the soil was just above neutral (7.4) in the study site. The texture of the soil was brown sandy loam. The macro nutrient status of the soil showed a high concentration of nitrogen at 149.3 kg/acre. The potassium content stood at 138.6 kg/acre while the phosphorus content showed a low of 19.4 kg/acre. The micro nutrient status of the soil was registered as Ca 1.5, Fe 1.8, Mn 3.6 and Zn 2.1 in ppm respectively.

The growth parameter percentage, shoot, root, number of leaves fresh and dry weight and Photosynthetic pigments of *Vigna radiata* L. (Table 2). The shoot and root weight increased in finger millet by inoculation of AM fungi *Glomus fasiculatum* in an unsterile soil which is low in available phosphorus (Bagyaraj and Manjunath, 1980). The inoculation of *Glomus fasiculatum* increased the growth of onion (Hirrel and Gerdemann, 1980). AM inoculation induced maximum plant height and biomass of shoot in maize and soybean (Thangaraju et al., 1986). There are many reports indicating positive plant response to the inoculation of *Azospirillum* sp. The effects depend on the bacterial strain, soil structure, plant cultivar and environmental conditions. In the field, deleterious agents such as pesticides, toxic metals, saline stress, etc., may reduce or eliminate the beneficial effects of *Azospirillum* on plant growth. There are reports describing increase in the yields in field experiments, with different maize cultivars inoculated with different bacterial strains. The present study AM inoculation significantly increased the shoot length, root length, number of leaves, fresh weight and dry weight,

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but the *Azospirillum* applied plants showed lower values. The AM inoculated plants showed higher values when compared to the Azospirillum plants.

Table 1. Physico-Chemical characteristic of soils at the study site

S.No.	Study locality	pH	Macro nutrients (kg/acre)			Micro nutrients (in ppm)				Soil texture
			N	P	K	Ca	Fe	Mn	Zn	
1	Botanical garden	7.4	149.3	19.4	138.6	1.5	1.8	3.6	2.1	sandy loam

Table 2. Influence of AM fungi and Azospirillum on growth and photosynthetic pigment of *Vigna radiata* L. on the 30 day

S. No	Inoculation Treatment	Shoot length (cm)	Root Length (cm)	Total length	Leaf Length (cm)	Leaf breadth	Chlorophyll contents		
							Chl -'a'(µg/g)	Chl -'a'(µg/g)	TotalChl(µg/g)
1	Control	34.5	8.2	41.6	6.9	5.2	0.273	0.026	0.299
2	Azospirillum	34.0 (-1.449)	9.1 (10.975)	39.2 (-5.769)	7.5 (8.695)	5.9 (13.461)	0.288 (-41.344)	0.039 (-70.895)	0.408 (-34.720)
3	AM Fungi	44.5 (28.985)	10.1 (23.170)	46.9 (12.740)	8.6 (24.637)	6.9 (32.692)	0. 365 (33.699)	0. 046 (76.923)	0. 495 (65.551)

(Per cent over control values are given in parameters).

The Photosynthetic pigments of Total chlorophyll, chlorophyll–a and chlorophyll–b, were maximum in AM inoculated cassava plants both under pot and field conditions (Ganesan and Mahadevan, 1994). Mycorrhizal infection by *Glomus fasciculatum* increased chlorophyll concentration in *Bouteloua gracilis* (Allen *et al.,* 1981). Champawat (1992) recorded greater shoot and root dry weight in chick pea plants inoculated with *Glomus fasciculatum*. Mycorrhizal plants translocate higher amount of photosynthates from shoot to root than non mycorrhizal plants without altering the leaf area and the AM fungi derive their carbon requirement from the host plants (Harold, 1980). Mycorrhizal infection by *Glomus fasiculatum* increased chlorophyll and phosphate concentrations by 28% and 70% respectively in rangeland grass *Bouteloua gracillis* (Allen *et al.,* 1981). Inoculation of blackgram in an unsterile soil with *Glomus epigaeum* increased the chlorophyll content and N, P and K content (Umadevi and Sitaramaiah, 1990). Total chlorophyll, chlorophyll–a and chlorophyll–b were maximum in AM inoculated cassava plants both under pot and field conditions (Ganesan and Mahadevan, 1994). Plant grown in soil inoculated with *Glomus fasciculatum* showed increased mycorrhizal colonization, fresh and dry shoot and root weight, chlorophyll content and phytochemical constituents (Selvaraj, 1989). Krishna *et al.* (1981) observed that bundle sheath chloroplasts were more in numbers and that the veins and mesophyll cells of mycorrhizal finger millet were larger than those of non mycorrhizal plants.

In the present study, the pigment contents (Chlorophyll a, b, total chlorophyll and carotenoid) increased with the advancement of age of the plant up to 30 days. An inoculated plants showed significant increase than the *Azospirillum* at corresponding levels of water treatment. It can be concluded that application of AM fungi in loamy soils will result in improved growth of crops.

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