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EFFECT OF DISTILLERY EFFLUENTS ON VESICULAR ARBUSCULAR MYCELIUM (VAM) INFECTION IN *Glycine max*

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ABSTRACT

A field experiment was conducted to study the effect of different distillery effluents; raw spent wash (RSW), biomethanated spent wash (BSW), recommended NPK+FYM (farm yard manure) and control (no fertilizers and effluent) on vesicular arbuscular mycelium (VAM). The study revealed that NPK+FYM showed highest VAM infection followed by 5 ha cm BSW, 10 ha cm BSW, 5 ha cm RSW, 10 ha cm RSW and lowest in control .

Keywords: Vesicular arbuscular mycelium (VAM), Soybean, RSW, BSW and NPK+FYM.

INTRODUCTION

Some fungi enter into a mutualistic relationship with plant roots called mycorrhizae (literally , "fungus root") in which the fungi actually becomes integrated into the physical structure of the roots. The fungus derives nutritional benefits of the plant roots, contributes to plant nutrition, and does not cause plant disease[1,6,9].

Mycorrhizal associations differ from other rhizosphere associations between plant and microorganisms by the greater specificity and organization of the plant fungus relationship . The Mycorrhizal association involves the integration of the plant roots and fungal mycelia, forming integrated morphological units . The widespread existence of mycorrhizal association between fungi and plant roots attests to the importance of this interaction .

Mycorrhizal associations exist for prolonged periods with the maintenance of a healthy physiological interaction between the plant and the fungus . The mycorrhizal associations of fungi and the plant roots represent a diverse relationship in terms of both structure and physiological function that leads to a nutrient exchange favourable to both partners . Enhanced uptake of water and mineral nutrients, particularly phosphorus and nitrogen, has been noted in many mycorrhizal associations, plant with mycorrhizal fungi are therefore able to occupy habitats they otherwise could not [3-5,8,10.]

There are two basic types of mycorrhizal associations : ectomycorrhizae and endomycorrhizae. In ectomycorrhizae, the fungus forms an external pseudoparenchymatous sheath more than 40 µm thick and constituting up to 40% of the dry weight of the combined root-fungus structure . The fungal hyphae penetrate the intercellular spaces of the epidermis and of the cortical region of the root but do not invade the living cells .The morphology of the root is altered , forming shorter, dichotomously branching clusters with reduced meristematic regions .

In contrast to the predominantly exogenous ectomycorrhizae , endomycorrhizae invade the living cells of the root , which become filled with mycelial clusters. Of the various microorganisms colonizing the rhizosphere, mycorrhizal fungi occupy the unique ecological position of being partly outside the host. The part of the fungi within the root does not encounter competition with other soil microorganisms. In a widespread form of endomycorrhizae, appearance of intracellular hyphal clusters causes these to be called vesicular-arbuscular (VA) mycorrhizae. In some cases endo and ectomycorrhizae may be combined and are referred to as an ectendomycorrhiza.

Endomycorrhizal associations in which the fungus penetrates into the plant root cells ,which are not of the vesicular –arbuscular (VA) type, occur in a few orders of plants , such as the Ericales which include heath, Arbutus, Azalea, Rhododendron, and American laurel. The endomycorrhizae of the plant genera belonging to the Ericales are characterized by non pathogenic penetration of the root cortex by septate fungal hyphae that often form intercellular coils .Although the fungi do not fix atmospheric nitrogen, the endomycorrhizal association may increase plant access to combined nitrogen in soil as demonstrated by better nitrogen nutrition in mycorrhizal as compared to nonmycorrhizal plants .There is greater phosphatase activity in mycorrhizal roots than in nonmycorrhizal roots and the mycorrhizal fungi can transfer phosphate from external sources to the host plant . The associations of endomycorrhizae in Ericales appears to improve the growth of the host plant in nutrient deficient soils, and the widespread occurrence of endomycorrhizal infection in Ericales indicate that these plant root tissues provide a good ecological niche for these fungi .

The chief diagnostic feature of VA mycorrhizae is the presence of vesicles and arbuscules in the root cortex. Inter-and intracellular hyphae are present in the cortex, and the infection inside the root is directly linked to an external mycelium that spreads into the soil. In general, the mycelium forms a loose network in the soil around the VA mycorrhizal root. These mycorrhizal fungi have the largest known resting spores of any fungi, with diameters of 20-400 µm The mycorrhizal mycelium appears to be more resistant than the root itself to abiotic stresses such as drought, metal toxicity, and soil acidity . The fungi increase plant growth through improved uptake of nutrients, especially phosphorus, made possible by the exploration by the external hyphae of the soil beyond the root hair and phosphorus depletion zones. The VA mycorrhizal association results in increased phosphate uptake by the plant and improved uptake of other ions , such as zinc , sulfate , and ammonium from soil [2,7]

MATERIAL AND METHODS

The present study was initiated during 2003, at the IISS, Bhopal to devise suitable management prescriptions for safe utilization of distillery effluents keeping in view long term implications of its use on soil health. Under this project microplot field experiments were conducted using soybean-wheat cropping sequence to study microbiological properties of soil following the applications of graded doses of treated (biomethanated) and untreated (raw) spent wash (hereinafter to be referred to as BSW and RSW respectively). The various distillery effluents BSW and RSW were collected from Som distilleries located at Bhopal. (M.P.).

The treatments were imposed in micro plots (1m X 1.2m) as per randomized block design with three replications. The experiment consisted of six treatments.

T1 Control

T2 NPK+FYM

T3 5ha cm biomethanated spent wash (BSW)

T4 10 ha cm biomethanated spent wash (BSW)

T5 5 ha cm raw spent wash (RSW)

T6 10 ha cm raw spent wash (RSW)

The determination of Vesicular arbuscular mycelium

The root samples were washed thoroughly in running tap water to reduce the sticking soil . They were soaked in 10 % KOH and kept for 1 day . The mycorrhizae roots were slightly heated for 10 min and solution was decanted . They were again washed with water and dipped in 10% HCl for 5 minutes. After removing acid, trypan blue was added and samples were again kept for 1 day . Finally trypan blue was decanted, Lacto glycerol was added on a glass slide and root samples were observed under 10x.

Table - 1 : Effect of distillery effluents on vesicular arbuscular mycelium (VAM) infection in soybean

Treatment	Infection of VA mycorrhiza in roots (%)	
	Sample 1	Sample 2
Control	38	40
NPK + FYM	70	72
5 ha cm BSW	58	60
10 ha cm BSW	56	58
5 ha cm RSW	55	56
10 ha cm RSW	54	55
Mean	55.16	56.8

RESULTS AND DISCUSSION

Soybean is one of the important leguminous plant which is a source of rich amount of proteins and edible oil . Other important materials from soybean include soy milk and lecithin. Soy milk is also used for the preparation of cheese. In our country it is one of the widely used and grown crop for multifarious uses and is also attributed with anticarcinogenic properties . Like other crops, its productivity is also effected apart from other factors by the degree of mycorrhizal infestation. In the present investigation this crop was subjected to number of the soil treatments to evaluate the mycorrhizal association in different soils. It is evident from table 1 that highest infection in terms of % (70 and 72 %) respectively was encountered in the soybean plants grown in a combination of NPK +FYM followed by 5 ha cm BSW with (58 and 60%) infection in sample 1 and sample II . In all the treated plots the infection of VA mycorrhizae was found to be more than 50 %, whereas it was below 50 %, in both the samples kept as control. It can thus be enhanced by proper manipulation of the soil which stimulates the VAM growth and the best combination for soybean is NPK +FYM.

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