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RESEARCH ARTICLE

EFFECT OF *FUNNELIFORMIS MOSSAE (AMF)* ON GROWTH OF WHEAT (*TRITICUM AESTIVUM*) GROWN IN FLY ASH AMENDED SOIL

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ABSTRACT

Fly ash, a residue of coal combustion from thermal power plant play potential role in bioreclamation of degraded agricultural soils. Fly ash contains some micro and macronutrients viz. Cu, Fe, Zn, Mo, Mg, K, P and Co, Cd, Cr, Pb, Ni which enhance the growth of plants. AMF helps plant growth by increasing uptake of nutrients, producing growth promoting hormones and suppress plant pathogens. In present study, utilization of beneficial microorganism viz. *AMF* e.g. *Funneliformis mossae* in fly ash amended soil for bioreclamation of degraded agricultural soil was studied. Pot assay method was conducted from last week of November to February. Various concentration of soil/fly ash (w/w) was prepared and were taken in different pots. Fly ash concentrations viz. 0%, 10%, 20%, 30%, 40% were taken in the respective pots. 0% i.e. only soil was considered as control. In first set, that is set no. F, only fly ash and soil was added (0%, 10%, 20%, 30%, and 40%) and in another set, set no. C soil+FA+*Funneliformis mossae* was taken. Seeds of Wheat cultivar Lok-1 was used as test crop. During pot assay method, morphological characters of wheat plant were studied i.e. Germination %, Shoot length and Root length etc. Morphological characters were compared between set F and set C, over the control. Increase in %germination, shoot and root length was observed in set C which contains *Funneliformis mossae* as compared in set F which contained soil and fly ash. Highest shoot and root lengths were observed in set C2 and C4 followed by F2 contains 20% and 40% fly ash respectively. Rate of % germination was observed high in set no. C2, C4 followed by C1.The present study showed that *AMF* viz. *Funneliformis mossae* had vital role on wheat growth in fly ash amended soil.

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INTRODUCTION

Fly ash is a notorious waste of coal combustion from Thermal power plant, has feasible role as an amendment material in agriculture field. Fly ash can be judiciously used for reclaiming degraded agricultural soils (Rai *et al*, 2010). The physical, chemical and mineralogical properties of the fly ash shows that the presence of some micronutrients like Fe, Zn, Cu, Mo, B, Mnetc. and some macro nutrients like K, P, Ca, Mg and S helps to improve soil health and growth of crop plants. Fly ash optimizes pH values of soil, reduces bulk density and improves soil texture and soils water holding capacity. Fly ash a residue of coal combustion is the deficient in Nitrogen content and organic 'C' content (Sharma, 2006). Fly ash also contains some toxic heavy metals viz. Cd, Co, Cr, Cu, Ni and Pb which may increase the chance of entrancein food chain.

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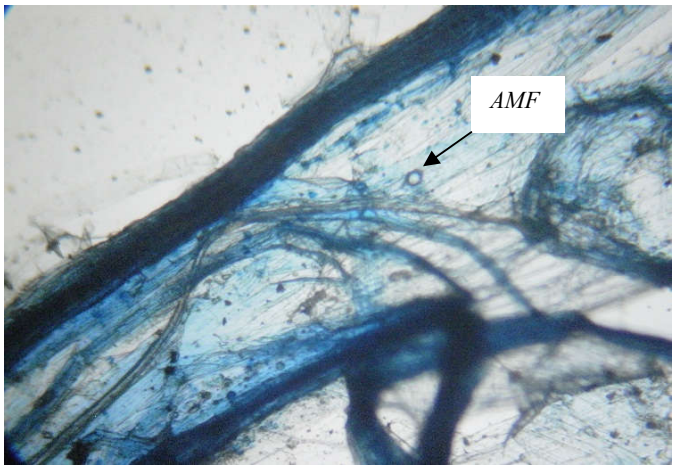
To overcome this problem, bioreclamation is the best alternative exploring the possible use of fly ash as soil modifier and nutrient supplier. Soil microbiota plays a vital role in soil fertility. These beneficial microorganisms play potential role to reclaim the degraded agricultural land by using fly ash as an amendment material. Several studies reveal the possible use of microorganisms and fly ash in agro climatic conditions. Microorganisms viz. *PGPR, PSB/PSF* and *Mycorrhiza* are the beneficial soil microbiota which have ability to fix Nitrogen, increases nutrient uptake by roots and also play role in solubilization of inorganic phosphate so as to increase uptake of 'P' by various positive effect on plant growth. It produces phytohormones and antibiotics which increases plant growth and suppress the phyoto pathogens. *AMF* also reduces the toxicity of heavy metals and enhances uptake of nutrients by roots (Khan, 2005*)* (Mohammad, 2004). To study the possible use of FA in agriculture many R &D institute, universities conducted the lab scale and pilot scale experiment. (viz. Regional Research Lab (RRL), Central Fuel Research Institute (CFRI) Dhanbad, National Aluminum Company (NALCO),

Roots with *Mycorrhiza*:



Effect of various fly ash amendments on growth of wheat cultivar Lok-1 by pot assay

Effect of *Funneliformis mossae* on growth of wheat grown in various fly ash amended soil

Angul, Orissa under the agency of "fly ash mission" of Government of India. Various agricultural crops like paddy, wheat, maize, soybean, pulses, vegetables like tomato, potato bringal and some medicinal and aromatic plants were tested under the agro climatic conditions (Aswar, 2001). In present research work possible amendment of fly ash with various doses viz. 0%, 10%, 20%, 30%, 40% were studied (Siddiqui, 2004) by inoculating with the *AMF* in the soil. Nursery trial was taken to study the effect of fly ash amendment in soil and *AMF* inoculation during the Wheat (*Triticum aestivum*) cultivation. The efficiency of *AMF* inoculation and effect of various doses of fly ash was studied by observing the morphological parameters of plants viz. seed germination %, shoot length and root length etc.

METHODS AND MATERIALS

Collection and preparation of sample

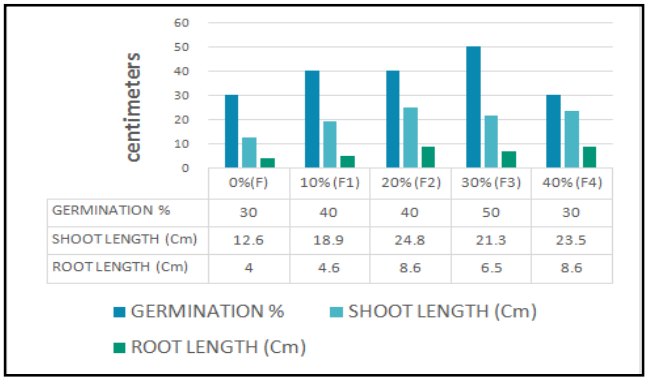
Fly ash was collected randomly from the dumping sites of Chandrapur Thermal Power Station, Chandrapur (M.S) India and soil sample was collected randomly from farm field situated in the village Choti Padoli, 5km away from Chandrapur city. Soil samples were air dried and then sieved through 2mm sieve. Seeds of Wheat cultivar Lok-1 was purchased from local market *and AMF (Glomales) e.g. Funneliformismossae* was purchased from Tata Energy and Research Institute (TERI), New Delhi.

Pot Assay

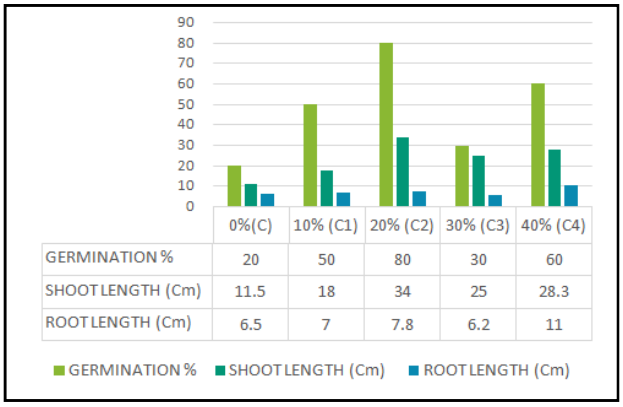
To design the amount of Fly ash utilization on large scale i.e.to determine the different doses of fly ash for amendment, the study was conducted on lab scale by pot assay method. Soil/fly ash (w/w) was taken in concentration of 0%, 10%, 20%, 30% and 40% in a pots. The respective pots were filled with 4 kg soil/fly ash mixture. The seeds of wheat cultivar Lok-1 was washed and then sown in the pots containing different soil/fly ash concentration (Singh *et al*, 2002) at the depth 10-15 with *AMF* inoculum. Spores of AMF i.e. *Funneliformis mossae* was first observed under microscope (Phillips and Hayman, 1970). Presence of bright spores was confirmed. Spores of *mossae* was inoculated first in onion seeds and infected roots of onion were chopped in fragments and then mixed with distilled water and then inoculated near the wheat seeds(Siddiqui, 2004) in the respective pots of set no. C viz. soil + FA (0%, 10%, 20%, 30%, 40%) + *AMF*(C, C1, C2, C3 and C4 respectively). Control set no. F i.e. soil/fly ash mixture of 0%, 10%, 20%, 30%, and 40% was also maintained simultaneously (viz. F, F1, F2, F3, and F4 respectively). 0% pot contains only soil was considered as control pot. The pot assay experiment was conducted in last week of November (Rabi season) and was terminated after 45 days. During the period, seed germination % was recorded. After 45 days of sowing, experiment was terminated and length of shoot and root were recorded

RESULT AND DISCUSSION

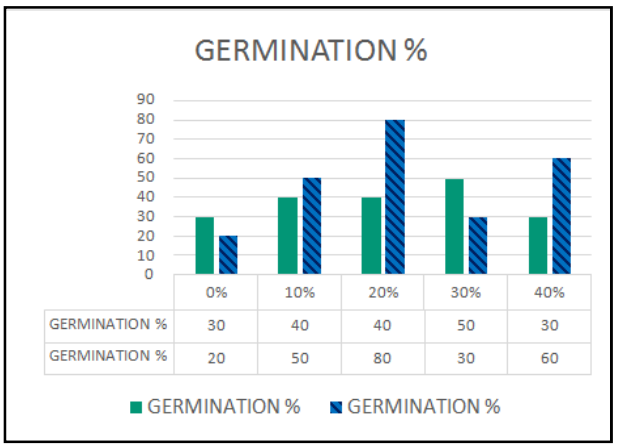
Among all the treatments, % germination was found more in set **C** as compared to set F. From set 'C', C2 showed highest seed germination (Graph-2and 3) followed by C4 and F2 i.e. at 20% and 40% fly ash amendment *with Funneliformis mossae* showed beneficial effect on seed germination as compared to set F was contained only FA and soil mixture.



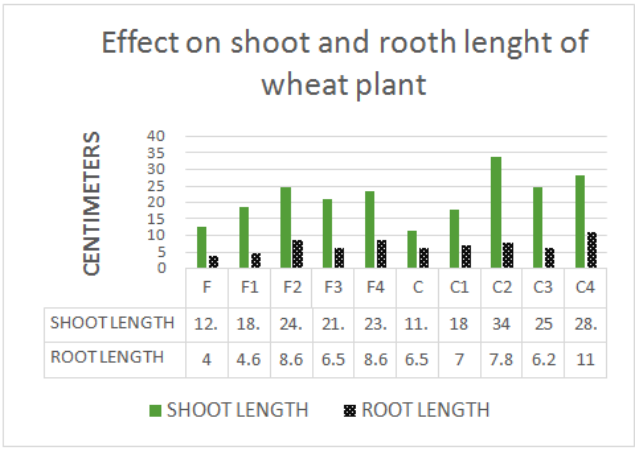
Graph 1. Effect of various fly ash amendments on growth of wheat cultivar Lok-1 by pot assay method



Graph 2. Effect of microbial isolate *AMF* e.g. *Funneliformis mossae* on growth of wheat grown in various fly ash amended soil



Graph 3.



Graph 4.

During the study of morphological characters, shoot length and root length of wheat plant was also recorded. There was an increased shoot and root length in pot C, highest length was observed in 20% (C2) and 40% (C4) pots fly ash amendment as compared to set F (Graph-4). Due to Fly ash amendment there showed increase in % germination and shoot/root length as compared to control i.e. only soil.

In present work, it was indicated that fly ash had potential role to increase the soil status. Increase in shoot length was also observed as compared to control (0%) i.e. only soil. Application of fly ash at 20% and 40% were found beneficial for the plant growth then at 10% and 30% concentration. Seed germination % was low in 10% and 30% as compared to 20% and 40% concentration soil/ fly ash mixture. In present study, it was suggested that 20% soil/ fly ash amendment, inoculated with *Funneliformis mossae* showed enhance growth of Wheat cultivar Lok-1 as compared to non-mycorrhizal amendment.

Conclusion

In present study pot assay method was carried to study the effect of *AMF* viz. *Funneliformis mossae* in various concentration of fly ash amended soil with wheat cultivar Lok-1. From the study it was showed that Fly ash amendment has beneficial role in degraded agricultural soil. *Funneliformis mossae (AMF)* showed vital role in 20% FA amended soil by providing more absorptive surface to the roots, so as to increase nutrient uptake which proved to be beneficial for growth of wheat plant.

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