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LOCAL AMF AND PLANT HEALTH - AN INSTANT EFFECT ON HUMAN HEALTH

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ABSTRACT ■ Bio-fertilizers are living organisms used as fertilizer which can change the rhizospheric environment and promote growth and development of the host plant without causing any harmful effect. Arbuscular Mycorrhizal (AM) fungal bio-fertilizer is important one because it affects symbiotically in the roots of almost all plants and its rhizosphere surroundings. AM fungal inoculation process is simple as they need no artificial media. It symbiotically penetrates into the host plants' feeder root cortex and makes a bridge between soil and roots. Various nutrients like N, P, K, Ca, Fe, Mn, Cu, Zn etc. are absorbed by AMF from the soil and transfer these to their hosts. AM fungi improve soil structure, suppress plant diseases and improve plant tolerance to water stress, salinity, soil acidity and heavy metal toxicity which is helpful for plant growth. Large scale applications of local AM fungi on selected plant like *Curcuma amada* (mango-ginger) show better yield. Biomass production increases by using rich AM spore containing soils. Hope that isolates from locally available AM fungi would be a boon to restore the ecosystem pristine for development of human health.

Key words: *AM-Fungi, Curcuma amada, inoculation, yield*

INTRODUCTION

Arbuscular Mycorrhizal Fungi (AMF) is considered as bio-fertilizer because they help plants to get water, macro and micro nutrients from soil (Marschner and Dell, 1994). Very often they protect the host plants from pathogens (Pozo and Azcon-Aguilar, 2007). These fungi help their host plants to thrive against different types of stressed conditions such as water stress, salt stress, heavy metal stress etc. (Auge et al. 2015). They are present in every type of soils except arctic region. AMF are obligate symbionts belonging to the phylum Glomeromycota and form mutalistic relations with about 80% plant species including agricultural crops. The fine hyphae of AM fungi physically bind soil particles together creating stable soil aggregates (Rilling *et al.* 2015) that helps to increase water infiltration and water holding capacity. AMF are natural biotic components of soil (Ghosh and Das, 2017) as they produce vesicles (Fig. 3) and arbuscules (Fig. 4) within host rootlet cortex and spores into the

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rhizosphere soil (Fig. 5). So, the introduction of AMF in less AMF soil will increase the soil fertility and the ecosystem will be more vivid. Recent study revealed that in natural environment non-mycorrhizal condition should be viewed as abnormal for the majority of the species (Smith and Smith, 2012). Diversity of AMF community within the soil depends on the plants community, soil type, season, rainfall and other climatic factors (Smith and Smith, 2012). In the present study an experiment was done to see how inoculum density and vivid spore affect the growth and yield of rhizome of *Curcuma amada* using natural soils in pot condition.

About the mango ginger: It is seasonal plant similar to ginger but have a mango taste. The plant is found in Gujarat, West Bengal, Uttar Pradesh, Uttarakhand, Karnataka and Tamil Nadu in India. Rhizome contains carbohydrate, curcuminoids, volatile essential oils, phenolic acids, terpenoids, amylase, enterokinase etc. Rhizome is commonly used in making pickles, chutney. Fresh rhizome is often used with betel leaf.

Medicinal value: It is a good appetizer and calming agent. It is antibacterial, antifungal, anti-inflammatory and antioxidant. Other activities of the said plant is as antiallergic, analgesic, digestive and cytotoxic *i.e.* works as an immune cell or venom in our body. The rhizome has properties to inhibit the growth of triglycerides in our body.

Instant therapy by mango ginger: 25g amada+100g sesame oil, heat till lukeworm: paste used to relieve body pain as calming agent. 2 tbs amada juice + 2 tbs milk/rose water, mix well: apply on face leave for 20 minutes then rinse with water: this helps to detoxify the body and improve skin complexion, get rid of acne and other skin problems. 2 tbs amada + small amount of coconut oil, apply on irritated skin: helps as antiallergic. Amada + milk , daily use : helps to relieve pitta and diabetes and skin diseases. Regular use of amada in small dose will relieve from cold, cough, bronchitis, asthma and will increase digestive strength. 100g amada powder + 100g black pepper powder+ 200g drumstick bark paste , boil : apply on swelling in the joints to get relief. 10g each amada+fenugreek+Brahmi+Amla powder and 20g Shikakai powder in 100g coconut oil to form paste, apply on scalp, and leave for 30 minutes, clean with shampoo: it will help to get rid of dandruff. So, there is a need for research in improving the quality and quantity of drug and other crop products in relatively shorter period and at lower expense by using AM fungi. Southwest Bengal has tropical dry deciduous forests with many valuable medicinal plants and tuber crops which have been reported from these forests time to time that needs attention for proper health care.

STUDY AREA

Soils for pot culture were collected from four different sites of erstwhile Midnapore district. These were forest soil of Gopegarh, and two different cultivated land soils such as Lalgarh and Nepura. Anthill soils from Gopegarh were also collected for *C. amada* pot culture from May, 2017 to October, 2017.

MATERIALS AND METHODS

Soil was collected from field and placed in a bag separately before this unwanted materials in soil was discarded. For each type of soil, 5 poly pots were taken with 2 kg soils. Each soil sample contains different types of AM mycorrhizal spores. In each poly pot specific sized rhizome of *C. amada* was placed. The packets were placed in net house and watered as per the requirements day by day. Similarly spore density of each type of soils was calculated using standard wet sieving and decanting technique (Gerdemann and

Nicolson, 1963). Photographs of spores were taken to study the AM fungi. After the physical death of plants watering was stopped. Rhizomes were collected from pot soil and weighed individually after removing soil from rhizome. Pot soils were air dried and preserved for further study.

RESULTS AND DISCUSSION

After 6th month of plantation plants became inert and aerial parts were completely dried. After final harvest soils of different sites show different results of rhizome biomass increase (Table 1). Here, highest yield was observed in case of Gopegarh and lowest was observed in case of Lalgarh agricultural field. As per previous count highest spore density of AMF was observed in Goegarh forest soil (693 per 100g soil) and lowest in case of Lalgarh agricultural field soil (225 per 100g soil). Anthill soil contains different types of vivid AMF spores (470 per 100g soil) like forest soils (Fig. 2). In the same study it is observed that natural forest soil contains more AMF spore in comparison to agricultural land which is supported by earlier work of Ghosh and Das, 2017a . Farmers use different types of chemical fertilizers and pesticides for better yield of their crops. These chemical fertilizers decrease soil microflora day by day even causes soil pH disbalance. Our observation also supports the same result as AMF spores present less in number in case of two agricultural lands than forest soils even anthill soils. Macro- and micro nutrients were not applied externally during experiment so the AMF supply nutrients to the crop applied. Other activities of soil microflora rather than AMF were present in all the cases which were assumed as neglected. The result also explained that the density of AMF in soil positively related to the growth and yield of the *C. amada* rhizome in experimental condition. Therefore, it is concluded that natural soil may be used for inoculum production and more field trials to be incorporated later for better result.

CONCLUSION

AM bio-fertilizers being essential components of organic farming play a vital role in maintaining long term soil fertility and sustainability. It mobilizes fixed macro and micro nutrients or convert insoluble P in the soil into available form, thereby increases their efficiency and availability. In context of both the cost and environmental impact of chemical fertilizers, excessive reliance on the chemical fertilizers is not viable strategy in long run. As AM is easy to handle and need no synthetic media for mass production, it may be incorporated as biofertilizer in present day

Table 1. Yield of rhizome biomass after 120 days treatment by AMF on *C. amada*

Sl. No.	Wt. of Rhizome (g)	1st Pot	2nd Pot	3rd Pot	4th Pot	5th Pot	Yield (%)	Spore/2 kg soil
1. Gopegarh	Starting	8	5	7	5	7	398.43	±13900
	Final	39.42	26.51	31.04	21.76	27.97		
2. Anthill	Starting	9	8	15	6	8	237.67	±9400
	Final	16.95	19.66	66.09	33.97	18.66		
3. Nepura	Starting	1.5	1.5	2	1.3	2	172.77	±5175
	Final	6.72	2.45	5.28	4.8	3.4		
4. Lalgarh	Starting	19	14	18	13	12	153.59	±4500
	Final	49.14	50.42	49.71	27.27	15.68		

N.B.: Final mean wt. of rhizome in gram (g) after harvest using local soil with AM fungi.

Fig. 1 Rhizome, roots and bulbous roots of *Curcuma amada* after harvest through AMF inoculation

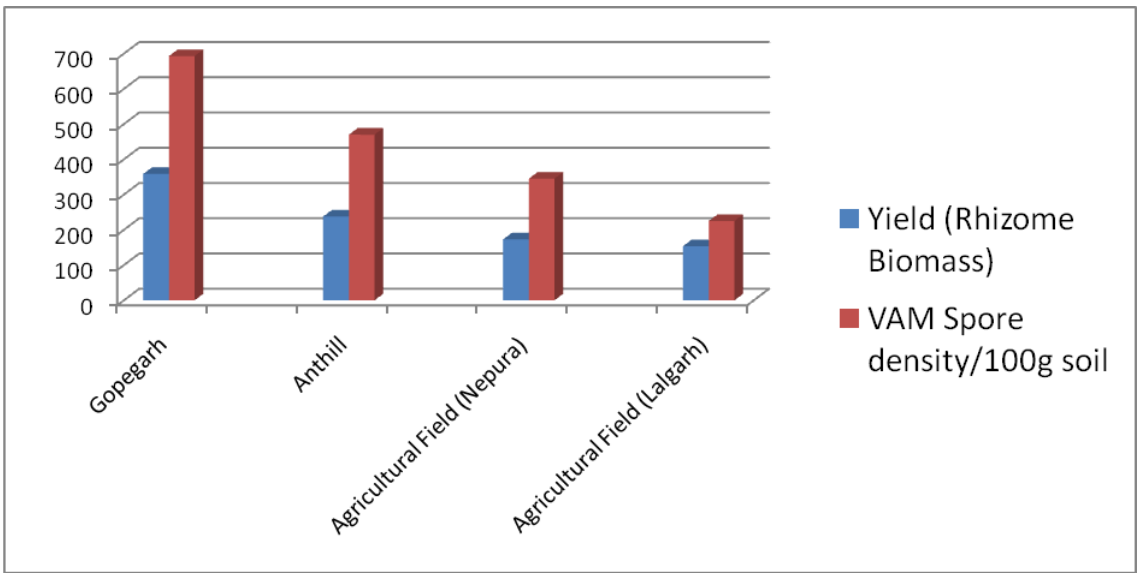

Fig. 2 Yield of Rhizome of *C. amada* and AMF spore density of respective site soils

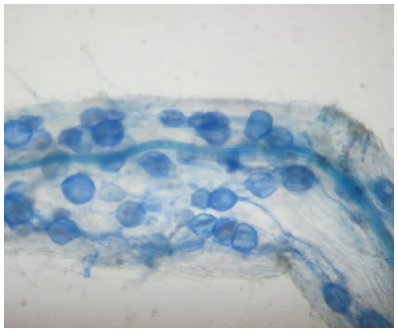

Fig. 3 Vesicle

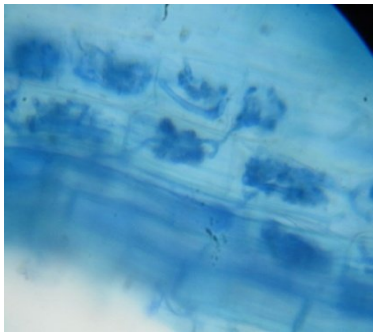

Fig. 4 Arbuscule

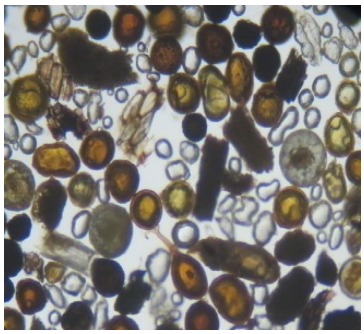

Fig. 5 AMF Spores

scenario. Mango ginger has 'curcuminoid' as a component and so many medicinal properties. It may be cultivated very easily by using forest soil. From the result it is observed that soil with more AM spore density produce more biomass as yield. Forest soils have more spores than cultivated one. Use of chemical fertilizer for better production causes death of soil flora in both the experimental and cultivated conditions. Mango ginger is used as raw, so chemical fertilizer and chemical pesticide should not be used for its production. Hope that like this plant, other tuber crops and other cash crops can be cultivated with the help of AM and other biofertilizers for better yield.

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