Experiment On Amada (*Curcuma amada Roxb.)* And It's Yield By Local VAM Fungi

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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. Vesicular Arbuscular Mycorrhizal (VAM) fungal bio-fertilizer is important one because it affects symbiotically in the roots of almost all plants and its rhizosphere surroundings. VAM fungal inoculation process is simple as they need no artificial media. It symbiotically penetrates in to 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. absorbed by VAMF from the soil and transfer these to their hosts. VAM 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 VAM fungi on selected plant like Curcuma amada (Mango-Ginger) show better yield. Biomass production increases by using rich VAM spore containing soils. Hope that isolates from locally available VAM fungi would be a boon to restore the ecosystem pristine for development of human health.*

Keywords- VAM-Fungi, Currcuma amada Roxb., inoculation and Yield

I. INTRODUCTION

Vesicular Arbuscular Mycorrhizal Fungi (VAMF) is considered as bio-fertilizer because they help plants to get water, macro and micro nutrients from soil (Marschner and Dell, 1994). Very often then 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 and heavy metal stress etc. (Auge et al. 2015). They are present in every type of soils except arctic region. VAMF are obligate symbionts belonging to the phylum Glomeromycota and form mutualistic relations with about 80% plant species including agricultural crops. These fungi also convert hard to digest organic materials into simple form that other organisms can use. The fine hyphae of VAM fungi physically bind soil particles together creating stable soil aggregates (Rilling et al. 2015) that helps to increase water infiltration and water holding capacity. VAMF are natural biotic components of soil (Ghosh and Das, 2017, Ghosh and Verma, 2017, Ghosh, 2018) as they produce vesicles (Fig. 3) and arbuscules (Fig. 4) within host rootlet cortex and spores in to the rhizosphere soil (Fig. 5). So, the introduction of VAMF in less VAMF 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 VAMF 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 experiment done to see how inoculums density and vivid spore effect 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 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 anti allergic, 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 Luke worm: paste use 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. 2tbs amada + small coconut oil, apply on irritated skin: helps as anti allergic. Amada + milk , daily use : helps to relieve pitta and diabetes and skin disease. 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 relieve. 10g each amada+fenugreek+Brahmi+Amla powder and 20g Shikakai powder in 100 gm coconut oil to form paste, apply on scalp, and leave for 30 minutes, clean with shampoo: it will help to get rid

of from 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 VAM 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. Note: tbs-Table spoon.

II. STUDY AREA

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

III. MATERIALS AND METHOIDS

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 VAM 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 VAM fungi. After the physical death of plants watering was stopped. Rhizomes were collected from pot soil and weighted individually after removing soil from rhizome. Pot soils were air dried and preserved for further study.

IV. RESULTS AND OBSERVATION

After 6th month of plantation plants became inert and aerial parts were completed dried. After final harvest different site soils 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 VAMF 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 VAMF spores (470 per 100g soil) like forest soils (Fig. 2). In the same study it is observed that natural forest soil contain more VAMF spore in compare 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 micro-flora day by day even causes soil pH misbalance. Our observation also support the same result as VAMF 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 VAMF fungi supply nutrients to the crop applied. Other activities of soil micro-flora rather than VAMF were present in all the cases which were assumed as neglected. The result also explained that the density of VAMF 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 inoculums production and more field trials to be incorporated later for better result.

Table 1. Yield of rizome biomass after 120 days treatment by VAMF 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 means wt. of rhizome in gram (g.) after harvest using local soil with VAM fungi.

Fig. 1 Rhizome, roots and bulbous roots of Curcuma amada after harvest through VAMF inoculation (Pot culture for one season study).

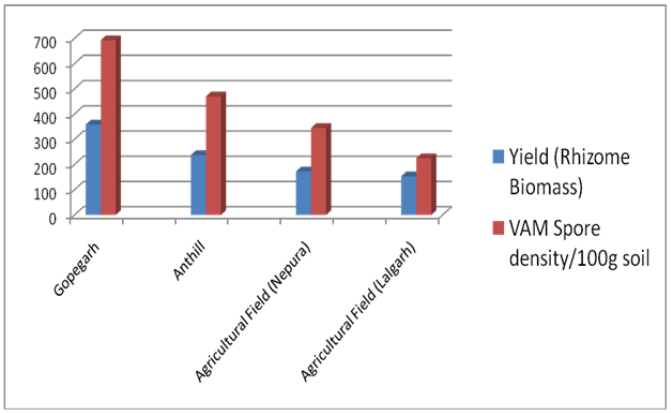

Fig. 2 Yield of Rhizome of C. amada and VAMF spore density of respective site soils

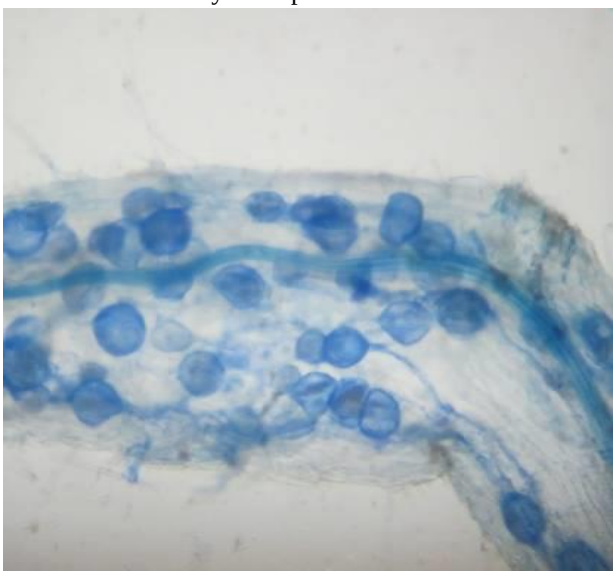

Fig. 3 Vesicle of VAM fungi

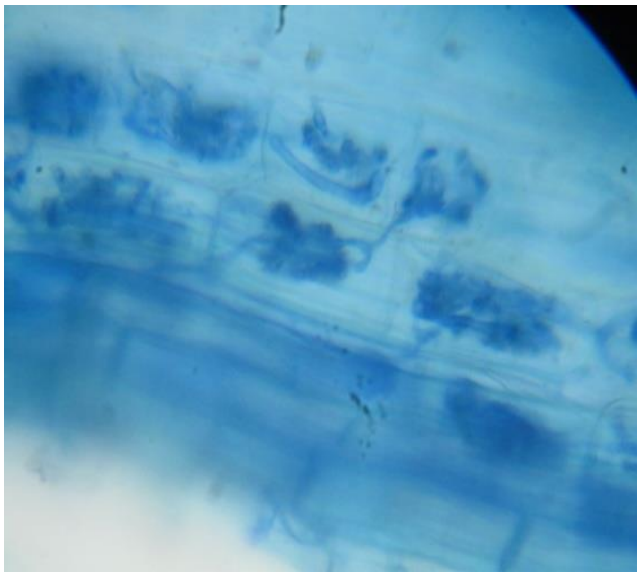

Fig. 4 Arbuscule of VAM fungi

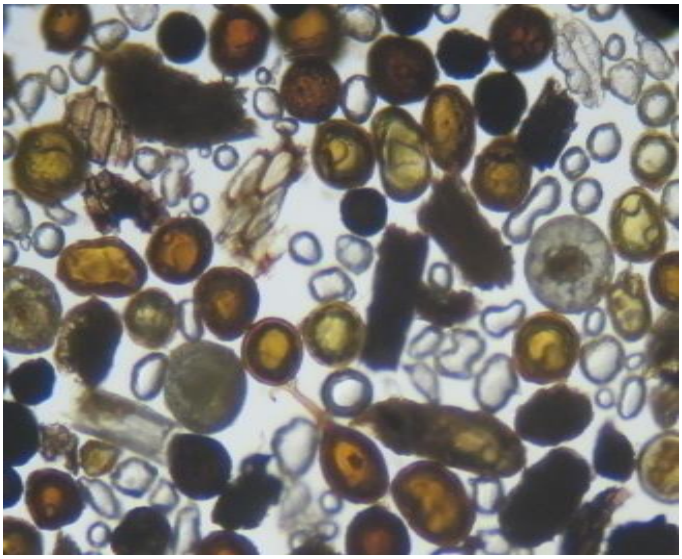

Fig. 5 VAMF spores in natural forest soil

V. CONCLUSION

VAM 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, there by 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 VAM is easy to handle and need no synthetic media for mass production, it may be incorporated as bio fertilizer in present day 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 VAM spore density produce more biomass as yield. Forest soils have more spores than cultivated condition. Use of chemical fertilizer for better production causes death of soil flora in both the experimental cultivated. Mango ginger is used as raw, so chemical fertilizer and chemical pesticide should not be used for its production. Hope that as this plant, other tuber crops and other cash crops can be cultivated with the help of VAM and other bio fertilizers for better yield.

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