

ABSTRACT
OF
THE THESIS
SCREENING OF INDIGENOUS VAM BIOFERTILIZER
FOR INCREASING THE PRODUCTIVITY OF TWO
VEGETABLE CROPS

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ABSTRACT

The research work for the thesis entitled “**SCREENING OF INDIGENOUS VAM BIOFERTILIZER FOR INCREASING THE PRODUCTIVITY OF TWO VEGETABLE CROPS**” was carried out in the Department of Botany and Forestry, Vidyasagar University, Midnapore-721102, India.

The entire work of the thesis is presented in six chapters

Chapter 1 contains a brief review of the existing theoretical and experimental knowledge relevant to the present work. **Chapter 2** deals with the description of the experimental techniques and materials used in the present investigation. The result of the investigation is presented in **Chapter 3** and discussion in **Chapter 4**. **Chapter 5** contains summary of the experiments and conclusions. References are presented in **Chapter 6**.

A brief description of the main findings is given below.

The red lateritic soil of south West Bengal, India is classified as Lithic Haplustalfs of Chhotonagpur plateau area. Soil is acid i.e. low in organic carbon, nitrogen and phosphorus. Use of chemical fertilizers under green revolution creates more acidity where phosphorus, nitrogen, potassium and other nutrients get immobilized.

VAM symbiosis is now widely accepted as an essential component of any plant community and play unique role in uptake of nutrient and water particularly in nutrient poor dry soil. Plants inoculated with indigenous VAM fungi can mobilize P from rock phosphate more efficiently and create a favourable environment for the development of ecosystem process. So, screening of effective VAM species for plant inoculation was thought necessary. The test crops selected for the studies are *Capsicum annuum* and *Solanum melongena*.

Capsicum annuum is not native to acid lateritic soil and require day temperatures between 27⁰C to 32⁰C, night temperatures of 21⁰C to 27⁰C and annual rainfall of 75-125 cm. *C.annuum* is comparatively a new entrant in this region. Unfavourable temperature

and water supply are the basic reason for bud, blossom and fruit drops. It is not very sensitive to soil acidity. *Solanum melongena* on the other hand is traditionally grown here, in rotation under rice based cropping system.

In acid lateritic soil, the two Solanaceous crops Capsicum (*Capsicum annuum*) and brinjal (*Solanum melongena*) were selected with two objectives of restoring and increasing the fertility of the soil through indigenous VAM, fertilizer amendments and increasing the productivity of two vegetables.

The experiments with Capsicum and Brinjal were conducted initially in the pots in 2003-2004 and 2004-2005. Further the experiments with the crops were carried out in field in 2005-2006 and 2006-2007. Fertilizer amendments were also tried under field condition to evaluate the efficacy of VAM fungi in promoting productivity with or without fertilizers or with rock phosphates.

Seven experiments were conducted to have an elaborate idea about the indigenous VAM status, seasonal variation of VAM status, isolation of indigenous VAM and study on the effect of VAM and its combinations and soil amendments on performance of the two vegetable crops.

A general survey (Experiment- 1) was conducted to investigate the mycorrhizal status of vegetation of south West Bengal, India. The survey was conducted on random basis.

Indigenous VAM were isolated using funnel technique. Three indigenous VAM species, *Acaulospora dilatata*, *Glomus mosseae* and *Glomus fasciculatum* were isolated in pure culture, then mass cultured in sand soil mixture (1:1) on Sorghum (*Sorghum vulgare* pers.). The isolated three VAM strains were native to red-lateritic soil of Paschim Medinipur and therefore they were selected for experiments.

Experiments with Capsicum

Experiment 2A was conducted for two years, i.e. 2003-2004 and 2004-2005 under controlled net house conditions in pot using capsicum (*Capsicum annuum*.L) as the test crop. The treatments included inoculation by *A.dilatata*, *G.fasciculatum*, *G.mosseae*, Mixed inoculum and Control.

It was observed that application of VAM enhanced the growth, yield and nutrition of *Capsicum*. Treatments with Mixed inoculum were found significantly effective in improving the growth, N, P, fruit yield, VAM infection and acid phosphatase activity in *Capsicum*. Fruit nutrition quality such as protein and carbohydrate content were increased with Mixed inoculum, where as ascorbic acid content in fruit, plant dry weight and alkaline phosphates activity improved with *A.diltata* inoculations.

Experiment 2B was conducted for two years (2005-2006 and 2006-2007) under field conditions where the treatments were same as pot experiment.

Plant growth and fruit yield increased with all VAM inoculations. Mixed inoculum produced maximum plant growth, fruit yield and nutrition but *G. mosseae* induced more NPK uptake in plant tissue. Ascorbic acid content, VAM infection percentage and acid phosphates activity were increased with *A.dilatata* inoculations.

Experiment 2C was conducted under field condition with fertilizer amendments using *C.annuum* as the test crop. The treatments included inoculation by *A.dilatata*, *G.mosseae*, Mixed inoculum and Control. In order to realize practical importance, the experiment was conducted with NPK fertilizer and rock phosphate (RP) amendments in field during 2007-2008.

Use of fertilizer with VAM increased growth and yield of *C.annuum*. Combination of NPK fertilizer with Mixed inoculum induced plant NPK content, average fruit weight, fruit nutrition, acid phosphatase activities along with VAM infection percentage.. In RP amendments, the observations were similar in trend to that of NPK fertilizer amendments but yield and nutrition of fruit improved with Mixed inoculum and *G.mossae* respectively.

Experiments with Brinjal

Experiment 3A was conducted same way as 2B for two years (2003-2004 and 2004-2005) with Brinjal (*S.melongena*.L) as test crop. The treatments included were similar to that in experiment 2A.

VAM inoculation to *S.melongena* resulted higher plant growth, fruit yield and nutrition. Treatments with Mixed inoculum were found significantly effective in improving the growth and fruit yield and fruit quality of *S.melongena*, other parameters like VAM infection, alkaline phosphatase activity and content of P also increased with Mixed inoculum. However, plant dry weight, K content in plant tissue and acid phosphates activity improved with *A.dilatata* inoculations.

Experiment 3B was also conducted for 2 years 2005-2006 and 2006-2007 with Brinjal (*S.melongena* L)) as test crops.

In the line of the trend of pot experiments, application of VAM enhanced the growth, yield and nutrition of *S.melongena*. Mixed inoculation improved plant height and average fruit weight but highest fruit yield and enhanced fruit quality, higher alkaline phosphatase quality, mycorrhizal dependency was observed with *G.mosseae* inoculations. *A.dilatata* enhanced more N and P to the plant tissue.

For the field level soil amendment, experiment 3C was set up in 2007-08 similar to the experiment 2C of *C.annuum* L. The experiments were laid to see the effect of fertilizers and VAM together at field level.

The observations were more or less similar in trend in both NPK and RP amendments. Plant growth and yield improved with all VAM inoculations with NPK and rock phosphate amendments compared to control. Both NPK fertilizer and RP amendments in combination with Mixed inoculum increased fruit yield and average fruit weight of *S.melongena*. However, *A.dilatata* induced plant biomass and protein content in fruits. *S.melongena* was found highly dependent on *A.dilatata* in both NPK and RP amendments.

The indigenous VAM have enough potential to improve productivity of *Capsicum annuum* and *Solanum melongena* but the native soil lacked the normal VAM population. Efficiency of VAM under pot condition was also reflected in the field. Over all, *A.dilatata* improved the plant biomass, NPK, ascorbic acid, protein, acid phosphatase activities and VAM infection but these were not reflected in yield. Mixed inoculum was found more effective in increasing the yield and fruit quality over single VAM species. Among single inoculations, *G.mossseae* performed better than *A.dilatata* in terms of yield of both crops. In general, all VAM treatments amplified growth, nutrition, and yield of two vegetable crops. Plant growth improved with all VAM inoculations with NPK fertilizer and Rock phosphate amendments but the *Capsicum* yield and average fruit weight of *S.melongena* was observed more in RP fertilizer compared to NPK fertilizers amendments. Rock phosphate amendments with VAM appeared to be a better option than NPK fertilizer to enhance the productivity of *C.annuum*. Best performance was observed with Mixed inoculum compared to single inoculations.

Use of NPK fertilizer is an expensive option to enhance the productivity of *C.annum* and *S.melongena* and also a serious threat to soil health and environment. VAM and rock phosphate induce better yield and fruit quality of the test crops. Rock phosphate is cheaper and VAM is a natural and persistent resource. So, it may be a better option for the farmers to attain the desired productivity with minimum damage to ecological and socioeconomic condition as well as in reduction of heavy use of agrochemicals.

In nutshell, application of VAM with rock phosphates appeared to be a viable alternative when yield, nutrition, quality and economic feasibility are taken in to consideration.