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RESEARCH ARTICLE

GROWTH ENHANCING ASSOCIATION OF *GLUCONACETOBACTER DIAZOTROPHICUS* AND AM FUNGI IN SUGARCANE

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ABSTRACT

The field experiment was conducted with three different level of nitrogen. Phosphorus and muriate of potash namely 50%, 75% and 100% and set treatment with *Gluconacetobacter diazotrophicus* and Soil application of AM Fungi were studied in randomized block design. In the present investigation significant improvements were observed in sugarcane germination percentage, cane height, cane girth, individual cane weight, milleable canes and cane yield. The highest growth parameters and yield noticed in treatment T9-50% NPK + *G. diazotrophicus* + AM fungi. The results also confirmed that the use of these microbes as biofertilizers would support and enhance sugar cane yield equivalent to or greater than yields supported by recommended inorganic N.P. and K fertilizers.

INTRODUCTION

India is one of the resourceful developing country in the asian continent and the world. The development and economical growth mainly through agriculture and its allied activities. Now our country facing so much of pain because of deficient sugar production virtually by minimized productive area under sugarcane cultivation. The minimization actually due to price reduction to the commercial cane and increased cost of price for the fertilizers which are regularly utilized by the farmers in the sugarcane cultivation. Now a days the microbiologist and agricultural scientists concentrating much about the organic farming and it paves the way for the identification of different diazotrophs associated with various agricultural crops among the organisms a wonderful nitrogen fixing diazotroph has been isolated form brazilian rhizosphere soil, root, stem bud and leaves of sugarcane and also from other sugar rich crops by Cavalcante and Dobereiner (1988) and described it as *saccharobacter nitrocaptans* but DNA-rRNA and DNA–DNA hybridization reveled that this diazotroph is a new species belonging to the genus *Acetobacter* now the name has been renamed as *Gluconacetobacter diaztrophicus.*

Recent studies in sugarcane combining with nitrogen balance and nitrogen dilution measurements have brought proof of more than 50 per cent of the plant nitrogen coming from the air (Boddey *et al.,* 2003). Certain cultivars of sugarcane not fertilized with nitrogen and phosphorus but infected with *G. diazotrophicus* and AM fungi do not requires the addition of any nitrogenous and phosphatic fertilizers to achieve optimum cane yield.

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AM fungi is the most abundant kind of mycorrhizae found in association with every taxonomic group of plants and the list of species not infected is probably far shorter than the infected ones, these fungal associations are beneficial to crop plants in many ways, including enhancing the nutrient availability especially phosphorus, enhance water uptake and induces resistant against diseases and increase the yield (Lekberg and koids, 2005).

Gluconacetobacter diazotrophicus, and AM fungal inoculation enhances the growth and development of sugarcane by fixing nitrogen in various parts of sugarcane via root, stem bud leaves along with producing growth promoting hormones and by solubilizing, mobilizing phosphorus, potash and zinc compounds and protecting plants from stresses and pathogens.

In the present study an attempt has been made to cultivate the sugarcane crops by minimizing 25 to 50 per cent of recommended N, P and K fertilizers.

MATERIALS AND METHODS

Isolation and characterization

Gluconacetobacter diazotrophicus cultures were isolated from the sugarcane samples following the methodology of cavacante and Dobereiner (1988) one gram of sugarcane samples (root, stem, bud and leaf) were thoroughly washed in sterile water, placed in 70 percent alcohol for 15 seconds and immediately washed with sterile water for about 3-4 times repeatedly. The surface sterilized samples were macerated in a sterile pestle and mortar. A drop of suspension as such and 10^{-2} dilution inoculated into various enrichment media via semisolid LGI, semisolid acetic LGI medium and semisolid diluted cane juice medium. The tubes were incubated at room temperature without causing disturbance until the formation of sub surface pellicles. The isolated cultures were grown in acetic LGI medium and single colony was streaked on

Table 1. Interaction effect of *G.diazotrophicus* and AM fungi with graded levels of NPK fertilizers on the growth and yield of sugarcane

		Germination percentage	Cane height (cm)	Cane girth (mm)	Individual cane weight (kg)	Cane yield (t ha-1)	Percentage increased over control
T_1	100% NPK (control)	56.30	75.00	82.80	1.017	97.90	-
T_2	75% NPK (Control)	55.80	72.20	80.60	0.941	90.78	-
T_3	75% NPK + *G.diazotrophicus*	58.00	74.30	80.01	1.052	96.73	6.55
T_4	75% NPK + AM fungi	49.61	79.51	82.89	0.971	97.34	7.22
T_5	75% NPK *G.diazotrophicus* + AM fungi	63.05	76.90	84.31	1.130	103.97	14.14
T_6	50% NPK (Control)	50.38	75.00	86.28	0.851	76.19	-
T_7	50% NPK + *G.diazotrophicus*	62.33	79.30	89.69	1.057	103.39	35.70
T_8	50% NPK +AM fungi	75.00	78.10	83.11	0.947	88.51	16.17
T_9	50% NPK + *G.diazotrophicus* + AM Fungi	67.20	78.0	89.00	1.170	119.18	56.42
	CD	**3.31**	**4.58**	**1.55**	**0.031**	**0.682**	

acetic LGI agars slants and the young cultures at expontial phase i,e on 7th day were taken for further characterization, mass multiplication and also used for field studies.

ISOLATION OF AM FUNGI

a) Collection of soil sample

The rhizosphere soil were collected with the help of a steel pipe (2 dia, 50 cm long) inclined at about 15^0 can be derived into the soil about 20-25 cm at root zone. This method enables the collection of soil sample from different depths, there by precisely accounts for better AM fungal diversity. Place the collected soil samples in a Ziploc bag and carefully transport to the laboratory and store at 4^0C until processed.

b) AM fungal spore isolation

AM fungal spores were isolated from the collected rhizosphere soil samples by following wet sieving and decanting method (Gerdemann and Nicolson). 100g of soil sample mixed with 1000 ml of water (1:10) stir vigorously and allow heavier particles to settle for a few seconds, pass the suspension through a set of sieves to retain the desired spores, generally 250-38 µm (if total population is to be assessed, the finest available sieve should be employed). Repeat the process, till the suspension become colourless. Wash the material retained on the sieves to ensure that all colloidal material passes through the sieve. Transfer the sievings to a separate beaker and filter through what man No;1 filter paper and observe through stereozoom microscope and the isolated spores were mass multiplied by using selected host and the inoculum were used for field studies.

Growth and yield observation.

Total number of germinated shoots were recorded on 30 days after planting and expressed in terms of percent, the total number of milleable canes was counted and expressed in 000 ha^{-1} and the other growth parameters like cane height, cane girth and cane yield was measured at the time of harvest and expressed the height in cm, girth in cm, and cane yield expressed as t ha-1.

RESULTS AND DISCUSSION

The results of the field experiments conducted at Vilagam Village Cuddalore Districts Tamilnadu showed that *Gluconacetobacter diazotrophicus* and AM fungi with graded levels of NPK (50 per cent) fertilizers significantly influenced the growth and yield of sugarcane interms of cane height, cane girth, individual cane weight and cane yield when compared to control and AM fungi with graded levels of NPK fertilizers. It showed contribution by *G.diazotrophicus* and AM fungi (Boddey *et al.,* 1995).

Regarding the germination percentage no significant difference was noticed, among the treatments the development of sugarcane shoot and root system takes place only after 35 days of planting the setts. The interaction of *G.diazotrophicus* and AM fungi enhanced the growth, development and yield of sugarcane through Nitrogen fixation, phosphorus and zinc solubilization, phosphorus mobilization and by producing some growth promoting substances like IAA, gibberellins etc.

In the present paper we reported the fungal – diazotroph interactions on the growth and yield of sugarcane namely *G.diazotrophicus* and AM fungi .Hence these two organisms found to be a better combination for sugarcane as a bioinoculants.

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