SHORT COMMUNICATION

INFLUENCE OF ORGANIC FERTILIZERS ON THE POPULATION LEVELS OF *TRICHODERMA* SPP. AND *PSEUDOMONAS FLUORESCENS* IN SUGARCANE

K.V. Naga Madhuri[1*], K. Vijay Krishna Kumar[3], N. Sreeram Reddy[2], M . Subba Rao[1], T. Prathima[3], M. Hemanth Kumar[1], V. Sai Sruthi[3], N. V. Sarala[1] and V.Giridhar[1]

Abstract

In a replicated field study during 2010, the effect of organic fertilizers (NPK), organic phosphorus (Biophos®) and organic potash (Biopotash®), supplied by Prathista Industries Ltd, Hyderabad, Andhra Pradesh, on rhizospheric populations of Trichoderma spp. and Pseudomonas fluorescens in sugarcane was evaluated in combination with inorganic fertilizers. At harvest, population levels of Trichoderma spp. and fluorescent Pseudomonads were enumerated in soil samples from crop rhizosphere. The highest population of Trichoderma spp. was recorded in plots applied with 100% organic fertilizers (8.8 x 10 ^{4} CFU/g soil) and in plots treated with 100% FYM (8.3 x 10^{4} CFU/g soil) with no significant differences. Next best population levels were noticed in plots treated with recommended dose of fertilizers (RDF) in 50% organic and 50% inorganic form. Control plots with RDF in inorganic form recorded Trichoderma population of 3.2 x 10^{4} CFU/g soil with no significant differences with Biophos and Biopotash treatments. Highest population of P. fluorescens was recorded with 100% organic fertilizers of Prathista group (6.3 x 10^{6} CFU/g soil) followed by RDF as 100% FYM. Overall, organic fertilizers have excellent scope and potential in ameliorating soil health through facilitating growth of beneficial microflora in sugarcane.

Key words: *Sugarcane, organic fertilizers, Trichoderma, Pseudomonas*

Sugarcane is a major cash crop of India and is cultivated in an area of 5.1 million hectares with an annual production of 340 million tonnes (2008-09). Cane cultivation in the country is affected by several biotic stresses, of which diseases play a major havoc. Of the different fungal diseases, red rot induced by *Colletotrichum falcatum* is a devastating disease causing significant losses to cane yield and quality (Chaudhry et al. 1999).

Among the different biocontrol agents inhabiting rhizospheric soils of sugarcane, strains of *Pseudomonas fluorescens*, belonging to Plant Growth Promoting Rhizobacteria (PGPR), are widely used in plant disease management due to their ability to produce antibiotics (Mavrodi et al. 2007) and excellent antagonistic potential through production of antibiotics such as 2, 4-Diacetylphloroglucinol (Mavrodi et al. 2007). Besides, they also exhibit superior growth-promoting characteristics such as effective root colonization, ability to produce endospores and capacity to inhibit multiple pathogens (Kloepper et al. 2004). Among the fungal biocontrol agents, *Trichoderma* spp. effectively controlled sugarcane pathogens (Singh et al. 2008) and enhanced cane yields under field conditions (Singh et al. 2008). However, field level applicability of fungal and bacterial bioagents has yet to gain momentum under Indian conditions due to varied reasons.

K. V. Naga Madhuri[1], K. Vijay Krishna Kumar[3], N. Sreeram Reddy[2], M . Subba Rao[1], T. Prathima[3], M. Hemanth Kumar[1], V. Sai Sruthi[3], N. V. Sarala[1] and V.Giridhar[1]
Acharya NG Ranga Agricultural University, [1]Agricultural Research Station, Perumallapalle, [2]Prathista Industries Ltd, Hyderabad, and [3]Regional Agricultural Research Station, Tirupati, India
email : nagamadhurikv@gmail.com

In view of the human health and environmental problems posed by inorganic fertilizers (Arisha and Bradisi 1999), the positive effect of organic manures on yield (Bokhtiar et al. 2008) and the consumer demand for quality and safe organic products (Ouda and Mahadeen 2008), there is an urgent need to improve organic fertilizers with natural materials through biological processes. In the present study, the effect of various organic fertilizers and their combinations with chemical fertilizers on population levels of beneficial microflora was studied.

Field experiments were conducted during 2010-11 at Agricultural Research Station, Perumallapalle, Andhra Pradesh, in Randomized Block design with three replications to study the comparative efficacy of organic fertilizers and chemical fertilizers in sandy loam soils with the early maturing variety 2003 V 46. Seven treatments were imposed involving organic and inorganic fertilizers and their combinations, *viz*. T1: 100% RDF through fertigation using available inorganic chemical fertilizers; T2: 100% Prathista organic fertilizers through fertigation; T3: 100% N through FYM; T4: 25 % RDF through chemical fertilizers + 75% through Prathista organic fertilizers through fertigation; T5: 100% P through Prathista Bio Phos (N & K as inorganic); T6: 100% K through Prathista Bio Phos (N & P as inorganic); T7: 50 % RDF through chemical fertilizers + 50% through Prathista organic fertilizers through fertigation. A common dose of Aishwarya (Prathista Organic manure) @ 100 kg/acre was applied to all the treatments except control. Fertigation to the crop was scheduled depending on crop growth starting from 20 days after planting up to 180 days. Each treatment consisted of 8 rows of 8m length with paired row spacing of 60 cm x 120 cm and sowing was done adopting overlapping method using 40,000 three budded setts /ha.

Soil samples were collected from rhizosphere of sugarcane seedlings at harvest. Isolation of bioagents was carried out on *Trichoderma* specific media (for *Trichoderma* spp.) and on King's B medium (for *P. fluorescens*) using standard protocols. *Trichoderma* spp. were identified according to Rifai (1969). Colonies of *P. fluorescens* were characterized both by morphological and biochemical methods using standard procedures for confirmation.

Of the different treatments, highest population levels of *P. fluorescens* were recorded in plots that received 100% organic fertilizers supplied by Prathista Industries Ltd, Hyderabad, India (6.3 x 10^6 CFU/g soil) (Table 1). This was followed by the treatment that received RDF as 100% FYM (5.2 x 10^6 CFU/g soil). The population levels in the treatment that received RDF as 75% organic and 25% inorganic fertilizers were 4.9 x 10^6 CFU/g soil, and no significant differences were noticed with that of plots that received RDF as 100% FYM. The next best treatment in terms of *P. fluorescens* population was that of RDF as 50% organic and 50% inorganic fertilizers (2.9 x 10^6 CFU/g soil). The treatments that received RDF with organic potassium and organic phoshporus supplied by Prathista Industried Ltd and others in the form of inorganic have recorded *P. fluorescens* population densities of 2.3 x 10^6 and 2.1 x 10^6 CFU/g soil respectively. All these treatments were significantly superior over control which recorded a population of 1.9 x 10^6 CFU/g soil.

The population levels of *Trichoderma* spp. were the highest in plots applied with 100% commercial organic fertilizers supplied by Prathista Industries Ltd and 100% farm yard manure (8.8 x 10^4 and 8.3 x 10^4 CFU/g soil, respectively) with no significant differences between them (Table 1). The next higher population levels of *Trichoderma* spp. were observed in plots that received RDF as 75% organic and 25% inorganic fertilizers (6.8 x 10^4 CFU/g soil) followed by plots that received RDF as 50% organic and 50% inorganic fertilizers (4.8 x 10^4 CFU/g soil). The population levels of these fungal antagonists in treatments with organic phosphorus + inorganic N & K fertilizers and with organic potassium + inorganic N & P were 3.2 x 10^4 and 3.4 x 10^4 CFU/ g soil respectively. The control plots recorded population levels of 3.2 x 10^4 CFU/g soil. The treatments involving organic phosphorus and organic potassium (T6 and T5), when applied with other inorganic fertilizers, were, however, not significantly superior over control.

From our studies, it is evident that the population levels of beneficial fungal and bacterial antagonists at hartest were significantly enhanced by treatments. The highest population levels of *Trichoderma* spp. and *P. fluorescens* were noticed in plots that received 100% organic fertilizers supplied by

Table 1. Effect of commercial organic fertilizers in sugarcane (cv. 2003V46) on population levels of *Trichoderma* spp. and *Pseudomonas fluorescens* enumerated during 2010-11

Treatment[1]	Population levels[2]	
	Pseudomonas fluorescens[3] (x 10^6 CFU/g soil)	*Trichoderma* spp[1] (x 10^4 CFU/g soil)
T1: 100% RDF as inorganic (Control)	1.9 g	3.2 ef
T2: 100% organic fertilizers	6.3 a	8.8 a
T3: 100% RDF as FYM	5.2 b	8.3 ab
T4: 25% RDF through inorganic + 75% organics	4.9 bc	6.8 c
T5: 100% phosphorus through Biophos (100% N & K as inorganic)	2.1 ef	3.2 ef
T6: 100% potash through Biopotash (100% N & P as inorganic)	2.3 e	3.4 e
T7: 50% RDF through inorganic and 50% through organic fertilizers	2.9 d	4.8 d

[1] Fertilizers were applied from 20 days after planting up to 180 days after planting at an interval of 10 days depending on crop growth

[2] Values are means of five replications. [3]Means followed by a common letter in the columns are not significantly different according to LSD (P>0.05)

Prathista Industries Ltd. The population levels of *Trichoderma* spp. were on par in FYM treated plots and in plots that received 100% organic fertilizers of Prathista Industries Ltd. Commercial organic products of Prathista also contributed to multiplication and establishment of these antagonistic populations when applied in conjunction with inorganic fertilizers at various combinations. The commercial organic products of Biophos and Biopotash when applied with other inorganic fertilizers have given varied results with respect to *Trichoderma* spp. and *P. fluorescens* populations. While the population levels of *Trichoderma* spp were at par with the control for Biophos and Biopotash, these products recorded significantly higher population levels of *P. fluorescens* over control. Overall, our results suggest that commercial organic fertilizers of Prathista Industries Ltd. have excellent potential for improving the beneficial microflora in sugarcane.

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