

Original Research Article

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Study the Effect of *Glucanoacetobacter diazotrophicus* and PSB Formulations on Quality Parameter on *suru* Sugarcane

P.P. Khandagale^{1*}, M.M. Keskar², S.K. Ghodke² and B.S. Raskar²

¹Agricultural Research Station, Niphad, Dist. Nasik (M.S.), India

²Central Sugarcane Research Station, Padegaon, Tal. Phaltan, Dist. Satara (M.S.), India.

*Corresponding author

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Sugarcane is one of the most important cash crops of the India. Study was carried the effect of *Glucanoacetobacter diazotrophicus* and PSB formulations on quality parameter on *suru* sugarcane. Out of seven treatment the T3 i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment was found most effective than other treatment as it recorded the highest NMC, Sucrose *Glucanoacetobacter* population at harvest stage of the crop, however, it was at par with T2 i.e. RDF (100% N, P₂O₅ and K₂O), T4 i.e. 50% N+ *Glucanoacetobacter* liquid based set treatment, T5 i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment, T6 i.e. 50% N+ *Glucanoacetobacter* liquid based seedling treatment and T7 i.e. 50% N+ *Glucanoacetobacter* liquid based foliar spray treatment in most of growth, yield, microbial and quality parameter. They save 50% N (125 kg/ha) and 25% P (29 kg/ha) for *suru* sugarcane besides the improved yield, quality and sustenance of soil fertility.

Introduction

Sugarcane (*Saccharum officinarum* L.) is one of the most important food and cash crop of the tropics and subtropics which was cultivated in about 121 countries encompassing approximately half of the world. Sugarcane (*Saccharum spp. hybrid*) is a tall, perennial grass (family Poaceae, subfamily Panicoide), and is cultivated in tropical and warm-temperate regions between 35°N and 35°S and from sea level to altitudes of 1,000 m in a wide variety of soil types (Reis *et al.*, 2007). Most of the commercial sugarcane varieties are hybrids with

Saccharum officinarum. The optimal temperature for sugarcane cultivation is between 20 and 35°C and the minimum rainfall requirement is 1,200mm per year (Ando, 2010). The stalks (stems) of sugarcane are harvested at 9 to 18 months after planting the mother stem cutting (setts). It over 5.05 million hectare area in the country with a production of 348.19 million tonnes, out of which more than 66% is concentrated in the sub-tropical states. The production and productivity of sugarcane is severely affected by the various diseases. They are playing an important role in Indian economy and a key role to the socio-economic prosperity in the

state of Maharashtra. Sugarcane was cultivated on 8.35 lakh hac. area in Maharashtra (2015-16) with the production of 83.79 lakh tone and productivity is 88 t/ha (Anonymous 2015). The Govt. of India take a decision of blending the ethanol in petrol at 10 % so in future may enhances its importance. Consortiums of endophytic bacteria include various bacteria like, *Acetobacter*, *Agrobacterium*, *Burkholderia*, *Azospirillum*, *Herbaspirillum*, *Azoarcus* etc. *Acetobacter diazotrophicus* now a day's known as *Glucanoacetobacter diazotrophicus* is an acid loving bacterium requiring pH of 4.0 to 4.5 for growth and N fixation. It showed positive growth at 250, 300 and 400C temperature. Among the biofertilizers, the endophytic bacteria *Glucanoacetobacter* and *Herbaspirillum* are gaining more importance, since they fix atmospheric nitrogen endosymbiotically.

Materials and Methods

The investigation was carried out at SRS trial at Central sugarcane Research Station, Padegaon, Tal. Phaltan Dist. Satara (Maharashtra) in 2015-16. Soil was medium black it belongs to Inceptisols. The climate of this area is semi-arid. The seedling material of sugarcane Co.M -0265 (Phule - 0265). The experiment was laid out in RBD design on 10.2.2015 with three replications and seven treatments including one control and one recommended dose of fertilizers. Have Plot size, gross 6.0 x 6.0 m (5 rows 1.2 m apart) and net 3.6 x 5.0 m (3 rows). Plot was harvested at 4.3.2016. Basal dose of nitrogen, phosphorus, and potassium i.e. recommended dose (250:115:115 kg of N, P₂O₅ and K₂O ha⁻¹) along with organic manures i.e. full dose of FYM, *Acetobacter diazotrophicus* and PSB as per the different treatment details per plot and replication wise were given before transplanting of seedlings. Remaining doses of fertilizers were applied at 6-8, 12-14, and

18-20 weeks after transplanting i.e. top dressing.

Treatment details

T₁ = Absolute control

T₂ = Only RDF (100% N, P₂O₅ and K₂O). No *Glucanoacetobacter* and PSB as set/seedling treatment.

T₃ = Set treatment – lignite based culture of *G. diazotrophicus* 10 kg + PSB 1.25 kg in 100 lit water/ha for 30 min (Recommended check).

T₄ = Set treatment – liquid culture of *G. diazotrophicus* @ 1 lit. + PSB @ 1 lit. in 100 lit water/ha for 30 min.

T₅ = Seedling treatment – lignite based culture of *G. diazotrophicus* 10 kg + PSB 1.25 kg in 100 lit water/ha (Drench the coco-pith trays containing 30 days old seedlings with this solution).

T₆ = Seedling treatment – liquid culture of *G. diazotrophicus* @ 1 lit. + PSB @ 1 lit. in 100 lit water/ha ((Drench the coco-pith trays containing 30 days old seedlings with this solution).

T₇ = Foliar spray of *G. diazotrophicus* liquid culture at 60 days after planting @ 1 lit. in 500 lit water/ha + 1.25 kg PSB soil application through 100 kg compost at 60 days after planting in furrows.

The data was analyzed statistically by using randomized block design as per procedure described by Panse and Sukhatme (1985).

No. of millable canes (NMC)

The NMC was significantly influenced by inoculation treatments. In general, the NMC

ranged from 77,670 to 89,520 per hectare. Among the treatment T₃ i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment recorded highest No. of millable canes (89,520 per hectare), however, it was at par with T₂ i.e. RDF (100% N, P₂O₅ and K₂O) (86,220 per hectare), T₄ i.e. 50% N+ *Glucanoacetobacter* liquid based set treatment (84,000 per hectare), T₅ i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment (86,220 per hectare), T₆ i.e. 50% N+ *Glucanoacetobacter* liquid based seedling treatment (83,190 per hectare) and T₇ i.e. 50% N+ *Glucanoacetobacter* liquid based foliar spray treatment (83,110 per hectare).

Cane yield (t/ha)

The cane yield was significantly influenced by the inoculation treatments. The overall cane yield ranged from 87.87 to 121.66 t/ha. Among the treatment T₂ i.e. RDF (100% N, P₂O₅ and K₂O) recorded highest cane yield (121.66 tonn/ hectare), however, it was at par with T₃ i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment, (120.83 tonn/

hectare), T₄ i.e. 50% N+ *Glucanoacetobacter* liquid based set treatment (117.19 tonn/ hectare), T₅ i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment (117.85 tonn/ hectare), T₆ i.e. 50% N+ *Glucanoacetobacter* liquid based seedling treatment (115.58 tonn/ hectare) and T₇ i.e. 50% N+ *Glucanoacetobacter* liquid based foliar spray treatment (113.80 tonn/ hectare).

CCS yield (t/ha)

The CCS yield was significantly influenced by the inoculation treatments. The overall CCS yield ranged from 11.38 to 17.60 t/ha. Among the treatment T₂ i.e. RDF (100% N, P₂O₅ and K₂O) recorded highest CCS yield (17.60 tonn/ hectare), however, it was at par with T₃ i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment, (17.30 tonn/ hectare) and T₅ i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment (16.02 tonn/ hectare). These results are in conformity with those reported by Mehta *et al.*, (1996), Kumar (2012) and Soomro *et al.*, (2013) (Table 1).

Table.1

Tr. No.	Treatment details	NMC/ha (1000) 2016-17	Cane yield (t/ha)	CCS yield	Sucrose %	Microbial count at harvest (10 ⁴)
T ₁	Absolute Control	77.67	87.87	11.38	18.91	4.67
T ₂	RDF (100% NPK)	86.22	121.66	17.60	19.80	5.00
T ₃	50 % N+ Aceto lignite based (set treat)	89.52	120.83	17.30	20.30	8.83
T ₄	50 % N+ Aceto liquid based (set treat)	84.00	117.19	15.83	19.53	8.33
T ₅	50 %N+Aceto lignite based (seedling treat)	86.22	117.85	16.02	20.12	8.67
T ₆	50 % N+ Aceto liquid based (seedling treat)	83.19	115.58	15.84	19.23	8.17
T ₇	50 % N+ Aceto liquid based (foliar Spray)	83.11	113.80	15.25	19.13	7.17
	SE±	2.09	2.56	0.54	0.29	0.27
	CD at 5 %	6.43	7.87	1.68	0.88	0.84

Sucrose (%)

The sucrose% was significantly influenced by the inoculation treatments. The overall sucrose% ranged from 18.91 to 20.30%. Among the treatment T₃ i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment, recorded highest sucrose% (20.30%), however, it was at par with T₂ i.e. RDF (100% N, P₂O₅ and K₂O) (19.80%), T₄ i.e. 50% N+ *Glucanoacetobacter* liquid based set treatment (19.53%) and T₅ i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment (20.12%).

Glucanoacetobacter count at harvest (x10⁴)

Among different treatments, the treatment T₃ i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment, recorded significantly higher *Glucanoacetobacter* count (8.83x10⁴) at harvest stage of the crop, This was at par with T₄ i.e. 50% N+ *Glucanoacetobacter* liquid based set treatment (8.33x10⁴) and T₅ i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment (8.67x10⁴) at harvest stage of the crop.

In conclusion, the treatments, T₃ i.e. 50% N+ *Glucanoacetobacter* lignite based set treatment was found most effective than other treatment as it recorded the highest tillering count at 120 DAP, Total height, Cane girth, No. Internode, NMC, Brix, Sucrose *Glucanoacetobacter* population at harvest stage of the crop, however, it was at par with T₂ i.e. RDF (100% N, P₂O₅ and K₂O), T₄ i.e. 50% N+ *Glucanoacetobacter* liquid based set treatment, T₅ i.e. 50% N+ *Glucanoacetobacter* lignite based seedling treatment, T₆ i.e. 50% N+ *Glucanoacetobacter* liquid based seedling treatment and T₇ i.e. 50% N+ *Glucanoacetobacter* liquid based foliar spray treatment in most of growth, yield, microbial and quality parameter. Same result found in Rajkumar *et al.*, study 2017. These result

indicated that, set and seedling treatment (Drench the coco-pith trays containing 30 days old seedlings with this solution) of sugarcane with lignite based, liquid formulations and spray the liquid culture at 60 days after planting of *G. diazotrophicus* and PSB (soil application through 100 kg compost at 60 days after planting in furrows) will save 50% N (125 kg/ha) and 25% P (29 kg/ha) for *suru* sugarcane besides the improved yield and quality and sustenance of soil fertility. Influence of application of phosphorus solubilizing bacteria (PSB), *Bacillus megatherium* var. *Phosphaticum*, at 10 kg ha⁻¹ of lignite based culture with and without varying amounts of P fertilizer was studied on soil available P changes and sugarcane growth and yield. The PSB application increased the PSB population in the rhizosphere and the plant available P status in the soil. It also enhanced tillering, stalk population and stalk weight, and led to a cane yield increase of 12.6% over no application. When used in conjunction with P fertilizers, PSB reduced the required P dosage by 25%, Sundra *et al.*, (2002).

Similar results were also reported by Mehta *et al.*, (1996), Chauhan *et al.*, (2010) and Babar *et al.*, (2011) who opined that apportioning of nitrogen dose through soil and that harvested from the air by the *entophytic* bacteria, substantiate the need of crop thereby improving the physiological conditions of photosynthetic activities leading to more yields. The rhizosphere soil condition with respect to moisture and other physical properties also plays a key role to accelerate the microbial activity, also might be due to drip irrigation which maintained the soil moisture.

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