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# Effect of microbial consortium as soil and plant health products on growth and yield of *Suru* sugarcane (*Saccharum officinarum* L.)

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**Abstract**
An experiment entitled "Effect of Microbial Consortium as Soil and Plant Health Products on Growth and Yield of *Suru* Sugarcane (*Saccharum officinarum* L.)" was conducted at Research Farm, Shiroli (Pulachi) Regional Sugarcane and Jaggery Research Station, Kolhapur (M.S.), India, during the year 2024-25. The experiment was conducted in a randomized block design with ten treatments each of these was replicated thrice, which includes drenching of soil health product and foliar application of plant health product as a microbial consortium with different fertilizer levels. The obtained result showed that the growth and yield of sugarcane were significantly influenced by the microbial consortium treatments and maximum cane yield (169.49 t $ha^{-1}$) and higher growth attributing characters such as number of tillers at 120 DAP (115.55 thousand $ha^{-1}$), plant height at harvest (337.33 cm), millable cane height (252.67 cm) and also higher germination (84.03%) and final plant count (77.31%) were recorded with 100% RDF + Drenching of soil health product at planting, 30, 75 and 120 DAP + Foliar application of plant health product at 60 DAP.

**Keywords:** Sugarcane, microbial consortium, growth, yield, drenching, foliar application

## Introduction
Sugarcane (*Saccharum officinarum* L.) is among India's most important commercial crop plays a vital role in the agricultural as well as industrial economy. Sugarcane is the main source of sugar (80%) globally and holds a remarkable position as a cash crop. It is one of the main crops of earning foreign exchange. It constitutes the major raw material for sugar production and for jaggery making. Among the nations that cultivate sugarcane worldwide, India comes in second in terms of both acreage (20.4%) and production (18.6%). The USDA' S Foreign Agricultural Service (FAS) estimated that India's sugar production would be 34 MMT for 2023-24 season. FAS also estimated that India's sugar production for 2024-25 is expected to be 35.5 MMT. In India, the area under sugarcane cultivation for the marketing year 2024-25 is estimated to be 5.42 million hectares (MHa), according to the USDA. This is a slight decrease from the previous estimate of 5.45 MHa for 2023-24.

A microbial consortium is a community of two or more diverse microorganisms that work together to achieve common goals. They can enhance nutrient availability, suppress diseases, promote plant growth, improve soil health, manage abiotic stress, increase crop productivity, and support sustainable farming methods. The antioxidant properties of inoculants in microbial consortium promote breakdown of organic matter and increase humus content in soil and are thus being considered as an alternate way of reducing the use of chemicals in agriculture (Carvajal-Munoz and Carmona-Garcia, 2012) [2].

In India, continuous sugarcane cropping with the use of only inorganic fertilizers has led to depletion of biological fertility of the soil and posing threat to long term soil productivity. To stop the continuous decline in biological soil fertility it is important to use biofertilizers as microbial consortia in combination with chemical fertilizers. Sugarcane is a very demanding crop that requires a lot of micronutrients from the soil in addition to roughly 205 kg N, 55 kg $P_2O_5$, and 275 kg $K_2O$ for a cane yield of 100 t $ha^{-1}$ (Yaduvanshi and Yadav, 1990) [14]. Fertilizer

demand for sugarcane is high and this can be boosted by biofertilizers along with chemical and organic fertilizers. The nitrogen-fixing and phosphate-solubilizing bacteria are preferred among various microorganisms because they can partially fulfill the fertilizer demand. To stop the ongoing decline in biological soil fertility it is important to use bio-fertilizers in combination with chemical fertilizers Hence, in crucial to understand sugarcane crop growth and yield as influenced by microbial consortium. It is decided to conduct the field experiment entitled "Effect of Microbial Consortium as Soil and Plant Health Products on Growth and Yield of *Suru* Sugarcane (*Saccharum Officinarum* L.)".

## Materials and Methods

An agronomic field investigation was carried out during *suru* season of 2024-25 at Research Farm, Regional Sugarcane and Jaggery Research Station, Shiroli (*Pulachi*), Kolhapur. The objective of experiment was to study the effect of microbial consortium as soil and plant health products on growth and yield of *suru* sugarcane. The experiment was laid out in the randomized block design with three replication and ten treatments. The treatments consist of Absolute control ($T_1$), 100% RDF (Recommended dose of fertilizers) ($T_2$), 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_3$), 75% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_4$), 50% RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_5$), 25% RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_6$), Zero RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_7$), P, K RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_8$), 50% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP ($T_9$), 75% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP ($T_{10}$). The gross and net plot size were 8.0 m x 9.0 m and 6.0 m x 6.0 m respectively. Soil of the experimental field was silty loam. The soil fertility status of experimental site was medium in organic carbon (0.76%), low in available nitrogen (278.42 kg $ha^{-1}$), medium in available phosphorus (19.60 kg $ha^{-1}$), and high in available potassium (314.27 kg $ha^{-1}$). The electrical conductivity and pH values were 0.21 $dSm^{-1}$ (normal-low saline) and 6.84 (neutral), respectively. Sugarcane of variety Co 86032 (*Nira*) was planted on 9$^{th}$ January, 2024 with row spacing of 150 cm. Drenching of soil health product at planting, 30, 75, and 120 DAP, foliar application of plant health product at 60 DAP and Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75, and 120 DAP was done by using a knapsack sprayer. Growth parameters such as number of tillers, millable cane height, plant height was recorded periodically from five randomly selected plants from each net plot and cane yield (t $ha^{-1}$) was recorded at the time of harvest. Germination count and final plant count was recorded from $m^{-1}$ row length at 45 DAP and at the time harvest respectively. The data recorded for various characters were statistically analyzed by adopting the procedure of analysis as per Panse and Sukhatme, 1985 [8].

## Results and Discussion

### A) Effect of Microbial Consortium Treatments on Growth Parameters of Sugarcane

#### 1. Germination (%)

Germination is a crucial stage that directly influences crop stand and productivity. Application of microbial consortium didn't show significant variations in germination count (%). The germination (%) at 45 DAP was ranging between 75.12% to 84.03% this shows less variations among all the treatments with the application of microbial consortium. Application of 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_3$) recorded higher germination% (84.03). These results were found in agreement with the findings of Banerjee *et al.*, (2018) [1], Murumkar *et al*., (2017) [6], Mahatma *et al*., (2016) [3] and Ranjan *et al.*, (2020) [10]. The microbial consortia had limited influence on initial germination but contributed significantly to crop growth and yield at later stages by enhancing nutrient availability and improving soil biological activity.

#### 2. Final Plant Count (%)

Final plant count at harvest refers to the number of plants without considering tillers per meter row length recorded at the time of harvesting. mean final plant percentage was ranging between 65.16% to 77.31%. Application of 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of plant health product at 60 DAP ($T_3$) recorded higher final plant count% (77.31). The nutrient and biofertilizer applications influence growth and yield quality but may not significantly alter final cane count when crop stand is uniformly good.

#### 3. Number of Tillers (thousand $ha^{-1}$)

The number of tillers per clump is a key growth parameter in sugarcane that directly influences the final cane yield. The number of tillers recorded at 120 DAP was significantly influenced by the microbial consortium treatments. The maximum number of tillers (115.55 thousand $ha^{-1}$) at 120 DAP were recorded with application of 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of plant health product at 60 DAP ($T_3$) was statistically on par with treatment 75% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_4$) and 75% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP ($T_{10}$). The lowest number of tillers was recorded with absolute control ($T_1$). Optimal availability of major nutrients and improved nutrient uptake due to microbial consortium resulted in maximum number of tillers per plant. These results are in conformity with the findings of Banerjee *et al.*, (2018) [1], Ranjan *et al.*, (2020) [10], Patel and Chaudhari (2018) [9] and Mahatma *et al*., (2016) [3].

#### 4. Plant Height (cm)

Plant height in sugarcane is a key growth parameter that reflects the crop's vegetative vigor and overall health. Maximum mean plant height (337.33 cm) at harvest was recorded with 100% RDF + Drenching of soil health product at planting, 30, 75 and 120 DAP + Foliar application of plant health product at 60 DAP ($T_3$) which was statistically on par with treatment 75% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_4$)

(323.67 cm), 75% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP ($T_{10}$) (318.67 cm) and 100% RDF (Recommended dose of fertilizers) ($T_2$) (307.00 cm). Timely availability of nutrients, especially during the grand growth phase along with repeated drenching and foliar application microbial consortium led to better root proliferation, nutrient solubilization, reduced nutrient losses, hormone production (like IAA), and root development, leading to improved nutrient uptake and vigorous shoot elongation resulted in maximum plant height. These findings corroborate with the results obtained by Banerjee *et al.,* (2018) [1], Murumkar *et al*., (2017) [6], Shankaraiah (2007) [12], Meena and Kumar (2015) [4].

**5. Millable Cane Height (cm)**

Millable cane height is a crucial growth parameter that directly influences the yield potential of sugarcane. Maximum mean millable cane height of (252.67 cm) was recorded with 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_3$) which was statistically on par with treatment 75% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_4$) (246.33 cm), 75% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP ($T_{10}$) (243.67 cm) and 100% RDF (Recommended dose of fertilizers) ($T_2$) (235 cm). The lowest mean millable cane height of (219.33 cm) was recorded with absolute control ($T_1$). The maximum mean millable cane height was recorded with 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_3$) this might be due to the combined application of full RDF, repeated microbial drenching, and timely foliar application created an optimal soil-plant environment that supported enhanced root development, nutrient uptake, and vegetative vigor, resulting in maximum millable cane height. Similar results are reported by Nazirkar *et al*., (2010) [7] and Murumkar *et al*., (2017) [6].

**B) Effect of Microbial Consortium Treatments on Yield of Sugarcane**

Cane yield expressed in tonnes hectare$^{-1}$ (t ha$^{-1}$), is a crucial parameter to assess the productivity of sugarcane under different nutrient and microbial consortium treatments. The maximum mean cane yield of (169.49 t ha$^{-1}$) was recorded with 100% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_3$), which was statistically on par with treatment 75% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP ($T_4$) (164.43 t ha$^{-1}$) and 75% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP ($T_{10}$) (159.88 t ha$^{-1}$). The lowest mean cane yield of (92.58 t ha$^{-1}$) was recorded with absolute control ($T_1$). The repeated drenching along with foliar application of microbial consortium possibly ensured sustained microbial activity and efficient nutrient uptake. The integration of full recommended fertilizer dose with microbial consortium through drenching and foliar applications can be an effective strategy for sustainable sugarcane production. The similar findings were also acknowledged by Mahatma *et al*., (2016) [3], Banerjee *et al.,* (2018) [1], Ranjan *et al.,* (2020) [10], Patel and Chaudhari (2018) [9], Sinha *et al.,* (2019) [13], Mohanty *et al.,* (2013) [5] and Shankaraiah and Hunsigi (2000) [11].

**Table 1:** Growth and yield of sugarcane as influenced by microbial consortium treatments in sugarcane

| | Treatments | Germination (%) | Final plant count (%) | Number of Tillers (thousand ha$^{-1}$) | Plant height (cm) | Millable cane height (cm) | Mean Cane yield (t ha$^{-1}$) |
|---|---|---|---|---|---|---|---|
| $T_1$ | Absolute control | 75.12 | 65.16 | 83.98 | 283.33 | 219.33 | 92.58 |
| $T_2$ | 100% RDF (Recommended dose of fertilizers) | 82.18 | 73.03 | 100.09 | 307.00 | 235.00 | 140.02 |
| $T_3$ | 100% RDF + Drenching of Soil health Product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP | 84.03 | 77.31 | 115.55 | 337.33 | 252.67 | 169.49 |
| $T_4$ | 75% RDF + Drenching of Soil health product at planting, 30, 75 and 120 DAP + Foliar application of Plant health product at 60 DAP | 82.64 | 74.65 | 107.87 | 323.67 | 246.33 | 164.43 |
| $T_5$ | 50% RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP | 80.79 | 71.18 | 97.68 | 301.33 | 232.00 | 133.11 |
| $T_6$ | 25% RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP | 77.20 | 66.43 | 92.22 | 290.67 | 224.00 | 113.72 |
| $T_7$ | Zero RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP | 76.16 | 65.51 | 87.04 | 288.00 | 220.67 | 105.91 |
| $T_8$ | P, K RDF + Drenching of Soil health product at planting, 30, 75, and 120 DAP + Foliar application of Plant health product at 60 DAP | 79.51 | 69.44 | 94.44 | 294.00 | 229.33 | 120.85 |
| $T_9$ | 50% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP | 80.56 | 70.72 | 96.94 | 299.00 | 230.67 | 126.83 |
| $T_{10}$ | 75% RDF + Drenching of MPKV consortium Acetobacter + PSB + KSB at 30, 75 and 120 DAP | 82.29 | 74.19 | 105.37 | 318.67 | 243.67 | 159.88 |
| S.Em± | | 2.54 | 2.72 | 4.44 | 10.80 | 6.93 | 8.51 |
| CD @ 5% | | NS | NS | 13.20 | 32.11 | 20.60 | 25.29 |
| General Mean | | 80.04 | 70.76 | 98.11 | 304.3 | 233.36 | 132.68 |

**Conclusion**

Application of 100% RDF + drenching of soil health product at planting, 30, 75 and 120 DAP + foliar application of plant health product at 60 DAP recorded the significantly highest

germination%, final plant count%, number of tillers, plant height, millable cane height and maximum cane yield (t $ha^{-1}$) of suru sugarcane.

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**Disclaimers**
All opinions and conclusions in this article are those of the authors and do not necessarily reflect the views of their institutions. The authors are solely responsible for the accuracy and completeness of the content and disclaim any liability for direct or indirect losses arising from its use.

**Conflict of Interest**
The authors declare no conflicts of interest, and no external funding or sponsorship influenced the study design, data collection, analysis, publication decision, or manuscript preparation.

**References**
1. Banerjee K, Puste AM, Gunri SK, Jana K, Barman M. Effect of integrated nutrient management on growth, yield, quality and soil health of spring planted sugarcane (*Saccharam officinarum* L.) in West Bengal. Indian J Agron. 2018;63(4):41-7.
2. Carvajal-Munoz JS, Carmona-Garcia CE. Benefits and limitations of biofertilization in agricultural practices. Livest Res Rural Dev. 2012;24(3):1-8.
3. Mahatma L, Makwana KV, Sabalpara AN. Enhancement of sugarcane production and productivity by the biofertilizers with graded chemical fertilizers. Indian J Sugarcane Technol. 2016;31(1):6-9.
4. Meena BS, Kumar P. Improving productivity, nutrient uptake, quality and sustainability of sugarcane (*Saccharum spp.* Hybrid complex) varieties through nutrient management of NPK in clay loam soil of Rajasthan. Indian J Sugarcane Technol. 2015;30(02):104-9.
5. Mohanty M, Biswal S, Mishra PJ. Effect of integrated nutrient management on yield and quality of sugarcane (*Saccharum spp.* hybrid complex) in Odisha. Indian J Sugarcane Technol. 2013;28(2):47-9.
6. Murumkar DR, Nalawade SV, Indi DV, Pawar SM. Response of sugarcane seed plot to microbial inoculation by *Glucanoacetobacter diazotrophicus* and phosphate-solubilizing bacteria. Sugar Tech. 2017;19(1):26-32.
7. Nazirkar RB, Domale NR, Deshpande AN. Soil properties and sugarcane response as influenced by integrated nutrient management. An Asian J Soil Sci. 2010;5(2):411-4.
8. Panse VA, Sukhatme PV. Statistical methods for Agricultural Workers. Revised Ed. ICAR; 1985.
9. Patel D, Chaudhari M. Integrated application of organic, inorganic and biological fertilizers for enhancing sugarcane productivity and improving soil health in plant ratoon cycle. J Pharmacogn Phytochem. 2018;7(3):1586-9.
10. Ranjan A, Jha CK, Kumar N, Thakur SK, Singh S, Kumar V, *et al*. Effect of split application of organic manures and fertilizers on productivity, quality and economics of sugarcane grown on calcareous Entisol of Bihar. J Pharmacogn Phytochem. 2020;9(4):1445-50.
11. Shankaraiah C, Hunsigi G. Effect of associative nitrogen fixing and phosphate solubilizing bioagents on growth, yield and quality of sugarcane. Trop Agric Res. 2000;12:163-76.
12. Shankaraiah C. Nitrogen management through biological process on nitrogen use efficiency in sugarcane and environmental protection. Sugar Tech. 2007;9(2&3):132-6.
13. Sinha SK, Prasad V, Prasad RK. Integrated effect of organic manure and *Azotobacter* with inorganic fertilizer on soil properties, yield and quality of sugarcane plant-ratoon system under calcareous soil. J Pharmacogn Phytochem. 2019;5:321-6.
14. Yadhav Y. Isolation and characterization of genetically two distant group of *Acetobacter* from new host plant. J Appl Bacteriol. 1990;86:1053-10.