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Evaluation of sweet sorghum bagasse compost for its plant growth-promotion, yield and nutritional traits

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ABSTRACT

Three cellulose-degrading microbes, *Aspergillus awamori*, *Bacillus subtilis (*ATCC 6633) and *Myceliophthora thermophila* (ATCC 48104), were earlier reported to decompose sweet sorghum bagasse and the bagasse compost to promote plant growth-promotion (PGP). In this investigation, the bagasse compost prepared with these strains was evaluated for their PGP, grain yield and nutritional properties in sweet sorghum under field conditions. The bagasse compost, prepared with the selected strains, significantly enhanced PGP traits of sweet sorghum including leaf area up to 30%, leaf weight up to 20%, root weight up to 40% and shoot weight up to 27% at 45 days after sowing (DAS); stover weight up to 11%, panicle weight up to 21%, grain yield up to 29% and brix % up to 30% at harvest over the uninoculated control compost. Harvested grains from the bagasse compost prepared with the selected strains enhanced their mineral contents including iron up to 36% (68 ppm), zinc up to 35% (20 ppm), calcium up to 49% (132 ppm) and magnesium up to 25% (1607 ppm) over the uninoculated control compost. In the rhizosphere, the bagasse compost prepared with the strains also significantly enhanced organic carbon up to 43%, available P up to 12% and total nitrogen up to 8% over the uninoculated control compost. This study confirms the use of bagasse compost prepared with the selected microbial strains for enhanced PGP, grain yield and grain nutrient contents in sweet sorghum.

Key words: *Cellulose degrading microbes , Micronutrients, Plant growth-promotion and Yield traits*
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Sweet sorghum (*Sorghum bicolor* L. Moench) is one of the important C4 cereal and part of grain sorghum used as food crops for more than 500 million people in the world, particularly in Africa and South-East Asia (Char et al. 2020). It is also used as animal feed, biofuel and alcoholic beverages (Rao et al. 2009; Manasa et al. 2021). In India, sweet sorghum is widely grown under rain-fed agriculture for food, feed and ethanol production (Gopalakrishnan et al. 2020). Sweet sorghum is best suited to produce ethanol as it contains higher total reducing sugar (22 23%) and more sugar (10 15%) when compared to sugarcane (Huligol et al. 2004). After crushing the sweet sorghum stalks for juice, having a range of brix values (14 23%), it is important to utilize bagasse effectively for the economy and sustainability. There are two options for utilizing the bagasse either as a substrate for composting and converting them into high-value organic manures or as livestock feed. The option of converting bagasse into manure is advantageous for the simple reason of maintaining soil fertility. under rainfed situations as well as creating an additional source of income generation for the farmers.

Sweet sorghum bagasse contains extremely low levels N, P, K and micronutrients but rich in organic carbon (470 g kg^{-1} of bagasse) resulting in a wide C-to-N ratio of approximately 100-to-1 (Bernai et al. 1998). Therefore there is a requirement of N rich amendments such as urea/ammonium sulphate to the bagasse to obtain optimum C-to-N ratio for better composting. In addition, it is also equally important to identify effective strains of cellulose-degrading microbes for rapid composting. Cellulose-degrading microbes such as *Thermoactinomyces* sp., *Thermomonospora* sp., *Thermopolyspora* sp., *Streptomyces* sp., *Aspergillus* sp., *Bacillus* sp. and *Pseudomonas* sp. are reported for composting various crop residues (Zeng et al. 2011). Application of good quality compost not only supports plant growth but also helps to bring waste management and agriculture together towards a society with a more circular economy (Blouin et al. 2019).

Earlier, we reported three cellulose-degrading microbes, *Aspergillus awamori*, *Bacillus subtilis* ATCC 6633 and *Myceliophthora thermophila* ATCC 48104, to decompose sweet sorghum bagasse and the bagasse compost could be utilized for growth promotion of plants (Gopalakrishnan et al. 2020). The objective of this study was to evaluate the bagasse compost prepared with these strains for their plant growth promotion (PGP), grain yield and grain nutritional contents in sweet sorghum under field conditions.

MATERIAL AND METHODS

Cellulose-degrading microbes used in this study

One bacterium, *Bacillus subtilis* ATCC 6633, and two fungi, *Myceliophthora thermophila* ATCC 48104 and *Aspergillus awamori* (GenBank accession: MH011355), reported earlier to have cellulose degrading capabilities were used in this study (Gopalakrishnan et al. 2020). Both *B. subtilis* ATCC 6633 and *M. thermophila* ATCC 48104 were acquired from American Type Culture Collection (ATCC), Manassas, VA 20108, USA while the *A. awamori* was collected from microbial gene bank, ICRISAT, Patancheru, India.

Composting of sweet sorghum bagasse

The bagasse of sweet sorghum (SSV 74) was collected after juice extraction from the stalk. The sweet sorghum bagasse constitutes moisture (84%), carbon (35%), nitrogen (1.0%), CN ratio (35%) and pH 6.8. A total of nine different types of bagasse compost were prepared that include 1. = control- only sorghum bagasse (SB); 2. = SB + rice straw (RS); 3. SB + RS + *A. awamori*; 4. SB + RS + *B. subtilis*; 5. SB + RS + *M. thermophile*; 6. = SB + farmyard manure (FYM); 7. = SB + FYM + *A. awamori*; 8. SB + FYM + *B. subtilis*; 9. SB + FYM + *M. thermophile*. The bagasse and rice straw or FYM were added at the ratio of 3:1 and composted as described earlier (Gopalakrishnan et al. 2020). In brief, the composting was done as a heap on the soil surface in a field. The selected cellulose-degrading microbes were formulated as peat-based inoculants and added (@ 1000 g [10^8 CFU g^{-1}] per heap) as per the treatmental requirement. Powdered Mussoorie rock phosphate (@ 5% of bagasse) and urea (@ 0.38% of bagasse) were mixed thoroughly along with the bagasse and rice straw or FYM including those in uninoculated controls. The heap was covered with rice straw bundles in nets and left undisturbed for 30 days. Moisture of the composting pile was maintained (60 70%) throughout the composting process. At the end of 30 days after start of the trial, the heap was mixed thoroughly, released earthworms (*Eudrilus eugeniei*; 500 numbers per heap, including in uninoculated control) and left undisturbed for another 30 days. The composting process was completed in 60 days.

Evaluation of sweet sorghum bagasse composts under field conditions

The six-bagasse compost prepared with the three selected strains of cellulose-degrading microbes and the three controls (only bagasse, bagasse + rice straw and bagasse + FYM) were further evaluated for their PGP traits on sweet sorghum under field conditions at ICRISAT, Patancheru (17°302 N; 78°162 E; altitude 549 m) during the post rainy season of 2020–21. In the cropping season, a maximum temperature ranging from 30.1–36.0 °C and a minimum temperature ranging from 12.4–17 °C were recorded. Soils at the experimental site are classified as Vertisols, having 3.5% iron, 2.8% aluminium, 1.0% organic matter, 0.8% magnesium, 0.6% lime, 0.2% potassium carbonate, 0.1% phosphorus and 0.07% nitrogen. A total of nine treatments were planned. The details of the treatments were as follows: T1 = control- compost prepared with sorghum bagasse (SB) + rice straw (RS); T2 = compost prepared with SB + RS + *A. awamori*; T3 = compost prepared with SB + RS + *B. subtilis*; T4 = compost prepared with SB + RS + *M. thermophila;* T5 = control- compost prepared with SB + farm yard manure (FYM); T6 = compost prepared with SB + FYM + *A. awamori*; T7 = compost prepared with SB + FYM + *B. subtilis*; T8 = compost prepared with SB + FYM + *M. thermophile*; and T9 = compost prepared with only SB. The selected nine composts were incorporated in the field at the rate of 2.4 t ha^{-1} at the time of field preperations. The field trial was carried out with three replications in 4 m plots with a spacing of 75 cm (between the rows) and 10 cm (between the plants) in the randomized complete block design (RCBD) design. As per the crop recommendation, a basal dose of di-ammonium phosphate (100 kg ha^{-1}) was applied at field preparation while urea (100 kg ha^{-1}) was applied just after the thinning as side-dressing. Seeds of sweet sorghum (variety ICSV 93046) were sown at a distance of 10 cm between plants and at 3 cm depth. All the agronomic practices required for growing sweet sorghum including irrigation and weeding have been carried out as and when required. At 45 days after sowing (DAS), plant height, leaf area, leaf dry weight, root dry weight and shoot dry weight were recorded. The crop was harvested manually at physiological maturity and the growth and yield traits such as panicle length, stover dry weight, panicle dry weight, grain weight, grain yield and BRIX % were recorded. At harvest, 5 6 panicles with self-seed sets that share above 80% of mature seeds in each plot had also been harvested and sun-dried for 15 days. At the end of sun drying, the grain samples were ground in a titanium-coated mill (SuperMill 1500, Newport Scientific Europe Ltd.) and analyzed in Inductively Coupled Plasma-Mass Spectrometry (ICP–MS; Agilent 7500c, Agilent Technologies) for the elements such as Fe, Zn, Ca and Mg and expressed in ppm. Just after harvest, rhizosphere soil samples (0 15 cm) were also collected from each plot and analyzed for organic carbon %, available phosphoruus and total nitrogen as per the standard protocols of Nelson and Sommers (1982), Olsen and Sommers (1982) and Novozamsky et al. (1983), respectively.

Statistical analysis

The data collected from the field experiment was analysed statistically through ANOVA (Genstat 20. version) to examine the efficiency of the selected composts on sweet sorghum growth and yield parameters along with biofortification efficiency. Post harvest analysis for significant differences between means was performed through Tukey's HSD test for multiple comparisons by setting *P*-value to 0.05 (Tukey 1977).

RESULTS AND DISCUSSION

Composting of sweet sorghum bagasse

The nine different types of bagasse compost such as control- only SB, SB + RS, SB + RS + *A. awamori*, SB + RS + *B. subtilis*, SB + RS + *M. thermophile*, SB + FYM, SB + FYM + *A. awamori*, SB + FYM + *B. subtilis* and SB + FYM + *M. thermophile* was completed by 60 days. A total of about 500kg of each nine composts were prepared.

Evaluation of sweet sorghum bagasse composts under field conditions

At 45 DAS, the bagasse compost prepared with rice straw and selected cellulose-degrading microbes amended treatments significantly enhanced PGP traits of sweet sorghum including leaf area up to 30%, leaf weight up to 20%, root weight up to 40% and shoot weight up to 27% over the bagasse compost prepared only with rice straw. The bagasse compost prepared with FYM and the selected microbes amended treatments also significantly enhanced PGP traits of sweet sorghum including leaf area up to 17%, leaf weight up to 18%, root weight up to 8% and shoot weight up to 17% over the bagasse compost prepared only with FYM. The response of bagasse compost prepared with rice straw and selected microbes amendments were found better than FYM and selected microbes amendments. The bagasse-only compost (uninoculated control) was found to promote the least PGP traits among all treatments (Table 1).

At harvest, the bagasse compost prepared with rice straw and selected microbes amended treatments significantly enhanced PGP traits of sweet sorghum including stover weight up to 11%, panicle weight up to 21%, grain yield up to 29% and brix percentage up to 14% over the bagasse compost prepared only with rice straw. The bagasse compost prepared with FYM and selected microbes amended treatments also significantly enhanced PGP traits of sweet sorghum including stover weight up to 4%, panicle weight up to 15%, grain yield up to 18% and brix percentage up to 30% over the bagasse compost prepared only with FYM. Yet again, at harvest, the bagasse compost prepared without strains (uninoculated control) was found to promote the least PGP traits among all treatments (Table 2).

At harvest, the harvested grains of sweet sorghum from the bagasse compost prepared with rice straw and selected microbes amended treatments were found to significantly enhance the mineral contents such as Fe up to 36%. Zn up to 35%, Ca up to 25% and Mg up to 20% over the bagasse compost prepared only with rice straw. The harvested grains of sweet sorghum from the bagasse compost prepared with FYM and selected microbes amended treatments were also found to significantly enhance the mineral

Table 1. Effect of different sweet sorghum bagasse composts on growth promoting traits in sweet sorghum under field conditions – at 45 days after sowing

	ICSV93046				
Composts prepared with	**Plant height (cm)**	**Leaf area (cm² plant⁻¹)**	**Leaf weight (g plant⁻¹)**	**Root weight (g plant⁻¹)**	**Shoot weight (g plant⁻¹)**
SB+RS	112^{b}	1480^{a}	8.70^{ab}	3.38^{ab}	5.31^{a}
SB+RS+ *A. awamori*	113^{bc}	2036^{bc}	10.04^{bcd}	4.03^{bc}	7.30^{b}
SB+RS+ *B. subtilis*	110^{b}	2128^{c}	10.92^{cd}	5.62^{e}	7.19^{b}
SB+RS+ *M. thermophila*	115^{bcd}	1933^{bc}	10.53^{cd}	4.59^{cd}	6.10^{ab}
SB+FYM	112^{b}	1749^{ab}	9.45^{bc}	6.90^{f}	6.16^{ab}
SB+FYM+ *A. awamori*	118^{cd}	2117^{c}	11.56^{d}	7.47^{f}	7.36^{b}
SB+FYM+ *B. subtilis*	120^{d}	1917^{bc}	10.09^{bcd}	4.60^{cd}	7.42^{b}
SB+FYM+ *M. thermophila*	117^{cd}	2075^{bc}	10.55^{cd}	5.30^{de}	7.35^{b}
Control	102^{a}	1461^{a}	7.57^{a}	2.64^{a}	5.27^{a}
Mean	113	1877	9.93	4.95	6.66
SE±	1.540	102.2	0.550	0.2688	0.472
SD	7.4	314.3	1.7	1.6	1.1
CV%	2.4	9.4	9.6	9.4	12
THSD	0.38	17.7	0.2	0.19	0.18

Note: SB = Sweet sorghum bagasse; RS = Rice-straw; FYM = Farmyard manure; Means having the same letter within a column do not differ significantly using Tukey's test at P = 0.05. THSD, Tukey's honestly significant difference; S = standard error; CV = coefficients of variation; SD = standard deviation.

Table 2. Effect of different sweet sorghum bagasse composts on growth promoting and yield traits in sweet sorghum under field conditions – at harvest

Composts prepared With	**Panicle length (cm)**	**Stover weight (g plant¹)**	**Panicle weight (g plant¹)**	**Grain weight (g plant¹)**	**Grain yield (t ha¹)**	**Brix (%)**
SB+RS	19.6^{ab}	87.0^{abc}	33.1^{ab}	24.3^{ab}	4.25^{ab}	7.3^{a}
SB+RS+ *A. awamori*	19.9^{ab}	87.9^{abc}	34.0^{ab}	27.9^{ab}	4.89^{ab}	8.5^{a}
SB+RS+ *B. subtilis*	19.8^{ab}	90.6^{abc}	37.5^{ab}	28.8^{ab}	5.04^{ab}	7.7^{a}
SB+RS+ *M. thermophila*	20.5^{b}	97.4^{c}	41.7^{b}	34.4^{b}	6.01^{ab}	7.5^{a}
SB+FYM	19.3^{a}	88.5^{abc}	30.6^{a}	24.3^{ab}	4.26^{ab}	7.2^{a}
SB+FYM+ *A. awamori*	19.5^{a}	78.1^{ab}	35.0^{ab}	29.6^{ab}	5.19^{ab}	8.5^{a}
SB+FYM+ *B. subtilis*	19.8^{ab}	86.4^{abc}	32.0^{ab}	26.5^{ab}	4.64^{ab}	10.2^{a}
SB+FYM+ *M. thermophila*	20.5^{b}	92.1^{bc}	36.1^{ab}	29.6^{ab}	5.18^{ab}	7.8^{a}
Control	19.1^{a}	77^{a}	29.8^{a}	21.3^{a}	3.73a	6.8^{a}
Mean	19.8	87.3	34.4	27.4	4.80	7.9
SE±	0.28	4.02	3199	3.41	0.596	1.05
SD	0.6	9	12	10	1.8	2.3
CV%	2.5	8	16	21	21.5	22.8
THSD	0.17	0.69	0.76	0.66	0.20	0.20

Note: SB= Sweet sorghum bagasse; RS= Rice-straw; FYM= Farmyard manure; Means having the same letter within a column do not differ significantly using Tukey's test at P = 0.05. THSD, Tukey's honestly significant difference; SE = standard error; CV = coefficients of variation; SD = standard deviation.

contents such as Fe up to 27%. Zn up to 18%, Ca up to 49% and Mg up to 25% over the bagasse compost prepared only with FYM (Table 3).

At harvest, the rhizosphere soils of the bagasse compost prepared with rice straw and selected microbes amended treatments significantly enhanced organic carbon up to 43%, available P up to 12% and total nitrogen up to 8% over the bagasse compost prepared by only with rice straw. The rhizosphere soils of the bagasse compost prepared with FYM and selected microbes amended treatments also significantly enhanced organic carbon up to 21%, available P up to 12% and total nitrogen up to 3% over the bagasse compost prepared only with FYM (Table 4). Identification of good decomposing microorganisms, particulary those capable of producing ligninolytic and cellulolytic enzymes, plays an important role in decomposing sweet sorghum bagasse (Mishra *et al.,* 2017). In the present study, the selected three microbes, *A. awamori*, *B. subtilis* ATCC 6633 and *M. thermophila* ATCC 48104, were earlier reported to produce cellulase and degrade sweet sorghum bagasse (Gopalakrishnan *et al.,* 2020). Therefore, these three strains were used in this study for the degradation of bagasse. The sweet sorghum bagasse contains higher levels of organic carbon (34 36%) and lower levels of macro and micronutrients resulting in a higher C:N ratio, therefore it cannot be applied directly into the soil (De Bertoldi *et al.,* 1985). Higher CN ratio are widely known to prolong composting duration and immobilization of the nutrients in the microbial biomass. Therefore, in the present study, to bring down the CN ratio of sweet sorghum bagasse, FYM or rice straw (at 25%) was added. In the present investigation, Mussoorie rock phosphate (5%), urea (0.38%) and earthworms (500 numbers at 30 days after the start of the trial) were also added while composting bagasse, as these ingredients were reported to enhance rapid composting and enriching the final compost (Rupela *et al.,* 1998).

In the present study, about 500 kg of each nine composts including control-only SB, SB + RS, SB + RS + *A. awamori*, SB + RS + *B. subtilis*, SB + RS + *M. thermophile*, SB + FYM, SB + FYM + *A. awamori*, SB + FYM + *B. subtilis* and SB + FYM + *M. thermophile* were prepared and further evaluated for their PGP under field conditions. At 45 DAS and harvest, the bagasse compost prepared with rice straw or FYM and selected microbes amended treatments significantly enhanced PGP traits including leaf area, leaf weight, root weight,shoot weight, panicle weight, grain yield and brix percentage over the bagasse compost prepared only with rice straw or FYM. The response of bagasse compost prepared with rice straw was found better than FYM. At both 45 DAS and harvest, the bagasse-only compost (uninoculated control) was found to promote the least of PGP traits among all treatments. Compost made from cattle dung and vegetable wastes as raw material added as soil supplement significantly enhanced plant growth and yield of wheat and strawberry under field conditions (Singh et al. 2008; Joshi *et al.,* 2013). Vermicompost made of rice straw was reported to promote plant growth and nodulation of garden pea (Maji *et al.,* 2017). Composts prepared from sugarcane bagasse using *Bacillus subtilis* and *Schizophyllum commune* were reported to enhance the biomass of sorghum under field conditions (Bambharolia *et al.,* 2021). The selected three cellulose-degrading microbes in the present study were earlier reported to produce indole acetic acid (IAA) with the range of 8.1 16.5 µg/ml (Gopalakrishnan *et al.,* 2020). Microorganisms producing IAA are reported to help in the germination of seeds and the promotion of shoots and roots and thereby helping the plants to access nutrients and water from deeper soil depth (Khamna *et al.,* 2009). Among the selected three microbes, *A. awamori* was also earlier reported to produce siderophore (Gopalakrishnan *et al.,* 2020), which functions as solubilizing agent of iron and helps the plants to inhibit plant pathogens (Tokala *et al.,* 2002). The mechanism by which the three selected cellulose-degrading microbes could consistently enhance agronomical and yield traits on sorghum can be attributed to their enzymatic activities, such as the ability to produce indole acetic acid and siderophore activities.

In the present study, the harvested grains of sweet sorghum from the bagasse compost prepared with rice straw or FYM and selected microbes amended treatments were found to significantly enhance the mineral contents such as Fe, Zn, Ca and Mg over the bagasse compost prepared only with rice straw or FYM. Also, the rhizosphere soils of the bagasse compost prepared with rice straw or FYM and selected microbes amended treatments

Table 3. Effect of different sweet sorghum bagasse composts on grain mineral contents

Composts prepared with	ICSV93046			
	Fe (ppm)	Zn (ppm)	Ca (ppm)	Mg (ppm)
SB+RS	43.3[a]	18.04[ab]	99.8[bc]	1279[ab]
SB+RS+ *A. awamori*	52.5[ab]	27.62[d]	132.8[d]	1607[b]
SB+RS+ *B. subtilis*	50.7[ab]	21.17[c]	99.7[bc]	1138[ab]
SB+RS+ *M. thermophila*	68.1[c]	20.27[bc]	80.3[ab]	1190[a]
SB+FYM	42.9[a]	16.89[a]	63.9[a]	1025[a]
SB+FYM+ *A. awamori*	52.3[ab]	19.75[bc]	86.7[ab]	1178[a]
SB+FYM+ *B. subtilis*	59.0[bc]	20.04[bc]	125.9[cd]	1325[ab]
SB+FYM+ *M. thermophila*	45.1[a]	20.53[bc]	113.6[bcd]	1366[ab]
Control	68.4[c]	20.55[bc]	87.7[ab]	1219[a]
Mean	53.6	20.5	99.5	1281
SE±	3.57	0.787	8.11	97.8
SD	7.2	0.82	24.15	130.2
CV%	11.5	6.6	14.1	13.2
THSD	1.83	0.25	1.75	14.08

Note: SB = Sweet sorghum bagasse; RS = Rice-straw; FYM = Farmyard manure; Means having the same letter within a column do not differ significantly using Tukey's test at P = 0.05. THSD, Tukey's honestly significant difference; S = standard error; CV = coefficients of variation; SD = standard deviation.

Table 4. Effect of different sweet sorghum bagasse composts on soil biochemical properties – at harvest

Composts prepared with	Organic carbon %	Available P (ppm)	Total N (ppm)
SB+RS	0.20[a]	10.90[a]	576[a]
SB+RS+ *A. awamori*	0.25[a]	11.63[a]	607[a]
SB+RS+ *B. subtilis*	0.31[a]	12.44[a]	622[a]
SB+RS+ *M. thermophila*	0.35[a]	12.41[a]	626[a]
SB+FYM	0.27[a]	12.38[a]	613[a]
SB+FYM+ *A. awamori*	0.34[a]	14.09[a]	617[a]
SB+FYM+ *B. subtilis*	0.31[a]	11.46[a]	613[a]
SB+FYM+ *M. thermophila*	0.30[a]	13.00[a]	634[a]
Control	0.27[a]	11.05[a]	577[a]
Mean	0.29	12.15	609
SE±	0.046	1.361	23.9
SD	0.1	1.8	32.5
CV%	27.4	19.4	6.8
THSD	0.17	0.21	2.40

Note: SB = Sweet sorghum bagasse; RS = Rice-straw; FYM = Farmyard manure; Means having the same letter within a column do not differ significantly using Tukey's test at P = 0.05. THSD, Tukey's honestly significant difference; SE = standard error; CV = coefficients of variation; SD = standard deviation.

significantly enhanced organic carbon, available P and total nitrogen over the bagasse compost prepared only with rice straw or FYM. The increase in mineral (such as Fe, Zn, Ca and Mg) content of sweet sorghum grains could be due to the mineral mobilizing potentials of the selected cellulose-degrading microbes via secretion of siderophores, which was earlier reported in biochemical studies (Gopalakrishnan *et al.,* 2020). There are reports of the enhancement of root-uptake and transport systems and associations with beneficial soil microorganisms for crop nutrition (Prasanna *et al.,* 2015). Application of composts is now widely accepted by researchers as well as farmers for their beneficial traits as it normally contains beneficial microbes, that help the plants to mobilize and acquire macronutrients such as P and K and micro-nutrients such as Fe and Zn and also inhibit plant pathogens (Perner *et al.,* 2006). Microbial biofortification is now a widely accepted phenomenon as bacteria and fungi are reported to enhance plant growth along with micronutrients such as Fe, Zn, Ca and Mg in grains of various crops including wheat, rice, pearl millet, chickpea and pigeonpea (Rana *et al.,* 2015; Yasin *et al.,* 2015; Gopalakrishnan *et al.,* 2016; Sathya *et al.,* 2016; Singh et al. 2018; Srinivas *et al.,* 2022). In the current study, although all the tested composts enhanced Fe, Zn, Ca and Mg contents in grains, there are variations in the specific micronutrient enriched and growth parameter enhanced. The higher level of Fe contents in some treatments might be due to possible dust contamination that happened during the sampling of harvested grains whereas other nutrients are not influenced by dust contamination, aluminum and titanium are largely present in dust/atmosphere (Govindaraj *et al.,* 2020). In the present study, the variation in micronutrient concentration could be also due to the adoption potentials of the applied cellulose-degrading microbes with the already existing microflora in the compost and its capability to ease the compost-bound minerals and their expression levels. Beneficial microorganisms when introduced into a new environment, particularly under field conditions, finds it difficult to survive and perform their duties due to competition from other native microorganisms and predators, unpredictable environmental conditions, soil type, plant species and inoculant density (Slininger *et al.* 2003). To our best knowledge, perhaps, this is the first study that reports the use of compost made from sweet sorghum bagasse for PGP, yield enhancement and nutritional traits in sweet sorghum.

CONCLUSION

The usefulness and effectiveness of sweet sorghum bagasse compost, prepared with the selected three cellulose-degrading microbes, *A. awamori*, *B. subtilis* ATCC 6633 and *M. thermophila* ATCC-48104, for growth promotion, yield and nutritional traits were well demonstrated in sweet sorghum under field conditions. However, there is a need to determine the effectiveness of these bagasse composts under multi-location trials and to understand their interaction with native soil micro-flora and micro-fauna with host plants and the environment. The selected three cellulose-degrading microbes need to be formulated, mass multiplied and given to farmers for better degradation of sweet sorghum bagasse under on-farm conditions. Further, the value addition of sweet sorghum bagasse compost needs to be done with biocontrol and/or PGP microorganisms.

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