

IMPACT OF DIFFERENT CULTIVARS AND ORGANIC MANAGEMENT PRACTICES ON SOIL NUTRIENT STATUS AND MICROBIAL POPULATION OF SOIL IN FOXTAIL MILLET (*SETARIA ITALICA* L.)

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ABSTRACT

A field experiment was conducted at Assam Agricultural University, Jorhat during the summer seasons of 2023 and 2024 to evaluate the effect of different organic management practices on soil nutrient, microbial population and plant uptake in foxtail millet (*Setaria italica* L.). The experiment was laid out in factorial randomized block design (RBD) with three replications. The soil of the experimental site was sandy loam in texture with acidic reaction (pH 5.5), medium in organic carbon (0.73%), medium in available nitrogen (243.56 kg/ha), low in phosphorus (17.83) and the available potassium (140.15 kg/ha). The treatment consisted of two different factors viz., three foxtail millet cultivars C₁: Gossaigaon local, C₂: Majuli local, C₃: SiA-3156 and four organic nutrient management practices. viz., O₁: vermicompost @ 2t/ha, O₂: seed biopriming with *beejamrutha* @ 4% +vermicompost @ 2t/ha, O₃: seed biopriming with *beejamrutha* @ 4% + vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS and O₄: seed biopriming with *beejamrutha* @ 4% + vermicompost @1t/ha + *jeevamrutha* @4% as foliar spray at 30 and 55 DAS. Experimental findings revealed that significantly higher percentage of organic carbon, soil microbial population, and soil microbial biomass carbon, available N, P₂O₅ and K₂O, were found highest under the treatment seed biopriming with *beejamrutha* @ 4% +vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS (O₃) during the two years of study.

KEYWORDS: microbial population, organic carbon, available nitrogen, soil microbial biomass carbon, organic management practices

INTRODUCTION

Millets are a group of diverse small seeds grown as crops or grains for human food and feed throughout the world. Foxtail millet is one of the most popular minor millet and is most suitable for many soil types and different weather conditions. It also has high water use efficiency as well as high nutrient use efficiency. Organic farming which conceives on avoidance of agrochemicals, providing insights into long term resource security leads to sustainability, food security and thriving environmental concerns. Presently, global agriculture is facing issues like droughts, famines, salinity, and weather fluctuations. Analogous to climate change, intensive agriculture practices like indiscriminate use of fertilizers and tillage operations to attain the goals of food security cause degradation of soil fertility, nutrient use efficiency and increased erosion of soil. Excessive use of chemical fertilizers contaminates the soil, air and water, reduces the fertility and accessibility of nutrients in the soil, thereby causing environmental hazards. With the natural resources becoming scarcer and increased use of fertilizers leading to the enhanced cost and pressure on farmers. Conventional farming has a predominant impact on attaining the green revolution goals driven mainly by synthetic fertilizers, pesticides and high-yielded crops. Conventional farming, on the contrary, makes a significant amount of chemical pesticides and inorganic fertilizers, which have detrimental effects on the environment and human health. Conventional farming's heavy reliance on synthetic fertilizers leads to nutrient runoff into water sources, thereby causing eutrophication and impairing aquatic ecosystems. Consumers are gradually prioritizing ecologically safe, chemical-free and nutritious foods, prompting a move toward organic practices. Organic farming or increased use of organic manures, at its core, diminishes the usage of synthetic fertilizers, pesticides, growth regulators and livestock feed additives, with sustainability objectives encircling environmental, social and economic dimensions. Diverging from conventional farming, organic farming relies on compost, manure, green manure, and bone meal instead of synthetic fertilizers and pesticides which overall improves the soil physical, chemical and biological health. It is now a well-established fact that organically managed soil exhibits greater soil organic carbon and total nitrogen,

lower nitrate leaching and biological soil quality, so better soil health is inevitable for better growth and development of crop leading to higher production. The crop foxtail millet responds very well to organics due to its low nutrient requirement and it's wide adaptive nature towards any environment.

MATERIALS AND METHODS

The field experiment was conducted in an area of 650 m² at the organic block of Instructional-cum-Research Farm, Assam Agricultural University, Jorhat-13. The experiment was conducted in the site of the farm which was located at 26°47' N latitude, 94°13' E longitude and at an elevation of 86.56 meters above mean sea level. Before laying out of the experiment, representative soil sample was collected randomly from a depth of 0-15 cm for analysis of initial soil physico-chemical and biological properties. The texture of the soil was found to be sandy loam and acidic in reaction and medium in organic carbon. For both the years i.e. 2023 and 2024 available N and K₂O were medium in range whereas P₂O₅ was low. The treatment consisted of two different factors viz., three foxtail millet cultivars C₁: Gossaigaon local, C₂: Majuli local, C₃: SiA-3156 and four organic nutrient management practices. The experiment was laid out in factorial randomized block design (RBD) with three replications.

Table 1: Treatments details of experiments undertaken in foxtail millet

Treatment No.	Treatment details
T ₁	Gossaigaon local + vermicompost @2t/ha
T ₂	Gossaigaon local +seed biopriming with <i>beejamrutha</i> @ 4% solution+ vermicompost @2t/ha
T ₃	Gossaigaon local +seed biopriming with <i>beejamrutha</i> @ 4% solution + vermicompost @1t/ha+ <i>panchyagavya</i> @ 3% as foliar spray at 30 and 55 DAS
T ₄	Gossaigaon local +seed biopriming with <i>beejamrutha</i> @ 4% solution + vermicompost @1t/ha+ <i>jeevamurtha</i> @ 3% as foliar spray at 30 and 55 DAS
T ₅	Majuli local + vermicompost @2t/ha
T ₆	Majuli local +seed biopriming with <i>beejamrutha</i> @ 4% solution + vermicompost @2t/ha
T ₇	Majuli local +seed biopriming with <i>beejamrutha</i> @ 4% solution +vermicompost @1t/ha+ <i>panchyagavya</i> @ 3% as foliar spray at 30 and 55 DAS
T ₈	Majuli local +Seed biopriming with <i>beejamrutha</i> @ 4% solution + vermicompost @1t/ha+ <i>jeevamurtha</i> @ 3% as foliar spray at 30 and 55 DAS
T ₉	SIA 3156+ vermicompost @2t/ha
T ₁₀	SIA 3156+ seed biopriming with <i>beejamrutha</i> @ 4% solution + vermicompost @2t/ha
T ₁₁	SIA 3156+ seed biopriming with <i>beejamrutha</i> @ 4% + vermicompost @1t/ha + <i>panchyagavya</i> @ 3% as foliar spray at 30 and 55 DAS
T ₁₂	SIA 3156 + seed biopriming with <i>beejamrutha</i> @4% + vermicompost @1t/ha+ <i>jeevamurtha</i> @ 3% as foliar spray at 30 and 55 DAS

Plant analysis

The plant samples i.e., both grain and stover which were collected at harvest from each plot were oven-dried at 60°C. The obtained stover samples were converted to the powdered form by using the electric grinder and the grain samples were crushed in mortar and pestle for chemical analysis.

Nutrient content (%)

To determine the N (%) content present in both seed and straw were analyzed by the Kjeldahl method described by Jackson (1973). Phosphorus content (%) present in the samples were estimated by using the Vanadomolybdate yellow colour method (Jackson, 1973) and potassium content was analyzed by using neutral normal ammonium acetate method (Jackson, 1973).

Soil analysis at harvest

Treatment wise the soil samples were collected from a depth of 0-30 cm from the respective plots. The collected samples were air dried and with the help of a 2mm diameter sieve they are sieved. The samples were assessed for soil texture, bulk density, pH, and organic carbon, available Nitrogen, Phosphorus and Potassium and expressed in kg/hectare.

Organic carbon (%)

The organic carbon in soil was estimated as per the guidelines of Walkley and Black (1934). In a 250 ml conical flask, one gram of dried soil and 10 ml K₂Cr₂O₇ (potassium dichromate) was added along with the conc. H₂SO₄ slowly. The flask was shaken thoroughly and left undisturbed for 30 minutes. 200 ml distilled water, 10 ml H₃PO₄ and one ml diphenyl amine indicator were added. The titration with ammonium ferrous sulphate was done till the colour changed from purple to green. The final OC estimation was done with the help of initial and end titration readings.

Available nitrogen in soil

The available N in the soil was estimated by the alkaline potassium permanganate method (Subbaiah and Asija, 1956). 20 grams of air-dried, sieved soil into a 500 ml round- bottom flask or a digestion tube. 100 ml of 0.32% KMnO₄ solution and 100 ml of 2.5% NaOH solution was added into the flask containing the soil. These reagents oxidize the organic matter in the soil to release ammonia (NH₃). The flask was connected to Kjeldahl distillation apparatus. Heat the mixture to boil and distill the ammonia (NH₃) released from the reaction. The released ammonia is trapped in 50ml of 0.02 N sulfuric acid contained in a conical flask placed under the distillation apparatus. The distillation is allowed to continue until approximately 150 ml of the distillate has been collected in the conical flask after ensured that all the ammonia is absorbed by the sulfuric acid during distillation. After distillation is complete, titrate the remaining excess sulfuric acid in the conical flask using a standard sodium hydroxide solution (0.02 N NaOH). Use methyl red or mixed indicator to detect the end point, where the color changes from pink to pale yellow. The amount of ammonia nitrogen released is proportional to the volume of standard NaOH used to titrate the residual H₂SO₄.

Available phosphorous in the soil

The available P in the soil was estimated by Bray's method.

Available potassium in the soil

The available K in the soil was estimated with the help of a flame photometer (Jackson, 1973). Five grams of soil as well as ammonium acetate solution (NH₄OAc) was added to a 250 ml conical flask and shaken on a mechanical shaker for 10 minutes. The pH of the sample was adjusted to 7.0 and the suspension was filtered with Whatman paper no. 1. The final readings were recorded with the help of flame photometer.

Biological properties of soil

For the biological properties of soil estimation, the fresh soil samples were collected from the respective plots and preserved in the refrigerator. The collected soil samples were subjected to laboratory analysis at the laboratory of Soil Microbiology under the Department of Soil Science, Assam Agricultural University, Jorhat under the technical guidance of soil scientists.

Soil microbial population (cfu/g of soil)

For the estimation of the soil microbial population viz., fungi and bacteria, from the depth of 0-15 cm the fresh soil samples were collected from the three different locations in the plot. Through the standard serial dilution technique and pour plate method using various media the microbial population was enumerated. For the enumeration of fungal population and bacterial population, Potato Dextrose Agar (PDA) media and Nutrient Agar (NA) media respectively was used as plating media. Inside a BOD incubator, the cultured plates were incubated at 30 (±) 1°C. After 3rd day and 5th day of incubation the bacterial and fungal population was enumerated with the help of following formula:

Total viable count = Average number of colonies × Size of aliquot × Dilution factor

Soil microbial biomass carbon (µg/g of dry soil)

The soil microbial biomass carbon determination was done with the help of chloroform fumigation-extraction technique (Vance *et al.*, 1987). It was measured from the differences in extractable organic carbon between fumigated and non-fumigated soil and expressed on weight basis as µg/g of dry soil.

Statistical analysis

The data obtained from the investigation wherever relevant was subjected to were statistically analyzed for Factorial Randomized Block Design (RBD) as described by Panse and Sukhatme (1978).

Table : 2 Initial physico-chemical analysis of the soil in the experimental field

Particulars	Values	Textural class/status	Method adopted
A. Physical analysis			
Sand (%)	58.57	Sandy loam in texture	International pipette method (Piper, 1966)
Silt (%)	23.10		
Clay (%)	18.33		
Bulk density (mg/m ³)	1.43		Core sampler technique
B. Chemical analysis			
pH (1:25 soil water suspension)	5.5	Acidic	Glass electrode method (Jackson, 1973)
Organic carbon (%)	0.73	Medium	Wet digestion method (Walkey and Black, 1934)
Available N (kg/ha)	243.56	Medium	Kjeldahl Method (Subbaish and Asija, 1956)
Available P ₂ O ₅ (kg/ha)	17.83	Low	Bray's method (Jackson, 1973)
Available K ₂ O (kg/ha)	140.15	Medium	Neutral normal ammonium acetate method (Jackson, 1973)

Different organic inputs used in the experiment

Table 3: N, P, K content of different bio inputs used in the experiment

Sl. No.	Bioinputs	N (%)	P(%)	K(%)
1	<i>Vermicompost</i>	2.5	0.9	1.61
2	<i>Beejamrutha</i>	0.65	0.40	0.49
3	<i>Panchagavya</i>	1.92	0.28	0.50
4	<i>Jeevamrutham</i>	1.5	0.27	0.28

Table 4: Microbial population of the different bio inputs used in the experiment

Sl. No.	Bioinputs	Bacterial count ($\times 10^6$ cfu /g dry soil)	Fungal count ($\times 10^4$ cfu /g dry soil)
1	<i>Beejamrutha</i>	15.4	10.5
2	<i>Panchagavya</i>	21.90	8.00
3	<i>Jeevamrutham</i>	19.66	7.33

RESULT & DISCUSSION

N, P, K content and uptake in plants at harvest

NPK content in plants

The ability of nutrient absorption of a crop is influenced by its physiological mechanisms and availability of nutrients in soil. N, P, K content in grain as well as stover as affected by different cultivars and organic management practices are presented in Table 5 & 6.

Effect of cultivars

The data relevant to NPK content in grain and stover was found to be significant by the influence of foxtail millet cultivars. The highest N content (1.46% in 2023 and 1.46% in 2024), P content (0.38% in 2023 and 0.39% in 2024), K content (0.47% in 2023 and 0.47% in 2024) in grain was obtained by the cultivar SiA-3156 which was at par with Gossaigaon local cultivar. In case of stover also the highest N content (0.48% in 2023 and 0.49% in 2024), P content (0.12% in 2023 and 0.12% in 2024), K content (0.27% in 2023 and 0.27% in 2024) was obtained by the cultivar SiA-3156. The lowest N, P, K content in grain and stover was found in Majuli local cultivar.

Effect of organic management practices

Among different recommended organic practices, O₃ i.e., seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS was recorded the highest N (1.45% and 1.46%), P (0.38% and 0.39%), K (0.47% and 0.48%) content in grain and in case of stover the highest N (0.48% and 0.49%), P (0.11% and 0.12%) and K (0.28% and 0.28%) content which was at par with the treatment O₄ i.e., seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *jeevamrutha* @ 3% as foliar spray at 30 and 55 DAS. It might be due to the application of foliar sprays at proper intervals which contains huge amount of effective microorganisms and growth regulating hormones, which improved the biological efficiency of the crop by regulating the metabolic processes in the plant thereby creating a effective source sink relationship which could have contributed to better absorption and translocation of nutrients ultimately increased the nutrient content in the plant. Abdullahi *et al.* (2014) also reported similar findings in organic pearl millet.

Interaction effect

Interaction effect between cultivars and organic management practices on NPK content in grain and stover was found to be non significant.

Table 5: Effect of cultivars and organic management practices on NPK content in grains of foxtail millet

Treatment	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
	2023	2024	2023	2024	2023	2024
Cultivars						
C ₁ = Gossaigaon local	1.43	1.44	0.36	0.37	0.45	0.46
C ₂ = Majuli local	1.43	1.43	0.35	0.36	0.43	0.45
C ₃ = SiA-3156	1.45	1.46	0.38	0.39	0.47	0.47
S.Em (±)	0.003	0.002	0.003	0.002	0.007	0.005
C.D. (P=0.05)	0.008	0.007	0.008	0.006	0.021	0.014
Organic management practices						
O ₁ = Vermicompost@ 2t/ha	1.42	1.43	0.36	0.37	0.43	0.44

O ₂ = Seed biopriming with <i>beejamurtha</i> @ 4% +vermicompost @2t/ha	1.43	1.44	0.36	0.36	0.44	0.44
O ₃ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>panchagavya</i> @ 3% as foliar spray at 30 and 55 DAS	1.45	1.46	0.38	0.39	0.47	0.48
O ₄ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>jeevamrutha</i> @ 3 % as foliar spray at 30 and 55 DAS	1.44	1.45	0.37	0.38	0.45	0.46
S.Em(±)	0.003	0.003	0.003	0.009	0.009	0.006
C.D. (P=0.05)	0.008	0.009	0.008	0.027	0.027	0.017
Interaction	NS	NS	NS	NS	NS	NS

Table .6 Effect of cultivars and organic management practices on N, P, K content in stover of foxtail millet

Treatment	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
	2023	2024	2023	2024	2023	2024
Cultivars						
C ₁ = Gossaigaon local	0.48	0.49	0.10	0.11	0.27	0.26
C ₂ = Majuli local	0.47	0.46	0.09	0.10	0.26	0.26
C ₃ = SiA-3156	0.48	0.49	0.12	0.27	0.27	0.27
S.Em (±)	0.002	0.003	0.003	0.002	0.004	0.004
C.D. (P=0.05)	0.006	0.009	0.009	0.006	0.011	0.012
Organic management practices						
O ₁ = Vermicompost@ 2t/ha	0.46	0.46	0.10	0.10	0.25	0.25
O ₂ = Seed biopriming with <i>beejamurtha</i> @ 4% +vermicompost @2t/ha	0.47	0.47	0.10	0.11	0.26	0.26
O ₃ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>panchagavya</i> @ 3% as foliar spray at 30 and 55 DAS	0.49	0.50	0.11	0.12	0.28	0.28
O ₄ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>jeevamrutha</i> @ 3 % as foliar spray at 30 and 55 DAS	0.48	0.49	0.10	0.11	0.27	0.26
S.Em(±)	0.002	0.003	0.003	0.003	0.004	0.004
C.D. (P=0.05)	0.006	0.010	0.009	0.008	0.012	0.011
Interaction	NS	NS	NS	NS	NS	NS

Available N, P₂O₅, K₂O status of soil at harvest

Data on N, P₂O₅ and K₂O (kg/ha) of foxtail millet at harvest are shown in Table 7. The available soil nutrients were significantly influenced by foxtail millet cultivars and organic management practices.

Effect of cultivars

The data relevant to available N, P₂O₅, and K₂O status of soil at harvest were significantly varied by different cultivars. The highest available nutrients (N- 232.77 kg/ha and 231.77 kg/ha in 2023 and 2024 respectively, P₂O₅- 18.46 kg/ha and 18.71 kg/ha in 2023 and 2024 respectively, K₂O- 144.05 kg/ha and 143.04 kg/ha in 2023 and 2024, respectively) found under the cultivar SiA-3156 cultivar. The lowest available nutrient status (N- 226.15 kg/ha and 225.67 kg/ha in 2023 and 2024) respectively, P₂O₅- 17.53 kg/ha and 17.57 kg/ha in 2023 and 2024 respectively, K₂O- 138.83 kg/ha and 139.17 kg/ha in 2023 and 2024, respectively) under Majuli local cultivar.

Effect of organic management practices

Available N, P₂O₅, K₂O status of soil at harvest significantly influenced by different organic management practices. Estimated data revealed that the highest available nutrients (N- 235.89 kg/ha and 231.89 kg/ha in 2023 and 2024 respectively, P₂O₅- 23.25 kg/ha and 22.62 kg/ha in 2023 and 2024 respectively, K₂O-142.31 kg/ha and 141.40 kg/ha in 2023 and 2024, respectively) found under the treatment under the treatment O₃ i.e. seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS was followed by the treatment which was at par with the treatment O₄ i.e., seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *jeevamrutha* @ 3% as foliar spray at 30 and 55 DAS. This could be attributed to continuous and steady supply of nitrogen, which increased the root exudates that act as a substrate for microorganisms and promote nitrogen mineralization, thus increasing greater availability of nitrogen status in soil. Various organic acids produced during

the decomposition of organics that solubilizes phosphate which reduces phosphorus fixation and also decreases potassium fixation due to its capacity to hold potassium in plant available form.

Interaction effect

Interaction effect between cultivars and organic management practices on available NPK status in soil at harvest (kg/ha) in plants was found to be non significant.

Table 7. Effect of cultivars and organic management practices on available N P₂O₅, K₂O and organic carbon (%) status of soil at harvest of foxtail millet

Treatment	N (kg/ha)		P ₂ O ₅ (kg/ha)		K ₂ O (kg/ha)		Organic carbon (%)	
	2023	2024	2023	2024	2023	2024	2023	2024
Cultivars								
C ₁ = Gossaigaon local	244.49	240.19	23.38	22.37	141.86	140.77	0.74	0.73
C ₂ = Majuli local	238.25	234.08	23.63	22.66	144.07	143.10	0.73	0.74
C ₃ = SiA-3156	225.85	223.60	22.96	21.93	135.47	138.13	0.74	0.74
S.Em (±)	0.56	0.53	0.04	0.06	0.07	0.08	0.001	0.001
C.D. (P=0.05)	1.67	1.57	0.12	0.17	0.20	0.23	NS	NS
Organic management practices								
O ₁ = Vermicompost@ 2t/ha	240.68	238.02	23.62	22.17	141.18	139.74	0.73	0.73
O ₂ = Seed biopriming with <i>beejamurtha</i> @ 4% +vermicompost @2t/ha	237.28	234.50	23.42	22.47	141.86	141.03	0.73	0.74
O ₃ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>panchagavya</i> @ 3% as foliar spray at 30 and 55 DAS	235.89	231.89	23.25	22.62	142.31	141.40	0.74	0.75
O ₄ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>jeevamrutha</i> @ 3 % as foliar spray at 30 and 55 DAS	230.93	227.05	23.03	22.07	141.18	140.50	0.74	0.74
S.Em(±)	0.65	0.61	0.14	0.07	0.08	0.09	0.004	0.003
C.D. (P=0.05)	1.92	1.82	0.42	0.21	0.24	0.26	0.012	0.010
Interaction	NS	NS	NS	NS	NS	NS	NS	NS
Initial value	243.56	243.56	17.83	17.83	136.15	136.15	0.73	0.73

Table 8. Effect of cultivars and organic management practices on biological properties of soil at harvest of foxtail millet

Treatment	Bacterial population (× 10 ⁶ cfu g ⁻¹)		Fungal population (× 10 ⁴ cfu g ⁻¹)		Soil microbial biomass carbon (µg/g of soil)	
	2023	2024	2023	2024	2023	2024
Cultivars						
C ₁ = Gossaigaon local	5.76	5.87	4.12	4.12	340.43	339.34
C ₂ = Majuli local	5.82	5.86	4.10	4.11	339.22	338.14
C ₃ = SiA-3156	5.90	5.92	4.12	4.13	341.43	340.57
S.Em (±)	0.04	0.03	0.01	0.01	0.39	0.38
C.D. (P=0.05)	NS	NS	NS	NS	1.16	1.12
Organic management practices						
O ₁ = Vermicompost@ 2t/ha	5.43	5.52	4.08	4.10	338.22	337.22
O ₂ = Seed biopriming with <i>beejamurtha</i> @ 4% +vermicompost @2t/ha	5.63	5.66	4.10	4.11	338.80	338.14
O ₃ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>panchagavya</i> @ 3% as foliar spray at 30 and 55 DAS	6.18	6.23	4.14	4.15	343.18	341.84

O ₄ = Seed biopriming with <i>beejamurtha</i> @ 4% + vermicompost @ 1t/ha + <i>jeevamrutha</i> @ 3 % as foliar spray at 30 and 55 DAS	6.02	6.12	4.12	4.13	341.22	340.22
S.Em(±)	0.05	0.04	0.01	0.01	0.45	0.44
C.D. (P=0.05)	0.14	0.12	0.03	0.03	1.35	1.29
Interaction	NS	NS	NS	NS	NS	NS

Soil microbial population

Data relevant to microbial population in soil are represented in Table 8.

Effect of cultivars

The effect of cultivars on both bacterial and fungal population was found to be non significant. However, maximum value in bacterial population and fungal population was recorded under SiA-3156 cultivar.

Effect of organic management practices

Microbial population in soil was significantly influenced by different organic management practices. Bacterial population (6.18×10^6 cfu g⁻¹ and 6.23×10^6 cfu g⁻¹ in the year 2023 and 2024 respectively), fungal population (4.14×10^4 cfu g⁻¹ and 4.15×10^4 cfu g⁻¹ in the year 2023 and 2024, respectively) were recorded highest under the treatment O₃ i.e., seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS which was at par with the treatment O₄ i.e., seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *jeevamrutha* @ 3% as foliar spray at 30 and 55 DAS (Bacterial population 6.02×10^6 cfu g⁻¹ and 6.12×10^6 cfu g⁻¹ in the year 2023 and 2024 respectively and fungal population 4.12×10^4 cfu g⁻¹ and 4.13×10^4 cfu g⁻¹ in the year 2023 and 2024, respectively). The increase in microbial count could be attributed to easily available micronutrients due to the application of panchagavya, jeevamrutham and organic manure act as sources of organic carbon for the build up of microbial population. There was no significant effect was found between the cultivars and organic management practices with respect to microbial population.

Soil microbial biomass (µg/g of soil) carbon of soil at harvest

Data recorded on soil microbial biomass carbon and microbial population are presented in Table 4.23.

Effect of cultivars

Data relevant to soil microbial biomass carbon (µg/g of soil) was significantly influenced by different cultivars. Among different cultivars SiA-3156 recorded highest microbial biomass carbon (341.43 µg/g and 340.57 µg/g during the year 2023 and 2024, respectively).

Effect of organic management practices

Different organic management practices influenced the soil microbial biomass carbon (µg/g of soil) of soil at harvest. Estimated data revealed that highest soil microbial biomass carbon (343.18 µg/g and 341.84 µg/g in the year 2023 and 2024, respectively) was found with the application of treatment O₃ i.e., seed biopriming with *beejamurtha* @4% + vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS which was followed by the treatment O₄ i.e., seed biopriming with *beejamurtha* @ 4% + vermicompost @ 1t/ha + *jeevamrutha* @ 3 % as foliar spray at 30 and 55 DAS (341.22 µg/g and 340.22 µg/g in the year 2023 and 2024, respectively). It might be due to rise in microbial biomass carbon in response to increasing amount of organic manures and formulations. Due to the application of easily decomposable organic manures like vermicompost, beejamrutham which stimulate microbial activity in the soil or also it incorporates various exogenous microorganisms which lead to increase in microbial biomass carbon (Perucci, 1992).

CONCLUSION

All three cultivars and organic management practices significantly influenced soil nutrient status and microbial population of soil in foxtail millet. The status of available N, P₂O₅, K₂O at harvest recorded highest in treatment O₃ (seed biopriming with *beejamrutha* @ 4% +vermicompost @ 1t/ha + *panchagavya* @ 3% as foliar spray at 30 and 55 DAS) for both the years. Soil properties like organic carbon, soil microbial biomass carbon, soil microbial population in the soil after harvest recorded highest in the treatment O₃ for both the years.

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