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Soil Microbial Community, Enzymatic Activity, And Yield Under Natural Farming In Maize *(zea Mays L.)*

Malla Reddy M*, Vinay G and Padmaja B

Department of Agronomy, Agricultural College, Professor Jayashankar Telangana State Agricultural University, Jagtial-505 327 Telangana State, India.

ABSTRACT

The present study was carried out to evaluate natural farming and the performance of maize in comparison with inorganic and organic farming. The highest grain yield was recorded in the inorganic method, which was superior to organic and natural farming. In turn, organic farming was superior by 55 % to the natural farming method. Particularly, the grain yield of DHM 117 hybrid, in inorganic farming was 342 % higher than in Aswini variety whereas, it was 131, 176 percent higher in organic and natural farming methods, respectively. Similarly, stover yield in the inorganic method was 55 and 89 % higher than in organic and natural farming, respectively. The population of microbes (bacteria and fungi) in the organic method was significantly superior to inorganic and natural methods. Significantly higher urease and dehydrogenase activity was recorded in the organic method over inorganic and natural farming. Notably higher organic carbon content was left in the soil after maize crop in the organic method over the other methods, while pH and EC did not change due to farming methods or variety/hybrid. Higher, available N and K2O were recorded in inorganic farming while available P2O5 and Zn were higher in organic farming.

Keywords: *Organic farming, Natural Farming, Chemical farming, Microbial population, etc.*

INTRODUCTION

Population growth and climate change challenge the country's food needs and provide arguments for an increased intensification of agriculture [1]. The green revolution technology served as a boon to the nation and within no time it has become the bane leading to adverse impacts like stagnating crop productivity, soil degradation, biodiversity losses, the rising cost of cultivation, and greenhouse gas emissions [2]. Therefore, the possible options were organic farming [3], [4] and natural farming [5], [6], [7] which are the ecological or regenerative agriculture approaches that are based on making optimal use of internal natural resources and processes (Jeevamritha, Beejamrutha, Neemastra, mulching, FYM, vermicompost, etc.) without application of any kind of chemicals to the soil biosystems [8]

Globally, the demand for organic food is more than the conventionally grown products [9] but the crop productivity of the former is lower than the latter [10]. At the same time, organic production systems have the potential to contribute to a sustainable ecosystem through better soil microbial diversity and the build-up of soil organic matter (SOM) [11].

**Corresponding Author: Malla Reddy M*
Email Address: ganeshamaduru@gmail.com

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Soil is a complex ecosystem hosting bacteria, fungi, plants, and animals [12]. For sustainable farming, healthy soil is the most important factor. Beneath the imprint of one's foot, extending down into the soil, are 300 miles of mycorrhizal fungal hyphae. In healthy soil, these fungi together with the full coteries of soil microbes help in the regeneration, resilience, and revitalization of the soil system making all needed nutrients available to the plants through fixation, decomposition, solubilisation, and mineralization [13].

The practices of natural farming include the use of Jeevamritha, Beejamrutha, Neemastra, and mulching. In all these practices, cow dung or cow urine and undisturbed soil are crucial for the development of diverse microorganisms. [14] found that many cow dung microorganisms have shown a natural ability to increase soil fertility through phosphate solubilization. Cow dung has an antifungal substance that inhibits the growth of coprophilous fungi. Jeevamritha is a fermented microbial culture that provides nutrients, but most importantly, acts as a catalytic agent that promotes the activity of microorganisms in the soil, and also increases the population of native earthworms. Beejamrutha is effective in protecting young roots from fungus as well as from soil-borne and seed-borne diseases that commonly affect plants after the monsoon period [5]. Moreover, mulching has a huge positive effect on soil organic carbon (SOC) content due to enhanced soil and water conservation, return of biomass to the soil, and formation of humus through the activity of the soil fauna that increases soil biodiversity.

To sustain plant production under organic fertilization, soils inevitably need a high capacity to break down organically bound nutrients into minerals, which then become available to plants.

Extracellular microbial enzymes such as ureases break down urea into carbon dioxide and ammonia, which makes this enzyme as a potential indicator for soil microbial mineralization capacity, whereas to assess soil microbial activity, dehydrogenase serves as a widely used indicator. Dehydrogenase activity reflects intracellular microbial redox processes, thus functioning as an indicator for soil microbial metabolic activities.

Maize is an exhaustive crop and has wide adaptability and may be a potential crop under the organic production system [15] However, it has been assumed that the cultivation of high-yielding varieties is not possible under organic farming as they demand more nutrients which cannot be fulfilled by organic sources due to slow release pattern but experimental findings revealed that they still maintain the good organic matter content which helps the plant to uptake nutrients for a longer time [16]. The identification of varieties for organic production plays an important role in crop production [17] [18]. Therefore, the present study was carried out to find out soil microbial changes and soil fertility status under natural farming in comparison to organic and chemical farming in maize.

MATERIALS AND METHODS

A) Experiment details:

The experiments were carried out in rainy and rainy seasons during 2016-17 in the same plots at Agricultural College, Jagtial, Telangana State, India. It falls under a semi-arid climatic region situated at an altitude of 243.4 m above mean sea level at 18049'40'' N latitude and 78056'45'' E longitude. The weekly mean minimum and maximum temperatures during the rainy season ranged from 17.70C to 33.40C respectively. Mean relative humidity ranged from 51.1 to 93.1% and the wind speed ranged between 1.0 to 6.6 km/hr and the evaporation rate ranged from 0.8 to 4.2 mm. A total of 668.5 mm of rainfall was received over 40 rainy days. Correspondingly, the weekly mean minimum and maximum temperatures during the post-rainy season ranged from 19.50C and 40.70C, respectively. Mean relative humidity ranged between 53.9 and 74.3% and the wind speed ranged between 0.6 and 3.7 km /hr and the evaporation rate ranged from 3.0 to 4.0 mm. A total of 5 mm of rainfall was received during the season. The experimental soil was sandy clay loam in texture, neutral in reaction (7.65), normal electrical conductivity (0.074 d S/m), and low in organic carbon content (0.47%). The available N, P2O5, K2O, and Zinc contents were 164, 43, 277kg/ha, and 0.3 ppm, respectively. Deccan Hybrid Maize 117 (DHM 117) and Cultivar Aswini were used in the study. Compared to the hybrid vs cultivar in the present study because it was advocated to use the seeds of indigenous cultivars in the principles of natural farming to avoid external inputs and the cultivar seed can be used for a few seasons without purchasing from outside the farm.

B) Experiment layout:

The experiment was laid out in randomized block design with factorial concept replicated three times. Eight treatment combinations were taken viz., factor I: Hybrid vs cultivar:2 (V1: DHM-117, V2: Aswini), factor II: Farming methods: 4, F1: Control (no fertilizers or manures), F2: Zero Budget Natural Farming (Seed treatment with Beejamrutha + application of Jeevamrutha at fortnightly intervals + mulching with organic residues + plant protection with natural pesticides/fungicides like Neemastram, Agnastram and Pullatimajjiga (Fermented butbuttermilF3: Organic farming [FYM @ 20 t/ha (basal) + Vermicompost @ 5 t/ ha each at knee high stage and tasselling stage (top dressing) + plant protection with organic products + manual weeding] and F4: Chemical farming (recommended dose of 200:60:50 kg/ha of N:P2O5:K2O as urea, didiammonium phosphate and muriate of potash + pest and weed control with chemical based pesticides).

After the land preparation, maize seeds were sown at 60 cm x 20 cm in a plot area of 43.2 m2 with 12 rows per each plot. Duringthe post rainy season, the plots were not disturbed and were assigned with the same set of treatments as done in rainy season. Field preparation was done with a small rotary tiller followed by leveling with hand-operated implements. A seed rate of 20 kg/ha was adopted. Thinning and gap filling was done 12 days after germination and one healthy seedling per hill was maintained. The crop was principally raised with incident rainfall with supplementing irrigation during rainy season whereas totally under irrigation during post rainy season.

C) Preparation of organic decoctions

Different formulations used in natural farming were prepared as per the protocols described [8]. Beejamrutha was prepared by mixing 5 kg desi cow dung, 5 liters of desi cow urine, 50 g lime, and 100 g soil from ant hill with 20 liters of water and kept overnight for fermentation. On the day of sowing, maize seeds were soaked in the Beejamrutha solution and dried in the shade before sowing. Jeevamrutha was prepared by placing 200 liters of water in a barrel and adding 10 kg fresh desi cow dung, 10 liters of desi cow urine, 2 kg each of jaggery and chickpea flour and 100 g of soil from ant hill. The mixture was fermented for 3 days in shade conditions. It was used for spraying in the field after filtering. Mulching was done with the use of paddy straw (8 inch layer) when the crop was at 3-4 leaf stage. Neemasthram was prepared by mixing of 10 liters of cow urine, 5 kg of cow dung, and 10 kg neem leaves (Azardiracta indica) in 200 liters of water and fermented for 5 days in shade condition. This fermented solution was applied as repellent in the form of a spray. Agnasthram was prepared by mixing the 10 kg neem leaves paste, 3 kg tobacco leaf powder, 3 kg garlic paste and 4 kg green chillies paste.

In control treatment and organic farming method, the weeds were controlled by hand weeding at 10 days intervals up to 50 DAS. While in natural farming, mulch acted as a weed suppresser. Pre-emergence application of Atrazine 50 % WP @ 3.75 kg/ ha with hand weeding at 10 and 40 DAS was practiced in the chemical farming method.

Fertilizer management in natural farming through basal application of ganajeevamrutha (solid form) @ 500 kg/ ha was followed by Jeevamrutha (liquid form) @ 500 L/ ha along with irrigation water starting from 15 DAS till harvest at 15 days interval. When rainfall occurred, it was sprayed directly on the soil through knapsack sprayer. While in organic farming, FYM was applied basally @ 20 tonnes/ha and vermicompost was applied @ 5 tonnes ha-1each at knee high and tasseling stages and in chemical farming, a recommended dose of 200:60:50 kg/ ha of N: P2O5:K2O as urea, di ammonium phosphate and murate of potash was applied, respectively. Nitrogen and potassium was applied in three equal splits i.e., as basal dose, at knee high and at flowering stage. The recommended dose of phosphorous was applied as a basal dose.

Plot-wise composite soil samples from 0-15 cm were taken with the help of tube auger. The sample soil was air –dried, processed, and passed through a sieve of 2 mm for estimating the microbial population. Dehydrogenase activity and urease activity were determined by using methods given by [19], [20], respectively. The data were analyzed statistically applying the analysis of variance technique for randomized block design (RBD) with factorial concept as suggested by [21]. Critical difference for examining the treatment means for their significance was calculated at 5 per cent level of probability.

RESULTS AND DISCUSSION

The grain yield of maize has shown large variations due to different farming methods. The grain yield of maize was maximum in inorganic farming during both seasons (*kharif* - 3431; *rabi* – 3701 kg/ ha) with an excess of 90.44 and 95.08 percent over that in absolute control (*kharif* -328; *rabi* – 182 kg/ ha) (Table 1). Application of inorganic fertilizers might had supplemented to the immediate nutrient requirement of the crops resulting in higher yields during both seasons. On the other hand, the yield of maize due to organic and natural farming was noted to be 1378 and 888 kg/ha which was just 40.16 and 25.88 per cent of the yield obtained in inorganic farming during *kharif*. Similarly, during *rabi* the yields under organic and natural farming were 1926 and 628 kg/ ha which accounted to 52.04 and 16.97 per cent of the yield obtained in inorganic farming. The crop in organic farming has managed to attain half the yield obtained in inorganic farming. But under natural farming, the crop growth and expression were less and hence yield was meager. An overview of different farming methods indicated a probable gradual release of nutrients to the consequent crop during *rabi* in organic farming against the natural farming method as the yield of subsequent *rabi* crop has increased in this method as compared to that in natural farming. In naturing farming, there was a considerable decrease in the yield of the crop following *kharif* crop. Conversion of conventional systems to organic agriculture can result in a reduction in yield [22] and lower temporal yield stability [23]. Yield differences between organic and conventional (inorganic) farming vary considerably with growing conditions, management practices, and crop types, with legumes showing a considerably smaller yield gap than cereals or tubers [10].

Among the varieties, DHM 117 was parred excellent than Ashwini in achieving higher yields in any type of farming method or season. The yield of DHM 117 was higher during *kharif* (2342 kg/ ha) than in rabi (2152 kg/ ha) in all the farming methods except in organic farming. Whereas, Ashwini fared well during *rabi* (1067 kg/ ha) than in *kharif* (671 kg/ ha) irrespective of the farming methods. During both seasons, the variety DHM 117 with inorganic management has produced maximum grain yield (*kharif* – 5596; *rabi* – 5223 kg/ ha) over all the other treatment combinations.

However, with grain yield, the stover yield of maize during both *kharif* and *rabi* seasons varied significantly due to farming methods and varieties (Table 2). Inorganic farming resulted in the highest stover yield of maize during both *kharif* (6732 kg/ha) and rabi (5843 kg/ha) which is 3.62 and 3.49 times higher, respectively than in absolute control. The crop under organic farming has recorded 64.72 and 70.97 per cent that of inorganic stover yield during *kharif* and *rabi*, respectively. Whereas, the crop in natural farming marked up to 52.87 and 46.88 per cent that of inorganic stover yield during both seasons, respectively. Readily available nutrients for the crops uptake might had resulted in higher synthesis and accumulation of the assimilates in the dry matter witnessing higher stover yields in inorganic farming method. Compared to grain yields, the stover yields in organic and natural farming methods earmarked >50 % stover yields, respectively that of inorganic management which confirms slow release of nutrients through the organic sources in these methods. However, it is understood that the crop in the above farming methods has inclined to apportioning nutrients more to biomass than to the grain. Similar to the grain yield, the stover yields in all the farming methods were more during kharif than under *rabi*.

Congruent to grain yield, the stover yields of maize were highest with DHM 117 during both seasons (*kharif* – 6406; *rabi* – 4536 kg /ha), indicating its dependability for yields (grain/stover) in any type of farming method. Similar to the grain yield result, the stover yield of Ashwini was highest in rabi (2666 kg /ha) than *kharif* (1847 kg /ha). However, in any of the season the stover yield recorded by Ashwini was ≤50 per cent of that by DHM 117. In both seasons, DHM 117 with inorganic management was found outstanding with the highest stover yields (*kharif* – 9969; *rabi* – 7227 kg /ha) over the other farming methods.

The soil microbial activity measured in terms of urease and dehydrogenase activity indicated significant differences only due to farming methods. The varieties or their interaction with farming methods presented insignificant differences in either of the seasons.

The urease and dehydrogenase activities measured showed a gradual increase in microbial population up to 60 DAS and there after a dethereafterrds harvest indicating mineralization of the nutrients from 60 DAS due to degeneration of the microbial population in the soil irrespective of the farming methods (Table 3). The urease activity in the soil differed over the seasons in different farming methods. It was maximum in organic farming during *kharif,* while in the inorganic method during *rabi* at all the stages of sampling. Conversely, the dehydrogenase activity was maximum in organic farming method alone in either of the seasons. [24] also noticed the highest activity of the enzymes, especially dehydrogenase, and urease in the organically farmed soil, which was characterized by a higher accumulation of soil organic matter. Dehydrogenases are commonly found in organic matter-rich soils and they are regarded as good indicators of the respiratory metabolism of microbes [25]. [26] reported that ureases participate in ammonification, during which ammonia is released from urea, amino acids, and purine in the processes associated with soil organic matter transformations that occur with the participation of soil microorganisms and their enzymes . The increase in urease activity in inorganic farming during *rabi* might be due application of urea as a source of nitrogen which probably had increased the abundance of both ureolytic and non-ureolytic bacteria [27]. Though an account of ureolytic bacteria was not taken in the present study, a higher bacterial count than the fungal count confirms the above result.

The fungal and bacterial count observed in the maize soil varied significantly due to farming methods alone during both seasons. The varieties and their interaction with the farming methods have no significant impact (Table 4). Irrespective of the seasons, the microbial count (Fungi and bacteria) was highest in the organic farming method at different dates of sampling. The fungal count in the organic farming method during *kharif* was 8.25 (30 DAS), 14.67 (60 DAS), 10.25 (harvest), and during *rabi* – 10.08 (30 DAS), 15.83 (60 DAS), 11.42 (harvest) (x 105) CFU/ g dry soil. The bacterial count in the organic farming method during *kharif* was – 19.00 (30 DAS), 29.0 (60 DAS), 22.5 (harvest), and during *rabi* – 16.58 (30 DAS), 34.0 (60 DAS), 26.83 (harvest) (x 105) CFU/ g dry soil. It has been observed that both the fungal and bacterial counts are higher during *rabi* than *kharif.* More aerated conditions, higher soil temperatures and carbon sources than *kharif* might had resulted in a higher population of microorganisms during *rabi*. Among the microbial communities, the bacterial population was higher than the fungal population during both seasons and it was noted that the population count of both the communities increased up to 60 DAS and thereafter decreased towards the harvest of maize. A similar result was obtained by [28] with higher bacterial counts than fungal counts in different farming methods and both the populations were highest in organic farming method. Addition of FYM to the soil might have served as a source of carbon and energy for these microorganisms resulting in their multiplication and increased population.

The soil chemical properties studied in terms of available nitrogen, phosphorus, potassium, and zinc differed significantly due to farming methods alone. No significant response was observed with varieties and their interaction with the farming methods. The availability of soil nutrients viz., nitrogen, phosphorus, potassium and zinc were higher in organic farming methods during both seasons (Table 5). However, the soil available nitrogen in natural (132.7 kg /ha) and inorganic (160.6 kg /ha) farming methods were found at par to organic faming during *kharif*, while inorganic (190.3 kg /ha) farming alone was found equivalent to organic farming during *rabi*. With regards to potassium availability, the inorganic farming method was found at par to organic method similar to available nitrogen during both seasons. While, natural farming method was equivalent to organic farming only during *rabi*. Higher nutrient availability in organic and natural farming plots may be attributed to the mineralization of the nutrients and high enzyme activity causing the transformation of nutrients to available forms. Whereas in the inorganic farming plots, non-extraction of native nutrients due to external application and considerable enzyme activity might have transformed the native soil nutrients into the available forms.

Among the different soil physical parameters measured, except soil organic carbon, the soil pH and EC did not differ significantly due to different farming methods or maize varieties or their interaction in this consecutive two-season study (Table 6). However, the soil organic carbon was noted to vary due to different farming methods alone during both the seasons and it was maximum in the organic farming method (*kharif* – 0.76; *rabi* – 0.75 %).

Scientific studies on dynamics of soil microbial populations with organic and natural farming practices under different cropping systems is need of hour.

Table 1. Grain yield of maize as influenced by different farming methods.

Kharif

Treatments	Grain yield (kg/ ha)				
	Absolute control	Natural farming	Organic farming	Inorganic Farming	Mean
DHM 117	546	1304	1923	5596	2342
Aswini	111	473	834	1266	671
Mean	328	888	1378	3431	
Factors	SEm(±)	C.D. (0.05)			
Farming method	79	242			
Variety/hybrid	56	171			
Interaction	112	342			

Rabi

Treatments					
	Absolute control	Natural farming	Organic farming	Inorganic Farming	Mean
DHM 117	286	739	2361	5223	2152
Aswini	78	518	1490	2180	1067
Mean	182	628	1926	3701	
Factors	SEm(±)	C.D. (0.05)			
Farming method	60	183			
Variety/hybrid	43	130			
Interaction	85	259			

Table 2. Stover yield of maize as influenced by different farming methods.

Kharif

Treatments	Stover yield (kg /ha)				
	Absolute control	Natural farming	Organic farming	Inorganic farming	Mean
DHM 117	3298	5802	6557	9969	6406
Aswini	420	1315	2158	3495	1847
Mean	1859	3559	4357	6732	
Factors	SEm(±)	C.D. (0.05)			
Farming method	175	533			
Variety/hybrid	124	377			
Interaction	248	754			

Rabi

Treatments					
	Absolute control	Natural farming	Organic farming	Inorganic farming	Mean
DHM 117	2384	3475	5058	7227	4536
Aswini	965	2003	3236	4459	2666
Mean	1674	2739	4147	5843	
Factors	SEm(±)	C.D. (0.05)			
Farming method	135	410			
Variety/hybrid	96	290			
Interaction	191	580			

Table 3. Urease activity and Dehydrogenase activity in the rhizosphere of maize as influenced by different farming methods.

Treatments	Urease activity (μg NH_4^+ /g /2 h)						Dehydrogenase activity (μg TPF/ g /day)					
	30 DAS		*60 DAS*		*Harvest*		*30 DAS*		*60 DAS*		*Harvest*	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
DHM 117	41.88	44.00	54.50	63.17	25.92	30.42	1.33	1.65	1.95	2.20	1.43	1.49
Aswini	43.04	44.70	55.83	64.63	26.96	33.00	1.28	1.70	1.79	2.21	1.41	1.53
SEm(±)	1.03	1.07	1.45	1.19	0.76	0.92	0.02	0.05	0.06	0.07	0.03	0.03
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Absolute control	31.00	33.42	39.17	53.17	18.83	24.33	0.82	1.13	1.03	1.75	0.96	1.04
Natural farming	42.50	42.58	55.50	61.25	25.83	28.50	1.34	1.66	2.15	2.30	1.45	1.61
Organic farming	52.92	47.25	68.33	68.42	33.25	34.67	1.65	2.08	2.29	2.62	1.72	1.81
Inorganic farming	45.42	54.20	57.67	72.75	27.83	39.33	1.42	1.82	2.01	2.16	1.54	1.58
SEm(±)	1.46	1.51	2.05	1.69	1.07	1.29	0.03	0.07	0.08	0.10	0.05	0.05
CD (0.05)	4.42	4.59	6.21	5.12	3.26	3.93	0.10	0.20	0.24	0.31	0.15	0.14
Interaction												
SEm(±)	2.06	2.14	2.90	2.39	1.52	1.83	0.05	0.09	0.11	0.14	0.07	0.06
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

TPF: Tri phenyl formazan

Table 4. Fungal and Bacterial population in the rhizosphere of maize as influenced by different farming methods.

Treatments	Fungi (x 10^5 CFU/ g dry soil)						Bacteria (x 10^7 CFU/ g dry soil)					
	30 DAS		*60 DAS*		*Harvest*		*30 DAS*		*60 DAS*		*Harvest*	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
DHM 117	5.88	7.63	10.08	11.08	7.38	8.29	12.q	15.21	20.42	24.18	14.79	17.54
Aswini	6.08	7.92	10.38	11.79	7.71	8.71	13.38	15.92	21.50	25.8	14.50	18.21
SEm(±)	0.16	0.19	0.29	0.31	0.20	0.24	0.35	0.39	0.57	0.68	0.54	0.42
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Absolute control	5.25	6.83	8.25	9.25	6.17	7.00	9.08	11.08	16.67	20.92	11.92	13.67
Natural farming	6.92	9.17	11.92	13.08	8.08	8.92	14.75	16.58	24.50	27.65	16.83	20.33
Organic farming	8.25	10.08	14.67	15.83	10.25	11.42	19.00	12.25	29.00	34.0	22.50	26.83
Inorganic farming	3.50	5.00	6.08	7.58	5.67	6.67	9.33	12.33	13.67	16.33	7.33	10.67
SEm(±)	0.23	0.27	0.41	0.44	0.28	0.34	0.50	0.55	0.81	0.96	0.54	0.59
CD (0.05)	0.69	0.81	1.23	1.33	0.86	1.04	1.52	1.67	2.46	2.92	1.62	1.78
Interaction												
SEm(±)	0.32	0.38	0.58	0.62	0.40	0.48	0.71	0.78	1.15	1.36	0.76	0.83
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 5. N, P_2O_5, K_2O, and Zn content of soil after harvest of maize as influenced by different farming methods.

Treatments	Available N (kg /ha)		Available P_2O_5 (kg /ha)		Available K_2O (kg /ha)		Available Zn (ppm)	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
DHM 117	134.4	151.1	41.99	48.03	334.0	326.1	0.17	0.24
Aswini	142.0	160.0	43.99	50.87	317.0	341.8	0.19	0.25
SEm(±)	6.8	3.80	1.18	1.37	10.2	10.6	0.01	0.01
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Absolute control	113.9	104.3	30.93	25.62	245.9	215.4	0.12	0.12
Natural farming	132.7	147.3	40.04	40.09	324.2	350.0	0.15	0.19
Organic farming	145.5	179.7	53.17	83.62	345.0	375.0	0.32	0.48
Inorganic farming	160.6	190.3	45.41	48.45	387.0	395.3	0.12	0.20
SEm(±)	9.6	5.4	1.07	1.93	14.4	10.6	0.01	0.01
CD (0.05)	29.0	11.5	5.06	5.86	43.6	45.8	0.04	0.04
Interaction								
SEm(±)	13.5	7.6	2.36	2.73	20.3	21.3	0.02	0.02
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
Initial Status	164		43		277		0.3	

Table 6. pH, EC and OC of soil after harvest of maize as influenced by different farming methods.

Treatments	pH		EC (d S/m)		OC (%)	
	Kharif	*Rabi*	*Kharif*	*Rabi*	*Kharif*	*Rabi*
DHM 117	7.6	7.8	0.07	0.16	0.55	0.50
Aswini	7.5	7.8	0.08	0.16	0.60	0.5
SEm(±)	0.1	0.1	0.01	0.0	0.03	0.2
CD(0.05)	NS	NS	NS	NS	NS	NS
Absolute control	7.7	7.8	0.06	0.14	0.43	0.34
Natural farming	7.6	8.0	0.07	0.16	0.55	0.59
Organic farming	7.5	7.9	0.07	0.16	0.76	0.75
Inorganic farming	7.5	7.6	0.08	0.17	0.58	0.41
SEm(±)	0.2	0.2	0.01	0.01	0.04	0.2
CD (0.05)	NS	NS	NS	NS	0.12	0.08
Interaction						
SEm(±)	0.2	0.28	0.01	0.01	0.05	0.4
CD (0.05)	NS	NS	NS	NS	NS	NS

CONCLUSION

It can be concluded, the maize hybrid 'DHM 117' performed better than 'Aswini' variety concerning yield across all the farming methods. Natural farming practices were found inferior to inorganic and organic farming in terms of yield of maize. Natural farming practices resulted in improved microbial status (bacteria and fungi) and enzyme activity (urease and dehydrogenase) over the inorganic method after orgtheanic method. Organic farming left higher organic carbon content in the soil after maize crop while other properties were not altered.

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