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Correlation of soil mycoflora and productivity in organic and inorganic farming of *Triticum aestivum*

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Abstract
In present investigation a field experiment was conducted in a *Triticum aestivum* field during 2010-2013, to study the effect of various fermented liquid organic inputs and inorganic inputs on rhizosphere and Non-rhizosphere mycoflora population and yield. The soil rhizosphere and Non-rhizosphere mycoflora population was studied by using serial dilution technique. Result observed that application of organic inputs like Farm yard manure, Beejamruth and Jeevamruth increases rhizosphere and Non-rhizosphere fungal population in terms of colony forming unit (CFU) in organic field. The application of inorganic inputs lowers the rhizosphere and Non-rhizosphere mycoflora population (CFU) compare to organic field of *Triticum aestivum*. The yield obtained in organic field was higher than inorganic field and it is significantly correlated with the mycoflora population.

Keywords: *triticum aestivum*, yield, mycoflora, organic and inorganic inputs

1. Introduction
Microorganisms are beneficial in increasing the soil fertility and plant growth as they are involved in several biochemical transformation and mineralization activities in soil. Rhizosphere microorganisms had an important influence on soil properties, nutrient uptake and plant growth and development (He and Li, 1999). Soil microflora plays a pivotal role in evaluation of soil conditions and in stimulating plant growth (Singh *et al.,* 1999) [20].
During past decades, conventionally managed agricultural system has used synthetic fertilizer and pesticides to improve crop productivity. This intensive use of agrochemicals will definitely reduce the biodiversity, increase irreversible erosion of soil and reduce soil organic matter (Dick, 1992: Schiavon *et al.,* 1995) [2, 19].
Continuous use of chemical fertilizers over a long period may cause imbalance in soil microflora and thereby indirectly affect biological properties of soil leading to soil degradation. The indiscriminate use of chemical fertilizers without compost increases the soil acidity, decreases the soil fertility index, losses biological diversity, contaminants in food and adversely affects the human health.
There is a long history of research comparing the profitability of conventional and organic farm management systems. Some research has found that profitability of organic farming is low compared to inorganic i.e. conventional farming. In other hand low profitability in organic farm attributed due to adverse effect of conventional farming on soil health.
Application of farm yard manure improves soil health (Haynes and Naidu, 1998) [9] and fertility (Haikel *et al.,* 2000) [7], resulting in an increase in the growth and yield of different crops i.e. maize (Gajri *et al.,* 1994) [5], rice (Dinesh *et al.,* 1998) [3], wheat (Sushila and Gajendra, 2000) [21], soybean (Hati *et al.,* 2006) [8].
The present investigation was carried out to study the Correlation between soil mycoflora and productivity under influence of organic and inorganic inputs applied field of *Triticum aestivum* during the period 2010-2013.

2. Materials and Methods
2.1 Field Study site
Agricultural fields of Nanded district of Maharashtra were selected for the study of rhizosphere and Non-rhizosphere mycoflora populations and productivity (yield) under the influence of organic and inorganic inputs applied field of *Triticum aestivum* during the period 2010-2013. The selected experimental organic field was supplied with farm yard manure and organic liquid like Jeevamruth and Beejamruth (Palekar, 2006) [16]. The Jeevamruth applied to field crop and Beejamruth applied to seed. The inorganic field supplied with regular chemical fertilizers.

2.2 Collection of soil samples
Rhizosphere soil samples were collected from organic and inorganic crop fields of *Triticum aestivum* crop by digging out soil around the rhizosphere area up to 20 cm from plant to a dimension of 15 cm height and 7 cm diameter. The five samples were collected from sampling site from each selected crop field and mixed together into a single. Similar sampling was taken from Non-rhizosphere zone (25 - 40 cm away from the plant). These soil samples were collected in sterile polythene bags and brought to the laboratory.

2.3 Quantitative estimation of soil fungal population
The rhizosphere and Nom-rhizosphere fungi were estimated by Serial dilution method (Waksman, 1992) [22]. The collected soil samples from both the organic and inorganic inputs applied field were used for preparation of different serial Dilutions such as $10^{-2,}$ 10^{-3}, 10^{-4}, and 10^{-5}. Then transferred 1 ml aliquots from each dilution were used to count the fungal

population on Martins Rose Bengal Agar Medium, potato dextrose agar and Czapek's Dox Agar. One percent streptomycin solution was added to the medium before pouring into petriplates for preventing bacterial growth and plates were kept for incubation at 28 ºC for 4-7 days for fungi. After 6 days of incubation the different colonies were counted from different organic and inorganic soil plates.

2.4 Statistical analysis

The quantitative analysis of fungal population was studied at 10^{-3} dilution. The percentage contribution of each colony forming units (CFU) of different fungal isolate was calculated by using the formula.

$$\text{CFU/ g dry soil} = \frac{\text{Mean plate count X dilution factor}}{\text{dry weight of soil}}$$

2.5 Collection of yield data

The yield data of wheat were collected for three successive years of selected crop from both organic and inorganic field during 2010-2011, 2011-2012 and 2012-2013 in terms yield q/acre.

2.6 Correlation between Population of soil mycoflora & yield

The collected yield data of selected different crop plants from organic and inorganic fields were correlated with mycoflora population (colony forming unit) at 10^{-3} dilution with the help of SPSS statistical software

3. Results and Discussion

The results on population of soil rhizosphere mycoflora in organic and inorganic cropping systems of Wheat field during the year 2010-2013 are presented in Table 1.

In organic field, Population of rhizosphere fungi ranged from 38.4×10^{-3} to 48.8×10^{-3}CFU/g of soil (2010-11), 39.2×10^{-3} to 49.2×10^{-3}CFU/g of soil (2011-12) and 44.9×10^{-3} to 56.3×10^{-3}CFU/g of soil (2012-13). In inorganic field, Population of rhizosphere fungi ranged from 26×10^{-3} to 36×10^{-3}CFU/g of soil (2010-11), 24.8×10^{-3} to 36.8×10^{-3}CFU/g of soil (2011-12) and 20.5×10^{-3} to 33.0×10^{-3}CFU/g of soil (2012-13).

The results on population of soil Non-rhizosphere mycoflora in organic and inorganic cropping systems of Wheat field during the year 2010-2013 is presented in Table 2.

In organic field, Population of Non-rhizosphere fungi ranged from 21.6×10^{-3} to 29.6×10^{-3}CFU/g of soil (2010-11), 19.2×10^{-3} to 28.8×10^{-3}CFU/g of soil (2011-12) and 23.7×10^{-3} to 35.3×10^{-3}CFU/g of soil (2012-13). In inorganic field, Population of Non-rhizosphere fungi ranged from 11.6×10^{-3} to 21.2×10^{-3}CFU/g of soil (2010-11), 11.2×10^{-3} to 25.6×10^{-3}CFU/g of soil (2011-12) and 10.3×10^{-3} to 18.6×10^{-3}CFU/g of soil (2012-13).

The overall results showed that the application of organic inputs like Farm yard manure and Jeevamruth had significantly increased the population of soil rhizosphere and Non-rhizosphere mycoflora in organic field as compare to inorganic field during the period 2010-13.

The high chloride content, electrical conductivity, total soluble salts and low organic matter lowers the occurrence of diversity of microfungal population in the rhizosphere soil of halophytic plant *Zygophyllum qatarense* (Qaher, 2002) [17]. Continuous application of high doses of Igran significantly reduced the rhizosphere fungal population of *Vicia faba* plants grown in soils (Ahemad *et al.,* 2002) [1]. Organic agriculture field's significantly higher numbers of cultivable filamentous fungi by 110%, in comparison to conventional fields (Lelde *et al.,* 2011) [12]. The soil fungal populations were more in organic fields than inorganic field (Padmavathy and Poyyamoli 2011) [15]. The soil rhizosphere fungal abundance was greater in organic field compare to conventional management rhizosphere of maize and soybean crops (Nastasija *et al.,* 2012) [14].

The data presented in table 3 shows the application of organic inputs like farm yard manure and Jeevamruth during the period 2010-13 in organic field of Wheat yield increases. While during 2010-13 in inorganic field there was decrease or increasing yield means there is no continuity.

In organic field of wheat the recorded yield in 2010-11 was (10.7 q/acre), 2011-12 was (12.4 q/acre) and 2012-13 was (15.1 q/acre).In inorganic field of wheat the recorded yield in 2010-11 was (12.2 q/acre), 2011-12 was (11.6 q/acre) and 2012-13 was (10.9 q/acre).

Application of organic inputs like Jeevamruth and Panchagavya were significantly increases grain yield (3387 kg ha) and Straw yield (4632 kg ha') of rice (Divya and Babalad 2012). farm yard manure at the 7.5 t ha^{-1} with Jeevamruth recorded highest yield (Rs.27,384 ha^{-1}) net profit compare to the treatment 100 per cent Recommended dose of fertilizer (RDF) (Rs. 25,475 ha^{-1}) in Sunflower (*Helianthus annuus* L.) (Manjunathas *et al.,* 2009) [13]. Combinations of Beejamruth+ Jeevamruth + Panchagavya were best treatment and resulted in significantly highest yield of tomato as compared to RDF alone (Gore and Sreenivasa, 2011) [6].

For soil mycoflora population in organic field there is a strong positive correlation between soil mycoflora and yield in an organic farm (Table 4). Thus there is strong evidence from sample values to believe that in organic fields as soil mycoflora population increases yield also increases. For soil mycoflora population in inorganic field there is a moderate negative correlation between soil mycoflora and yield in inorganic farm.

Applications of organic manures to the soils under cultivated land use systems are helpful to improve the activity of soil microflora (bacteria, actinomycetes and fungi) for sustainable soil productivity (Rudramurthy and Gurumurthy 2007) [18]. Long term repeated application of organic fertilizer enhances in organic matter and soil fertility which results in increase in soil microbial activity and increase crop yields as compared to inorganic fertilizers (Herencia *et al.*, 2008) [11].

Table 1: Population of Rhizosphere mycoflora (x 10^{-3} CFU/g soil) in organic and Inorganic field of wheat.

S. No	Months	Organic field			Inorganic field		
		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	39.2	42.4	48.6	32.8	29.6	24.5
2	Dec	45.6	49.2	54.3	36.0	32.8	33.0
3	Jan	48.8	47.2	56.3	31.2	36.8	29.6
4	Feb	38.4	39.2	44.9	26.0	24.8	20.5
5	Mar	43.2	42.4	47.8	30.4	25.2	22.3
	Average	43.04	44.08	50.38	31.28	29.84	25.98
	S.D	±4.359	±4.043	±4.750	±3.648	±5.103	±5.199

Table 2: Population of Non-Rhizosphere mycoflora (x 10^{-3}CFU/g soil) in organic and Inorganic field of wheat.

S. No	Months	Organic field			Inorganic field		
		2010-11	2011-12	2012-13	2010-11	2011-12	2012-13
1	Nov	21.6	25.6	28.6	16.8	15.2	17.2
2	Dec	27.2	20.8	26.4	21.2	18.4	15.3
3	Jan	29.6	28.8	35.3	15.2	25.6	18.6
4	Feb	22.4	19.2	23.7	11.6	12.8	10.3
5	Mar	24.8	22.4	26.4	14.4	11.2	11.0
	Average	25.12	23.36	28.08	15.84	16.64	14.48
	S.D	±3.327	±3.853	±4.393	±3.539	±5.696	±3.695

Table 3: Comparison between crop Production in Organic and Inorganic field of different crops during 2010-2013.

S. No	Field	Organic yield Q/acre	Inorganic yield Q/acre
1	2010-2011	10.7	12.2
2	2011-2012	12.4	11.6
3	2012-2013	15.1	10.9

Table 4: Correlation between population of soil mycoflora and yield in Wheat.

Year	Organic field		Inorganic field	
	Rhizosphere	Non-Rhizosphere	Rhizosphere	Non-Rhizosphere
Over period 2010-13 (3 years)	0.966 Sig (2 tailed) 0.167	0.717 Sig (2 tailed) 0.491	0.977 Sig (2 tailed) 0.136	0.657 Sig (2 tailed) 0.544

4. Conclusion

The applications of organic inputs like Jeevamruth, farm yard manure and Beejamruth increases the soil mycoflora population and yield compared to inorganic inputs applied field. because in Jeevamruth and Beejamruth presence of cow dung, cow urine, legume flour and jaggary containing macro and essential micro nutrients, many vitamins, essential amino acids, growth promoting substances like auxin (IAA), gibberlic acid and beneficial microorganisms.

There is positive correlation between fungal population and yield in organic field compare to inorganic field. For soil mycoflora population in organic field there is a strong positive correlation between soil mycoflora and yield in organic farm. Thus there is strong evidence from sample values to believe that in organic fields as soil mycoflora population increases yield also increases

The Increase in soil mycoflora population enhances nutrient availability to crop ultimately increases growth and yield of crop plants. From this result we can conclude that organic liquid manure can be used for increase in microbial population and yield of crops for sustainable eco-friendly development of agriculture.

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6. References

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