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Influence of Organic and Inorganic Inputs on Soil Physico-Chemical Properties of Jowar Field

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Abstract: ***In present investigation a field experiment was conducted in Jowar (Rabi) field during 2010-2013, to study the effect of various liquid organic inputs and inorganic inputs on soil physico-chemical properties. Overall results shows in organic inputs applied field there is significantly minimum and maximum increase in soil properties like organic carbon (0.11 % to 0.34 %), phosphorus (6.62 kg/h to 15.16 kg/h), water holding capacity (3.3 % to 8.5 %) over inorganic inputs applied field. There is significantly decrease in pH (0.79 to 1.23) and Electrical conductivity (0.07 ms/cm to 0.36 ms/cm) of soil in organic field compared to inorganic field. The potassium content was higher in both fields. From above finding it is clear that application of organic inputs like farm yard manure, Beejamruth and Jeevamruth significantly improves soil nutrient properties which results in increase in fertility and productivity of soil for sustainable development.***

Keywords: Soil physico-chemical properties, Jowar, organic and inorganic inputs

1. Introduction

During past decades conventionally managed agricultural farming system using different types of synthetic fertilizer to increase the productivity. In market day to day there is introduction of different chemical fertilizers and pesticides which contain different chemical composition.

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). It is observed that continuous chemical nutrient management practices greatly lowers the fertility of soil at the end of long term field experiments (Vidyavathi *et al.,* 2011). To overcome this problem, now a day there is widespread interest in developing sustainable agricultural systems which exclude the external inputs, especially fertilizers and herbicides, to minimize the impacts on the environment and improve soils (Moonen and Barberi, 2008). The solution comes in the form of organic farming which completely exclude synthetic fertilizers. Now a day's organic farming basically runs for cultivation of land and crops as to keep soil fertile by use of organic fertilizers like FYM, biological materials, vermicompost, beneficial microbes and recently liquid organic inputs in the form of Panchagavya, Dasagavya, Beejamruth, Jeevamruth, Amritpani and Sanjivak which add the nutrients to soil for increased sustainable crop production. It is observed that application of different liquid manures results in quick build up of soil fertility through enhanced activity of soil micro-flora and fauna (Yadav and Mowade, 2004).

Different research study revealed that organic inputs increases the fertility of soil compared to inorganic inputs. The long term application of high dose of chemical fertilizers lowers the water holding capacity while addition of FYM increases (Prasad and Sinha, 1980). Application of organic fertilizer increases organic carbon content in different soil depth compare to inorganic and control (Chauhan *et al.,* 2011). As compared to chemical fertilizers addition of vermicompost increases organic carbon content of Rabi sorghum soil (Mastiholi, 1994). It is observed that there was increase in soil nitrogen content by addition of FYM (Gupta *et al.,* 1988).

It is reported that soil available phosphorus was significantly increases with addition of FYM or green manures (Singh *et al.,* 1998; Subbaiah and Kumaraswamy, 1996). Similarly regular manuring by addition of FYM in 45 years cotton-Jowar rotation increases available potassium compared to unmanuring (Khiani and More, 1984). There is decrease in Electrical conductivity in organic field over inorganic field. Soil pH was slightly higher in organic field due to generous addition of compost and mulching in organic plots (Padmavathy and Poyyamoli, 2011). Result shows vermicompost treated soil improves soil fertility as well as productivity (Karmakar *et al.,* 2013). It is Reported that Long term (7 years) application of FYM @ 15 tons per ha results in production of acids due to decomposition of organic matter over six irrigation of cropping period were reduces the soil pH (Chaudhary *et al.,* 1981). The products obtained from chemicals shows ill effects and now consumers buying organic products for human health, soil health and environment (Bhattacharyva and Chakraborty 2005).

Now it is important to consider the possible impact of chemical fertilizer on soil health there is urgent need of implementation of organic inputs for sustainable and eco-friendly development. The present investigation was carried out to study the effect of organic inputs (FYM, Jeevamruth and Beejamruth) and inorganic inputs on soil physico-chemical properties of Jowar (Rabi) cropping during the year 2010-2013.

2. Materials and Methods

2.1 Experimental Study site

Agricultural fields of Nanded district of Maharashtra were selected for the study of soil physico-chemical properties under the influence of organic and inorganic inputs applied field of Jowar (Rabi) during the period 2010-2013.The selected experimental organic field was supplied with farm

yard manure and organic liquid booster like Jeevamruth and Beejamruth (Palekar, 2006). 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 for Soil Physicochemical Analysis

The soil samples were collected monthly from organic and inorganic field Jowar (Rabi). The soil samples were collected to a depth of 0 to 30 cm from selected field. Soil samples from selected field were randomly sampled and mixed together to form composite sample. Then all collected organic and inorganic soil samples were put in separate polythene bag. Bags are labeled clearly indicating name of farmer, village, field number, field name and name of crop and then it brought to laboratory. In laboratory the collected soil samples were air dried and crushed with the help of mortar and pestle. Then passed through 2 mm mesh sieve to remove the coarse fragments (>2 mm). Then it again put into a clean polythene bag and sealed. Now such prepared sample can be used for analysis of different important physico-chemical properties of soil.

2.3. Analysis of physico-chemical properties of soil

The different monthly collected soil samples from organic and inorganic inputs applied field of crop plant were analyzed for different parameters by using different methods such as pH & Electrical conductivity (Agriculture dept. of Maharashtra), Organic carbon (Walkey and Black method 1934), Phosphorus (Olsen's Method 1965), Potassium (Hanway and Heidel 1952) were conducted Rashtriya chemical and fertilizers (RCF) soil testing lab Nanded.

3. Results and Discussion

The results of soil physico-chemical properties of organic inputs like (FYM, Jeevamruth and Beejamruth) applied field shows it improves soil fertility over inorganic inputs applied field.

The results on soil EC in organic and inorganic cropping systems of Jowar field during the year 2010-2013 is presented in Table 1. There is monthly variation in soil Ec. The average EC of organic field during 2010-13 showed highest decrease in 2012-13 (0.36 ms/cm), followed by 2011-12 (0.2 ms/cm) and 2010-11 (0.07 ms/cm) over inorganic farming. The decrease in Ec in organic field due to Decomposition of some plant materials like paddy-straw in soil during winter season (Bajpai *et al.,* 1980). Observed that organic inputs in the form of FYM at 5 tons per ha lowers electrical conductivity of the soil (Rathod *et al.,* 2003).

The results on soil organic carbon in organic and inorganic cropping systems of Jowar field during the year 2010-2013 are presented in Table 2 and Fig. 1 & 2. The average organic carbon of organic field during 2010-13 showed highest increase in 2012-13 (0.34 %), followed by 2011-12 (0.29 %) and 2010-11 (0.11 %) over inorganic farming. Significantly FYM increases Organic carbon 0.90 to 1.00 % (Sahu *et al.,* 2014; Muzaffar *et al.,* 2013).

The result on soil pH in organic and inorganic cropping systems of Jowar field during the year 2010-2013 is presented in Table 3.The average pH of organic field during 2010-13 showed highest decrease in 2012-13 (1.23), followed by 2010-11 (0.81) and 2011-12 (0.79) over inorganic farming. Regular application of FYM decreases in pH of soil by one unit from initial value due to decomposition and mineralization of organic matter (Singh *et al.,* 1980). Long term (7 years) application of FYM @ 15 tons per ha results in production of acids were reduces the soil pH (Chaudhary *et al.,* 1981).

The results on to soil phosphorus in organic and inorganic cropping systems of Jowar field during the year 2010-2013 are presented in Table 4 and Fig.3 and 4. The average phosphorus of organic field during 2010-13 showed highest increase in 2012-13 (15.16 kg/h), followed by 2011-12 (10.36 kg/h) and 2010-11 (6.62 kg/h) over inorganic farming. Similar results were reported by Shashidhar *et al*., (2009); Debasmita *et al.,* (2011) and Das and Dkhar (2012) for increase in soil phosphorus in organic field.

The results on soil potassium in organic and inorganic cropping systems of Jowar field during the year 2010-2013 are presented in Table 5 and Fig.5 & 6. The average potassium of organic field during 2010-13 showed highest in 2010-11 (20.6 kg/h), followed by 2011-12 (11.4kg/h) and lower in 2012-13 (34.2 kg/h) over inorganic farming. Increase in available potassium by 10 % over chemical fertilizers treatment due to addition of organic inputs. (Phule, 1993).

The results on soil water holding capacity (WHC) in organic and inorganic cropping systems of Jowar field during the year 2010-2013 is presented in Table 6 and Fig. 7 & 8. The average WHC of organic field of Jowar during 2010-13 showed highest increase in 2012-13 (8.5 %), followed by 2011-12 (3.48 %) and 2010-11 (3.3 %) over inorganic farming. Use of cattle manure and wheat straw increases in water holding capacity. (Singh *et al.*, 1998). The water holding capacity maximizes by addition of 5 tones of vermicompost per hectare compared with control. (Jadhav *et al.* 1993). Recently, it is observed that liquid organic manure can resolve many problems associated with soil fertility and crop productivity (Sreenivas *et al*., 2011).

4. Conclusion

The organic inputs like farm yard manure, Jeevamruth and Beejamruth increases the soil properties like organic carbon, phosphorus, potassium, water holding capacity and decrease in pH and Electrical conductivity of soil compared to inorganic inputs applied field. The Increase in soil nutrient results increasing fertility of soil ultimately increases growth and yield of crop plants .thus this liquid organic manure can be used as better alternative for inorganic inputs to maintain soil health for sustainable development.

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Table 1: Shows monthly variation of soil Electrical conductivity in organic & inorganic field of Jowar during the period 2010-2013

Sr. No	Months	Organic field			Inorganic field		
		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	0.36	0.28	0.24	0.48	0.52	0.60
2	Dec	0.34	0.26	0.28	0.42	0.40	0.48
3	Jan	0.34	0.26	0.21	0.39	0.46	0.58
4	Feb	0.32	0.30	0.26	0.37	0.49	0.72
5	Mar	0.31	0.29	0.22	0.36	0.52	0.62
	Average	0.334	0.278	0.242	0.404	0.478	0.60
	S.D	±0.019	±0.017	±0.028	±0.048	±0.050	±0.086

Table 2: Shows monthly variation of soil organic carbon in organic & inorganic field of Jowar during the period 2010-2013.

Sr.No	Months	Organic field			Inorganic field		
		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	0.56	0.60	0.64	0.52	0.40	0.42
2	Dec	0.46	0.52	0.58	0.36	0.32	0.28
3	Jan	0.38	0.46	0.49	0.34	0.19	0.16
4	Feb	0.46	0.56	0.61	0.26	0.16	0.18
5	Mar	0.40	0.46	0.54	0.26	0.10	0.12
	Average	0.452	0.52	0.572	0.348	0.234	0.232
	S.D	±0.070	±0.061	±0.058	±0.106	±0.122	±0.120

Table 3: Shows monthly variation of soil pH in organic & inorganic field of Jowar during the period 2010-2013.

Sr. No	Months	Organic field			Inorganic field		
		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	7.15	7.00	6.70	8.40	8.40	8.88
2	Dec	7.05	7.10	6.92	8.25	8.10	8.45
3	Jan	7.20	7.20	7.00	8.10	8.10	8.26
4	Feb	7.25	7.25	7.10	7.90	7.90	7.78
5	Mar	7.45	7.40	7.10	7.50	7.40	7.60
	Average	7.22	7.19	6.964	8.03	7.98	8.194
	S.D	±0.148	±0.151	±0.165	±0.349	±0.370	±0.515

Table 4: Shows monthly variation of soil phosphorus in organic & inorganic field of Jowar during the period 2010-2013.

Sr.No	Months	Organic field			Inorganic field		
		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	46.10	49.80	52.20	38.30	40.00	36.20
2	Dec	52.60	52.20	57.30	44.40	44.20	50.45
3	Jan	54.30	56.00	65.46	41.60	36.40	40.26
4	Feb	42.20	42.30	50.36	36.10	31.60	28.40
5	Mar	22.60	28.40	40.42	24.30	24.70	34.60
	Average	43.56	45.74	53.148	36.94	35.38	37.982
	S.D	±12.69	±10.90	±9.21	±7.74	±7.55	±8.17

Table 5: Shows monthly variation of soil Potassium in organic & inorganic field of Jowar during the period 2010-2013.

Sr.No	Months	Organic field			Inorganic field		
		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	460	480	520	540	526	540
2	Dec	520	540	510	555	550	530
3	Jan	522	500	490	530	510	580
4	Feb	530	510	495	418	460	520
5	Mar	540	523	524	426	450	540
	Average	514.4	510.6	507.8	493.8	499.2	542
	S.D	±31.41	±22.73	±14.97	±66.20	±42.93	±22.80

Table 6: Shows monthly variation of soil water holding capacity in organic & inorganic field of Jowar during the period 2010-2013

Sr.No	Months	Organic field	Inorganic field

		2010-2011	2011-2012	2012-2013	2010-2011	2011-2012	2012-2013
1	Nov	69.60	69.90	72.45	64.00	64.10	61.56
2	Dec	67.00	67.00	70.30	63.20	62.90	60.30
3	Jan	66.40	66.40	69.40	62.80	62.80	61.84
4	Feb	64.40	64.40	68.20	62.40	62.20	61.00
5	Mar	63.50	63.50	69.76	62.00	61.80	62.90
	Average	66.18	66.24	70.022	62.88	62.76	61.52
	S.D	±2.38	±2.49	±1.56	±0.769	±0.873	±0.970

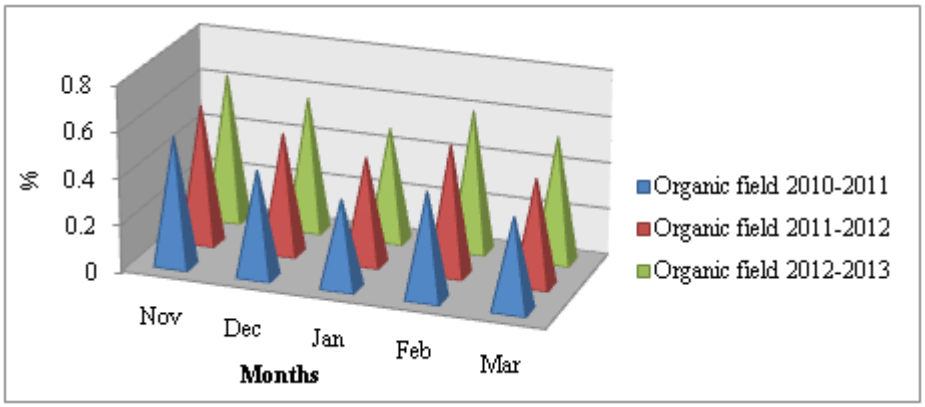

Figure 1: Monthly variation of soil organic carbon in organic field of Jowar during the period 2010-2013.

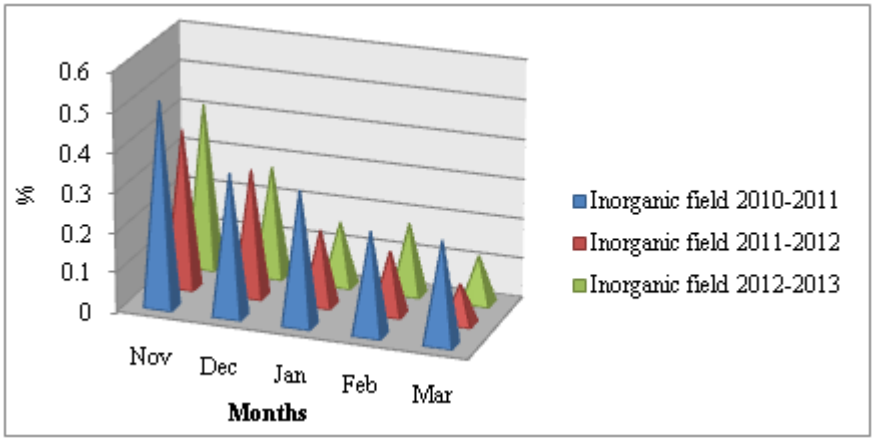

Figure 2: Monthly variation of soil organic carbon in inorganic field of Jowar during the period 2010-2013

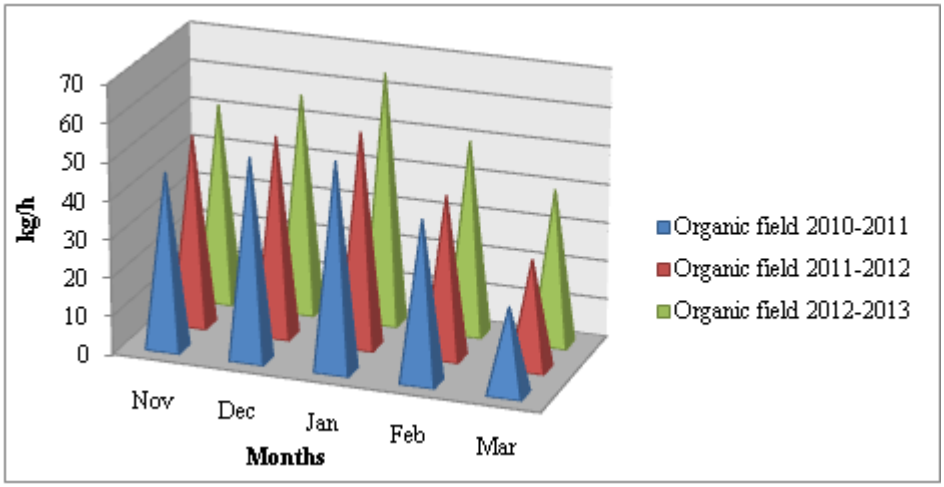

Figure 3: Monthly variation of soil phosphorus in organic field of Jowar during the period 2010-2013

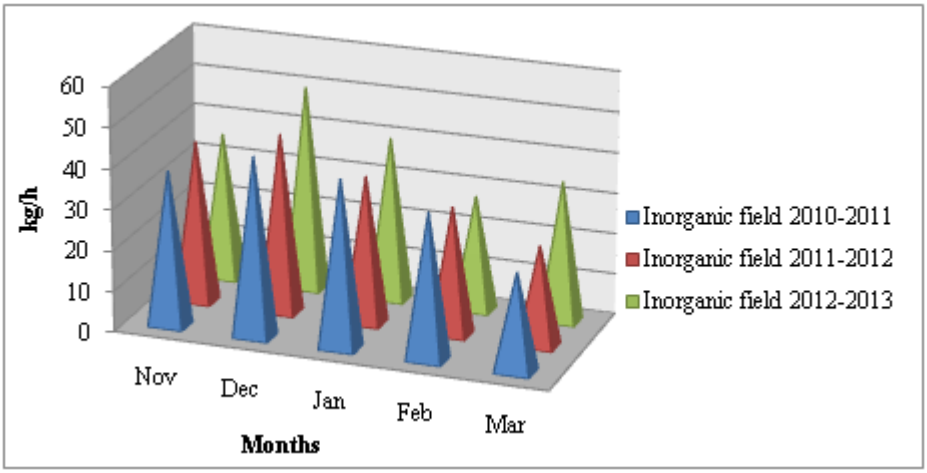

Figure 4: Monthly variation of soil phosphorus in inorganic field of Jowar during the period 2010-2013.

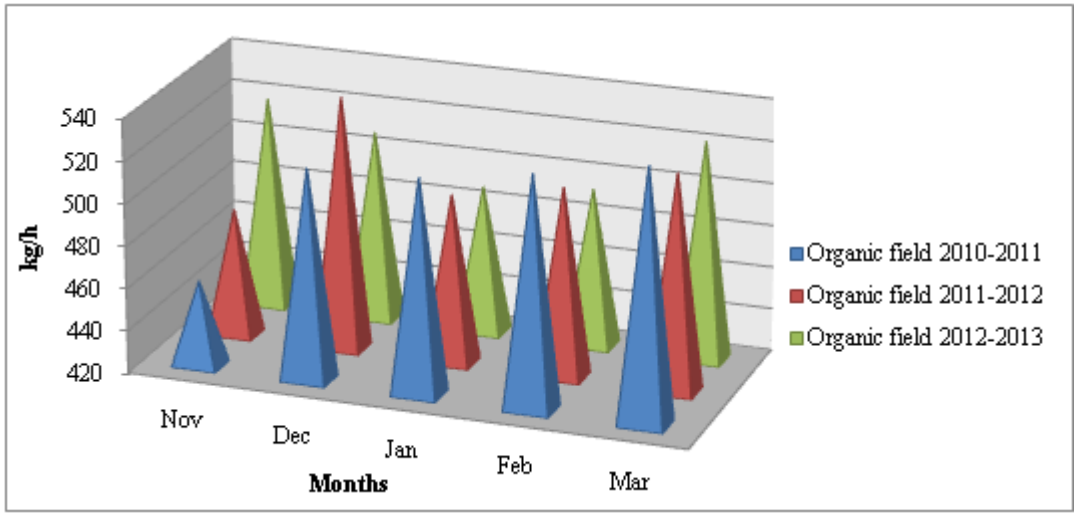

Figure 5: Monthly variation of soil potassium in organic field of Jowar during the period 2010-2013.

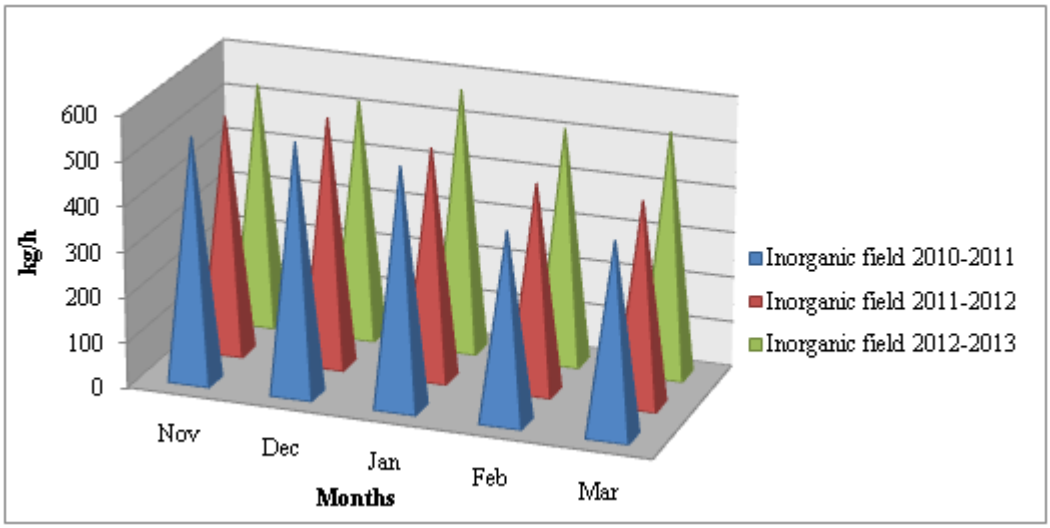

Figure 6: Monthly variation of soil potassium in inorganic field of Jowar during the period 2010-2013.

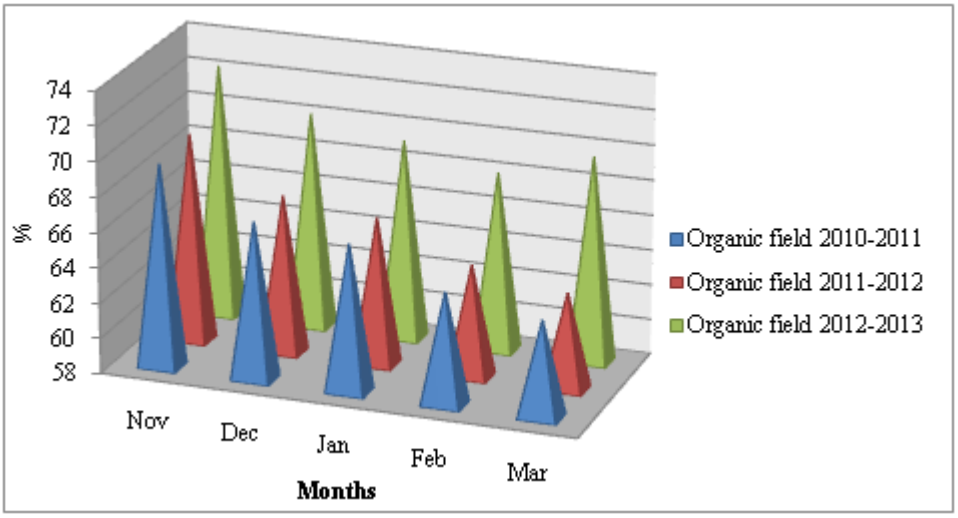

Figure 7: Monthly variation of soil water holding capacity in organic field of Jowar during the period 2010-2013.

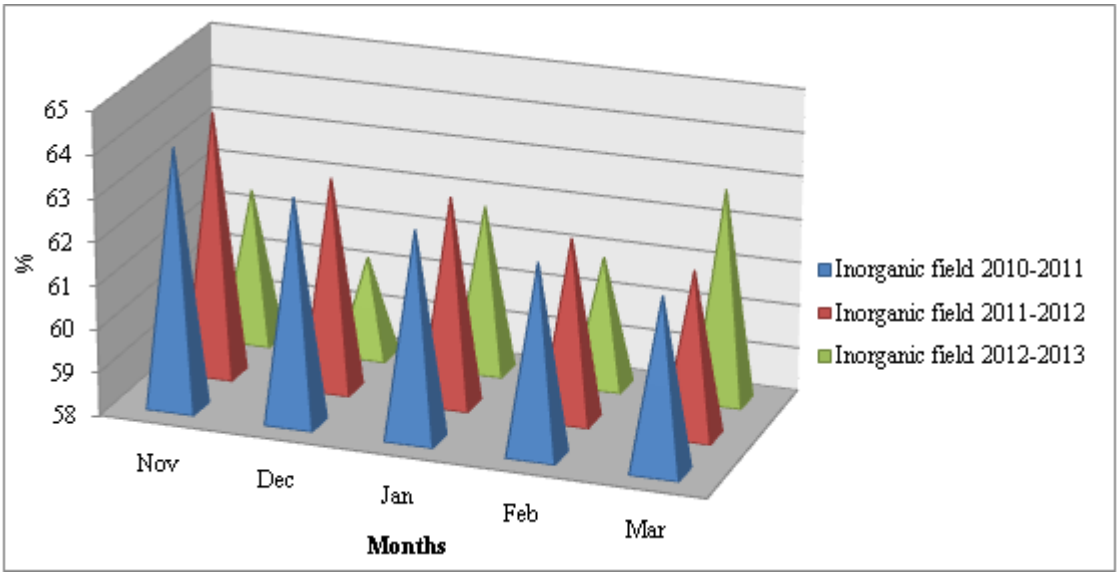

Figure 8: Monthly variation of soil water holding capacity in inorganic field of Jowar during the period 2010-2013.

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