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Effect of organic manures on yield, quality and uptake of rabi sorghum

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Abstract
A field studies were conducted for two years (2015-16 to 2016-17) on a clay loam soil at the IFSRP, Rahuri, to study the evaluation of organic farming package for *Kharif* onion based cropping system on yield, quality and uptake of rabi sorghum. The residual effect of 50% N through FYM + 50% N through vermicompost and direct effect of 50% N through FYM + 50% N through vermicompost was recorded significantly higher yield, quality and uptake of nutrients in rabi sorghum than rest of the treatments.

Keywords: rabi sorghum, yield, quality, uptake, organic manures

Introduction
Today, the burgeoning population pressure has forced many countries to use chemicals and fertilizers to increase the farm productivity for meeting their ever-increasing food requirements. The applications of such high input intensive technologies have undoubtedly increased the production and labour efficiency, but, there is a growing concern over their adverse effects on soil productivity and environmental quality. Promoting organic agriculture offers one of the most promising options available for achieving food security and other basic needs of humanity apart from conserving natural resources. People are gradually realizing the danger of modern day production system and asking for chemical fertilizer and pesticide residue free food items and that encouraging the rapid development of organic agriculture in the country. Application of scientific approaches to organic farming practices holds the possibility of maintaining and in some cases increasing the yield over long run, while sustaining bio-diversity, soil fertility, soil biological cycles and natural ecosystem processes and services that underpin the agriculture. Apart from this, it allows the farmers to overcome the risk of crop failures and increased cost of production. The philosophy behind the concept of organic farming is to feed the soil, rather than the crop and it is a means of giving back to nature what has been taken from it. Hence, the organic farming is a sustainable production and management system which focuses on health of soil, ecosystem and human beings.
According to the National Organic Standard Board of the US Department of Agriculture (USDA) organic farming is system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, herbicides, harmones, feed additives etc.) and to the maximum extent feasible relies upon biological system of nutrient mobilization and plant protection. Organic agriculture is therefore often termed as knowledge based rather than input based agriculture (Ramesh, 2008). Most of organic manures contain all the essential nutrients and therefore acts as a "balanced'' source of nutrients for crops. The organic manures have a very complex effect on soil physical environment, nutrient status and soil flora and fauna which directly influence on plant growth and development. Farmyard manure, vermi-compost and neem cake provides essential plant nutrients including micronutrients and they also have favorable effect to improve soil physical, chemical and biological environment. Similarly, the beneficial effect of vermin-compost was first highlighted by Darwin (1881) [3]. Since then, it has taken almost a century to appreciate its importance.

Materials and Methods
An experiment was conducted during 2015-16 and 2016-17 at the IFSRP, MPKV, Rahuri. The soil of the experimental field was clay loam in texture, low in available nitrogen (181 kg ha^{-1}), medium in available phosphorus (15 kg ha^{-1}) and very high in available potassium (403 kg ha^{-1}), respectively with pH 8.14. The experiment was laid out in split plot design with three replications. Nine combinations of three crop sequences (onion-sorghum, onion-wheat and onion-chickpea) and three combinations of organic nutrient sources *viz.* 50% N through FYM + 50% N through Vermicompost, 50% N through FYM + 50% N through Neem cake and 50%

N through Vermicompost + 50% N through Neem cake were the main plot treatments in *kharif* season replicated three times in randomized block design. During *rabi* season each main plot treatments of residual effect of organic nutrient sources was split into three sub plot treatments of organic nutrient levels *viz.* 100, 75 and 50% N through organic (In equal split of N through 50:50% FYM: vermicompost) to *rabi* season crops (Sorghum, Wheat and Chickpea) resulting in twenty seven treatment combinations replicated three times in split plot design. One additional control treatment of GRDF included for comparison.

Result and Discussion

Grain yield (kg ha^{-1})

Data pertaining to grain yield of *rabi* sorghum as influenced by different organic treatments was tabulated in Table 1. The mean grain yield was 2825, 3088 and 2956 kg ha^{-1} during first year, second year and pooled mean, respectively.

Residual effect of organic nutrient sources

The grain yield of *rabi* sorghum was significantly higher due to residual effect of 50% N through FYM + 50% N through VC (2927, 3191and 3059 kg ha^{-1}) than 50% N through FYM + 50 % N through NSC (2719, 2944 and 2832 kg ha^{-1})during 2015-16, 2016-17 and pooled mean. However, it was at par with 50% N through VC + 50% N through NSC during second year (3129 kg ha^{-1}) and on pooled mean (2979 kg ha^{-1}). The increase in grain yield by residual effect of 50% N through FYM + 50% N through VC over 50% N through FYM + 50% N through NSC were higher 7.64, 8.38 and 8.01% during first year, second year and pooled mean basis. This might be due to cumulative effect of all growth and yield attributes reflected on grain yield and more uptake of nutrients during development stage and more translocation of photosynthates from vegetative parts to reproductive parts. Similar results were reported by Patidar and Mali (2002), Singh *et al*. (2004) [11] and Nagrare (2017) [6].

Direct effect of organic nutrient levels

Among organic nutrient levels the crop supplied with 100% N (50% N through FYM + 50% N through VC) produced significantly highest grain yields of 3242, 3622 and 3432 kg ha^{-1} during 2015-16, 2016-17 and pooled mean basis, respectively over other levels of organic nutrients. On an average the direct application of 100% N through organic (50% N through FYM + 50% N through VC) increased the grain yield to the extent of 39.20, 43.04 and 41.17 per cent over 50% N through organic during 2015-16, 2016-17 and pooled mean basis, respectively. Vermicompost also act as a chelating agent and regulate the availability of micronutrients to plants thereby increase growth and yield by providing nutrients in available form. Kumara and Patil (2014) also reported that significantly higher bulb yield onion was recorded in 100% RDN through VC and farmyard manure. Similar results were reported Parmar and Sharma (2001), Patil (1998) [9], Chandrashekara *et al.* (2000) [2] and Jat *et al.* (2013) [4].

The control treatment 100% GRDF registered marginal grain yield of *rabi* sorghum over organic treatments during period of investigation.

Dry fodder yield (kg ha^{-1})

The dry fodder yield of *rabi* sorghum as influenced by different organic treatments are presented in Table 39. The mean dry fodder yield of sorghum was 7661, 7750 and 7705 kg ha^{-1} during 2015-16, 2016-17 and on pooled mean, respectively.

Table 1: Grain and dry fodder yield of *rabi* sorghum as influenced by different organic treatments

Treatment		Grain yield (kg ha^{-1})			Dry fodder yield (kg ha^{-1})		
		2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
A.	**Residual effect of organic sources of nutrient**						
K_1:	50% N FYM + 50% N VC	2927	3191	3059	7790	7840	7815
K_2:	50% N FYM + 50% N NSC	2719	2944	2832	7534	7726	7630
K_3:	50% N VC + 50% N NSC	2829	3129	2979	7660	7683	7671
	SEm ±	16.08	32.79	31.63	60.58	55.77	71.31
	CD at 5%	63.17	128.78	103.17	NS	NS	NS
B.	**Direct effect of organic nutrient levels**						
R_1:	100% N-Organic	3242	3622	3432	7940	8014	7977
R_2:	75% N Organic	2903	3110	3007	7637	7789	7713
R_3:	50 % N-Organic	2329	2532	2431	7406	7445	7426
	SEm ±	18.69	16.49	21.59	74.08	66.70	86.33
	CD at 5%	57.59	50.83	63.01	228.27	205.54	251.99
	Interaction (A x B)						
	SEm ±	32.37	28.57	37.39	128.31	115.54	149.53
	CD at 5%	99.75	88.05	109.15	NS	NS	NS
	Mean	2825	3088	2956	7661	7750	7705
	Control-GRDF	3484	3749	3616	8500	9035	8767

Residual effect of organic nutrient sources

The values of dry fodder yield were not differed statistically due to different treatments of residual effect of organic sources of nutrient.

Direct effect of organic nutrient levels

The effect of different levels of organic nutrient management on dry fodder yield of sorghum found to be significant. The application of 100% N through organic (50% N through FYM + 50% N through VC) produced significantly higher fodder yield of 7940, 8014 and 7977 kg ha^{-1} of rabi sorghum during 2015-16, 2016-17 and pooled mean basis, respectively than the dry fodder yield recorded in rest of the treatments.

The control treatment 100% GRDF registered marginal dry fodder yield of *rabi* sorghum over organic treatments during period of investigation.

Quality parameter

The quality parameter of *rabi* sorghum *viz.* protein content, total sugar and voluntary intake of fodder as influenced by different organic treatments are presented in Table 2.

Residual effect of organic nutrient sources

The quality parameters of *rabi* sorghum *viz.* protein and total sugar content in grain and voluntary intake of dry fodder were influenced significantly by residual effect of *kharif* treatments during both the years.

The residual effect of 50% N though FYM + 50% N though VC recorded significantly maximum values of quality parameters of sorghum *viz*, protein content (9.76 and 9.83%), total sugar (1.77 and 1.78%) and voluntary intake of dry fodder (83.99 and 84.10%) over the organic sources of 50% N though FYM + 50% N through NSC. However, it was at par with the residual effect of 50% N through VC + 50% N through NSC during both the years of experimentation. The increase in quality parameter of sorghum may be due to increase carbohydrate production during photosynthesis. Similar results are in line with Nagrare (2017) [6].

Direct effect of organic nutrient levels

The quality parameter of *rabi* sorghum were influenced significantly by different levels of organic treatments during 2015-16 and 2016-17, respectively.

Application of 100% N through organic (50% N through FYM + 50% N though VC) to *rabi* sorghum recorded significantly maximum values of quality parameters *viz.* protein content (9.76 and 9.70%), total sugar (1.76 and 1.76%) and voluntary intake of dry fodder (83.93 and 84.05%) over lower level of treatments. However, all the quality parameters was at par with application of 75% N through organic during both years of experiments. The increase in quality parameter of *rabi* sorghum may be due to increase N uptake of grain which is useful for synthesis of amino acids and translocation to the seed and improved protein content and total sugar. Similar results are in line with Ramamurthy and Shivashankar (1996) [10].

The control treatment 100% GRDF was recorded maximum value in respect of protein content while minimum in case of total sugar and voluntary intake of *rabi* sorghum than organic treatments.

Table 2: Quality parameter of *rabi* sorghum as influenced by different organic treatments

Treatment		Protein (%)		Total sugar (%)		Voluntary intake (%)	
		2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
A.	**Residual effect of organic sources of nutrient**						
K_1:	50% N FYM + 50% N VC	9.76	9.83	1.77	1.78	83.99	84.10
K_2:	50% N FYM + 50% N NSC	9.56	9.67	1.70	1.73	83.77	83.89
K_3:	50% N VC + 50% N NSC	9.72	9.82	1.72	1.76	83.95	84.06
	S. Em. ±	0.03	0.02	0.01	0.01	0.04	0.02
	CD at 5%	0.14	0.09	0.05	0.04	0.16	0.09
B.	**Direct effect of organic nutrient levels**						
R_1:	100% N-Organic	9.76	9.85	1.76	1.79	83.99	84.13
R_2:	75% N Organic	9.70	9.82	1.73	1.75	83.93	84.05
R_3:	50% N-Organic	9.58	9.66	1.70	1.72	83.79	83.88
	S. Em. ±	0.04	0.04	0.02	0.02	0.04	0.05
	CD at 5%	0.13	0.14	0.05	0.06	0.14	0.15
	Interaction (A x B)						
	S. Em. ±	0.074	0.080	0.102	0.130	0.082	0.090
	CD at 5%	NS	NS	NS	NS	NS	NS
	Mean	9.68	9.77	1.73	1.76	83.90	84.02
	Control-GRDF	9.79	9.88	1.70	1.73	83.57	83.82

Total nutrient uptake (kg ha^{-1})

The data pertaining to mean total uptake of nitrogen, phosphorous and potassium by *rabi* sorghum was 64.47, 13.84 and 82.84 kg ha^{-1} during first year and it was 69.35, 15.61 and 87.46 kg ha^{-1} during second year, respectively are presented in Table 3.

Table 3: Total uptake of N, P and K by *rabi* sorghum as influenced by different organic treatments

Treatment		Nitrogen (kg ha^{-1})		Phosphorous (kg ha^{-1})		Potassium (kg ha^{-1})	
		2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
A.	**Residual effect of organic sources of nutrient**						
K_1:	50% N FYM + 50% N VC	69.08	73.23	15.88	16.85	90.60	91.23
K_2:	50% N FYM + 50% N NSC	61.34	65.42	12.11	14.63	76.23	83.37
K_3:	50 % N VC + 50 % N NSC	62.99	69.41	13.52	15.36	81.68	87.78
	S. Em. ±	0.30	0.42	0.22	0.35	0.45	0.99
	CD at 5%	1.19	1.67	0.87	1.40	1.77	3.90
B.	**Direct effect of organic nutrient levels**						
R_1:	100% N-Organic	77.22	82.04	17.06	18.35	95.94	99.30
R_2:	75% N Organic	64.28	68.63	14.87	16.21	81.25	87.36
R_3:	50% N-Organic	51.93	57.39	9.58	12.28	71.32	75.72
	S. Em. ±	0.48	0.69	0.26	0.25	0.64	0.52
	CD at 5%	1.50	2.15	0.80	0.79	1.99	1.60
	Interaction (A x B)						
	S. Em. ±	0.84	1.21	0.45	0.44	1.12	0.90
	CD at 5%	NS	NS	NS	NS	NS	NS
	Mean	64.47	69.35	13.84	15.61	82.84	87.46
	Control-GRDF	80.43	90.63	26.75	29.40	98.02	100.62

Residual effect of organic nutrient sources

The residual effect of organic treatment on total uptake of nitrogen, phosphorous and potassium was influenced significantly during both the years. The residual effect of 50% N through FYM + 50% N through VC recorded significantly maximum total uptake of N (69.08 and 73.23 kg ha^{-1}), P (15.88 and 16.85 kg ha^{-1}) and K (90.60 and 91.23 kg ha^{-1}) by *rabi* sorghum than the residual effect of rest of the treatments. The higher plant nutrient uptake might be due to when organics are applied, nutrient will be released slowly and also the nutrient losses will be minimized due to increased absorption of nutrients as a result of increased cation exchange capacity with increased organic matter content. Similar results are reported by Patidar and Mali (2002) and Singh *et al*. (2004) [11].

Direct effect of organic nutrient levels

The total uptake of N (77.22 and 82.04 kg ha^{-1}), P (17.06 and 18.35 kg ha^{-1}) and K (95.94 and 99.30 kg ha^{-1}) increased significantly with increase in level of organic nutrient and it was maximum in 100% N through organic (50% N through FYM + 50% N through VC) as compared to the lower level of organic nutrients. These results confirm the findings of Brar *et al.* (2001) [1], Kadam *et al.* (2010) [5] and Jat *et al.* (2013) [4].

The control treatment 100% GRDF was recorded marginally total uptake of nutrients than organic treatments in respect of yield attributes of *rabi* sorghum. Marginally highest values of growth parameters, yield parameters, grain yield, fodder yield, biological yield, harvest index, quality parameters and nutrient uptake by *rabi* sorghum observed with the application of GRDF than all other organic treatments during both the years. Application of GRDF added higher amount of nutrients which cause better soil condition and thereby stimulating effect on the growth of the plant automatically leading to higher yield attributes and yield of sorghum. Mere *et al.* (2013) reported that seed yield, oil and protein content and yield of soybean, nutrient uptake was positive under treatment 125% RDF + FYM 5 t ha^{-1} due to better availability of desired and required nutrients in root zone.

Conclusion

It was concluded that the residual effect of 50% N through FYM + 50% N through vermicompost and direct effect of 50% N through FYM + 50% N through vermicompost recorded the higher yield and quality parameters of rabi sorghum as well as higher uptake by rabi sorghum.

References

1. Brar BS, Dhillon NS, Chhina HS. Integrated use of farm yard manure and inorganic fertilizers in maize. Indian Journal of Agricultural Sciences. 2001; 71(9):605-607.
2. Chandrashekara CP, Haralapur SI, Muralikriushna S, Girijesh GK. Response of maize to organic manure with inorganic fertilizers. Karnataka Journal of Agricultural Sciences. 2000; 13:1144-146.
3. Darwin C. The formation of vegetable mould through the action of worms with observations on their habits Faber and Faber Ltd, London, 1881, 9-153.
4. Jat MK, Purohit HS, Bahadur S, Garhwal RS, Choudhary M. Effect of integrated nutrient management on yield and nutrient uptake in Sorghum (*Sorghum bicolor).* Indian J. of Agron. 2013; 58(4):543-547.
5. Kadam RS, Amrutsagar MV, Deshpande NA. Influence of organic nitrogen sources with fulvic acid spray on yield and nutrient uptake of soybean on inceptisol. J. of Soils and Crops. 2010; 20(1):58-63.
6. Nagrare IM. Effect of organic sources on growth and yield of soybean-garlic cropping system. Ph. D Thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, 2017.
7. Parmar DK, Sharma V. Nitrogen requirement of single hybrid maize (*Zea Mays* L.) under rainfed condition. Ind. J Agric. Sci. 2001; 71(4):252-254.
8. Patidar M, Mali AL. Effect of farmyard manure, fertility levels and bio-fertilizers on growth, yield and quality of great millet. Indian J Agron. 2004; 49(2):117-120.
9. Patil SL. Response of *rabi* sorghum to tillage, moisture conservation practices, organics and nitrogen in Vertisols of semi-arid tropics. J Maharashtra Agric. Univ. 1998; 23(3):289-293.
10. Ramamurthy V, Shivashankar K. Effect of organic matter and Phosphorus on growth and yield of soybean (*Glycine max*). Indian J Agron. 1996; 41(1):65-68.
11. Singh SK, Varma SC, Singh RPd. Residual effect of organic and inorganic sources of nutrients in lowland rice on succeeding lentil. Indian J Agric. Res. 2004; 38(2):121-125.