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Effect of organic manures on yield, quality and uptake of onion

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Abstract
A field studies were conducted for 2 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 onion crop. The treatment 50% N through FYM + 50% N through vermicompost was recorded significantly higher yield, quality and uptake of nutrients in onion than rest of the treatments.

Keywords: Onion, 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.

Onion is a crop of low input and high returns. Most of the farmers in India are small and marginal. Onion cultivation is more suitable to them as these crops have higher cost benefit ratio than cereals. Onion used for flavouring dishes and adding taste. Besides, low pungent onions are used as salad. The quantum of flavouring and taste components in any commodity largely depends upon the genotypes and input management. Excess use of inorganic fertilizers reduces these components. Further, pesticides make them unfit from health security point of view. So demand for organic products of onion will increase. Being short duration crops, these crops can fit in any cropping system (Vyakaranahal *et al.*, 2008) [9].

Onion is a shallow-rooted crop suitable for various cropping patterns including intercropping and sequential cropping. The demand of onion in September-October month is much more, for completing this demand the kharif onion will cultivate with diversified cropping system growing with *Rabi* sorghum, wheat, chickpea in *Rabi* season after kharif onion. It is very much essential to develop a strong workable and compatible package of nutrient management through organic resources for various crops based on scientific facts.

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

Onion bulb yield (t ha^{-1})

Among the organic treatments, application of 50 % N through FYM + 50 % N through VC recorded significantly highest bulb yield of onion (36.07, 37.20 and 36.64 t ha^{-1}) in *kharif* season than treatment 50 % N through FYM + 50 % N through NSC (31.21, 33.05 and 32.13 t ha^{-1}) and at par with 50 % N through VC + 50 % N through NSC (33.39, 34.66 and 34.02 t ha^{-1}) during 2015-16, 2016-17 and pooled mean basis. The increased in bulb yield at 50 % N through FYM + 50 % N through VC were higher by 14.03 and 7.70 % over 50 % N through FYM + 50 % N through NSC and 50 % N through VC + 50 % N through NSC respectively on pooled data (Table 1). The results on bulb yield confirmed the trend observed earlier for the yield contributing characters and upheld the need of supplementing the organic sources through VC + FYM. This combination play key role in enhancing the efficiency of utilization of native as well as applied nutrients and augment the availability of certain micronutrients and improved the activities of soil microorganisms involved in nutrient transformation and fixation which leading to higher yield and yield components. Our results confirm the findings of Jawadagi *et al.* (2012) [1], Lambade (2013) [3], Rana and Badiyala (2014) [8], Meena *et al*. (2015) [5] and Nagrare (2017) [7]. The control treatment 100 % GRDF recorded marginally onion bulb yield t ha^{-1} over organic treatments during 2015, 2016 and pooled mean.

Table 1: Bulb yield of *kharif* onion as influenced by different organic treatments

Treatment		Bulb yield (t ha^{-1})		
		2015	2016	Pooled
K_1 :	50 % N FYM + 50 % N VC	36.07	37.20	36.64
K_2 :	50 % N FYM+ 50 % N NSC	31.21	33.05	32.13
K_3 :	50 % N VC + 50 % N NSC	33.39	34.66	34.02
	SEm ±	0.67	0.84	0.93
	CD at 5 %	2.01	2.53	2.69
	Mean	33.56	34.97	34.26
	Control- GRDF	36.15	38.16	37.16

Quality parameters

All the quality parameters were significantly influenced by application of different organic sources (Table 2 & 2a). The significantly higher values of quality parameters *viz.*, total soluble solids, reducing sugar, non-reducing sugar, total sugar, sulphur per cent, pungency per cent and carbohydrate was recorded with the application of 50 % N through FYM + 50 % N through VC compared to 50 % N through FYM + 50 % N through NSC and 50 % N through VC + 50 % N through NSC. However, the values of non-reducing sugar, total sugar and sulphur content were at par over 50 % N through VC + 50 % N through NSC during both the years and values of reducing sugar during second year. The quality attributes of onion improved due to increased carbohydrate production during photosynthesis with better source sink relationship and nutrient uptake besides excellent physiological and biochemical activities. The results support the findings of Meena *et al*. (2014) [6]. In control treatment 100 % GRDF, the values of all the quality parameters are lower as compared organic treatments.

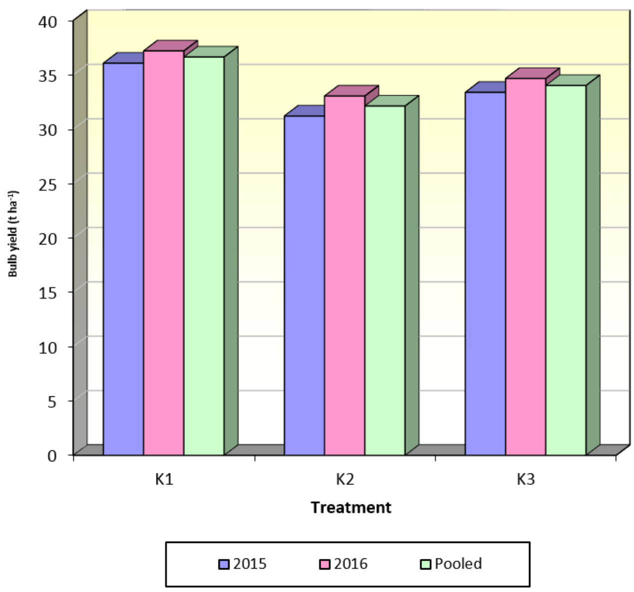

Fig 1: Bulb yield of onion as influenced by different organic treatments

Table 2: Quality parameters of onion as influenced by different organic treatments

Treatment		Total soluble solids (%)		Reducing sugar (%)		Non reducing sugar (%)		Total sugar (%)	
		2015	2016	2015	2016	2015	2016	2015	2016
K_1 :	50 % N FYM + 50 % N VC	12.75	12.85	3.41	3.64	4.48	4.66	7.89	8.34
K_2 :	50 % N FYM + 50 % N NSC	11.40	11.70	3.00	3.20	4.10	4.31	7.10	7.49
K_3 :	50 % N VC + 50 % N NSC	11.84	12.10	3.36	3.57	4.34	4.52	7.69	8.08
	SEm ±	0.12	0.14	0.03	0.04	0.09	0.09	0.10	0.09
	CD at 5 %	0.37	0.46	0.08	0.13	0.28	0.26	0.29	0.28
	Mean	12.00	12.22	3.26	3.47	4.31	4.50	7.56	7.97
	Control- GRDF	12.80	12.92	3.50	3.71	5.04	5.22	7.55	7.91

Table 2a: Quality parameters of onion as influenced by different organic treatments

Treatment		Sulphur (%)		Pungency (%)		Carbohydrate (%)	
		2015	2016	2015	2016	2015	2016
K_1 :	50 % N FYM + 50 % N VC	0.66	0.68	0.0063	0.0067	10.85	10.92
K_2 :	50 % N FYM + 50 % N NSC	0.60	0.63	0.0047	0.0049	10.33	10.45
K_3 :	50 % N VC + 50 % N NSC	0.64	0.67	0.0058	0.0061	10.66	10.63
	SEm ±	0.01	0.01	--	--	--	--
	CD at 5 %	0.05	0.04	--	--	--	--
	Mean	0.63	0.67	0.0056	0.0059	10.61	10.66
	Control- GRDF	0.68	0.71	0.0055	0.0057	10.15	10.21

Total nutrient uptake by onion

Nitrogen, phosphorous and potassium uptake by onion differed significantly due to different organic treatments (Table 3). The uptake of N (57.06 and 60.91 kg ha^{-1}), P (22.42 and 23.64 kg ha^{-1}) and K (47.16 and 53.19 kg ha^{-1}) was significantly higher with 50 % N through FYM + 50 % N through VC over rest of the treatments during both the years. This might be owing to increased supply of nutrients through FYM and VC to the crops, as well as due to the indirect effect resulting from reduced loss of organically supplied nutrients. Similar finding were reported by Mollangouda *et al*. (1995) [4], Kademani *et al.* (2003) [2] and Meena *et al.* (2014) [6]. The control treatment 100 % GRDF recorded marginally total nutrient uptake of onion crop over organic treatments during both the years of experimentation.

Table 3: Total nutrient uptake of N, P and K by onion as influenced by different organic treatments

Treatment		Nitrogen (kg ha-1)		Phosphorus (kg ha-1)		Potassium (kg ha-1)	
		2015	2016	2015	2016	2015	2016
K1 :	50 % N FYM + 50 % N VC	57.06	60.91	22.42	23.64	47.16	53.19
K2 :	50 % N FYM + 50 % N NSC	49.14	52.13	19.27	20.84	38.38	44.77
K3 :	50 % N VC + 50 % N NSC	52.45	55.67	20.65	21.94	41.78	47.90
	SEm ±	1.05	1.11	0.37	0.45	1.03	1.10
	CD at 5 %	3.16	3.33	1.13	1.36	3.10	3.31
	Mean	52.88	56.24	20.78	22.14	42.44	48.62
	Control- GRDF	56.84	62.16	23.88	26.18	51.24	58.69

Conclusion

It was concluded that the treatment 50% N through FYM + 50% N through vermicompost recorded the higher yield and quality parameters of onion as well as higher uptake by onion.

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