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Effect of integrated nutrient management on onion yield and soil properties under *Chromic Haplusterts* of Karnataka

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ABSTRACT

A field experiment was conducted during the Kharif season of 2002 and 2003 under *Chromic Haplusterts* (medium black soils) at Zonal Agricultural Research Station, Hiriyur to study the effect of Coir Pith Based Compost (CPBC) along with organic manures and inorganic fertilizers on yield of Onion. The study revealed that combined application of CPBC @ 15 t/ha along with press mud (PM) and half the recommended dose of fertilizer (RDF) gave significant higher bulb yield of onion (14.70 t/ha) as compared to RDF along with FYM (9.55 t/ha). The bulb yields were on par with the combined application of CPBC along with FYM and 50% RDF or combined application of CPBC and Green manure (GM) along with 100% RDF, indicating the utility of CPBC in onion cultivation. Higher net and gross returns were recorded with application of CPBC and PM @ 15 t/ha each along with 50% RDF with better benefit cost ratio. The yield and quality parameters also differed significantly among the various combinations of CPBC with PM or FYM in conjunction with inorganic fertilizers. Analysis of the soil after the harvest of onion crop did not show any significant difference in pH and EC among the treatments. However, organic carbon, available phosphorus and available potash were significantly higher due to application of CPBC, PM, FYM and GM along with 50% or 100% RDF.

Key Words: Onion, coir pith based compost, economics, soil properties

INTRODUCTION

Onion is an of the important vegetable crop of commerce in Karnataka. It is predominantly grown under rainfed condition in central dry zone of Karnataka although it is also grown under protective irrigation to some extent.

Continuous application of inorganic fertilizers to soil tends to reduce the yield of crops over time by affecting the soil properties. This calls for use of organic manures in crop production (Biswas and Bendi, 1989). Application of organic manures is known to improve the weight and girth of the individual bulbs in addition to influencing the quality and keeping quality of onion. Onion is a heavy feeder of nutrients and thus requires heavy doses of organic manures. On an average, onion crop requires about 30 t of farmyard manure (FYM) per hectare apart from inorganic fertilizers (Anon. 2005). In recent years, reduction in the cattle population and increasing mechanization of agriculture has led to an enormous reduction in the availability of organic manures. This calls for converting locally available resources into organic manures as well as evaluating their utility in crop production. Coir pith is one such waste material which is available freely and in plenty in Chitradurga district and, which can be converted into organic manure easily. Studies on the effect of combined application of Coir Pith Based Compost (CPBC) along with other organic sources of nutrients in combination with inorganic sources of nutrients on onion are lacking. Hence an attempt has been made to study the agronomic efficiency as well as economics of use of CPBC along with other organic sources of nutrients in onion.

MATERIAL AND METHODS

A field experiment was conducted during the Kharif season of 2002 and 2003 at Zonal Agricultural Research Station, Hiriyur under protective irrigation. The soil was medium black with pH of 8.7 and contained 0.45 % O.C, 20.8 kg/ha available P_2O_5 and 168.0 kg/ha of available K_2O. The experiment was laid out in a Randomized Complete Block Design with three replications. There were twelve treatment combinations (Table1), which included various combinations of inorganic fertilizers with various sources of organic manures viz., CPBC, FYM, Press mud (PM), Copper ore tailings (COT)

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Table 1. Treatment details

Treatment number	Details of treatments
T_1	Recommended Dose of Fertilizer alone (RDF) (125 N: 50 P_2O_5: 125K_2O Kg/ha)
T_2	Coir Pith Based Compost (CPBC) @ 15 t/ha + 50% RDF
T_3	CPBC @ 30 t/ha + 50% RDF
T_4	CPBC @ 15t/ha + Press Mud @ 15t/ha + 50% RDF
T_5	CPBC @ 15t/ha + Press Mud @ 15t/ha + RDF
T_6	CPBC @ 15t/ha + Copper ore tailings @ 1t/ha + 50% RDF
T_7	CPBC @ 15t/ha + Copper ore tailings @ 1t/ha + RDF
T_8	CPBC @ 15t/ha + Green Manuring @ 15t/ha + 50% RDF
T_9	CPBC @ 15t/ha + Green Manuring @ 15t/ha + RDF
T_{10}	CPBC @ 15t/ha + FYM @ 15t/ha+ 50% RDF
T_{11}	CPBC @ 15t/ha + FYM @ 15t/ha+ RDF
T_{12}	RDF + FYM @ 30t/ha

and green manure (GM). The CPBC had 1.06% N, 0.08% P, 0.85% K, FYM had 0.83% N, 0.20% P, 0.61% K, PM had 1.63% N, 1.47% P, 0.61% K, GM contained 0.60% N, 0.13% P, 0.40% K and COT contained 0.3% N, 0.04% P and 0.14% K. These organic manures were spread uniformly in the respective plots and incorporated in the soil to a depth of 8-10 cm before sowing. The seeds of onion cv. Satara Gharva three weeks which is widely grown in central dry zone of Karnataka, were sown on finely prepared seed bed and forty days old seedlings were transplanted at a spacing of 15 cm x 10 cm in the second week of July in both the years after incorporating the required quantity of inorganic fertilizers in each plot. Standard crop protection measures were adopted for onion cultivation during the crop growth.

After 110 days of transplanting, mature onion bulbs were harvested and sun dried. The bulbs were separated from the stalks and the bulb yield was recorded. Onion bulbs were cut horizontally and the number of layers was counted. A hand-held refractometer was used to measure the total soluble solids (TSS). Polar and equatorial diameter of bulb were measured by vernier calipers. Volume of the bulbs was measured as the amount of water displaced by the individual bulbs using a measuring cylinder. The prevailing rates of the inputs as well as the produce were used to work out the actual cost of cultivation, and the returns obtained from each treatment combination. The data were subjected to statistical analysis as per the method outlined by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Bulb yield of onion differed significantly due among the treatment combinations in which organic manure was applied along with fertilizers. The highest mean bulb yield of 14.7 t/ha was recorded with the combined application of CPBC with PM and half the recommended dose of fertilizer (RDF) as compared to RDF along with FYM (Table 2). The lowest mean bulb yield of onion was obtained with the application of RDF alone (7.66 t/ha). Studies conducted by Krishnamurthy and Sharanappa (2005) also indicated an increase in bulb yield of onion due to combined application of compost prepared from different sources along with RDF. Bulb yield of onion obtained by the combined application of CPBC either with COT or with FM were the same indicating the utility of compost prepared from agro waste like coir pith in producing onion.

Table 2. Bulb yield and quality parameters of onion as influenced by combined application of organic and inorganic sources of nutrients

Treatments	Bulb Yield (t/ha)			Quality parameters (Mean of two years)				
	2002	2003	Mean	Bulb Volume (ml)	Number of layers per bulb	Equatorial bulb diameter (cm)	Polar (cm) bulb diameter	Total soluble solids(%)
T_1	5.21	10.11	7.66	41.5	5.4	3.6	3.2	9.7
T_2	6.44	10.95	8.69	43.3	6.2	4.6	4.3	10.0
T_3	7.81	13.00	10.40	50.7	7.7	5.0	4.4	10.7
T_4	12.73	16.68	14.70	57.8	12.9	6.3	5.3	11.1
T_5	10.26	13.03	11.64	51.0	8.3	5.0	4.6	10.7
T_6	6.49	11.24	8.86	44.2	7.1	4.7	4.2	10.1
T_7	7.34	12.42	9.88	50.2	7.4	4.9	4.4	10.6
T_8	7.52	12.50	10.01	50.5	7.7	4.9	4.4	10.6
T_9	10.47	14.00	12.23	55.1	10.5	5.5	4.9	10.7
T_{10}	12.0	14.02	13.03	57.3	12.4	6.0	5.0	10.8
T_{11}	7.16	11.62	9.39	48.8	7.4	4.8	4.4	10.3
T_{12}	7.02	11.29	9.55	49.2	7.3	4.8	4.3	10.1
SEm±	9.32	8.59	9.19	12.13	6.35	5.13	2.99	4.05
C.D(*P=0.05*)	3.23	2.97	3.18	4.32	5.13	1.83	1.35	NS

The yield parameters of onion like bulb volume, number of layers per bulb, polar and equatorial diameter of the bulb differed significantly among the treatments in which CPBC was applied with different sources of organic and inorganic nutrients (Table 2). The volume of the bulbs was significantly higher with the application of CPBC and PM along with half of the RDF (57.8 ml), which is on par with application of CPBC and FYM along with half of the RDF (57.3 ml). The number of layers per bulb as well as equatorial and polar diameter of individual bulbs also followed a similar trend (Table 2). However, an important quality parameter of onion bulbs viz; Total soluble solids was not influenced by any of the treatment combinations, although it was higher in T4 (11.1%). These results are in conformity with those of Venna *et al* (1972), Hussaini and Aman (2000).

The economic benefits of use of CPBC along with other organic sources combined with recommended or half the RDF was assessed by calculating the net and gross returns and benefit cost ratio. The cost of cultivation ranged from Rs. 21,700/ha with RDF alone to Rs. 33,900 /ha with RDF along with recommended organic manures (Table 3). The highest gross return of Rs.73,500/ha was obtained by the combined application of CPBC along with PM and half of the RDF as compared to either RDF alone (Rs. 38,300 / ha) or combined application of RDF and FYM (Rs. 47,750 /ha). The gross return was the lowest with the application of RDF (Rs. 38,300/ha). Similarly, the highest net returns were obtained by the combined application of CPBC along with PM and half the RDF (Rs. 47,800/ha) followed by the combined application of CPBC with FYM and the RDF (Rs. 35,850/ha) as against the combined application of RDF alone, which recorded the lowest net returns (Rs.16,600/ ha). The benefit cost ratio of 2.86 was obtained by the combined application of CPBC and PM along with half the RDF which was on par with the remaining treatment combinations except the application of RDF alone and combined application of FYM with half the RDF. This is mainly because of lower cost of production of CPBC, as it is made from coir pith, a byproduct of industry, which is presently going waste. The benefit cost ratio was lowest with the combined application of RDF along with FYM (1.41). The lower net returns and benefit cost obtained with the combined use of manures and fertilizers may be attributed to higher cost as well as handling charges particularly with respect to FYM. The results are inconformity with the findings of Krishnamurthy and Sharanappa (2005).

Table 3. Economics of onion crop as influenced by combined application of organic and inorganic sources of nutrients (Mean of two years)

Tr. No	Cost of Cultivation (Rs /ha)	Gross Returns (Rs /ha)	Net Returns (Rs /ha)	B: C Ratio
T_1	21700	38300	16600	1.76
T_2	23300	43450	20150	1.86
T_3	26300	52000	25700	1.98
T_4	25700	73500	47800	2.86
T_5	30100	58200	28100	1.93
T_6	26800	44300	17500	1.65
T_7	24900	49400	24500	1.98
T_8	23800	50050	26250	2.10
T_9	28200	61150	32950	2.17
T_{10}	29300	65150	35850	2.22
T_{11}	30700	46950	16250	1.53
T_{12}	33900	47750	13850	1.41
SEm±	NA	11710	8416	2.63
C.D(*P=0.05*)	-	4150	3850	0.93

Rate of Onion : Rs. 5000 per ton

Soil analysis after the harvest of onion crop did not show any significant change in pH and EC among the treatments (Table 4). These observations are in line with those of Badanur *et al* (1990). But, the organic carbon was significantly higher (1.11 %) where CPBC and PM were applied @ 15 t/ha each along with 50% RDF as compared to application of 100% RDF alone. This could be attributed to better root growth and higher amount of plant residues added to soil after harvest (Bhriguvanshi, 1988; Bhandari *et al*, 1992). Similarly, available phosphorus was also higher in treatments where CPBC and PM were applied @ 15 t/ha each along with 100 % RDF (69.7 kg $P_2 0_5$ /ha) and 50% RDF (61.7 kg $P_2 0_5$ /ha) as compared to other treatments. Application of CPBC and PM, which are acidic in nature dissolved the fixed P of black soil and enhanced the available P content of the soil. This is in conformity with the findings of Subramanian and Kumaraswamy (1989). However, the available potash was significantly higher (221 kg K_2O /ha) where CPBC and GM were applied @ 15 t/ha each with 100% RDF, which was on par with CPBC @ 30 t/ha with 50% RDF or FYM @ 30 t/ha with 100% RDF or CPBC and FYM @ 15 t/ha each with 50 % or 100% RDF application. Since cellulose is a major component of coir pith, its contains various organic acids, which might have solubalised the non-exchangeable K to soluble forms of K to some extent (Chitra and Janaki, 1999).

Based on the present study, it can be concluded that CPBC can be used as a cheap source of nutrient as well as a better substitute to the scarcely available FYM. Apart from this, combined application of CPBC along with

Table 4. Soil properties after harvest of onion crop as influenced by CPBC and other organics and in-organics

Treatments	pH (1:2.5)	EC (1:2.5)	OC (%)	Av.P_2O_5 (Kg/ha)	Av.K_2O (Kg/ha)
RDF (100%) only	8.6	0.18	0.52	27.5	174
CPBC @ 15t/ha+RDF(50%)	8.6	0.18	0.95	31.3	170
CPBC @ 30t/ha+RDF (50%)	8.6	0.20	0.97	31.7	201
CPBC @ 15t/ha+Pressmud @15t/ha + RDF (50%)	8.6	0.19	1.11	61.7	190
CPBC @ 15 t/ha+Pressmud @ 15t/ha +RDF (100%)	8.6	0.17	1.02	69.7	183
CPBC @ 15t/ha+COT @ 1 t/ha+RDF (50%)	8.7	0.20	0.91	33.1	182
CPBC @15t/ha+COT @ 1t/ha +RDF (100%)	8.7	0.18	0.97	34.8	187
CPBC @ 15 t/ha+GM @ 15 t/ha+RDF (50%)	8.7	0.19	0.97	32.6	190
CPBC @ 15t/ha+GM @15 t/ha+RDF (100%)	8.6	0.18	0.93	42.8	221
CPBC @ 15t/ha+FYM @ 5t/ha+RDF (50%)	8.7	0.18	1.03	49.5	210
CPBC @ 15t/ha+FYM @ 15t/ha+RDF (100%)	8.6	0.19	0.97	53.5	206
FYM @ 30t/ha+RDF (100%)	8.6	0.17	0.97	47.5	204
CD (*P=0.05*)	NS	NS	0.19	12.8	30.3
Initial	8.7	0.15	0.50	20.8	168

PM saves the requirement of inorganic nutrients by about a half of the recommended levels.

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