

Organic Farming Packages for High Value Groundnut (*kharif*)-Onion (*rabi*) Cropping System for Saurashtra Region

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ABSTRACT

A field experiment was undertaken during 2003-04 to 2012-13 at Farming System Research Centre, Junagadh (Gujarat) to develop the organic farming package for system based high value groundnut (kharif)-onion (rabi) crop sequence in non replicated design. Total eight treatments were included with nutrient supplied through chemical fertilizers and organic manure or residue incorporation in addition to agronomic package of practices. At the end of 10th crop sequence, pod and haulm of groundnut and bulb yield of onion were augmented with application of 50% recommended dose of fertilizers (RDF) + 50% recommended dose of nitrogen (RDN) through farmyard manure (FYM) as compared to individual application of organic and inorganic fertilizers. Application of 50% RDF + 50% RDN through organic fertilizer in form of FYM recorded the highest groundnut equivalent yield (GEY) with 12% increase over RDF. The integrated nutrient supply treatment earned net income of ₹ 108203/ha which was 12% higher as compared to RDF. Among the different organic source of fertilizers treatments, 50% RDN through FYM + bio-fertilizer for N + rock phosphate to substitute the 'P' requirement of crops + phosphate solubilizing bacterial culture showed maximum pod yield. Though, the different organic packages showed inconsistent response under individual years.

Keywords: Organic package, FYM, Bio-fertilizer, Fertilizer, Crop sequence

1. INTRODUCTION

Scientific surveys and evidences indicate that application or spray of synthetic fertilizers, insecticide, fungicide, herbicide, hormones etc left undissolved and harmful elements which are transferred to human and other living bodies through grains, vegetables, fruits and grasses, causing a number of diseases, ailments and harmful effects on our health. Organic farming is a system of production that relies on animal manures, organic wastes, crop rotations, legumes and aspects of biological pest control. It avoids (or largely excludes) the use of synthetically produced fertilizers,

pesticides, growth regulators and livestock feed additives. It is the ecological production management system that promotes and enhances biodiversity, biological cycles and biological activity of the soil.

Organic farming is gaining gradual momentum across the world. Growing awareness of health and environmental issues in agriculture has demanded production of organic food which is emerging as an attractive source of rural income generation. World organic farming scenario indicate that about 310 lakh hectares land under organic farming with including 12.07 lakh hectares area of India. Gujarat ranks 12th place among the different states of India with respect to area under organic farming (Mahapatra *et al.*, 2009).

2. MATERIALS AND METHODS

This investigation was started at Farming System Research Centre, (AICRP-IFS), Department of Agronomy, Junagadh Agricultural University, Junagadh (Gujarat, India) from 2003-04 with a view to develop organic farming package for system based high value crops of groundnut (*kharif*)-onion (*rabi*) sequence. The soil was medium black with initial status of experimental site were organic carbon 0.51%, pH 7.43, E.C. 0.53 dS/m and medium in available nitrogen (231.68 kg/ha), phosphorous (19.24 kg/ha) and potassium (244.42 kg/ha). The experiment comprises seven treatments (Table 1) with large plot and non- replicated.

The statistical analysis was computed by considering year as replication. The gross and net area of the treatment was 300 m² and 193.8 m², respectively. Groundnut (cv. GG 20) was sown around the second fortnight of June. The application of chemical fertilizers as basal dose and organic manures like FYM, caster cake, and vermi-compost as per recommended dose of nitrogen basis were incorporated with soil at the time of field preparation. The bio-fertilizers (*Rhizobium* and phosphate solubilizing bacteria) were treated with groundnut kernels @ 4 g/kg kernel. The groundnut was sown at 60 cm x 10 cm spacing with seed rate of 120 kg/ha. Supplementary irrigation was given during dry spell.

Onion (cv. Agri Found Light Red) was transplanted in first week of December when the seedlings were about 45 days old. The transplanting of onion was done manually at spacing of 15 cm x15 cm. The basal application of chemical fertilizers and manures were applied as per treatments to all the plots at the time of land preparation. The remaining half dose of nitrogen in treatment T₁, T₇ and T₈ was applied in form of urea at 35 DAT of onion.

Table 1: Treatment details

T ₁	50% Recommended NPK+50% RDN as FYM
T ₂	Different organic sources each equivalent to 1/3 of recommended N (FYM + Vermicompost + Non-edible oil cake)
T ₃	T ₂ + Trap crop (maize in <i>Kharif</i> / Merigold in <i>Rabi</i>)
T ₄	T ₂ + Agronomic practices for weed and pest control (Non chemical pesticides and herbicides)
T ₅	50% N as FYM + Bio-fertilizer for N + rock phosphate + phosphate solubilizing bacterial culture (PSB)
T ₆	T ₂ + Bio-fertilizer containing N and P carriers
T ₇	100% NPK as per RDF or as per soil test

The experiment was conducted under assured irrigation facilities and need based irrigations were applied to onion as per recommended practices. The state recommended dose of fertilizers for groundnut and onion were 12.5-25-0 and 75-50-60 kg NPK/ha, respectively adopted.

3. RESULTS AND DISCUSSION

Groundnut yield

The mean pod yield of ten years indicated that pod yield was significantly influenced by different treatments. Application of 50% RDF through chemical fertilizers + 50% RDN through FYM recorded significantly the highest pod of 18.92 q/ha. The application of FYM, rock phosphate and bio-fertilizers (T₅) showed statistically similar pod yield. The mean pod yield of groundnut was increased over RDF (T₇) to the tune of 11.56% by application of 50% RDF through chemical fertilizers + 50% RDN through FYM (T₁). It is indicated that integrated nutrient management through organic and inorganic fertilizers is prime important to achieve better yield. The increases in pod yield under T₁ might be due to synergistic effect of optimum rate of integrated sources of nitrogen fertilizers, which enhanced the photosynthetic activity and accumulation of carbohydrates, which in turn translocated in large amount to the pods resulting in higher pod yield. Chaturvedi and Chandel (2005) also reported beneficiary effect of combined application of FYM and chemical fertilizers on yield of soybean based cropping.

Among the different organic source, application of 50% RDN through FYM + bio-fertilizer for N + rock phosphate + phosphate solubilizing bacterial culture (T₅) showed maximum pod yield.

Onion yield

The mean of 10th crop cycle, application of 50% RDF + 50% RDN through organic fertilizer reported significantly higher bulb yield (279.99 q/ha). While in organic treatments, different

organic sources like, FYM, Vermi-compost and non-edible oil cake each equivalent to 1/3 RDN + agronomic practices for weed and pest control gave maximum bulb yield (254.71 q/ha). These results indicated that application of inorganic and organic sources didn't performed better individually, but in combination, it showed better onion yield.

The results also revealed that bulb yield of onion was increased by 12.03% with application of 50% RDF through chemical fertilizers + 50% RDN through FYM (T_1) over application of only inorganic fertilizer (RDF).

Groundnut Equivalent Yield

A perusal of mean data on groundnut equivalent yield presented in Table 3 revealed that groundnut and onion fertilized with the 50% RDF through chemical fertilizer and 50% RDN in form of FYM (T_1) recorded significantly higher groundnut equivalent yield (59.01 q/ha). Inorganic fertilizers or organic fertilizers alone were failed to show their superiority but in combination reported better performance. The magnitude of increase in groundnut equivalent yield under T_1 was to the tune of 12.29% over RDF (T_7). Among the different organic source of nutrients, application of 50% RDN as FYM + bio-fertilizer for N + rock phosphate + PSB (T_5) showed better performance with mean maximum GEY (53.90 q/ha).

Economics of sequence

The gross return as influenced by different nutrient management (organic and inorganic) practices (Table 3) revealed that significantly highest mean gross income (₹ 164712/ha) was earned in plot treated with 50% RDF + 50% RDN through FYM, followed by organically treated plot with 50% RDN as FYM + bio-fertilizer for N + rock phosphate + PSB (T_5). The net return and benefit:cost (B:C) ratio (Table 3) were also maximum under integrated nutrient management treatment T_1 .

4. CONCLUSION

At the end of 10th crop sequence, the groundnut pod and onion bulb yields were augmented with application of 50% RDF + 50% RDN through FYM as compared to individual application of organic and inorganic sources. Application of 50% RDF + 50% RDN through FYM gave 12% higher GEY over RDF. The integrated nutrient supply treatment (T_1) earned net income of ₹ 108203/ha, which was 12% higher as compared to only chemical fertilizer (RDF) application.

REFERENCES

- [1] Chaturvedi, S. and Chandel, A.S.2005. Influence of odrganic and inorganic fertilization on soil fertility and productivity of soybean (*Glycine max*). *Indian Journal of Agronomy* **50**(4):311.
- [2] Mahapatra, B. S.; Ramasubramanian, T. and Chowdhury, H. (2009). Organic farming for sustainable agriculture: Global and Indian perspective. *Indian Journal of Agronomy* **54** (2): 178-185.

Table 2: Influence of different organic packages on pod yield of groundnut

Treatment	Groundnut pod yield (q/ha)									
	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2010-11	2011-12	2012-13	Mean
T ₁	32.66	21.98	20.02	16.17	17.43	18.29	13.08	14.26	16.41	18.92
T ₂	32.10	21.38	17.6	14.55	15.74	16.02	10.58	12.54	12.75	17.09
T ₃	33.23	22.19	18.27	15.04	14.82	15.92	10.47	12.28	12.13	17.15
T ₄	31.53	19.5	16.77	14.34	15.87	15.33	11.58	12.95	13.52	16.82
T ₅	31.94	21.93	19.25	15.79	16.23	17.26	10.42	15.28	16.82	18.32
T ₆	30.55	24.41	17.85	15.51	16.49	15.66	10.22	11.56	14.24	17.39
T ₇	30.29	22.39	17.39	13.03	16.51	13.6	11.92	12.87	14.6	16.96
S.Em.±										0.36
C.D. at 5%										1.02

Table 3: Influence of different organic packages on bulb yield of onion

Treatment	Bulb yield (q/ha)									
	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2010-11	2011-12	2012-13	Mean
T ₁	329.98	238.91	282.51	231.43	201.03	342.47	284.36	242.37	366.88	279.99
T ₂	319.92	201.24	234.78	207.95	182.15	310.91	249.95	208.36	321.16	248.49
T ₃	340.04	194.02	251.03	187.05	191.13	308.41	243.29	216.46	324.98	250.71
T ₄	360.01	208.46	260.32	180.19	171.67	301.06	255.05	223.63	328.18	254.29
T ₅	279.98	223.43	272.19	199.59	187.72	299.19	194.79	235.4	347.68	248.89
T ₆	279.36	203.3	253.36	192.21	194.22	293.58	259.49	212.08	302.38	243.33
T ₇	310.01	219.82	259.03	203.46	175.7	299.9	226.67	213.42	341.33	249.93
S.Em.±										5.37
C.D. at 5%										15.23

Table 4: Influence of different organic packages on groundnut equivalent yield (GEY) and economics of groundnut-onion cropping system (Mean over 2003-04 to 2012-13)

Treatment	GEY (q/ha)	Gross return (₹/ha)	Cost of cultivation (₹/ha)	Net return (₹/ha)	B:C
T₁	59.01	164712	56509	108203	1.83
T₂	52.76	146005	62595	83410	1.29
T₃	53.06	147354	62824	84530	1.31
T₄	53.15	148416	61932	86484	1.35
T₅	53.90	152945	57509	95436	1.58
T₆	52.42	145945	61607	84338	1.32
T₇	52.55	147795	55446	92348	1.58
S.Em.±	0.99	3211	647	3137	0.05
C.D. at 5%	2.80	9100	1835	8892	0.15