

# Evaluation of Organic Farming for Groundnut-Wheat Cropping Sequence

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## ABSTRACT

*A field experiment was conducted at Junagadh on clayey soil during 2010-11 to 2012-13 at Junagadh (Gujarat) to evaluate the potentiality of organic farming in groundnut-wheat cropping sequence in terms of productivity, profitability and soil health. Treatments comprised farmyard manure (FYM), farm compost (FC), vermicompost (VC, poultry manure (PM), biofertilizer (BF) and recommended dose of fertilizers (RDF). The organic manures were applied on equivalent N basis. Biofertilizer viz., Rhizobium for groundnut and Azotobacter for wheat was applied as seed treatment. Results revealed that application of FYM and VC recorded significantly higher pod yield (1786 and 1665 kg/ha) and haulm yield (3147 and 2978 kg/ha) of groundnut as compared to RDF. While RDF and VC recorded significantly higher grain yield (4332 and 3885 kg/ha) and straw yield (6404 and 5967 kg/ha) of wheat. Maximum net return and B:C ratio were obtained with FYM in groundnut and RDF to wheat. Overall maximum net return and B:C ratio from groundnut-wheat cropping system were realised with FYM. Application of organic manures to groundnut-wheat sequence significantly improved bulk density, organic carbon content, post harvest soil fertility, and increased uptake of N, P and K over RDF.*

**Keywords:** Fertilizer, FYM, compost, poultry manure, vermicompost, biofertilizer, Rhizobium, Azotobacter

## 1. INTRODUCTION

Indiscriminate and excessive use of chemicals has put forth a question mark on sustainability of agriculture in the long run calling attention for sustainable production which will address soil health, human health and environmental health and eco-friendly agriculture. Groundnut-wheat is one of the pre-dominant cropping sequences found suitable especially under Saurashtra conditions. The nutrient requirement of any crop must be based on entire cropping sequence. Hence it is highly essential to apply organic sources which are easily available and feasible. Maintenance of soil organic matter is pre-requisite for maintaining soil health and crop productivity. Therefore, the present study of organic farming in comparison to chemical fertilizers was undertaken in groundnut-wheat crop sequence.

## 2. MATERIAL AND METHODS

A field experiment was conducted at Junagadh during 2010-10 to 2012-13 at Department of Agronomy, Junagadh Agricultural University, Junagadh (Gujarat) to evaluate the potentiality of organic farming in groundnut (*kharif*)-wheat (*rabi*) crop sequence. Treatments comprising farmyard manure (FYM), farm compost (FC), vermicompost (VC), poultry manure (PM), biofertilizer (BF) and recommended dose of fertilizers (RDF) were tried in randomized block design with four replications. The soil of the experimental site was clayey in texture, slightly alkaline in reaction, low in available N and P and high in available K. The RDF for groundnut and wheat was 12.5-25-0 and 120-60-0 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O/ha, respectively. The FYM, farm compost, vermicompost and poultry manure were applied @ 2.500, 3.125, 0.625 and 1.250 t/ha to groundnut and 24.000, 30.000, 6.000 and 12.000 kg/ha to wheat on equivalent N basis. Biofertilizer viz., *Rhizobium* for groundnut and *Azotobacter* for wheat were treated with seeds @ 10 g/kg seed. Groundnut (cv. GG 20) and wheat (GW 366) were raised with recommended package of practices. Economics of different treatments was worked out on the basis of prevailing market price of inputs and produce. For organic treatments, 20% higher market price of produce was considered. Soil analysis for bulk density, organic carbon, and available NPK after harvest as well as plant analysis for NPK content were carried out by standard procedures.

## 3. RESULTS AND DISCUSSION

### *Crop Yield*

**Groundnut:** Significantly higher pod yield of 1786 kg/ha was recorded with application of FYM in pooled results, which remained statically at par with vermicompost (1665 kg/ha). On the other hand, significantly the lowest pod yield (1106 kg/ha) was recorded with biofertilizer (Table-1). Application of FYM recorded significantly the highest haulm yield of 3147 kg/ha, however it remained statistically at par with vermicompost (2978 kg/ha). While, significantly the lowest haulm yield (2045 kg/ha) was registered with biofertilizer (Table-1). Sagarka *et al.* (2010) and Sutaria *et al.* (2010) also reported similar results.

**Wheat:** Significantly higher grain yield of 4332 kg/ha and straw yield of 6404 kg/ha were recorded when crop was fertilized with RDF, but it remained statistically equivalent to vermicompost in respect of straw yield (5967 kg/ha). On the contrary, application of biofertilizer registered significantly the lowest grain yield of 2795 kg/ha and straw yield of 4541 kg/ha (Table-1). Similar results were also reported by Chaturvedi (2006) and Rajkhova and Borah (2008).

### *Economics*

**Groundnut:** Application of FYM recorded higher net returns of Rs. 65470/ha and B:C ratio of 5.13, followed by that of vermicompost which recorded net returns of Rs. 59663/ha and B:C ratio of 4.67 (Table-1).

**Wheat:** Fertilizing the crop with RDF recorded higher net returns of Rs. 57074/ha and B:C ratio of 3.60, followed by FYM in case of net returns (Rs. 48341/ha) and biofertilizer in case of B:C ratio (3.34) (Table-1).

**Cropping sequence:** Application of FYM resulted in higher net returns of Rs. 113810/ha and B:C ratio of 3.45, followed by vermicompost in case of net returns (Rs. 107882) and RDF in case of B:C ratio (3.42) from the groundnut-wheat cropping sequence (Table-1).

### *Nutrient Uptake*

**N uptake:** Application of FYM recorded significantly higher N uptake by groundnut (123 kg/ha). The seed treatment with biofertilizer recorded significantly lower uptake of N (74 kg/ha) (Table-2). Significantly higher uptake of N by wheat (127 kg/ha) was registered under RDF. Significantly lower uptake of N (82 kg/ha) was observed under biofertilizer (Table-2).

**P uptake:** Significantly higher uptake of P (12.8 kg/ha) by groundnut was recorded with FYM. Seed treatment with biofertilizer resulted in lower removal of P (7.6 kg/ha) (Table-2). Whereas, significantly higher uptake of P (19.3 kg/ha) by wheat was registered with RDF, but remained at par with vermicompost (18.1 kg/ha). The biofertilizer resulted in lower removal of P (12.7 kg/ha) (Table-2).

**K uptake:** Manuring with FYM recorded significantly higher uptake of K (31.2 kg/ha) by groundnut. Whereas, significantly lower uptake of K (17.9 kg/ha) was observed under biofertilizer (Table-2). Significantly higher uptake of K (78.9 kg/ha) by wheat was registered under RDF, but it was at par with vermicompost and FYM. Significantly lower uptake of K (58.7 kg/ha) was recorded with biofertilizer (Table-2).

### *Post Harvest Soil Fertility*

Application of organic manures improved soil health by decreasing bulk density and increasing organic carbon, and available N, P and K status after harvest of groundnut and wheat.

## **4. CONCLUSION**

Higher net return along with sustained soil health can be achieved by application of FYM to groundnut and wheat. Hence, under organic farming, groundnut-wheat crop sequence can be manured with FYM on equivalent N basis on clayey soil of south Saurashtra agro-climatic zone.

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**Table 1. Effect of different treatments on crop yield and net returns (Pooled over three years)**

Treatment	Groundnut yield (kg/ha)		Wheat yield (kg/ha)		Net returns (Rs/ha)			B:C ratio		
	Pod	Haulm	Grain	Straw	Groundnut	Wheat	Sequence	Groundnut	Wheat	Sequence
FYM	1786	3147	3627	5566	65470	48341	113810	5.13	2.58	3.45
FC	1554	2775	3323	5034	54958	41710	96667	4.47	2.36	3.08
VC	1665	2978	3885	5967	59663	48219	107882	4.67	2.33	3.05
PM	1359	2620	3068	4770	46405	33448	79853	3.91	2.00	2.62
BF	1106	2045	2795	4541	36250	42681	78931	3.54	3.34	3.42
RDF	1248	2282	4332	6404	32926	57074	90000	3.15	3.60	3.42
LSD (P=0.05)	131	233	296	535						

**Table 2. Effect of different treatments on nutrient uptake by crop (Pooled over three years)**

Treatment	N uptake (kg/ha)		P uptake (kg/ha)		K uptake (kg/ha)	
	Groundnut	Wheat	Groundnut	Wheat	Groundnut	Wheat
FYM	123	100	12.8	17.8	31.2	76.9
FC	104	95	10.9	16.0	26.1	65.2
VC	111	110	11.6	18.1	27.4	80.8
PM	95	90	10.2	15.5	24.8	64.6
BF	74	82	7.6	12.7	17.9	58.7
RDF	86	127	8.6	19.3	21.3	78.9
LSD (P=0.05)	8	8	0.9	1.5	2.2	11.7

**Table 3. Effect of different treatments on post harvest bulk density, organic carbon and available nutrients (Pooled over three years)**

Treatment	Bulk density (g/cm <sup>3</sup> )		Organic carbon (%)		Available N (kg/ha)		Available P (kg/ha)		Available K (kg/ha)	
	Groundnut	Wheat	Groundnut	Wheat	Groundnut	Wheat	Groundnut	Wheat	Groundnut	Wheat
FYM	1.350	1.422	0.78	0.70	223	219	36.0	35.8	252	242
FC	1.382	1.426	0.76	0.68	214	215	38.2	38.3	244	239
VC	1.386	1.449	0.73	0.63	199	209	43.3	41.4	247	236
PM	1.393	1.445	0.74	0.66	206	213	52.1	46.7	254	257
BF	1.412	1.475	0.71	0.61	196	197	32.8	31.2	226	218
RDF	1.460	1.478	0.49	0.51	190	203	29.9	34.6	236	228
LSD (P=0.05)	0.060	0.015	0.10	0.05	9	8	8.7	6.8	8	17

*FYM = Farmyard manure, FC = Farm compost, VC = Vermicompost, PM - Poultry manure, BF = Biofertilizer*

*RDF = Recommended dose of fertilizers*