



Research Article

ORGANIC NUTRIENT MANAGEMENT PACKAGES OF GREEN MANURING POTATO GROUNDNUT SEQUENCE

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Abstract: The field experiment was conducted during 2003-04 to 2014-15 at Centre for Research on Integrated Farming Systems, S.D. Agricultural University, Sardarkrushinagar (Gujarat) to study the "Organic nutrient management packages of green manuring-potato-groundnut sequence". Application of 50 % recommended NPK+ 50% N from FYM+ inorganic sources of micronutrients as per soil test produced the significantly highest potato equivalent yield (47338 kg/ha) of potato as well as recorded the maximum net return (₹ 1,01,551), BCR (1.75), system productivity (130), system profitability (278) and agro energy Kcal (38100), available N (246 kg/ha) and K (330 kg/ha).

Keywords: Potato equivalent yield, Farm yard manure, Benefit cost ratio, potato-ground nut, organic production

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Introduction

Awareness in health conscious has increased the demand of organic products at national as well as international level. The organic sources viz., bio fertilizers, FYM, castor cake, vermicompost and other highly concentrated organic manures are not easily available for nutrient management of high nutrient requiring crops like potato. Farmers of North Gujarat have been practicing in-situ green manuring and using organic manures for years to sustain the soil fertility and crop yield on long- term basis but persuasive confirmation of maintaining the comparable crop yield under organic, inorganic and integrated nutrient management systems is not adequate. At present some of package of practice for individual crops are available which are not enough to sustain the production management system. Potato followed by summer groundnut is prominent cropping system of this region. Therefore, information needs to be generated with respect to suitable combination of different organic sources and green manuring to develop the suitable nutrient-management practices for this high-value organic cropping system for better quality and high-productive food as well as sustainability. Moreover, the information for partial elimination of inorganic nutrients for sequenced cropping is not available. Hence, this experiment was planned.

Material and Methods

The experiment was initiated during 2003-04 at Research Farm, Centre for Research on Integrated Farming Systems, SDAU, Sardarkrushinagar (Gujarat) to study the "Organic nutrient management packages of green manuring-potato-groundnut sequence". The soil at the experimental site was loamy sand with organic carbon (0.26 %), B.D. (1.502 g/cc), porosity (43.32 %), low available nitrogen (195 kg/ha), medium in available phosphorus (23.9 kg/ha) and high in available potassium (261 kg/ha). The experiment was non-replicated with plot size of 300 m². The experiment comprises of eight treatments as given in [Table-1]. The sequence was green manuring- potato - summer groundnut. Green manuring crop sunhemp was grown during kharif in 1st week of July and incorporated after 45 days after sowing.

The potato crop was sown in last week of November and harvested in last week of February. The variety of potato was Khufari badsah sown keeping 45 cm x 20 cm distance. The summer groundnut crop was sown in 1st week of March and harvested in middle of June. The variety of groundnut was GG 20 sown keeping 45 cm x 10 cm distance. Organic source viz., FYM, vermi-compost, castor cake and rock phosphate were analyzed for their NPK composition and applied at the time of sowing according to the treatments. Nutrients contents of each organic material are given in [Table-2]. Seed rate of each crop viz., sunhemp (60 kg/ha), potato (2,500 kg/ha) and groundnut (120 kg/ha) were as per recommendation of North Gujarat. The seeds were treated as per treatment with Rhizobium and PSB culture and were dried under shade before sowing for 3 hrs. The potato and groundnut were fertilized with 220-110-220 NPK kg/ha and 25:50:00 NPK kg/ha, respectively. Tuber & haulm yields of potato and pod & haulm yields of summer groundnut were recorded at the time of harvest of each crop. Equivalent yield of potato was calculated on the basis of market rate of each crop during March 2014 for potato and July 2014 for groundnut. On visual observation damage of insect & pest was not severe in all the crops. Soil studies were carried out by taking soil samples from 0 to 22.5 cm depth at 8 different spots ascertained in a random manner. The samples were drawn before the application of fertilizers to the experimental field during the each year. Estimation of total nitrogen was done by modified Kjeldhal's method. Phosphorus was estimated by Olsen's method. Estimation of potassium was made from acid extract by flame photometric method as described by Jackson, (1973) [1].

Results and Discussion

Effect on potato equivalent yield (PEY)

The result revealed that highest PEY of potato was significantly influenced due to different treatments. The treatment T₇ (100% NPK+ Secondary and micro-nutrients based on soil test) produced the highest potato equivalent yield of potato in 2003-04 to 2004-05.

Organic Nutrient Management Packages of Green Manuring Potato Groundnut Sequence

Table-1 *Treatments details*

T ₁	50% recommended NPK+ 50% N from FYM + inorganic sources of micronutrients as per soil test
T ₂	Different organic sources each equivalent to 1/3 of recommended N (FYM + vermicompost + castor cake)
T ₃	T ₂ + Intercropping or trap crop (location specific in each season)
T ₄	T ₂ + Agronomic practices for weed and pest control (No chemical pesticides and herbicides)
T ₅	50% N from FYM + Bio fertilizer for N (Azotobacter/Rhizobium)+ Rock phosphate to substitute P requirement crop + Phosphate solubilizing bacterial culture (PSB-16)
T ₆	T ₂ + Bio fertilizer containing N (Azotobacter) and P carriers (PSB-16)
T ₇	100% NPK+ Secondary and micro-nutrients based on soil test

Table-2 *Nutrient contents of organic sources added*

Source	N %	P %	K %
FYM	0.53	0.21	0.48
Vermi-compost	0.92	0.73	0.75
Castor cake	4.95	0.31	0.83
Rock Phosphate	-	14	-
Green Manuring crop (Sunhemp)	2.3	0.2	1.62

Table-3 Effect of different treatments on potato equivalent yield of sequence (2003-04 to 2014-15 and pooled)

Treat.	Potato equivalent yield (kg/ha)												
	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Pooled
T ₁	30953	35932	39692	41790	44176	48520	44968	48899	48909	52238	64025	67926	47338
T ₂	19168	30839	41838	42458	40140	43772	41822	45502	45459	49278	63267	62900	43869
T ₃	17136	31048	41765	41040	40044	40097	37866	43190	42332	47482	62668	65113	42481
T ₄	16549	31201	41911	41605	38313	42446	40732	44937	43782	47568	62362	64995	43033
T ₅	14544	29090	38048	36382	33030	34002	32102	32039	31997	35922	47037	52438	34717
T ₆	16446	32185	42323	42809	43040	45623	43935	47322	46389	51024	63190	66632	45073
T ₇	32306	36144	42245	40342	40857	43003	41427	45078	44922	49442	59679	64790	45020
SEM ±													779
CD (0.05)													2207
CV %													6.27

Table-4 *Effect of different treatments on economics, system productivity, system profitability and agro energy (pooled)*

Treatments	Gross return (₹/ha)	Cost of cultivation (₹/ha)	Net return (₹/ha)	BCR	System productivity (kg/ha/day)	System profitability (₹/ha/day)	Agro energy K cal
T ₁	236688	135137	101551	1.75	130	278	38100
T ₂	219343	155412	63931	1.41	120	175	34975
T ₃	212407	158088	54319	1.34	116	149	33925
T ₄	215162	154986	60177	1.39	118	165	34334
T ₅	173584	134394	39191	1.29	95	107	27545
T ₆	225364	155831	69534	1.45	123	191	35841
T ₇	225100	128874	96226	1.75	123	264	36947

Calories/100 g :, Ground nut: 567, Potato: 97

Particulars	Farm gate prices (₹/kg) during 2014-15	Particulars	Farm gate prices (₹/kg) during 2014-15
Potato Tuber	5	Ground nut pod	40
Potato haulm	0.5	Ground nut straw	3

Table-5 *Soil fertility status after 2014-15 as affected by different treatments of organic farming*

Treat.	Available major nutrients (kg/ha)			Available secondary and micronutrient (mg/kg)					O.C. (%)	pH	EC (ds/m)	Bulk density (g/cc)	Porosity (%)
	N	P	K	S	Fe	Mn	Zn	Cu					
T ₁	246	29.64	330	16.36	10.96	18.16	1.7	0.72	0.36	7.1	0.128	1.456	45.06
T ₂	237	27.41	270	17.32	9.96	17.91	1.92	0.76	0.37	6.65	0.127	1.443	45.55
T ₃	234	28.87	286	18.12	9.46	17.36	1.42	0.64	0.37	6.53	0.118	1.439	45.7
T ₄	235	28.8	272	16.94	9.42	17.74	1.98	0.72	0.36	6.51	0.118	1.432	45.96
T ₅	223	31.06	301	15.56	8.48	16.18	1.36	0.66	0.34	6.93	0.122	1.452	45.21
T ₆	232	30.44	296	17.62	9.22	17.96	1.74	0.64	0.36	6.54	0.127	1.444	45.51
T ₇	234	26.3	299	16.26	12	6.08	1.6	0.32	0.28	7.04	0.112	1.461	44.87
Initial	195	23.9	261	13.26	3.26	6.24	0.42	0.36	0.26	7.16	0.14	1.502	43.32

While the result revealed that the highest potato equivalent yield of potato was significantly influenced due to different treatments. The treatment T₆ (Different organic sources each equivalent to 1/3 of recommended N (FYM + vermi compost + castor cake) + bio fertilizer containing N (Azotobactor) and P carriers (PSB-16) produced the highest potato equivalent yield of Potato in 2005-06 to 2006-07. After conversion period the result constantly revealed that the highest potato equivalent yield of potato was significantly influenced due to different treatments. The treatment T₁ (50% recommended NPK+ 50% N from FYM+ inorganic sources of micronutrients as per soil test) produced the highest PEY of Potato in 2007-08 to 2014-15. This result in agreement with [2] who reported insufficiency of manure for optimum yield of crops in short period of time, regardless of the amount (low) they used. On the other hand, [3] reported that application of high rate of nutrient rich farmyard manure alone was sufficient to increase potato yield. Depending on fertilizer combinations, farmyard manure gave a potato tuber yield increase of 38 - 82 % [4].

Pooled

The pooled results revealed that the highest potato equivalent yield of potato was significantly influenced due to different treatments. The treatment T₁ (50% recommended NPK+ 50% N from FYM+ inorganic sources of micronutrients as per soil test) produced the highest potato equivalent yield of potato. Moreover, potassium has stimulating effect on photosynthesis, phloem loading and translocation as well as synthesis of large molecular weight substances in storage organs, thereby contributing to the rapid bulking of the tubers [5].

Effect on soil properties

The highest content values of available N (246 kg/ha) and K (330 kg/ha) were recorded in treatment T₁ (50% recommended NPK+ 50% N from FYM+ inorganic sources of micronutrients as per soil test), P (31.06 kg/ha) was recorded in treatment T₅ (Different organic sources each equivalent to 1/3 of recommended N (FYM + vermi compost + castor cake) + Bio fertilizer containing N (Azotobactor) and P carriers (PSB-16). The highest values of organic carbon (0.37 %) was observed in T₂ Different organic sources each equivalent to 1/3 of recommended N (FYM + vermi compost + castor cake) and T₃ (T₂ + Intercropping or trap crop (location specific in each season)). The result finding similar with [6-7].

Economics

Economic of different treatment was worked out on the basis of selling price of tuber at the time of harvest market value of input. The data indicate that 50% recommended NPK+ 50% N from FYM+ inorganic sources of micronutrients as per soil test (T₁) recorded the maximum value of gross returns (₹ 236688) as well as maximum net return (₹ 101551).

Application of research: In North Gujarat condition increasing the organic farming area the research was framed out fifteen years ago.

Research Category: Farming System

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References

- [1] Jackson M.L. (1973) *Prentice Hall of India Pvt. Ltd., New Delhi.*
- [2] Daniel M. Pant L. M. and Nigussie D. (2008) *West Shoa Ethiopian Journal of Natural Resources*, 10, 85-101.
- [3] Rutunga V. and Neel H. (2006) *Biotechnol. Agron. Soc. Environ.*, 10, 217-228.
- [4] Baniuniene A., Zekaite V. (2008) *Latvian Journal of Agronomy*, 11.
- [5] Singh J.P. (1999) *16th World Congress of Soil Science Montpellier, France, 20-26 August. International Potash Research Institute, Basel, Switzerland*, 123-127.
- [6] Mahapatra B. S., Ramasubramanian T. and Chowdhury H. (2009). *Indian Journal of Agronomy* 54 (2): 178-185.
- [7] Willer H. (2008) *The World of Organic Agriculture: Statistics and Emerging Trends* 2008.