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FB Vani
Ph. D. Student, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India

PC Joshi
Associate Professor, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India

SG More
Assistant Professor, AAC, Beed, V.N.M.K.V, Parbhani, Maharashtra, India

VD Rathwa
Assistant Professor, Seth D.M. Polytechnic in Horticulture, Model farm, Anand Agricultural University, Vadodara, Gujarat, India

Corresponding Author:
FB Vani
Ph. D. Student, College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India

Effect of integrated nutrient management on economics of onion (*Allium cepa* L.) Under north Gujarat condition

FB Vani, PC Joshi, SG More and VD Rathwa

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Abstract
The result revealed that the ssignificantly maximum yield (585.07), net return (3,97,195 ₹/ha) and BCR (6.60) was found under treatment T_7 (75% RDN through vermicompost + 25% N through chemical fertilizer). Efficient nutrient management in *rabi* onion, application of 75% RDN through vermicompost alongwith 25% N through chemical fertilizer is beneficial for obtaining higher yield and economic return under North Gujarat Agro-climatic condition.

Keywords: Nutrient, INM, economics, yield, onion, allium

Introduction
Onion (*Allium cepa* L.) is one of the oldest bulb crops known to mankind and it is consumed worldwide. According to Vavilov (1951) [6] the primary centre of origin of onion lies in Central Asia. The near East and Mediterranean are the secondary centres of origin and it was introduced in India from Palestine (Yadav *et al*., 2013) [7] and it belongs to family *Alliaceae*. The other members of this family are garlic, leek *etc*. The *Allium* genus comprises of 300 to 500 species (Peterson *et al.,* 1988) [4] which are widely distributed in Northern temperate region ranging from Northern hemisphere, North America, North Africa, Europe and Asia. The common onion grown for dry bulb is *Allium cepa* L. It is valued for its distinct pungent flavour and is an essential ingredient in almost every kitchen around globe. Onion is also designated as "queen of the kitchen" (Selvaraj, 1976) [5]. The Onion is preferred because of its green leaves, immature and mature bulbs are either eaten raw or cooked as vegetables and among them mild flavoured are often preferred for salads. The bulbs are indispensable part in several preparation like soups, sauces, condiments, spice, medicine, seasoning of many foods and now a days many value added products like powder and flakes are also available. A distinct characteristic of onion is its alliaceous odour, which accounts for their use as seasoning in the food. The pungency in onion is due to a volatile compound known as Allyl-propyl disulphide ($C_3H_5S_2C_3H_7$). Onion contains an enzyme called Alliinase, which is released when an onion is cut or crushed and causes our eyes to tear.

India has the premier place in global production and export of onion. According to all India estimates given by NHB (*Anonymous*, 2016-17) [2] onion is being grown in area of 1,293 (000´ha) with total production of 21,718 (000´MT). The main onion growing states in India are Maharashtra, Gujarat, Karnataka, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh and Bihar. In Gujarat, onion occupies an area of about 44.50 thousand hectares with total bulb production of about 1,126.59 (000´ MT) (*Anon.* 2015) [1]. The major onion growing districts in Gujarat state are Bhavnagar, Amreli, Junagadh, Rajkot, Porbandar, Kutch, Dahod, Sabarkantha, Surendranagar, Vadodara, Mehsana, Jamnagar, Surat and Anand having 3.44 per cent area and 5.18 per cent share in production of the country (*Anon*. 2015) [1].

Organic agriculture is gaining movement in India due to the individual as well as group efforts to conserve environment and avoid contamination of farm produce from the use of chemical fertilizers and pesticides. The important tenet of organic food movement that promotes ecological soundness and sustainable use of natural resources also maintenance of crop diversity. The organic vegetable industry is flourishing due to consumer preference organically produce over traditionally grown vegetables as a result an increase in varieties and selection of many vegetables in retail, supermarket and restaurants.

Materials and Methods

The investigation was conducted at College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. - Mehsana (Gujarat). The different organic manures *viz.* farmyard manure, vermicompost, Poultry manure and Neem cake with chemical fertilizer were tested during the Rabi season of the year 2016. The experiment was laid out in a Randomized Block Design with seventeen treatments were employed and replicated thrice. To raise the crop recommended package of practices were followed. Dose of organic manures (FYM, Vermicompost, Poultry manure, Neem cake) for nitrogen as per treatments were applied in basal. After application of organic manures remaining P_2O_5 and K_2O for different treatments were applied as a basal in form of chemical fertilizers and remaining dose of nitrogen applied in four splits at 30, 50, 70 and 90 days from the date of transplanting.

The treatments were evaluated on the basis of plant growth and development behavior from ten randomly selected tagged plants at different stages. The mean data were subjected to statistical analysis following analysis of variance technique (Panse, V.G. and Sukhatme, P.V. (1978) [3].

Table 1: Treatments detail

Treatment Number	Notation	Treatments
1.	T_1	100% RDF (100:50:50 kg NPK/ha + 20 tonne FYM/ha)
2.	T_2	25% RDN through FYM + 75% N through chemical fertilizer
3.	T_3	50% RDN through FYM + 50% N through chemical fertilizer
4.	T_4	75% RDN through FYM + 25% N through chemical fertilizer
5.	T_5	25% RDN through vermicompost + 75% N through chemical fertilizer
6.	T_6	50% RDN through vermicompost + 50% N through chemical fertilizer
7.	T_7	75% RDN through vermicompost + 25% N through chemical fertilizer
8.	T_8	25% RDN through poultry manure +75% N through chemical fertilizer
9.	T_9	50% RDN through poultry manure +50% N through chemical fertilizer
10.	T_{10}	75% RDN through poultry manure + 25% N through chemical fertilizer
11.	T_{11}	25% RDN through neem cake + 75% N through chemical fertilizer
12.	T_{12}	50% RDN through neem cake + 50% N through chemical fertilizer
13.	T_{13}	75% RDN through neem cake + 25% N through chemical fertilizer

Table 2: Chemical properties of organic manures used in experiment

S. No.	Organic manures	N_2O (%)	P_2O_5 (%)	K_2O (%)
1.	FYM	0.51	0.22	0.52
2.	Vermicompost	1.64	0.47	0.63
3.	Poultry manure	2.35	2.61	1.43
4.	Neem cake	5.14	1.21	1.51

Table 3: Treatment wise application of organic manures and inorganic fertilizers (kg/ha)

Treat. No.	Required quantity (kg/ha)						
	FYM	Vermicompost	Poultry manure	Neem cake	Urea	DAP	MOP
T_1	20,000	-	-	-	175.24	108.68	86.45
T_2	4895	-	-	-	129.65	85.27	40.90
T_3	9792	-	-	-	83.15	60.90	-
T_4	14688	-	-	-	38.40	40.72	-
T_5	-	1524	-	-	126.59	93.36	67.18
T_6	-	3049	-	-	75.63	77.56	35.20
T_7	-	4583	-	-	30.24	61.66	35.26
T_8	-	-	1076	-	144.09	48.54	57.63
T_9	-	-	2118	-	108.68	-	75.27
T_{10}	-	-	3160	-	54.34	-	32.84
T_{11}	-	-	-	486	125.52	95.93	71.11
T_{12}	-	-	-	972	76.14	83.15	58.85
T_{13}	-	-	-	1458	26.77	70.34	46.63

Table 4: Effect of integrated nutrient management on economics and benefit cost ratio

Treatments	Yield per hectare (q)	Gross realization (₹/ha)	Total cost of cultivation (₹/ha)	Net returns (₹/ha)	Benefit Cost Ratio
T_1	390.09	312072	75022	237050	4.16
T_2	446.81	357448	58508	298940	6.11
T_3	480.14	384112	62024	322088	6.19
T_4	482.07	385656	66162	319494	5.83
T_5	449.75	359800	61757	298043	5.83
T_6	565.30	452240	69283	382957	6.53
T_7	585.07	468056	70861	397195	6.60
T_8	449.09	359272	58382	300890	6.15
T_9	532.49	425992	65780	360212	6.48
T_{10}	534.22	427376	66776	360600	6.40
T_{11}	401.55	321240	61034	260206	5.26
T_{12}	463.84	371072	67082	303990	5.53
T_{13}	467.17	373736	73130	300606	5.11

Appendix W: (Cost of cultivation of onion and other details of cost incurred.)

(A) Details of common operational cost of onion crop

S. No.		Particular	Labour	Frequency	Fixed Cost (₹.ha^{-1})
[A]	**Pre sowing operation**				
	1	Ploughing (8 hrs tractor)	1	1	4950
	2	Planking (4 hrs tractor)	2	1	2700
[B] sowing AND Transplanting					
	1	Preparation of seed bed & sowing of seeds	10	1	1500
	2	Cost of seeds (10 kg ha^{-1})	0	1	10000
	3	Sowing of seed and transplanting	18	2	5400
[C] Post sowing operations					
	1	Gap filling and thinning	12	2	3600
	2	Weeding	6	3	2700
	3	Inter culturing	12	1	1800
	4	plant protection measures	4	2	6500
[E]		Irrigation charges	-	-	7300
[F]		Harvesting cost	25	1	3750
[G]		Land revenue	-	1	50
[H]		Total fixed cost			50250

Note: Rate of various items

Tractor charges @ ₹ 600 per hours
Labour charges @ ₹ 150 per day
Cost of seed @ ₹ 1000 per kg
Irrigation charges @ ₹ 300 per irrigation
FYM cost @ ₹ 1000 per ton
Vermicompost cost @ ₹ 5000 per ton
Poultry manure cost @ ₹ 5000 per ton
Neem cake cost @ ₹ 14000 per ton
Urea cost @ ₹ 291 per 50 kg
DAP cost @ ₹ 1230 per 50 kg
MOP cost @ ₹ 625 per 50 kg

(B) Details of treatment wise cost of onion crop

Treatments (varieties)	Common cost/Fixed cost (₹)	Variable Cost (₹)	Total cost (₹)
T_1	50250	24772	75022
T_2	50250	8258	58508
T_3	50250	11774	62024
T_4	50250	15912	66162
T_5	50250	11507	61757
T_6	50250	19033	69283
T_7	50250	20611	70861
T_8	50250	8132	58382
T_9	50250	15530	65780
T_{10}	50250	16526	66776
T_{11}	50250	10784	61034
T_{12}	50250	16832	67082
T_{13}	50250	22880	73130

(C) Treatment wise cost of supplemented materials

Treat. No.	Treatment wise cost							Total Cost Rs/ha
	FYM (Rs.)	Vermi-compost (Rs.)	Poultry manure (Rs.)	Neem cake (Rs.)	Urea (Rs.)	DAP (Rs.)	MOP (Rs.)	
T_1	20000	-	-	-	1018	2673	1080	24772
T_2	4895	-	-	-	755	2098	511	8258
T_3	9792	-	-	-	484	1498	-	11774
T_4	14688	-	-	-	224	1001	-	15912
T_5	-	7620	-	-	737	2311	840	11507
T_6	-	16245	-	-	440	1908	440	19033
T_7	-	20611	-	-	176	1517	404	20611
T_8	-	-	5380	-	839	1194	720	8132
T_9	-	-	10590	-	633	-	941	11530
T_{10}	-	-	15800	-	316	-	411	16526
T_{11}	-	-	-	6804	733	2360	10785	10784
T_{12}	-	-	-	13608	443	2046	736	16832
T_{13}	-	-	-	20412	156	1730	583	22880

Results and Discussion

Influence of application of different levels of organic manure, inorganic fertilizer as well as combination of organic manures and inorganic fertilizers on yield, net return and benefit cost ratio in onion are presented in Table 1. Maximum yield (585.07), net return (3,97,195 ₹/ha) and BCR (6.60) was found under treatment T_7 (75% RDN through vermicompost + 25% N through chemical fertilizer) whereas, the minimum net return (2,37,050 ₹/ha) and BCR (4.16) was found in treatment T_1 100% RDF (100:50:50 kg NPK/ha + 20 tonne FYM/ha).

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