Int.J.Curr.Microbiol.App.Sci (2017) *6*(10): 5018-5022

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 10 (2017) pp. 5018-5022**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.610.475

Economics, Uptake of NPK and Fertility Status on Soil of Onion (*Allium cepa* L.) as Influenced by Integration of Organic and Inorganic Source of Nutrients

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Keywords

Onion, Economics, Nutrients uptake.

Article Info

Accepted:
29 September 2017
Available Online:
10 October 2017

A B S T R A C T

An experiment has been conducted to study the effects of application of different level of organic fertiliser and inorganic fertiliser on economic of onion production as well as the fertiliser uptake by plant. From the data it was found that the 25% RDF + 75% N of poultry manure was most effective treatment in respect to economics of onion cultivation for higher net return with greater benefit cost (B: C) ratio as well as uptake of NPK.

Introduction

Onion (*Allium cepa* L.) often called as "queen of the kitchen" belonging to the family Alliaceae is one of the most important commercial vegetable cum spice crops of India and widely cultivated throughout the world. It is an indispensable item in every kitchen as condiment and vegetable. It is used either in raw form and dehydrated form to add flavour and taste to Indian food. India is second largest producer of onion after china in the world, cultivating onion over an area of 1173.4 thousand hectare with total production of 203.3 lakh tonnes (NHB 2014). Onion is a shallow rooted crop and is highly responsive to fertilizers in terms of improvement in yield and quality of onion. As the availability of land is decreasing day by day, application of chemical fertilizers has become necessary to meet the demand for food grains.

So to sustain soil health and benign environment, balanced application of organic and inorganic fertilizers is essential. In addition to this, there was a pronounced improvement in NPK uptake by plant due to integration of inorganic and organic fertilisers. Keeping these facts under consideration present investigation has been formulated.

Materials and Methods

The present study was carried out during Rabi season at the experimental area of the Department of Horticulture (Veg. & Flori.), Bihar Agricultural College, Sabour, B.A.U., Sabour, Bhagalpur (Bihar). The organic carbon, available nitrogen, available P2O5, available K2O were 0.41 per cent, 228.15 kg

per ha, 49.25 kg per ha and 363.78 kg per ha, respectively in the soil. The experimental was laid out in randomised block design (RBD) replicated thrice with 14 treatments are applied in plot size 3.0 m x 1.5 m, with spacing 15 cm x 10 cm. All the 14 treatment combinations comprised of different combinations (Table–1).

The dose of Nitrogen through FYM, P.M. and V.C. was supplemented as basal dose before 20 days of planting of seedlings and inorganic sources of nutrients were applied at the time of planting of seedlings as per treatment detail.

The economic study of the crop was done by computing the cost of cultivation and net profit in rupees per hectare on the basis of prevailing rate of inputs and outputs obtained from the local market data pertaining to NPK uptake by plant (Kg/ha) obtained by multiplying the dry matter yield with respect to N, P_2O_5 and K_2O contents.

The statistical analysis of the data noted in all the observation was carried out by the method of analysis of variance as suggested by Fisher and Yates (1963).

Results and Discussion

The data pertaining to gross incomeas affected due to integrated use of inorganic and organic fertilizers have been given in Table-1.

The scrutiny of data clearly reveals that there was a marked variation on gross income per hectare when plots were treated with combined use of inorganic and organic fertilizers. The maximum gross income and net returns was obtained with integrated use of 25% RDF + 75% N through poultry manure (T9) closely followed by 50% RDF + 50% N through poultry manure (T6), sole application of 100% N through poultry manure (T12) and 75% RDF + 25% N through poultry manure (T3).

At higher dose of organic fertiliser, may improve the soil physical health results in better root growth, nutrient absorption and better bulb development. Similar results were also obtained by (Bagali *et al.*, 2012).

Maximum benefit: cost ratio was obtained under T9 followed by T6 due to the long availability of fertiliser to plants in terms of high dose of poultry manure for proper development of vegetative parts of the crop. It also lowers the cost of cultivation by reducing the cost of inorganic fertiliser. The results are in agreement with the finding of Chattoo *et al.*, 2010; Singh *et al.*, 2008.

A perusal of data reveals that there was a marked variation of uptake of NPK due to integrated use of inorganic and organic fertilizers. The plants grown under the combined application of 25% RDF + 75% N through poultry manure (T9) took significantly highest nitrogen (127.90 kg/ha), phosphorus (39.20 kg/ha) and potassium (242.29 kg/ha) from the soil (Table 2).

As different organic nutrient sources works as a slow releasing nutrient, helps in reducing the nutrients loss and synergetic effect of microbes in the soil enhance their or symbiotic nitrogen fixing capabilities.

Similar results were also reported by Nazir *et al.*, (2012) and Chattoo *et al.*, (2010). Similarly, higher availability of phosphorus under organic manure might be due to the production of organic acid by phosphorus solubilizing bacteria present in soil, which act as a chelating agent and form stable complex with Fe and Al abundantly available in acid soil and thereby releasing phosphorus to the soil solution making it available for more uptakes by the plant.

Table.1 Effect of integrated use of inorganic and organic fertilizers on economics of onion

Treatments	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
T_1 - N:P:K(120:60:80) 100% RDF	198608.00	**136505.00**	**2.20**
T_2-75% RDF+25%FYM	179296.00	112771.00	1.70
T_3-75% RDF+25%PM	201168.00	138143.00	2.20
T_4-75% RDF+25%VC	174792.00	105517.00	1.52
T_5-50% RDF+50%FYM	182656.00	111710.00	1.57
T_6-50% RDF+50%PM	211360.00	147414.00	2.30
T_7-50% RDF+50%VC	193008.00	116562.00	1.52
T_8-25%RDF+75%FYM	172512.00	97136.00	1.28
T_9-25%RDF+75%PM	230728.00	165861.00	2.65
T_{10}-25%RDF+75%VC	173368.00	89751.00	1.07
T_{11}-100% FYM	185936.00	106147.00	1.33
T_{12}-100% PM	205056.00	139627.00	2.12
T_{13}-100% VC	174400.00	83611.00	0.92
T_{14}- Control	107976.00	52187.00	0.93
C. D at 5%	7.12	2.0	13.71
C. V	3.80	4.14	4.49

Table.2 Effect of integrated use of inorganic and organic fertilizers on uptake of Nitrogen, Phosphorus and Potassium

Treatments	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)
T_1 - N:P:K(120:60:80) 100% RDF	116.56	200.88	32.64
T_2-75% RDF+25%FYM	109.45	171.78	24.78
T_3-75% RDF+25%PM	120.06	202.00	36.72
T_4-75% RDF+25%VC	105.44	170.40	23.71
T_5-50% RDF+50%FYM	112.65	180.22	27.62
T_6-50% RDF+50%PM	125.65	219.20	38.67
T_7-50% RDF+50%VC	115.21	199.05	29.22
T_8-25%RDF+75%FYM	101.45	137.80	20.53
T_9-25%RDF+75%PM	127.90	242.29	39.20
T_{10}-25%RDF+75%VC	121.21	207.74	38.00
T_{11}-100% FYM	109.13	191.78	24.37
T_{12}-100% PM	114.34	187.91	28.20
T_{13}-100% VC	103.93	148.51	22.73
T_{14}- Control	78.22	96.73	16.32
C.D. at 5%	7.12	2.0	13.71
C.V.%	3.80	4.14	4.49

Table.3 Effect of integrated use of inorganic and organic fertilizers on fertility status of soil

Treatments	pH	OC (%)	N(Kg/ha)	P2O5 (kg/ha)	K2O (kg/ha)
Before Experiment	7.22	0.40	215.15	29.25	233.78
T_1 - N:P:K(120:60:80)100% RDF	7.23	0.40	221.59	32.61	242.90
T_2-75% RDF+25%FYM	7.22	0.41	228.70	34.47	238.00
T_3-75% RDF+25%PM	7.22	0.41	228.09	32.53	241.78
T_4-75% RDF+25%VC	7.22	0.41	222.71	33.54	263.38
T_5-50% RDF+50%FYM	7.22	0.41	225.50	31.63	263.56
T_6-50% RDF+50%PM	7.22	0.41	222.50	30.58	244.58
T_7-50% RDF+50%VC	7.22	0.41	222.94	30.03	244.73
T_8-25%RDF+75%FYM	7.22	0.43	230.70	33.72	264.98
T_9-25%RDF+75%PM	7.21	0.43	220.25	34.05	265.49
T_{10}-25%RDF+75%VC	7.22	0.43	226.94	31.25	236.04
T_{11}-100% FYM	7.23	0.44	229.02	35.05	252.00
T_{12}-100% PM	7.22	0.45	231.81	36.15	255.87
T_{13}-100% VC	7.22	0.44	224.22	33.52	255.27
T_{14}- Control	7.21	0.40	212.93	22.93	227.05

Relatively less availability of inorganic fertilizers treated soil might be attributed to the fact that with organic manure decline potassium status of soils which may be due to the fact that humification of plant residues and soil organisms produce a type of organic matter with high CEC capable of holding soil K. Moreover, humus retains divalent cations (Mg ++ & Ca ++) more strongly than monovalent cations. Weaker retention of potassium relative to Ca and Mg may increase K availability but at the same time it renders the K more liable to leaching (Somani and Kanthaliya, 2004).The scrutiny of data reveals that there were no appreciable variations in available N, P_2O_5 and K_2O due to integrated use of inorganic and organic fertilizers (Table 3).

On the basis of results and discussion made so far, it can be concluded that application of 25% RDF + 75% N of poultry manure was found most effective treatment in respect to economics of onion cultivation for higher net return with greater benefit cost (B: C) ratio.

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How to cite this article:

Saksham Kumar Sinha, R.B. Verma, Amit Kumar, Ravi Kumar and Diwakar Kumar Bharti. 2017. Economics, Uptake of NPK and Fertility Status on Soil of Onion (*Allium cepa* L.) as Influenced by Integration of Organic and Inorganic Source of Nutrients. *Int.J.Curr.Microbiol.App.Sci*. 6(10): 5018-5022. doi: https://doi.org/10.20546/ijcmas.2017.610.475