Environment and Ecology 42 (4A) : 1659—1663, October—December 2024
Article DOI: https://doi.org/10.60151/envec/CWJD2355
ISSN 0970-0420

Studies on Integrated Nutrient Management on Onion (*Allium cepa* L.) cv Agrifound Light Red

Narendra Kumar, Ramesh Chand Meena, Mayaram, Razauddin, Sudhanshu Verma, Sutanu Maji

Received 9 April 2024, Accepted 17 September 2024, Published on 15 November 2024

ABSTRACT

Because of intensive farming, the INM system is now essential, due to the high cost of chemical fertilizers, unbalanced NPK use and deterioration of soil health and to minimize health hazards. The present experiment has been planned at Lucknow subtropical area with a sandy loam less fertile soil with higher pH of around 8.2. It has 10 treatments (Control 100% RDF, 100% FYM, 100% PSB, 75% NPK + 25% FYM, 50% NPK + 50% FYM, 25% NPK + 75% FYM, 75% NPK + 25% PSB, 50% NPK + 50% PSB, 25% NPK + 75% PSB) laid out at RBD with three replication. Seeds of onion variety Agrifound Light Red were treated with 0.02% thiram to check the infection of damping off and seedlings were transplanted after seven weeks at 20 cm × 10 cm spacing on 1m × 1m plot accommodating 45 plants in a plot. The results revealed that among the various treatments, the application of 75% RDF + 25% FYM showed better vegetative growth, bulb yield, and improved bulb physico-chemical quality.

Keywords Onion, INM, Growth, Yield, Quality.

INTRODUCTION

Since ancient times, onion (*Allium cepa* L.) has been used as a valuable nutritional resource as well as for its medical interest. The onion bulb is rich in minerals (calcium 27 mg, potassium 1.57 mg, phosphorus 39 mg) along with carbohydrates (11.0 g), protein (1.2 g), and vitamin C (11 mg), fiber (0.6 g), moisture (86.8 g) and 38 calories from the bulb, iron (0.7 mg), thiamine (0.08 mg), riboflavin (0.01 mg), and niacin (0.2 mg). Flavonoids found in it have also been linked to a lower the risk of chronic diseases like cancer, diabetes, and coronary heart disease (Hejazi *et al.* 2023) and have antibacterial and antifungal effects (Santas *et al.* 2008) (Prasad *et al.* 2021). Being a heavy feeder crop many fertilizer trials have demonstrated that all three major nutrients (NPK) are required for a high production of onion. The integrated system approach is a concept of ecological soundness that leads to sustainable agriculture, as well as a reliable technique of attaining fairly high output with a sustainable fertilizer economy, which could maintain and improve soil fertility in order to maintain long-term crop productivity. This can be accomplished by combining the use of natural

Narendra Kumar[1], Ramesh Chand Meena[2], Mayaram[3], Razauddin[4], Sudhanshu Verma[5], Sutanu Maji[6]*

[1,2,3,4,5]PhD Scholar, [6]Associate Professor

[1]Department of Horticulture, BHU, Uttar Pradesh, India

[2,3,4,5,6]Department of Horticulture, Babasaheb Bhimrao Ambedkar University (BBAU), India

Email: majisutanu@gmail.com
*Corresponding author

resources and nutrients, as well as their scientific control for optimal crop growth. This practice not only ensures reduced burden on chemical fertilizers but also to be helpful for maintaining soil fertility (Madhvi *et al.* 2022).

Because of intensive farming, the INM system is now very important, due to the high cost of chemical fertilizers, unbalanced NPK use and deterioration of soil health and now, it has become necessary in modern agriculture. Incorporating organic manure with INM can help to decrease the need for expensive inorganic fertilizers. In this context, similar attempt has been made to see the response of onion production towards integrated nutrient management system. However, some literatures (Balekar *et al.* 2018), (Khandelwal 2010), (Jawadagi *et al.* 2012), (Govind *et al.* 2015) have been found indicating a positive response of INM, but, it has been planned again on it at Lucknow subtropical area which has a sandy loam less fertile soil having higher pH of around 8.2. However, earlier reports (Ram *et al.* 2024, Prasad *et al.* 2017) have shown there was a good opportunity for onion cultivation in Lucknow area.

MATERIALS AND METHODS

The present investigation was conducted at Horticultural Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, UP, India during *rabi* season of 2020-21. The experiment comprised of 10 treatments (Control, 100% RDF, 100% FYM, 100% PSB, 75% NPK + 25% FYM, 50% NPK + 50% FYM, 25% NPK + 75% FYM, 75% NPK + 25% PSB, 50% NPK + 50% PSB, 25% NPK + 75% PSB) laid out at RBD with three replication. Seedling were raised on nursery beds of 3 m × 1 m raised bed (15 cm) prepared by mixing well rotten FYM in soil at the rate of 15 kg per square meter. Seeds of onion variety Agrifound Light Red were treated with 0.02% thiram to check the infection of damping off. Seeds were sown on 20th November, 2020 in shallow furrows 5-6 cm apart by dropping the seeds at 1-2 cm depth. A thin layer of powdered leaf mould was applied to cover the seed. Regular watering, hoeing, weeding, plant protection measures, were done time to time as per requirement. The seedlings were ready for transplanting within seven-eight weeks and transplanted in the main field at 20 cm × 10 cm spacing on 1 m × 1 m plot accommodating 45 plants in a plot. Observations were recorded on randomly sample plants for growth (plant height, number of leave, length of leave, neck thickness), average number of bulb per plot, bulb yield, average weight of bulb (g), and on quality parameters like neck thickness of bulb, number of scales per bulb, bulb diameter (cm), TSS (^{0}B), Ascorbic acid (mg/100 g) and pH value. The observed data were analyzed statistically using standard statistical methods as stated by (Sahu and Das 2014) and treatment means were compared at 5% levels of significance.

RESULTS AND DISCUSSION

The application of 75% NPK +25% FYM (T_4) recorded the maximum plant height (36.19 cm) followed by application of 75% NPK +25% PSB (T_7) at 30 days after transplanting (DAT) (Table 1). Similar observation was also recorded at 60 and 90 DAT where minimum plant height was seen in control condition and 75% NPK + 25% FYM showed the maximum plant height at 90 DAT which was statistically *at par* with application 75% NPK +20% PSB (plant height 66.45 cm followed by 65.88 cm) and minimum plant height (36.18 cm) was observed at 90 DAT in the control plant.

The application of 75% NPK + 25% PSB in the treatment (T_7) noted maximum number of leaves (9.22) at 30 DAT followed by T_4 i.e. 75% NPK + 25% FYM application. However, from 60 DAT onwards the number of leaves was found maximum under T_7 (75% NPK +25% PSB) followed by T_4 (75% NPK + 25% FYM) but, the difference was very less both at 60 and 90 DAT. At 90 DAT, maximum number of leaves (13.75) was in the treatment T_4 followed by T_7 (13.23) and minimum number of leaves was counted in control.

Application of 75% NPK + 25% FYM (treatment T_4) also showed maximum length of leaves (31.94 cm) at 30 DAT followed by 30.21 cm length with the application of 75% NPK + 25% PSB (T_7). At 60 DAT, maximum length of leaves was seen in the T_4 followed by T_7 and at 90 DAT, it was maximum with application of 75% NPK + 25% FYM (T_4) (63.69 cm)

Table 1. Effect of integrated nutrient management on vegetative growth of onion cv Agrifound Light Red.

Treat-ments	Treatment details	Plant height (cm)			Number of leaves per plant			Length of leaves (cm)			Neck thickness of plant (mm)		
		30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T_0	Control	20.52	34.52	36.18	4.13	6.22	7.12	10.35	21.04	30.65	1.93	2.25	4.60
T_1	100% RDF	33.52	61.85	63.83	8.16	8.39	9.95	22.75	34.18	49.67	3.40	5.35	6.54
T_2	100% FYM	30.66	58.62	60.99	7.30	9.12	10.18	26.63	37.54	54.27	4.74	6.88	8.21
T_3	100% PSB	30.78	58.21	59.29	7.08	9.47	10.70	28.53	41.42	57.97	5.72	7.83	9.65
T_4	75% NPK + 25% FYM	36.19	64.28	66.45	9.15	12.75	13.75	31.94	45.19	63.69	6.90	8.97	11.82
T_5	50% NPK + 50% FYM	31.66	61.06	61.56	6.49	10.22	11.14	23.42	35.91	52.62	4.38	6.34	7.62
T_6	25% NPK + 75% FYM	32.24	59.43	60.44	7.71	9.56	10.64	22.96	34.86	51.14	5.18	6.02	7.22
T_7	75% NPK + 25% PSB	34.32	63.33	65.88	9.22	11.99	13.23	30.21	43.77	61.70	6.33	8.45	10.82
T_8	50% NPK + 50% PSB	31.65	60.99	58.76	7.75	9.48	10.45	26.62	40.29	55.87	5.46	7.66	9.27
T_9	25% NPK + 75% PSB	29.31	56.28	59.56	6.61	8.78	11.30	26.51	39.20	54.25	4.95	7.14	8.58
	SEm (±)	0.83	0.153	0.195	0.088	0.065	0.085	0.129	0.177	0.150	0.114	0.097	0.070
	CD (p=0.05)	0.250	0.45	0.58	0.262	0.194	0.253	0.387	0.529	0.448	0.341	0.290	0.208

followed by T_7 (61.70 cm), while minimum length was recorded in control plants in all stages.

Similarly, 75% NPK + 25% FYM (T_4) recorded the maximum neck thickness of plant (6.90 mm) followed by application of 75% NPK +20% PSB (T_7) (6.33 cm) at 30 DAT and similar pattern was also seen at 60 DAT where maximum neck thickness was observed with T_4 (75% NPK + 25% FYM) (8.97 mm) followed by T_7 and subsequently at 90 DAT (11.82 mm). Significantly, maximum increase the neck thickness of bulb (1.87 cm) was under application of 75% NPK + 25% FYM (T_4) followed by 1.69 cm in treatment T_7 and minimum neck thickness was observed in the control (Table 1).

The high vegetative growth in terms of plant height, number of leaves leaf length plant basal thickness was observed with integrated use of 75% NPK and 25% FYM as well as 75% with 25% PSB. This increased vegetative growth might be attributed due to fact that FYM and PSB increased some growth

Table 2. Influence of integrated nutrient management on bulb yield of onion cv Agrifound Light Red.

Treatments	Treatment details	Average number of bulb per plot	Bulb yield per plot (kg)	Average weight of bulb (g)	Fresh bulb yield (q/ha)
T_0	Control	34.66	3.23	92.61	228.45
T_1	100% RDF	40.33	4.63	117.57	331.35
T_2	100% FYM	39.33	4.29	109.52	313.86
T_3	100% PSB	37.00	3.68	99.61	291.02
T_4	75% NPK + 25% FYM	44.33	5.23	120.50	402.02
T_5	50% NPK + 50% FYM	39.00	4.36	112.56	325.11
T_6	25% NPK + 75% FYM	39.66	4.41	111.73	323.51
T_7	75% NPK + 25% PSB	42.33	4.82	114.78	334.41
T_8	50% NPK + 50% PSB	39.33	4.31	111.73	319.63
T_9	25% NPK + 75% PSB	39.33	4.23	107.75	315.72
	SEm (±)	0.585	0.059	0.154	0.267
	CD (p=0.05)	1.751	0.176	0.462	0.801

Table 3. Bulb quality as influenced by integrated nutrient management on onion cv Agrifound Light Red.

Treatments	Treatment details	Neck thickness of bulb after harvest (cm)	Number of scales per bulb	Polar diameter (cm)	Equatorial diameter (cm)	TSS (^{0}B)	Ascorbic acid (mg/100 g)	pH value
T_0	Control	1.19	6.08	3.81	4.53	8.58	7.84	6.54
T_1	100% RDF	1.68	9.46	6.13	7.53	13.58	10.44	6.72
T_2	100% FYM	1.41	8.39	4.75	6.32	13.52	7.83	6.87
T_3	100% PSB	1.37	7.77	4.50	5.90	11.33	7.72	6.81
T_4	75% NPK + 25% FYM	1.87	11.14	6.32	7.95	14.53	10.58	7.16
T_5	50% NPK + 50% FYM	1.55	8.90	5.82	7.29	13.45	9.53	6.66
T_6	25% NPK + 75% FYM	1.61	8.63	5.61	4.49	13.46	9.55	6.46
T_7	75% NPK + 25% PSB	1.69	9.61	6.20	7.58	14.30	10.49	7.06
T_8	50% NPK + 50% PSB	1.66	8.44	5.68	7.44	11.69	8.78	6.74
T_9	25% NPK + 75% PSB	1.44	8.40	5.67	6.38	12.48	7.87	6.68
	SEm (±)	0.030	0.118	0.331	0.118	0.054	0.034	0.065
	CD (p=0.05)	0.089	0.352	0.992	0.354	0.162	0.101	0.194

promoting substances which help for better uptake of water and nutrient. Similar observations were also reported by Yogita *et al.* (2012). Inorganic NPK application along with organic manure and bio fertilizer might improve nutritional availability in the root zone as well as plant system. Higher nutrient content specially nitrogen increased the vegetative growth.

Table 2 showed that application of 75% NPK + 25% FYM (T_4) produced the maximum average number of bulb (44.33) followed by (42.33) in the treatment T_7 and minimum value in the control (T_0). The application of 75% NPK + 25% FYM (T_4) significantly increased the bulb yield showing maximum yield of 5.23 kg/plot and 402.02 q/ha followed by 4.82 kg/plot and 334.41 q/ha in the treatment 75% NPK +20% PSB (T_7).

Bulb yield one of the most important parameter for the evaluation of any nutrient management practices. In this experiment 75% NPK supplemented with 25% FYM and PSB caused maximum yield. Bagali *et al.* (2012), Singh *et al.* (2014) also narrated that higher levels inorganic fertilizer in combination with organic fertilizers recorded high bulb yield.

The application of 75% NPK + 25% FYM (T_4) recorded the highest bulb diameter (polar and equatorial diameter) followed by treatment T_7 and minimum value of polar diameter was seen in control (Table 3), similar to the bulb neck thickness after harvest. The application of 75% NPK + 25% FYM (T_4) also showed a higher weight of bulb (120.50 g) followed by the application of 100% RDF. Similarly, application of 75% NPK + 25% FYM (T_4) observed maximum number of scales per bulbs (11.14) followed by the application of 75% NPK +20% PSB (T_7) (9.61). Maximum TSS was estimated in the treatment T_4 (75% NPK + 25% FYM) followed by T_7 (75% NPK +20% PSB) and control showed minimum TSS content in bulb. Application of 75% NPK + 25% FYM (T_4) significantly increased the pH value of onion bulb (7.16) followed by 7.06 pH in T_7 and minimum in the treatment T_6 (25% NPK + 75% FYM).

It was established that the improved vegetative growth may lead to higher photosynthesis activities and mobilization of metabolites. Due to better photosynthates bulb quality was also improved. Phosphorus bacteria helped for better solubilization and mobilization of phosphorus in the soil to the plant system which might have role to improve bulb quality i.e. TSS, ascorbic acid content along with bulb weight and bulb diameter. High TSS content was found with the application inorganic fertilizer (75% RDF) in combination with bio fertilizer and FYM may be due to more utilization of inorganic nitrogen in the presence of bio fertilizer and possible higher synthesis of plant growth promoters. Application of 75% RDF along with PSB, poultry manure, *Azospirillum*, *Azotobacter,* VAM were also recommended by various researchers

in onion (Chhabra and Vishwakarma 2019).

Thus, from the results obtained from the present experiment, it may be concluded that application of 75% NPK + 25% FYM may be suggested for growing onion cv Agrifound Dark Red at Lucknow condition.

REFERENCES

Bagali AN, Patil HB, Chimmad VP, Patil PL, Patil ARV (2012) Effect of inorganics and organic on growth and yield of onion (*Allium cepa* L.). *Karnataka Journal of Agricultural Sciences* 25 (1) : 112—115.

Balekar MN, Shinde KG, Rathod DH, Patil BT (2018) Studies on integrated nutrient management for yield and nutrient uptake in onion (*Allium cepa* L.). *Journal of Allium Research*, pp 1.

Chhabra S, Vishwakarma G (2019) Effect of integrated nutrient management on growth, yield and quality of onion (*Allium cepa* L.) cv Palam Lohit. *Journal of Pharmacognosy and Phytochemistry* SP4 : 73—77.

Govind Maji S, Kumawat R, Pal A, Kumar S, Saha S (2015) Improvement of growth yield and quality of garlic (*Allium sativum* L.) cv G-282 through a novel approach. *The Bioscan* 10 : 23—27.

Hejazi N, Ghalandari H, Nouri M, Askarpour M (2023) Onion supplementation and health metabolic parameters : A systematic review and meta-analysis of randomized controlled trials. *Clinical Nutrition ESPEN* 58 : 1—13.

Jawadagi RS, Basavaraj N, Patil BN, Naik BH, Channappagoudar BB (2012) Effect of different sources of nutrient on growth, yield and quality of onion (*Allium cepa* L.) cv Bellery Red. *Karnataka Journal of Agricultural Sciences* 25 (2) : 232—235.

Khandelwal RB (2010) Effect of integrated nutrient management on yield and quality of onion (*Allium cepa* L.) cv N-2-4-1. ARS, Durgapura, Rajasthan. *Annual Report* 2010 : 50—54.

Madhvi DS, Chauhan A, Jarial K (2022) Effect of integrated nutrient management on growth, yield and quality of onion (*Allium cepa* L.). *Environment and Ecology* 40 (2A) : 613—620.

Prasad B, Maji S, Meena KR (2017) Effect of date of transplanting and mulching on growth, yield and quality of onion (*Allium cepa* L.) cv Nasik Red. *Journal of Applied and Natural Science* 9 (1) : 94—101.

Prasad M, Maji S, Ram M, Razauddin, Meena RS (2021) Performance of two cultivars of onion under different dates of transplanting as *kharif* production. *The Pharma Innovation Journal* SP-10 (12) : 493—497.

Ram M, Maji S, Razauddin MP, Meena RC (2024) Selection of suitable date of transplanting for year round production of Onion (*Allium cepa* L.) cv Agrifound Dark Red. *Environment and Ecology* 42 (1A) : 285—292.

Sahu PK, Das AK (2014) Agriculture and applied statistics – II. Kalyani Publisher.

Santas J, Carbo R, Gordon MH, Almajano MP (2008) Comparison of the antioxidant activity of two Spanish onion varieties. *Food Chemistry* 107 : 1210—1216.

Singh HD, Maji S, Kumar S (2014) Influence of plant bio-regulators on growth and yield of garlic (*Allium sativum* L.). *International Journal of Agricultural Sciences* 10 (2) : 546—549.

Yogita, Ram RB, Babu M (2012) Effect of inorganic and biofertilizers on growth and yield of onion (*Allium cepa* L.) cv Pusa Madhavi. *Plant Archives* 12 (2) : 645—648.