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Influence of Integrated Nutrient Management on Yield and Quality of Onion

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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ABSTRACT

The steady depletion of native soil fertility and the occurrence of multiple nutrient deficiencies in onion fields have led to the identification of nutrient management as a key factor limiting sustainable onion production. An experiment was carried out to study the Influence of integrated nutrient management on yield and quality of onion at Horticulture Research Farm, College of Horticulture, AAU, Anand during the three consecutive years 2021-22, 2022-23 and 2023-24. The experiment was laid out in Randomized Block Design with three replications and comprises twelve different integrated nutrient treatments along with control (RDF 75:60:50 NPK kg/ha) treatments and application of sulphur (20 kg and 40 kg/ha). Application of 50% RDN through VC+ 50% RDF + 40 kg S recorded maximum bulb equatorial diameters (6.13 cm), bulb weight (65.54 g) and bulb yield

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(42.83 t/ha) in pooled analysis. Whereas, maximum fibre content (5.66%) observed in application of 100% RDF (75:60:50 NPK kg/ha) + 40 kg S. While, TSS, phenol content, pyruvic acid and sulphur content in onion bulb were found non-significant in pooled data.

Keywords: INM; onion; bulb weight; TSS and fibre content.

1. INTRODUCTION

"Onion (*Allium cepa* L.) is one of the oldest bulb crops known to mankind and it is consumed worldwide. India produces about 26,830 MT of onion from an area of 1,639 Mha with productivity of 16.36 metric tonnes" (Anonymous, 2021). "Gujarat produces about 2109 MT of onion from an area of 821 Mha with productivity of 25.67 metric tonnes" (Anonymous, 2021).

"The onion crop is a highly nutrient responsive and the conventional methods of fertilization have undoubtedly helped in improving both bulb yield and quality. But, routine management practices appear to be incapable of maintaining yields over the long-term. The steady depletion of native soil fertility and the occurrence of multiple nutrient deficiencies in onion fields have led to the identification of nutrient management as a key factor limiting sustainable onion production. Use of Inorganic fertilizers is increases cost of cultivation" (Dilpreet, 2016; Sitapara et al., 2024; Singh et al., 2023). "Secondly the sole application of inorganic fertilizers deteriorates soil fertility level day by day, that affect the yield, economics of production and human health, whereas organic manures seems to act directly for increasing crop yield by accelerating the soil microbial activities, which supplies most of the essential nutrients to the plants in a slow release pattern. Indirectly, it improves the physical properties of soil such as aggregation, aeration, permeability and water holding capacity" (Chandramohan, 2002). "Integrated nutrient management (INM) offers an effective strategy" (Dimri and Singh, 2005) by the combined application of organic manures and inorganic fertilizers to increase yield of onion crop. Therefore, keeping in view the production of onion with judicial application of organic substances along with synthetic fertilizers is an integrated way to reduce health hazards, to protect environment as well as enhancing production of onion.

2. MATERIALS AND METHODS

The field experiment entitles "Influence of integrated nutrient management on yield and quality of onion" was laid out during the three consecutive years 2021-22, 2022-23 and 2023-24 at Horticultural Research Farm, College of Horticulture, Anand Agricultural University, Anand, Gujarat, India, during the *Rabi* season. The experiment was laid out with twelve treatments *i.e.* T_1: 100% RDF (75:60:50 NPK kg/ha), T_2: 10 t FYM +100% RDF (75:60:50 NPK kg/ha), T_3: 100% RDF (75:60:50 NPK kg/ha) + 20 kg S, T_4: 100% RDF (75:60:50 kg/ha) + 40 kg S, T_5: 25% RDN through FYM + 75% RDF + 20 kg S, T_6: 25% RDN through FYM + 75% RDF + 40 kg S, T_7: 25% RDN through VC + 75% RDF + 20 kg S, T_8: 25% RDN through VC + 75% RDF + 40 kg S, T_9: 50% RDN through FYM + 50% RDF + 20 kg S, T_{10}: 50% RDN through FYM + 50% RDF + 40 kg S, T_{11}: 50% RDN through VC+ 50% RDF + 20 kg S and T_{12}: 50% RDN through VC+ 50% RDF + 40 kg S. The treatment T_{12} (50% RDN through VC+ 50% RDF + 40 kg S) in a Randomized Block Design with three replications and plot size of 2.55 × 1.70 m. Onion seedling of Gujarat Junagadh Red Onion 11 variety was planted at spacing of 15 × 10 cm. Application of 50% Nitrogen, 100% P_2O_5 and K_2O was given as basal application while 50% Nitrogen was applied at 30 DATP and all organic manures and bentonite (Sulphur) was applied with organic manures as a basal.

For yield observation five plantwere randomly tagged. Bulb diameter at center portion was measure by Vernier calipers. Five bulbs from randomly chosen tagged plants were weighed by weighing balance and after that the average value was calculated. While, onion yield was recorded in kg per plot separately and converted into q/ha. The quality parameters *i.e.,* TSS estimated by digital refractometer from tuber at final harvest. Fiber and phenol content of pod was determined according to method suggested by Sadasivam and Manickam (1992). Pyruvic acid content of onion bulb was determined according to method suggested by DNPH colorimetric method (Anthon and Barrett, 2003). Sulphur content in onion bulb was determined according to method suggested by Williams and Steinbergs (1959). The pooled analysis was conducted in accordance with Panse and Sukhatme (1985) to examine the average effect of various treatments over time.

3. RESULTS AND DISCUSSION

3.1 Yield Parameters of Onion

3.1.1 Bulb weight (g)

The data revealed that the bulb weight was found significant in pooled analysis (Table 1). Maximum bulb weight (65.54 g) was recorded with the treatment T_{12} (50% RDN through VC+ 50% RDF + 40 kg S) but it was at par with treatment T_8 and T_{11}.

"The higher bulb weight of crops with the use of vermicompost and an inorganic fertilizer might be ascribed to higher nutrient concentration and beneficial effect on physical environment of soil. The beneficial effect of organic manures on yield might be due to the additional supply of plant nutrients as well as improvement in overall soil's physico-chemical and biological properties" (Datt *et al.* 2003). "It could also be attributed to the fact that after decomposition and mineralization, the applied manures supplied available nutrients directly to plant" (Singh *et al.* 2001). The role of N and S in improving the vegetative growth and accelerating the photosynthesis in storage organs of bulbs, ultimately resulting in an increased bulb fresh weight. These results are in agreement with those of Mishu *et al.* (2013) and Zaman *et al.* (2011). Similar improvement in yield of onion due to integrated use of vermicompost with chemical fertilizer by Sharma *et al.* (2005), Sharma *et al.* (2009) and Bagali *et al.* (2012).

3.1.2 Bulb equatorial diameter (cm)

The data revealed that the bulb equatorial diameter was found significant in pooled analysis (Table 1). Maximum bulb equatorial diameter (6.13 cm) was recorded with the treatment T_{12} (50% RDN through VC+ 50% RDF + 40 kg S) but it was at par with treatment T_8 and T_{11}.

"Increased bulb equatorial diameter with the application of integrated use of organics with inorganics might be attributed to the fact that the organic manures reduced bulk density thus increases porosity and resulted in the better development of physical condition of soil for better growth of bulb of onion plant" (Bagali *et al.* 2012).

3.1.3 Bulb yield (t/ha)

The data pertaining to bulb yield was found significant in pooled analysis (Table 1). Maximum bulb yield (42.83 t/ha) was recorded with the treatment T_{12} (50% RDN through VC+ 50% RDF + 40 kg S) but it was at par with treatment T_8 and T_{11}.

"An increase total bulb yield might be due to increase by better uptake of nutrients, resulting in faster synthesis and translocation of photosynthats from source (leaves) to sink (bulb) that the increased bulb diameter and weight of bulb which ultimately enhanced the yield" (Singh et al., 1997). The increased yields gained from vermicompost could be attributed to the addition of organic manures, which promotes soil microbial activity and supplies secondary and micronutrients in addition to primary nutrients. A combination of chemical fertilisers and organic manures provides a balanced supply of nutrients to the onion crop at all stages of growth. The increased bulb formation and larger-sized onions, improved overall yield might be since organic manure supplied balanced nutrition to the crop, improved soil condition and thereby resulted in better growth and development leading to higher yield. The above outcomes are correspondingly in nearby conformism by the result of Thangasamy *et al.* 2015, Sharma *et al.* 2018 and Rathod *et al.* 2020 in onion.

3.2 Quality Parameters of Onion

3.2.1 Total soluble solids (^{0}Brix)

The data pertaining to total soluble solids (^{0}Brix) influenced by different integrated nutrient management treatment in pooled data are presented in Table 2. The data show non-significant effect in pooled data.

3.2.2 Fibre content

The data revealed that the fibre content was found significant in pooled analysis (Table 2). Maximum fibre content (5.66%) was recorded with the treatment T_4 [100% RDF (75:60:50 NPK kg/ha) + 40 kg S] but it was at par with treatment T_6 and T_{12}.

3.2.3 Phenol content in onion bulb

The data on phenol content in onion bulb influenced by different treatments is presented in Table 2. Results revealed that effect of different treatments on phenol content in onion bulb was found non-significant during the pooled data.

Table 1. Influence of integrated nutrient management on yield parameters of onion

Treatment		Bulb weight (g)	Equatorial diameter (cm)	Bulb yield (t/ha)
T_1: 100% RDF (75:60:50 NPK kg/ha)		54.63^{f}	5.23^{e}	35.25^{f}
T_2: 10 t FYM +100% RDF (75:60:50 NPK kg/ha)		59.61^{de}	5.70^{bc}	38.74^{cde}
T_3 : 100% RDF (75:60:50 NPK kg/ha) + 20 kg S		56.55^{ef}	5.31^{de}	36.86^{ef}
T_4 : 100% RDF (75:60:50 NPK kg/ha) + 40 kg S		59.47^{de}	5.67^{bc}	38.81^{cde}
T_5: 25% RDN through FYM + 75% RDF + 20 kg S		58.21^{de}	5.42^{cde}	37.78^{de}
T_6: 25% RDN through FYM + 75% RDF + 40 kg S		60.45^{cd}	5.74^{bc}	39.04^{cde}
T_7: 25% RDN through VC + 75% RDF + 20 kg S		61.68^{bcd}	5.73^{bc}	39.86^{bcd}
T8: 25% RDN through VC + 75% RDF + 40 kg S		63.72^{abc}	5.91^{ab}	41.08^{abc}
T_9: 50% RDN through FYM + 50% RDF + 20 kg S		58.08^{de}	5.53^{cde}	37.35^{def}
T_{10}: 50% RDN through FYM + 50% RDF + 40 kg S		60.52^{cd}	5.63^{bcd}	39.09^{bcde}
T_{11}: 50% RDN through VC+ 50% RDF + 20 kg S		64.34^{ab}	5.96^{ab}	41.65^{ab}
T_{12}: 50% RDN through VC+ 50% RDF + 40 kg S		65.54^{a}	6.13^{a}	42.83^{a}
SEm±	Y	0.05	0.05	0.42
	T	0.10	0.10	0.77
	Y × T	0.18	0.18	1.45
CD at 0.05	Y	NS	NS	1.18
	T	Sig	Sig	Sig
	Y × T	NS	NS	NS
CV%		5.96	5.64	6.41

Note: Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Rang Test at 5% level of Significance

Table 2. Influence of integrated nutrient management on quality parameters of onion

Treatment		TSS (^{0}Brix)	Fibre content (%)	Phenol content (mg/100g)	Pyruvic acid content (µ mol/g)	Av. Sulphur content (ppm)
T_1: 100% RDF (75:60:50 NPK kg/ha)		15.02	4.68^{de}	83.22	1.32	2837
T_2: 10 t FYM +100% RDF (75:60:50 NPK kg/ha)		15.87	4.61^{e}	81.66	1.28	3261
T_3 : 100% RDF (75:60:50 NPK kg/ha) + 20 kg S		15.87	4.46^{e}	78.82	1.27	3070
T_4 : 100% RDF (75:60:50 NPK kg/ha) + 40 kg S		15.90	5.66^{a}	82.62	1.31	3207
T_5: 25% RDN through FYM + 75% RDF + 20 kg S		15.70	5.33^{ab}	79.19	1.27	3030
T_6: 25% RDN through FYM + 75% RDF + 40 kg S		16.08	5.62^{a}	81.82	1.32	3324
T_7: 25% RDN through VC + 75% RDF + 20 kg S		16.02	5.08^{bc}	82.87	1.31	2992
T8: 25% RDN through VC + 75% RDF + 40 kg S		16.18	4.53^{e}	82.92	1.18	3270
T_9: 50% RDN through FYM + 50% RDF + 20 kg S		16.03	4.66^{de}	77.10	1.25	3138
T_{10}: 50% RDN through FYM + 50% RDF + 40 kg S		15.91	4.74^{cde}	82.41	1.30	3385
T_{11}: 50% RDN through VC+ 50% RDF + 20 kg S		16.10	4.99^{bcd}	77.75	1.33	3095
T_{12}: 50% RDN through VC+ 50% RDF + 40 kg S		16.12	5.47^{a}	80.77	1.25	3233
SEm±	Y	0.09	0.05	0.81	0.01	33
	T	0.24	0.11	1.74	0.03	124
	Y × T	0.32	0.17	2.79	0.04	116
CD at 0.05	Y	0.26	0.14	2.27	0.03	94
	T	NS	Sig	NS	NS	NS
	Y × T	NS	NS	NS	0.12	327
CV%		3.44	5.91	5.97	5.80	6.36

Note: Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Rang Test at 5% level of Significance

3.2.4 Pyruvic acid content in onion bulb

The data pertaining to pyruvic acid content influenced by different integrated nutrient management treatment in pooled data are presented in Table 2. The data show non-significant effect in pooled data.

3.2.5 Sulphur content in onion bulb

The data pertaining to sulphur content in onion bulbas influenced by different integrated nutrient management treatment are presented in Table 2. The data concerning to the effect of integrated nutrient management treatments on sulphur content in onion bulbwas found non-significant in pooled analysis.

4. CONCLUSION

From the pooled result of three years, it can be concluded that application of 50% RDN through VC+ 50% RDF + 40 kg S recorded maximum bulb weight, bulb equatorial diameters and bulb yield. While in quality parameters, maximum fibre content in onion bulb observed in application of 100% RDF (75:60:50 NPK kg/ha) + 40 kg S.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Anonymous. (2021). Directorate of Horticulture, Gujarat State, Gandhinagar.

Anonymous. (2021). *Horticultural Statistics at a Glance*. Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

Anthon, G., & Barrett, D. M. (2003). Modified method for the determination of pyruvic acid with dinitrophenyl hydrazine in the assessment of onion pungency. *Journal of the Science of Food and Agriculture*, 83, 1210-1213.

Bagali, N., Patil, H. B., Chimmad, V. P., Patil, P. L., & Patil, R. V. (2012). Effect of inorganics and organics on growth and yield of onion. *Indian Karnataka Journal of Agriculture Science*, 25(1), 112-115.

Chandramohan, S. (2002). *Organic farming in cotton + blackgram intercropping system* (M.Sc. Thesis, Tamil Nadu Agricultural University, Coimbatore, India).

Datt, N., Sharma, R. P., & Sharma, G. D. (2003). Effect of supplementary use of farmyard manure along with chemical fertilizers on productivity and nutrient uptake by vegetable pea (Pisum sativum var. arvense) and buildup of soil fertility in Lahul Valley of Himachal Pradesh. *Indian Journal of Agricultural Sciences*, 73, 266-268.

Dilpreet, T. (2016). Growth, yield and quality of onion as influenced by integrated nutrient management. *International Journal of Agriculture Sciences*, 0975-3710.

Dimri, D. C., & Singh, V. P. (2005). Response of farm yard manure, nitrogen and row spacing on bulb weight and yield of onion (Allium cepa L.) cv. VL-3. *Progressive Horticulture*, 37(1), 185-187.

Mishu, H. M., Ahmed, F., Rafii, M. Y., Faru, G., & Latif, M. A. (2013). Effect of sulfur on growth, yield, and yield attributes in onion (Allium cepa L.). *Australian Journal of Crop Science*, 7, 1416-1422.

Panse, V. G., & Sukhatme, P. V. (1985). *Statistical Methods for Agricultural Workers* (5th ed.). Indian Council of Agricultural Research, New Delhi.

Rathod, N. B., Khandare, R. N., & Karle, A. S. (2020). Effect of organic, inorganic and integrated nutrient management on yield attributes, production of onion and soil properties, under vertisol of Maharashtra. *International Journal of Chemical Studies*, 8(1), 937-940.

Sadasivam, S., & Manickam, A. (1992). *Biochemical Methods for Agricultural Sciences*. Wiley Eastern Ltd., New Delhi.

Sharma, R. P., Datt, N., & Chander, G. (2009). Effect of vermicompost, FYM, and chemical fertilizers on yield and nutrient

uptake and soil fertility in okra-onion sequence in wet temperate zone of Himachal Pradesh. *Journal of Indian Society of Soil Science*, 57(3), 357-361.

Sharma, S. K., Garhwal, O. P., Mahala, P., & Yadav, T. V. (2018). Influence of integrated nutrient management on yield attributes and economics of kharif onion (Allium cepa L.) under loamy sand soils. *International Journal of Current Microbiology and Applied Sciences*, 7(6), 2806-2811.

Sharma, S., Dubey, Y. P., Kaistha, B. P., & Verma, T. S. (2005). Effect of Rhizobium inoculation and phosphorus level on symbiotic parameters, growth, and yield of French bean (Phaseolus vulgaris L.) in north-western acid Alfisol. *Legume Research*, 28, 103-106.

Singh, J., Prakash, S., Singh, B., Kumar, V., Kumar, S., & Singh, G. (2023). Influence of Integrated Nutrient Management (INM) on Bulb Yield and Profitability of Onion (*Allium cepa* L.) Crop in Western Uttar Pradesh, India. *International Journal of Plant Soil Science*, 35(18), 1158-1162.

Singh, L., Bhonde, S. R., & Mishra, V. K. (1997). Effect of different organic manures and inorganic fertilizers on yield and quality of rabi onion. *News Letter National Horticultural Research Development Foundation*, 17(3), 1-3.

Singh, R. P., Jain, N. K., & Poonia, B. L. (2001). Integrated nutrient management in rainy-season onion (Allium cepa). *Indian Journal of Agricultural Sciences*, 71(5), 310-312.

Sitapara, K. D., Pawar, Y. D., & Sable, P. A. (2024). Effect of Integrated Nutrient Management on Growth, Yield, and Quality of Green Onion. *Journal of Scientific Research and Reports*, 30(12), 116-123.

Thangasamy, A., & Lawande, K. E. (2015). Integrated nutrient management for sustainable onion production. *Indian Journal of Horticulture*, 72(3), 347-352.

Williams, C. H., & Steinbergs, A. (1959). Soil sulphur fractions as chemical indices of available sulphur in some Australian soils. *Australian Journal of Agricultural Research*, 10(3), 340-352.

Zaman, M. S., Hashem, M. A., Jahiruddin, M., & Rahim, M. A. (2011). Effect of sulphur fertilization on the growth and yield of garlic (*Allium sativum* L.). *Bangladesh Journal of Agricultural Research*, 36(4), 69-74.

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