



International Journal of Research in Agronomy

E-ISSN: 2618-0618

P-ISSN: 2618-060X

© Agronomy

www.agronomyjournals.com

2025; 8(2): 04-07

Received: 04-11-2024

Accepted: 10-12-2024

Kaushal Yadav

Department of Agricultural
Chemistry and Soil Science, Raja
Balwant Singh College, Bichpuri,
Agra, Uttar Pradesh, India

Manoj Pandey

Department of Agricultural
Chemistry and Soil Science, Raja
Balwant Singh College, Bichpuri,
Agra, Uttar Pradesh, India

Impact of integrated sulphur management on quality of brinjal, onion and garlic

Kaushal Yadav and Manoj Pandey

DOI: <https://doi.org/10.33545/2618060X.2025.v8.i2a.2506>

Abstract

A field experiment was conducted on sandy loam soils of Research Farm, Raja Balwant Singh College, Bichpuri, Agra (U.P.), during *Rabi* 2021-22 and 2022-23 to find out the impact of integrated sulphur management (Ten treatments were available: T1 = 100% NPK (control), T2 = 100% NPK + 15 kg S ha⁻¹, T3 = 100% NPK + 30 kg S ha⁻¹, T4 = 100% NPK + 45 kg S ha⁻¹, T5 = 100% NPK + 60 kg S ha⁻¹, T6 = 100% NPK + 15 kg S ha⁻¹ + 10 t FYM ha⁻¹, T7 = 100% NPK + 30 kg S ha⁻¹ + 10 t FYM ha⁻¹, T8 = 100% NPK + 45 kg S ha⁻¹ + 10 t FYM ha⁻¹, T9 = 100% NPK + 60 kg S ha⁻¹ + 10 t FYM ha⁻¹, and T10 = 150% NPK.) on growth, yield attributes and yield of onion, Brinjal and Garlic. Data from a two-year study demonstrated that diverse integrated sulphur management practices resulted in significant enhancements in quality characters of Brinjal, onion and Garlic over the control (100% RDF) during both the years. The highest quality parameters for Brinjal, including higher levels of dry matter, ascorbic acid, and crude protein content were measured with the treatment 100% NPK + 30 kg S ha⁻¹ + 10 t FYM ha⁻¹ (T7) was applied, followed by 100% NPK + 45 kg S ha⁻¹ + 10 t FYM ha⁻¹ (T8) were applied. The highest quality parameters for onions, including higher levels of dry matter, TSS (°Brix), and crude protein content were measured with the treatment where T8 (100% NPK + FYM @ 10t ha⁻¹ + 45 kg S ha⁻¹) was applied, followed by T9 (100% NPK + FYM @ 10t ha⁻¹ + 60 kg S ha⁻¹) were applied. The highest quality parameters for garlic, including higher levels of dry matter, TSS (°Brix), and crude protein content were measured with the treatment where T8 (100% NPK + FYM @ 10t ha⁻¹ + 45 kg S ha⁻¹) was applied, followed by T9 (100% NPK + FYM @ 10t ha⁻¹ + 60 kg S ha⁻¹) were applied. Thus, integration of sulphur, Farm Yard Manure and 100% RDF practice is viable option of integrated sulphur management to achieve higher quality parameters from Brinjal, onion and Garlic.

Keywords: Bulb, growth, levels of dry matter, ascorbic acid, and crude protein content

Introduction

Eggplant/brinjal (*Solanum melongena* L.), also known as aubergine, is one of the essential vegetables cultivated throughout the world. Eggplant/Brinjal is an important solanaceous vegetable crop of tropical and sub-tropical regions. It belongs to the nightshade family (solanaceae), which also comprises potatoes, peppers, tomatoes, and peppers.

Onions (*Allium cepa* L.) belong to the family Alliaceae and are widely cultivated as an important crop among the vegetables and spices (Mishu *et al.*, 2013) ^[1]. Onions are of high socioeconomic importance in Brazil and are the third most important vegetable crop in the country, behind only tomatoes and potatoes. Garlic (*Allium Sativum* L.) belongs to family Amaryllidaceae is cultivated worldwide primarily for its bulbs. It is also important foreign exchange earner for India. It is consumed by almost all people who take garlic has higher nutritive value than other bulb crops. It is rich in proteins, phosphorous, potassium, calcium, magnesium and carbohydrates. Ascorbic acid content is very high in green garlic. Which are used as seasoning. Regular consumption of garlic has been reported to reduce the risk of cardiovascular and other metabolic diseases including atherosclerosis, hyperlipidemia, thrombosis, hypertension, and diabetes (Banerjee & Maulik, 2002) ^[2].

Sulphur is present in soil in organic and inorganic forms. The organic sulphur accounts for more than 95% of the total sulphur in most soils of humid and semi humid regions. The quantity of organic and inorganic sulphur in a soil sample changes usually according to soil type and depth of sampling. In poorly drained or water logged soils, the main forms of inorganic sulphur in

Corresponding Author:

Kaushal Yadav

Department of Agricultural
Chemistry and Soil Science, Raja
Balwant Singh College, Bichpuri,
Agra, Uttar Pradesh, India

soils is sulfide and often elemental sulphur. Major factors affecting forms of sulphur are organic matter, texture, climate, altitude, salt content, vegetation, leaching, cropping intensity, flooding and carbonates. Transformation of added sulphur is more complex when organic or elemental/sulfide sources are used as compared to sulfate sources.

Integrated Sulphur Management is an approach that aims to optimize nutrient use efficiency in vegetable crops by integrating various sources of nutrients. This approach combines the use of natural and unnatural fertilizers, along with other management practices, for ensure sustainable as well as environmentally friendly vegetable crop production. In recent years, Integrated Sulphur Management has gained significant attention and has become an essential component of vegetable crop management (Khan *et al.*, 2008) [3]. INM (sulphur) provide balanced supply of essential elements required for optimal plant growth. This approach ensures that crops receive the necessary nutrients in the right proportions, leading to healthier and more productive plants. INM (sulphur) also help to improve soil fertility and structure. By incorporating natural material into the soil, INM (sulphur) helps enhance soil health and structure. Organic matter improves soil moisture retention, nutrient-holding capacity, and microbial activity, ultimately creating a favourable environment for vegetable crops to thrive. INM (sulphur) also focuses on minimizing nutrient losses and environmental pollution. Through precise nutrient application techniques, such as split application and site-specific fertilization, INM aims to reduce nutrient runoff and leaching. Therefore, the purpose of this study was to determine the impact of integrated sulphur management on quality parameters of Brinjal, onion and Garlic.

Materials and Methods

Field experiments were conducted at R.B.S. College Research farm (Agra). The climate of the study area is semi-arid with an average rain fall of about 690 mm per annum, about 80% of which is received during June to September. The soil of the experimental field was sandy loam in texture, having pH 8.01, organic carbon 0.352% and available N, P, K and S 186.99, 14.13, 164.31 kg ha⁻¹, and 9.92 mg ha⁻¹ respectively. Three replications of the field experiment were conducted using Randomized Block Design (RBD). Ten treatments were available: T1 = 100% NPK (control), T2 = 100% NPK + 15 kg S ha⁻¹, T3 = 100% NPK + 30 kg S ha⁻¹, T4 = 100% NPK + 45 kg S ha⁻¹, T5 = 100% NPK + 60 kg S ha⁻¹, T6 = 100% NPK + 15 kg S ha⁻¹ + 10 t FYM ha⁻¹, T7 = 100% NPK + 30 kg S ha⁻¹ + 10 t FYM ha⁻¹, T8 = 100% NPK + 45 kg S ha⁻¹ + 10 t FYM ha⁻¹, T9 = 100% NPK + 60 kg S ha⁻¹ + 10 t FYM ha⁻¹, and T10 = 150% NPK. Brinjal in various plots received the recommended application of sulphur and fertilizer (150:50:50 kg N, P₂O₅, and K₂O ha⁻¹) based on the treatment. In accordance with treatments, the beds received the full amount of phosphorus, potash, and sulfur as well as one-third of the nitrogen through DAP, muriate of potash, uttam sultone, and urea. The residual amount of nitrogen was spread out across two split doses of 1/3 and 1/3, spaced one month apart and sixty days apart, respectively, following planting. In order to supply 10 tonnes of FYM per hectare as per treatment, a basal dressing of well decomposed farm yard manure was spread to the field. A day prior to sowing, it was well combined. The observations for each treatments on quality parameters viz., higher levels of dry matter, ascorbic acid, and crude protein content were recorded following standard procedures. The spacing adopted was 20x10 cm. Onion crop was irrigated after planting and later as and

when required. The crop was harvested at physiological maturity and yield data were recorded. The observations for each treatment on quality parameters viz., higher levels of dry matter, ascorbic acid, and crude protein content were recorded following standard procedures. In Garlic a basal dressing of well decomposed farm yard manure was applied in the field to supply 10 tonnes FYM per hectare as per treatment. Brinda in various plots was treated with the recommended dose of fertilizer (120:60:60 kg N, P₂O₅, and K₂O ha⁻¹) and sulfur. In accordance with treatments, the beds received the full amount of phosphorus, potash, and sulfur as well as one-third of the nitrogen through DAP, muriate of potash, uttam sultone, and urea. After planting, the remaining amount of nitrogen was divided into two split doses of 1/3 and 1/3, administered one month apart and 45 days apart, respectively. A day prior to sowing, it was well combined. The observations for each treatment on quality parameters viz., higher levels of dry matter, ascorbic acid, and crude protein content were recorded following standard procedures. For determining the growth and yield attributing characters five plants from each plot were randomly selected and tagged in second row of either side in the field. The data collected from the experiments were subjected to statistical analysis by applying the procedure for randomised block design. Overall differences were tested by 'F' test at 5% level of significance as suggested by (Gomez & Gomez, 1984). In case of significant result, critical difference at 5% level of probability was also calculated for testing the significance between two treatment means.

Results and Discussion

Effect of Integrated Sulphur Management on quality attributes in Brinjal

An overview of data in Table-1 showed that application of 100% NPK + 30 kg S ha⁻¹ + 10 t FYM ha⁻¹ (T7) in a combination treatment resulted in significant increase in quality parameters viz., higher levels of dry matter, ascorbic acid, and crude protein content of Brinjal at all growth stages over the control (100% RDF) during both the years.

Table 1: Effect of Integrated Sulphur Management on quality attributes in Brinjal

Treatments	Quality					
	Dry matter content (%)		Ascorbic acid (%)		Crude protein (%)	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T ₁	6.61	6.66	18.59	18.68	4.32	4.36
T ₂	6.71	6.77	19.20	19.30	4.44	4.48
T ₃	7.00	7.06	20.93	20.99	4.94	4.99
T ₄	6.87	6.97	20.28	20.39	4.76	4.80
T ₅	6.78	6.88	19.78	19.88	4.57	4.61
T ₆	7.12	7.16	21.38	21.49	5.13	5.18
T ₇	7.45	7.49	23.43	23.54	5.82	5.86
T ₈	7.39	7.43	22.81	22.92	5.69	5.74
T ₉	7.30	7.34	22.54	22.65	5.51	5.56
T ₁₀	7.21	7.24	22.02	22.13	5.32	5.37
S.Em±	0.11	0.13	0.33	0.27	0.08	0.07
CD at 0.05	0.32	0.37	0.99	0.81	0.24	0.21

Among various treatment, the maximum Dry matter content (7.45 and 7.49%), Ascorbic acid (23.43 and 23.54%) and Crude protein (5.82 and 5.86%) was recorded in treatment with the treatment where 100% NPK + 30 kg S ha⁻¹ + 10 t FYM ha⁻¹ (T7)) were applied followed by the application of the treatment 100% NPK + 45 kg S ha⁻¹ + 10 t FYM ha⁻¹ (T8) were applied, they were statistically at par with each other while significantly

superior over rest of the treatments at all stages of crop growth during 2021 and 2022, respectively.%). Integrated sulphur management practices showed significant improvement on quality viz., dry matter content in fruit of brinjal crop than control (100% RDF) treatment during both the years. This might be due to FYM provides essential organic matter and nutrients, enhancing soil fertility and structure. This leads to better root development and nutrient uptake by the plants. This may be because FYM improves soil fertility and structure by supplying nutrients and organic materials that are necessary. Better root formation and nutrient uptake by the plants result from this. The production of proteins and amino acids, which are essential for the growth and development of plants, depends on sulphur. Additionally, it enhances the brinjal's flavour and nutritional value as mentioned by Dhakad *et al.* (2019) [4], Hasan *et al.* (2013) [5], Patidar and Bajpai (2018) [6], Mirza *et al.* (2018), Mona *et al.* (2011) [7], and Paswan *et al.* (2022) [8].

Effect of Integrated Sulphur Management on quality attributes in Onion

An overview of data in Table-2 showed that application of T8 (100% NPK + FYM @ 10t ha⁻¹ + 45 kg S ha⁻¹) in a combination treatment resulted in significant increase in quality parameters viz., higher levels of dry matter, ascorbic acid, and crude protein content of onion at all growth stages over the control (100% RDF) during both the years.

Table 2: Effect of Integrated Sulphur Management on quality attributes in Onion

Treatments	Quality					
	Dry matter content (%)		TSS (°Brix)		Crude protein (%)	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T ₁	11.77	11.89	12.87	13.00	5.73	5.79
T ₂	11.94	12.06	13.29	13.42	5.89	5.95
T ₃	12.08	12.20	13.69	13.83	6.06	6.12
T ₄	12.46	12.58	14.49	14.64	6.56	6.62
T ₅	12.25	12.36	14.04	14.18	6.31	6.37
T ₆	12.66	12.79	14.80	14.95	6.81	6.87
T ₇	13.00	13.13	15.60	15.76	7.30	7.38
T ₈	13.27	13.38	16.24	16.36	7.72	7.78
T ₉	13.16	13.29	15.79	15.95	7.55	7.63
T ₁₀	12.83	12.96	15.24	15.39	7.05	7.13
S.Em±	0.12	0.19	0.23	0.19	0.11	0.09
CD at 0.05	0.37	0.56	0.67	0.58	0.33	0.26

Among various treatment, the maximum Dry matter content (13.27 and 13.48%), TSS (16.24 and 16.36 °Brix) and Crude protein (7.72 and 7.78%) was recorded in treatment with the treatment where T8 (100% NPK + FYM @ 10t ha⁻¹ + 45 kg S ha⁻¹) were applied followed by the application of the treatment T9 (100% NPK + FYM @ 10t ha⁻¹ + 60 kg S ha⁻¹) were applied, they were statistically at par with each other while significantly superior over rest of the treatments at all stages of crop growth during 2021 and 2022, respectively. Integrated sulphur management practices showed significant improvement on quality viz., dry matter content in fruit of brinjal crop than control (100% RDF) treatment during both the years. This might be because it is well recognized that both organic and inorganic nutrient sources can provide sufficient macro- and micronutrients, which are important for improving quality since they cause desired enzymatic changes that occur throughout the whole development process of the plant. Similar findings were reported by Barman *et al.* (2020) [9], Singh *et al.* (2019) [10], Ghotekar *et al.* (2015) [11], Sha *et al.* (2019) [12], and Barman *et al.* (2023) [13].

Effect of Integrated Sulphur Management on quality attributes in Garlic

An overview of data in Table-3 showed that application of T8 (100% NPK + FYM @ 10 t ha⁻¹ + 45 kg S ha⁻¹) in a combination treatment resulted in significant increase in quality parameters viz., higher levels of dry matter, ascorbic acid, and crude protein content of garlic at all growth stages over the control (100% RDF) during both the years.

Table 3: Effect of Integrated Sulphur Management on quality attributes in garlic

Treatments	Quality					
	Dry matter content (%)		TSS (°Brix)		Crude protein (%)	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T ₁	39.50	39.89	29.85	30.15	8.85	8.94
T ₂	40.06	40.47	30.83	31.14	9.11	9.20
T ₃	40.52	40.93	31.77	32.09	9.36	9.46
T ₄	41.79	42.22	33.62	33.96	10.13	10.24
T ₅	41.09	41.47	32.57	32.90	9.75	9.85
T ₆	42.48	42.91	34.34	34.69	10.52	10.62
T ₇	43.60	44.04	36.19	36.56	11.29	11.40
T ₈	44.53	44.88	37.67	37.96	11.93	12.02
T ₉	44.14	44.59	36.63	37.00	11.67	11.79
T ₁₀	43.04	43.48	35.35	35.71	10.90	11.01
S.Em±	0.66	0.63	0.48	0.51	0.18	0.15
CD at 0.05	1.95	1.87	1.41	1.51	0.52	0.46

Among various treatment, the maximum Dry matter content (44.53 and 44.88%), TSS (37.67 and 37.96 °Brix) and Crude protein (11.93 and 12.02%) was recorded in treatment with the treatment where T8 (100% NPK + FYM @ 10t ha⁻¹ + 45 kg S ha⁻¹) were applied followed by the application of the treatment T9 (100% NPK + FYM @ 10t ha⁻¹ + 60 kg S ha⁻¹) were applied, they were statistically at par with each other while significantly superior over rest of the treatments at all stages of crop growth during 2021 and 2022, respectively. This might be because it is well recognized that both organic and inorganic nutrient sources can provide sufficient macro- and micronutrients, which are important for improving quality since they cause desired enzymatic changes that occur throughout the whole development process of the plant. Similar findings have been reported by Singh *et al.* (2023) [14], Divyasree *et al.* (2021) [15], Priyanshu *et al.* (2019) [16], and Thangasamy and Lawande (2018) [17].

Conclusion

On the basis of the results illustrated from the present investigation it can be concluded that quality parameter for onion and garlic were noticed superior with T8 (100% NPK + FYM @ 10t ha⁻¹ + 45 kg S ha⁻¹) and in brinjal quality parameter were noticed superior with 100% NPK + 30 kg S ha⁻¹ + 10 t FYM ha⁻¹ (T7). Thus, integration of Sulphur Farm Yard Manure and 100% RDF practice is viable option of integrated sulphur management to achieve higher quality from brinjal, onion and garlic.

References

1. Mishu HM, Ahmed F, Rafii MY, Golam F, Latif MA. Effect of sulphur on growth, yield and yield attributes in onion (*Allium cepa* L.). Aust J Crop Sci. 2013;7(9):1416-1422.
2. Banerjee SK, Maulik SK. Effect of garlic on cardiovascular disorders: a review. Nutr J. 2002;1:1-14.
3. Khan M, Shil N, Noor S. Integrated nutrient management for sustainable yield of major vegetable crops in Bangladesh. Bangladesh J Agric Environ. 2008;4(5):81-94.

4. Dhakad H, Verma SK, Singh SP, Gaur D, Arya V, Sharma K, *et al.* Effect of sulphur levels in combination of organic and inorganic sources of nutrient on plant growth and yield of potato (*Solanum tuberosum* L.). J Pharmacogn Phytochem. 2019;8(4):1855-1861.
5. Hasan MM, Chowdhury MAH, Saha BK, Islam MR. Influence of phosphorus and sulphur on yield, yield attributes and biochemical composition of brinjal. J Agrofor Environ. 2013;6(2):109-114.
6. Patidar P, Bajpai R. Effect of integrated nutrient management (INM) on yield parameters of Brinjal. Int J Chem Stud. 2018;6(3):1158-1160.
7. Mona MA, Mahmoud AR, El-Desuki M, Rizk FA. Yield and fruit quality of eggplant as affected by organic and mineral fertilizers application. Res J Agric Biol Sci. 2011;7(2):196-202.
8. Paswan A, Choudhary A, Raj S, Sonloi P, Sonwani A. Effect of integrated nutrient management on yield of Brinjal. Int J Agric Food Sci. 2022;4(1):12-16.
9. Barman G, Verma S, Raj S, Bisen R. Impact of different organic and inorganic fertilizers with varying sulphur doses on growth and yield of onion (*Allium cepa* L.) in Bilaspur, Chhattisgarh region, India. Int J Agric Plant Sci. 2020;2(4):9-13.
10. Singh H, Singh V, Singh J. Effect of organic and inorganic nutrient sources on productivity, profitability and soil fertility in onion (*Allium cepa*) under Entisol. Indian J Agric Sci. 2019;89(5):851-855.
11. Ghotekar P, Katkar RN, Kharche VK, Laharia GS, Ghawade SM, Lakhe SR. Effect of sources and levels of sulphur on yield and quality of onion and soil fertility status. J Agric Res Technol. 2015;40(1):163-166.
12. Sha K, Madhavan S, Muraleedharan A, Seerangan G. Effect of integrated use of nutrients on growth and yield of onion (*Allium cepa* var. aggregatum) cv. Gnanamedu local. J Pharmacogn Phytochem. 2019;8(2S):564-566.
13. Barman GD, Verma SK, Diwakar S, Parihar SS. Evaluate the organic and inorganic fertilizers doses for growth and yield of onion (*Allium cepa* L.) under Bilaspur Chhattisgarh region. The Pharma Innovation J. 2023;12(7):3174-3176.
14. Singh B, Sharma HR, Impa HR. Effect of Integrated Nutrient Management on Growth, Yield and Quality in Garlic (*Allium sativum* L.). Int J Plant Soil Sci. 2023;35(22):648-654.
15. Divyasree G, Kaleeswari RK, Chitdeshwari T, Priya RS, Karthikeyan S. Comparative evaluation of sulphur sources on growth, yield and quality of garlic (*Allium sativum* L.). J Appl Nat Sci. 2021;13(4):1310-1316.
16. Priyanshu AB, Singh MK, Malik S, Kumar M, Kumar V, Tripathi SK, *et al.* Effect of integrated nutrient management on growth characters of garlic (*Allium sativum* L.) cv. Yamuna Safed-3. Prog Agric. 2019;19(2):242-246.
17. Thangasamy A, Lawande KE. Effect of integrated nutrient management on garlic yield, nutrient uptake and pungency. Agropedology. 2018;28(01):8-13.