Annals of Plant and Soil Research 27(1): 118-122 (2025)
https://doi.org/10.47815/apsr.2025.10444

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

KAUSHAL YADAV, MANOJ PANDEY AND SANDEEP SINGH

Department of Agricultural Chemistry and Soil Science, Raja Balwant Singh College Bichpuri, Agra (U.P.) 283 105

Received: October, 2024; Revised accepted: Febuary, 2025

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 used: T_1 = 100% NPK (control), T_2 = 100% NPK + 15 kg S ha^{-1}, T_3 = 100% NPK + 30 kg S ha^{-1}, T_4 = 100% NPK + 45 kg S ha^{-1}, T_5 = 100% NPK + 60 kg S ha^{-1}, T_6 = 100% NPK + 15 kg S ha^{-1} + 10 t FYM ha^{-1}, T_7 = 100% NPK + 30 kg S ha^{-1} + 10 t FYM ha^{-1}, T_8 = 100% NPK + 45 kg S ha^{-1} + 10 t FYM ha^{-1}, T_9 = 100% NPK + 60 kg S ha^{-1} + 10 t FYM ha^{-1}, and T_{10} = 150% NPK.) profitability of onion, brinjal and garlic. Data from a two-year study demonstrated that diverse integrated sulphur management practices resulted in significant enhancements in profitability characters of brinjal, onion and garlic over the control (100% RDF) during both the years. In onion and garlic treatment T_8 (100% NPK + FYM 10 t ha^{-1} + 45 kg S ha^{-1}) resulted in higher cultivation costs, gross returns, net returns, and benefits: cost ratio, followed by T_9 (100% NPK + FYM 10 t ha^{-1} + 60 kg S ha^{-1}) in both years among integrated sulphur management strategies. The use of T_7 (100% NPK + FYM 10 t ha^{-1} + 30 kg S ha^{-1}) among integrated sulphur management strategies produced greater gross return, net return, and benefit: cost ratio of brinjal crop, followed by T_8 (100% NPK + FYM 10 t ha^{-1} + 45 kg S ha^{-1}) in both years. Thus, integration of sulphur, farm yard manure and 100% RDF practice is viable option of integrated sulphur management to achieve higher profitability parameters from brinjal, onion and garlic.

Keywords: Profitability, integrated, gross return, net return, and benefit: cost ratio

INTRODUCTION

Brinjal or eggplant (*Solanum melongena L.*) known as Baigan in Hindi, is one of the most common, popular and principal vegetable crop grown in India. It can be grown in almost all parts of India except higher altitudes round the year. The unripe fruit is used as cooked vegetable, for the preparation of various dishes such as roasted, fried, stuffed, pickled and cooked forms. Brinjal fruits are fairly good source of calcium, phosphorus, iron and vitamins A, B and C. It has some ayurvedic medicinal properties and white brinjal is said to be good of diabetic patients, it has also been recommended as an excellent remedy for those suffering from liver complaint. 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 and Maulik, 2002).

Fertilizers containing sulfur aid in improving plant uptake of N, P, K, and Zn. Due to the synergistic effect of sulphur on these elements, their efficiency is enhanced which result in increased crop productivity. Sulphur fertilization is a feasible technique to suppress the plant uptake of undesired toxic elements because of the antagonistic relationship between sulphur and other elements including Mg, Mo, and Se. Thus, sulphur fertilizers are not only useful in increasing crop production and quality of produce but also in improving soil condition for crop growth. 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

*Corresponding author: E-mail: yadavkaushal999@gmail.com

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 soils are 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 sulphate sources.

The productivity of soil depends upon the adequate and balanced amount of all the essential nutrients including the secondary nutrients. The continuous use of NPK fertilizers has remarkably increased production but simultaneously brought about problems related to secondary nutrient deficiency particularly that of sulphur in soils As a result, the proper balance and complementary use of chemical fertilizer (sulphur fertilizer) and organic manure in crop production took particular relevance. In the Agra region of Uttar Pradesh, the advantages of integrated sulphur management on vegetable crop productivity and soil fertility enhancement have not yet been thoroughly studied.

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 aused: T_1 = 100% NPK (control), T_2 = 100% NPK + 15 kg S ha^{-1}, T_3 = 100% NPK + 30 kg S ha^{-1}, T_4 = 100% NPK + 45 kg S ha^{-1}, T_5 = 100% NPK + 60 kg S ha^{-1}, T6 = 100% NPK + 15 kg S ha^{-1} + 10 t FYM ha^{-1}, T_7 = 100% NPK + 30 kg S ha^{-1} + 10 t FYM ha^{-1}, T_8 = 100% NPK + 45 kg S ha^{-1} + 10 t FYM ha^{-1}, T_9 = 100% NPK + 60 kg S ha^{-1} + 10 t FYM ha^{-1} and T_{10} = 150% NPK. Brinjal in various plots received the recommended application of sulphur and fertilizer (150:50:50 kg N, P_2O_5 and K_2O ha^{-1}) based on the treatment. In accordance with treatments, the beds received the full amount of phosphorus, potash, and sulphur as well as one-third of the nitrogen through DAP, muriate of potash, uttam sultone (as a sulphur source), and urea. The economics of brinjal, onion and garlic a practice determines whether growers will recommend and use it. As a result, in order to determine which treatment is appropriate for the research and to increase net profit per hectare, it is crucial to calculate the economics of the treatments that were evaluated. The observations for each treatment on profitability parameters *viz.,* cultivation costs, gross returns, net returns, and benefits: cost ratios were recorded following standard procedures. For determining the profitability 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 and 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 Profitability 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} (T_7) in a combination treatment resulted in significant increase in Profitability parameters *viz*., cultivation costs, gross returns, net returns, and benefits: cost ratio of Brinjal at all growth stages over the control (100% RDF) during both the years.

Table 1: Effect of Integrated Sulphur management practices on Profitability attributes of brinjal at harvest

Treatments	Economics (Rs.)							
	Cost of cultivation		Gross return		Net return		B:C Ratio	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T_1 : 100% NPK (Control)	63415	63437	188622	190576	125207	127138	1.97	2.00
T_2: 100% NPK + 15 kg S ha^{-1}	63971	63993	194335	196486	130364	132493	2.04	2.07
T_3: 100% NPK + 30 S kg S ha^{-1}	65082	65104	241129	244609	176047	179505	2.71	2.76
T_4: 100% NPK + 45 kg S ha^{-1}	65637	65660	227639	230173	162001	164514	2.47	2.51
T_5: 100% NPK + 60 kg S ha^{-1}	64526	64549	209410	211741	144883	147193	2.25	2.28
T_6: 100% NPK + 15 kg S ha^{-1}+ 10 t FYM ha^{-1}	85415	85437	263306	266750	177891	181313	2.08	2.12
T_7: 100% NPK + 30 kg S ha^{-1}+ 10 t FYM ha^{-1}	87082	87104	335675	337120	248593	250015	2.85	2.87
T_8: 100% NPK + 45 kg S ha^{-1}+ 10 t FYM ha^{-1}	87637	87660	328954	331390	241316	243730	2.75	2.78
T_9: 100% NPK + 60 kg S ha^{-1}+ 10 t FYM ha^{-1}	86526	86549	307231	310032	220705	223483	2.55	2.58
T_{10}: 150% NPK kg ha^{-1}	85971	85993	285629	288810	199658	202817	2.32	2.36

Among various treatment, the maximum cultivation costs (₹ 87637 ha^{-1} and ₹ 87660 ha^{-1}, respectively), gross returns (₹ 335675 & 33712 ha^{-1}), net returns (₹ 248593 and 250015 ha^{-1}), and benefits: cost ratio (1:2.85 and 1:2.87) was recorded in treatment with the treatment where 100% NPK + 30 kg S ha^{-1} + 10 t FYM ha^{-1} (T_7)) were applied followed by the application of the treatment 100% NPK + 45 kg S ha^{-1} + 10 t FYM ha^{-1} (T_8) 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 2021-22 and 2022-23, respectively. Due to better gross returns and a marginal drop in cultivation costs under these systems, the B:C ratio was higher under these treatments. These results closely match those published by Hasan *et al.* (2013), Mona *et al.* (2011), Patidar and Bajpai (2018), Mirza *et al.* (2018), Dhakad *et al.* (2019), and Paswan *et al.* (2022).

Effect of Integrated Sulphur Management on Profitability 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 Profitability parameters viz., cultivation costs, gross returns, net returns, and benefits: cost ratio of onion at all growth stages over the control (100% RDF) during both the years.

Table 2: Effect of Integrated Sulphur management practices on Profitability attributes of onion at harvest

Treatments	Economics (Rs.)							
	Cost of cultivation		Gross return		Net return		B:C Ratio	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
T_1 : 100% NPK (Control)	53790	53818	158199	159789	104409	105971	1.94	1.97
T_2: 100% NPK + 15 kg S ha^{-1}	54346	54374	166080	167760	111734	113386	2.06	2.09
T_3: 100% NPK + 30 S kg S ha^{-1}	54902	54929	181449	183284	126548	128355	2.30	2.34
T_4: 100% NPK + 45 kg S ha^{-1}	56013	56040	211443	213582	155431	157542	2.77	2.81
T_5: 100% NPK + 60 kg S ha^{-1}	55457	55485	195638	197617	140181	142132	2.53	2.56
T_6: 100% NPK + 15 kg S ha^{-1}+ 10 t FYM ha^{-1}	75790	75818	234459	236830	158669	161012	2.09	2.12
T_7: 100% NPK + 30 kg S ha^{-1}+ 10 t FYM ha^{-1}	76902	76929	276219	279013	199317	202084	2.59	2.63
T_8: 100% NPK + 45 kg S ha^{-1}+ 10 t FYM ha^{-1}	78013	78040	303921	305995	225908	227955	2.90	2.92
T_9: 100% NPK + 60 kg S ha^{-1}+ 10 t FYM ha^{-1}	77457	77485	295557	298546	218100	221061	2.82	2.85
T_{10}: 150% NPK kg ha^{-1}	76346	76374	256568	259163	180222	182789	2.36	2.39

Among various treatment, the maximum cultivation costs (₹ 78013 ha^{-1} and ₹ 78040 ha^{-1}, respectively), gross returns (₹ 303921 & 305995 ha^{-1}), net returns (₹ 225908 & 227955 ha^{-1}), and benefits: cost ratio (1:2.90 and 1:2.92) was recorded in treatment 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 2021-22 and 2022-23, respectively. The better yield and higher crop market price are credited with the greater advantages. Due to better gross returns and a marginal drop in cultivation costs under these systems, the B:C ratio was higher under these treatments. These results closely match those published by Gondane *et al.* (2018), Mishra *et al.* (2017) and Barman *et al.* (2020).

Effect of Integrated Sulphur Management on Profitability attributes in Garlic

An overview of data in Table 3 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 Profitability parameters viz., cultivation costs, gross returns, net returns, and benefits: cost ratio of garlic at all growth stages over the control (100% RDF) during both the years.

Table 3: Effect of Integrated Sulphur management practices on Profitability attributes of garlic at harvest

Treatments	Economics (Rs.)							
	Cost of ultivation		Gross return		Net return		B:C Ratio	
	2021-22	2022-23	2021 - 22	2022-23	2021-22	2022-23	2021-22	2022-23
T_1 : 100% NPK (Control)	81114	81512	234724	237100	153610	155588	1.89	1.91
T_2: 100% NPK + 15 kg S ha^{-1}	81670	82067	245024	247504	163354	165437	2.00	2.02
T_3: 100% NPK + 30 S kg S ha^{-1}	82225	82623	270284	273016	188059	190393	2.29	2.30
T_4: 100% NPK + 45 kg S ha^{-1}	83336	83734	306996	310100	223660	226366	2.68	2.70
T_5: 100% NPK + 60 kg S ha^{-1}	82781	83178	286744	289644	203963	206466	2.46	2.48
T_6: 100% NPK + 15 kg S ha^{-1}+10 t FYM ha^{-1}	103114	103512	326236	329536	223122	226024	2.16	2.18
T_7: 100% NPK + 30 kg S ha^{-1}+10 t FYM ha^{-1}	104225	104623	376916	380728	272691	276105	2.62	2.64
T_8: 100% NPK + 45 kg S ha^{-1}+10 t FYM ha^{-1}	105336	105734	412916	416688	307580	310954	2.92	2.94
T_9: 100% NPK + 60 kg S ha^{-1}+10 t FYM ha^{-1}	104781	105178	401164	405220	296383	300042	2.83	2.85
T_{10}: 150% NPK kg ha^{-1}	103670	104067	352244	355808	248574	251741	2.40	2.42

Among various treatment, the maximum cultivation costs (₹ 105336 ha^{-1} and ₹ 105734 ha^{-1}, respectively), gross returns (₹ 412916 & 416688 ha^{-1}), net returns (₹ 307580 & 310954 ha^{-1}), and benefits: cost ratio (1:2.92 and 1:2.94) was recorded in treatment with the treatment where T_8 (100% NPK + FYM @ 10t ha^{-1} + 45 kg S ha^{-1}) were applied followed by the application of the treatment T_9 (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 2021-22 and 2022-23, respectively. The better yield and higher crop market price are credited with the greater advantages. Due to better gross returns and a marginal drop in cultivation costs under these systems, the B:C ratio was higher under these treatments. These findings are close conformity with the results reported by Verma *et al.* (2013).

CONCLUSION

On the basis of the results illustrated from the present investigation it can be concluded that profitability parameter for onion and garlic were noticed superior with T8 (100% NPK + FYM @ 10t ha^{-1} + 45 kg S ha^{-1} and in brinjal profitability parameter were noticed superior with 100% NPK + 30 kg S ha^{-1} + 10 t FYM ha^{-1} (T_7). Thus, integration of sulphur, farmyard manure and 100% RDF practice is viable option of integrated sulphur management to achieve higher quality from brinjal, onion and garlic.

REFERENCES

Banerjee, S.K. and Maulik, S.K. (2002) Effect of garlic on cardiovascular disorders: a review. *Nutrition Journal*, **1**, 1-14.

Barman, G., Verma, S., Raj, S. and Bisen, R. (2020) 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. *International Journal of Agriculture and Plant Science*, ***2*****(**4), 09-13.

Dhakad, H., Verma, S.K., Singh, S.P., Gaur, D., Arya, V., Sharma, K., Gupta, N., Tomar, A. S., Sharma, S.K. and Rajput, B.K. (2019) Effect of sulphur levels in combination of organic and inorganic sources of nutrient on plant growth and yield of potato (*Solanum tuberosum* L.). *Journal of Pharmacognosy and Phytochemistry*, ***8*****(**4), 1855-1861.

Gomez, K.A. and Gomez, A.A. (1984) *Statistical procedures for agricultural research*. John wiley & sons.

Gondane, S.P., Bansod, P.N. and Kadu, J.B. (2018) Effects of levels of sulphur on soil properties, growth, yield and economics of onion. *International Journal of Chemical Studies*, ***6***(6), 2632-2636.

Hasan, M.M., Chowdhury, M.A.H., Saha, B.K. and Islam, M. R. (2013) Influence of phosphorus and sulphur on yield, yield attributes and biochemical composition of brinjal. *Journal of Agroforestry and Environment*, ***6***(2), 109-114.

Mirza, I.A.B., Sirsath, M.K. and Khazi, G.S. (2018) Production and productivity of soybean as influenced by integrated sulphur management. *Journal of Pharmacognosy and Phytochemistry*, ***7*****(**1S), 2469-2471.

Mishra, N., Patro, H., Ray, M. and Das, S. (2017) Effect of sulphur sources and levels on growth and yield of onion (*Allium cepa* L.). *Indian Agriculturist*, ***61***(1/2), 43-46.

Paswan, A., Choudhary, A., Raj, S., Sonloi, P. and Sonwani, A. (2022) Effect of integrated nutrient management on yield of Brinjal. *International Journal of Agriculture and Food Science*, **4**(1), 12-16.

Patidar, P. and Bajpai, R. (2018) Effect of integrated nutrient management (INM) on yield parameters of Brinjal. *International Journal of Chemical Studies*, **6**(3), 1158-1160.

Verma, S., Choudhary, M.R., Yadav, B.L. and Jakhar, M.L. (2013) Influence of vermicompost and sulphur on growth and yield of garlic (*Allium sativum* L.) under semi arid climate. *Journal of Spices and Aromatic Crops*, ***22***(1), 20-23.