



Effect of Nutrient Management on Growth, Yield and Economics of Rabi Onion

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ABSTRACT

On-Farm Trials (OFTs) were carried out by Krishi Vigyan Kendra, Sikar-II (SKNAU, Jobner) during the rabi seasons of 2023–24 and 2024–25 on 20 farmers' fields to assess the impact of improved nutrient management practices on growth, yield and economics of *rabi* onion under field conditions. The treatments included farmers' practice, recommended dose of fertilizers (RDF: 100:50:50 kg N: P₂O₅: K₂O /ha) and RDF supplemented with two foliar sprays of NPK (13:00:45) @ 5 g/l. The results clearly indicated that RDF combined with foliar application of NPK significantly enhanced growth attributes such as plant height, neck thickness and bulb diameter, resulting in the highest bulb yield (420.23 q/ha), which was 25.78 per cent higher than farmers' practice (334.11q/ha). The improved nutrient management practice also recorded higher gross returns (₹336,184/ha), net returns (₹233,484 ha⁻¹) and benefit–cost ratio (3.27) compared to RDF alone and farmers' practice. An extension gap of 86.12 q/ha highlighted the considerable scope for yield enhancement through adoption of the demonstrated technology. The study concluded that integration of foliar application of NPK (13:00:45) with RDF was an effective, economically viable and farmer-friendly nutrient management strategy for enhancing productivity and profitability of *rabi* onion under the semi-arid conditions of Rajasthan.

Keywords: Bulb yield, Economics, Onion, Foliar fertilization.

INTRODUCTION

Onion (*Allium cepa* L.) is an important vegetable crop in India, widely grown for household consumption as well as commercial purposes. It plays a vital role in the daily diet and contributes significantly to farmers' income and the agricultural economy. Onion bulbs are valued for their distinctive flavour, nutritional quality and medicinal properties. Although India ranks among the leading onion-producing countries, productivity in many regions remains below potential, largely due to imbalanced fertilizer use and inefficient nutrient management practices. Proper and balanced application of essential nutrients, particularly nitrogen, phosphorus and potassium, is necessary for achieving healthy vegetative growth, optimum bulb development and higher yields. However, farmers often apply fertilizers in inadequate or non-recommended proportions, which results in poor nutrient use efficiency and reduced economic returns. While soil application of the recommended dose of fertilizers supports crop growth, nutrient supply during

critical growth stages may not always be sufficient. Under such situations, foliar application of water-soluble fertilizers has emerged as a useful supplementary approach, as it ensures quick availability of nutrients during periods of high demand. Foliar nutrition improves nutrient uptake, photosynthetic activity and assimilate translocation, ultimately enhancing bulb formation in onion. Therefore, integration of soil-applied recommended fertilizers with foliar nutrient sprays may offer a practical solution for improving productivity and profitability. In view of this, the present on-farm trials were conducted to study the effect of recommended dose of fertilizers alone and in combination with foliar application of NPK (13:00:45) on growth, bulb yield and economics of rabi onion under farmers' field conditions.

MATERIALS AND METHODS

The study was carried out during the rabi seasons of 2023–24 and 2024–25. The trials were conducted on twenty farmers' fields in Sikar district of

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Table 1. Effect of nutrient management on growth parameters of rabi onion.

Treatment	Plant height (cm)	Neck thickness (cm)	Bulb diameter (cm)
T ₁ : 70 kg N, 40 kg P ₂ O ₅ and 10 kg K/ha (Farmers' practice)	42.39	1.88	5.85
T ₂ : RDF (100:50:50 NPK kg/ha) (Recommended practice)	49.76	2.15	6.44
T ₃ : RDF (100:50:50 NPK kg/ha) + 2 foliar sprays of NPK 13:00:45 @ 5 g/l water	51.14	2.38	6.69
SEm ±	0.11	0.07	0.11
CD (5%)	0.24	0.14	0.24
CV (%)	5.62	9.80	5.63

Rajasthan, representing semi-arid agro-climatic conditions. Prior to transplanting, composite surface soil samples (0–15 cm) were analyzed, which revealed slightly alkaline soil reaction (mean pH 7.9), low to medium organic carbon content (0.38%), low available nitrogen (228 Kg/ha), medium available phosphorus (18 kg/ha) and medium to high available potassium (310 kg/ha). The On-Farm Trials (OFTs) followed a non-replicated methodology and involved three nutrient management practices, namely farmers' practice (70 kg N, 40 kg P₂O₅ and 10 kg K₂O/ha), recommended dose of fertilizers (RDF: 100:50:50 kg N:P₂O₅:K₂O/ha) and RDF supplemented with two foliar sprays of NPK (13:00:45) @ 5 g/l applied at 30 and 45 days after transplanting. All agronomic operations were carried out uniformly in accordance with regional recommendations. Observations on growth attributes, bulb yield and economic returns were recorded from individual farmers' fields, and pooled mean data of twenty farmers over two seasons were used for interpretation. The results were analyzed using descriptive statistics based on average performance under OFT conditions.

RESULTS AND DISCUSSION

Growth Parameters

Growth of rabi onion responded markedly to different nutrient management practices under farmers' field conditions (Table 1). Treatment T₃ (RDF + two foliar sprays of NPK 13:00:45 @ 5 g/l) recorded the highest plant height (51.14 cm), neck thickness (2.38 cm) and bulb diameter (6.69 cm), and was superior to RDF alone (T₂) and farmers' practice (T₁). Enhanced growth under T₃ can be attributed to the combined effect of balanced soil fertilization and foliar nutrient supplementation, which ensured timely availability of nutrients during critical growth stages,

improved photosynthetic efficiency and promoted effective translocation of assimilates towards bulb development. Application of RDF alone also resulted in improved growth parameters compared to farmers' practice, highlighting the importance of balanced fertilization in onion cultivation. The relatively lower growth recorded under farmers' practice may be due to inadequate and imbalanced nutrient supply. The consistent improvement in growth parameters across different farmers' fields indicates the stability and adaptability of integrated nutrient management practices under semi-arid conditions, where nutrient availability from soil may be constrained by moisture stress. These observations are in agreement with earlier findings reporting enhanced growth of onion due to combined application of soil and foliar nutrients (Deshmukh *et al*, 2019; Asodariya *et al*, 2022; Wabalepatil *et al*, 2023).

Bulb Yield and Yield Attributes

Bulb yield of rabi onion was significantly influenced by nutrient management treatments (Table 2). The highest bulb yield (420.23 q/ha) was obtained under T₃, registering a yield advantage of 25.78 per cent over farmers' practice. This was followed by RDF alone (T₂), which produced a yield of 382.90 q/ha with a 14.60 per cent increase over T₁, while the lowest yield was recorded under farmers' practice. The superior yield under integrated nutrient management may be attributed to improved nutrient availability throughout the crop growth period, particularly during bulb initiation and enlargement stages, resulting in better bulb development, enhanced assimilate partitioning and improved physiological efficiency of the crop. The additional yield advantage observed with foliar supplementation over RDF alone suggests that soil-applied nutrients may not always be sufficient to meet crop demand during peak

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Table 2. Effect of nutrient management on bulb yield and economics of rabi onion

Treatment	Bulb yield (q/ha)	Increase in yield (%)	Gross cost (₹/ha)	Gross return (₹/ha)	Net returns (₹/ha)	B:C ratio
T1: 70 kg N, 40 kg P ₂ O ₅ and 10 kg K/ha (Farmers' practice)	334.11	—	94,220	267,288	173,068	2.84
T2: RDF (100:50:50 NPK kg/ha) Recommended practice)	382.90	14.60	99,150	306,320	207,170	3.09
T3: RDF (100:50:50 NPK kg/ha) + 2 foliar sprays of NPK 13:00:45 @ 5 g/l water	420.23	25.78	102,700	336,184	233,484	3.27

growth phases, emphasizing the complementary role of foliar nutrition. Similar yield responses under integrated nutrient management have been reported earlier, wherein foliar application of water-soluble fertilizers in combination with RDF resulted in improved bulb size, bulb weight and total yield of onion (Deshmukh *et al.*, 2019; Asodariya *et al.*, 2022; Wabalepatil *et al.*, 2023; Haripriya *et al.*, 2025). Earlier studies by Sliman *et al.* (1999) and Tekeste *et al.* (2018) also highlighted the critical role of balanced nitrogen nutrition in enhancing bulb formation and yield in onion.

Economics

Economic analysis clearly demonstrated the advantage of integrated nutrient management in rabi onion cultivation under farmers' field conditions (Table 2). Although treatment T₃ involved a marginally higher cost of cultivation (₹102,700 ha⁻¹), it resulted in the highest gross return (₹336,184 ha⁻¹), net return (₹233,484 ha⁻¹) and benefit-cost ratio (3.27). RDF alone also proved economically superior to farmers' practice with a B:C ratio of 3.09, whereas farmers' practice recorded the lowest economic returns. Higher profitability under integrated nutrient management can be attributed to improved nutrient use efficiency and higher marketable yield. The additional expenditure incurred on foliar fertilization was adequately compensated by increased returns, indicating the economic feasibility of this practice for adoption by farmers. These results corroborate earlier findings emphasizing the role of balanced and integrated fertilization in improving productivity and profitability of onion (Gnanasundari *et al.*, 2022; Yadav *et al.*, 2025).

CONCLUSION

The findings of the present study clearly indicated that nutrient management practices significantly influence growth, bulb yield and economic returns of *rabi* onion under farmers' field conditions. Application of the recommended dose of fertilizers (100:50:50 kg N:P₂O₅:K₂O/ha) supplemented with two foliar sprays of NPK (13:00:45) @ 5 g/l proved most effective in enhancing growth attributes, bulb yield and profitability compared to RDF alone and farmers' practice. Despite a marginal increase in cost of cultivation, this integrated approach resulted in higher net returns and benefit-cost ratio, reflecting efficient utilization of nutrients. The consistent performance of this practice across farmers' fields under semi-arid conditions highlights its suitability for wider dissemination through extension programmes, frontline demonstrations and advisory services. Therefore, integrated use of soil and foliar fertilization can be recommended as a practical, economically viable and farmer-friendly strategy for improving productivity and profitability of *rabi* onion.

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