

Effect of Biostimulant FOLERGY on Onion Yield and Quality

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ABSTRACT

Field experiment was conducted during Kharif 2025–26 at the Agriculture Research Station, Achalpur, Maharashtra, to evaluate the effect of the Biostimulant Folergy on growth, yield, and quality of white onion (Bhima Shubhra). The experiment was laid out in a Randomized Block Design with eight treatments and three replications. Folergy contains humic and fulvic acids, potassium, glycine amino acid, vitamins C and E, myo-inositol, and organic carbon. Treatments comprised soil application, foliar sprays, and their combinations at different doses.

Application of Folergy significantly improved plant growth, bulb development, and yield attributes compared with the untreated control. The combined soil application of Folergy @ 500 g acre⁻¹ (1250 g/ha) at 15 and 30 days after planting (DAP) along with foliar sprays @ 2.0 g L⁻¹ at 25 and 45 DAP (T₇) recorded the highest plant height (66.0 cm), number of leaves (12.0), bulb diameter (6.59 cm), average bulb weight (102.27 g), and bulb yield (313.30 q ha⁻¹), representing a 28.77% increase in yield over the control (243.31 q ha⁻¹). The same treatment also produced the highest proportion of Grade A bulbs (81%) and the lowest neck thickness (0.72 cm), indicating superior bulb maturity and marketable quality. Total soluble solids (TSS) ranged from 10.0 to 11.0%, with the highest value observed in T₇, although differences were statistically non-significant among treatments.

The improved performance was attributed to enhanced root growth, nutrient uptake, photosynthetic efficiency, stress tolerance, and assimilate translocation induced by the humic and fulvic acids, amino acids, vitamins, and myo-inositol present in Folergy. The study concluded that combined soil application of Folergy @ 500 g acre⁻¹ and foliar sprays @ 1.5–2.0 g L⁻¹ at 25 and 45 DAP is an effective agronomic practice for improving productivity, bulb quality, and profitability of Kharif onion under adverse environmental conditions.

Keywords: Onion, Folergy, Biostimulant, humic acid, fulvic acid, Kharif onion, bulb yield, bulb quality, stress tolerance.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops in India and contributes significantly to farmers' income. India is the world's second-largest producer of onion, with Maharashtra being the leading onion-producing state. Although onion is cultivated during the Kharif, late Kharif, and Rabi seasons, Kharif onion cultivation often experiences lower productivity due to unfavourable environmental conditions.

During the Kharif season, excessive rainfall and waterlogging conditions reduce soil aeration, impair root growth, decrease nutrient uptake, and increase the incidence of soil-borne diseases. These adverse conditions result in poor bulb development, lower yield, and inferior bulb quality, thereby reducing the profitability of onion cultivation.

Plant bio stimulants have emerged as an important component of sustainable crop production by improving nutrient use efficiency, stimulating root growth, and enhancing plant tolerance to abiotic stresses. Among these, humic and fulvic acids are well known for their beneficial effects on soil health, root development, nutrient absorption, and overall plant growth.

Folergy is a plant bio stimulant containing humic and fulvic acids, 8% K₂O, 7% glycine amino acid, 12% vitamin C, 0.2% vitamin E, myo-inositol, and 25% organic carbon, with a pH of 6.5. It is formulated for both soil and foliar application to improve root health, enhance nutrient utilization, maintain soil fertility, and increase crop tolerance to environmental stresses. These properties make Folergy particularly suitable for supporting onion crops grown under the stressful conditions prevalent during the Kharif season.

Therefore, the present investigation was undertaken to evaluate the effect of Folergy biostimulant on the growth, yield, and bulb quality of Kharif onion. It was hypothesized that the combined action of humic and fulvic acids, amino acids, vitamins, potassium, and organic carbon would enhance plant vigour, improve stress tolerance, and ultimately increase bulb yield and quality under Kharif growing conditions.

MATERIALS AND METHODS

Experimental Site

A field experiment was conducted during the Kharif season of 2025–26 at the Agriculture Research Station (ARS), Achalpur, Dist. Amravati, Maharashtra, under Dr. Panjabrao Deshmukh Krishi Vidyapeeth (Dr. PDKV), Akola. The objective of the study was to evaluate the effect of the biostimulant FOLERGY on growth, yield, quality, and economics of onion cultivation.

Experimental Material

The experimental crop was white onion (*Allium cepa* L.) variety Bhima Shubhra. Folergy, a bio stimulant containing humic and fulvic acid as major components, was used for soil and foliar applications as per treatment schedule.

Soil Characteristics

Prior to initiation of the experiment, representative soil samples were collected from the experimental field and analysed for physico-chemical properties. The soil was slightly alkaline in reaction with pH 8.09 and electrical conductivity (EC) of 0.19 dSm⁻¹. The soil contained 0.82% organic carbon, available nitrogen 206.98 kg ha⁻¹, available phosphorus 36.38 kg ha⁻¹, available potassium 476.34 kg ha⁻¹, available sulphur 14.32 mg kg⁻¹ and calcium carbonate 2.75%.

Experimental Design and Crop Establishment The experiment was laid out in a Randomized Block Design (RBD) with eight treatments and three replications. The plot size was 3.0 m × 1.5 m. Healthy onion seedlings were raised in a nursery and transplanted on 15 September 2025 at a spacing of 15 cm × 10 cm.

A recommended fertilizer dose of 100:50:50:30 kg ha⁻¹ NPKs was applied uniformly to all treatments according to the package of practices recommended by the university. All agronomic and plant protection measures were followed uniformly throughout the crop growth period.

Treatment Details

The treatments consisted of different methods and doses of FOLERGY application as follows:

Treatment	Details
T ₁	Soil application of FOLERGY @ 500 g acre ⁻¹ (1250 g ha ⁻¹) at 15 and 30 DAP
T ₂	Foliar spray of FOLERGY @ 1.0 g L ⁻¹ water at 25 and 45 DAP

T₃	Foliar spray of FOLERGY @ 1.5 g L ⁻¹ water at 25 and 45 DAP
T₄	Foliar spray of FOLERGY @ 2.0 g L ⁻¹ water at 25 and 45 DAP
T₅	Soil application of FOLERGY @ 500 g acre ⁻¹ (1250 g ha ⁻¹) + foliar spray of FOLERGY @ 1.0 g L ⁻¹ water
T₆	Soil application of FOLERGY @ 500 g acre ⁻¹ (1250 g ha ⁻¹) + foliar spray of FOLERGY @ 1.5 g L ⁻¹ water
T₇	Soil application of FOLERGY @ 500 g acre ⁻¹ (1250 g ha ⁻¹) + foliar spray of FOLERGY @ 2.0 g L ⁻¹ water
T₈	Control (No FOLERGY application)

For foliar applications, Orsil adjuvant was added at the rate of 0.25 ml L⁻¹ spray solution.

Observations Recorded

Observations on growth, yield and quality, were recorded from each treatment.

Growth Parameters

final plant stand

Plant height (cm) at 60 days after planting (DAP).

Number of leaves per plant at 60 DAP.

Days to harvesting.

bulb diameter (cm).

Neck thickness (cm).

Average cured bulb weight (g).

Bulb yield per hectare (q ha⁻¹).

Quality Parameters

Total Soluble Solids (TSS, %). Recorded with hand Refractometer.

Percentage of Grade A bulbs (>60 mm diameter). On weight basis

Bulbs were graded according to National Horticulture Board standards into:

Grade A (>60 mm)

Grade B (40–60 mm)

Grade C (20–40 mm)

The percentage of Grade A bulbs was calculated on weight basis: Calculated on weight basis as percentage of total yield.

Statistical Analysis

The data generated from various observations were subjected to statistical analysis following the procedures

for Randomized Block Design (RBD) as described by Gomez and Gomez (1984). The significance of treatment effects was tested using the F-test at the 5% level of probability. Standard error of mean [SE(m)] and critical difference (CD) at 5% significance were calculated and given in Table.

RESULTS AND DISCUSSION

The Observations were recorded for growth and yield parameters and presented in Table 1.

Table 1. : Effect of Biostimulant Folergy on Kharif Onion variety on Bhima Shubhra

Treatment	Plant Stand at Harvest (per plot)	Plant Height at 60 DAP (cm)	Number of Leaves at 60 DAP	Days to Harvesting	Bulb Diameter at Harvest (cm)	Neck Thickness at Harvest (cm)	Average Bulb Weight (g)	Bulb Yield (q/ha)	Grade A Bulbs (%)	TSS (%)
T1	288	56.17	9.5	133	5.57	1.22	81.4	253.3	65	10.59
T2	294	60.67	9.5	132	5.76	1.06	84.87	256.41	67.33	10.62
T3	294	59	10	132	5.84	1.04	86.6	268.41	70	10.65
T4	295	60	10.5	130	5.92	0.84	88.53	281.3	72	10.7
T5	296	62.56	10.5	130	6.22	0.8	91.27	282.19	74	10.71
T6	298	63	11	125	6.38	0.8	100.4	303.3	77	10.85
T7	299	66	12	120	6.59	0.72	102.27	313.3	81	11
T8 (Control)	270	50	8.5	137	5.42	1.36	75	243.31	50	10
SE (M) ±	5.96	1.84	0.61	3.07	0.21	0.03	3.2	9.86	3.27	0.37

Plant Stand at Harvest

The initial plant stand was uniform (300 plants per plot) in all treatments. At harvest, all FOLERGY-treated plots recorded significantly higher plant stand than the control. The highest final plant stand (299.33 plants plot⁻¹) was recorded in T₇ compared to 270.00 plants plot⁻¹ in the control. The improved plant survival may be attributed to enhanced root growth and nutrient uptake resulting from the humic and fulvic acid components of FOLERGY. Humic substances are known to stimulate root elongation, increase root surface area, and improve nutrient absorption, resulting in better plant establishment and survival (Canellas and Olivares, 2014; Nardi et al., 2002).

Plant Height

Plant height differed significantly among treatments. The maximum plant height (66.00 cm) was recorded in T₇, whereas the control recorded only 50.00 cm. Treatments receiving both soil and foliar applications were statistically at par with T₇. Enhanced plant height may be attributed to the hormone-like activity of humic substances, which improve nutrient uptake, cell division, and photosynthetic efficiency. Similar increases in vegetative growth due to humic acid application have been reported in onion and other vegetable crops by Khaled and Fawy (2011) and Calvo et al. (2014).

Number of Leaves

The number of leaves per plant increased significantly due to Folergy application. The maximum number of leaves (12.00) was observed in T₇ compared to 8.50 in the control. Increased leaf production is important because leaves are the primary source of photosynthates for bulb development. The superior performance of combined soil and foliar applications may be attributed to improved nutrient assimilation and metabolic activity. Similar findings were reported by El-Desuki et al. (2011), who observed increased leaf production and vegetative growth in onion following bio stimulant application.

Days to Harvesting

Folergy application accelerated bulb maturity. The earliest harvesting was observed in T₇ (120 days after planting), whereas the control required 137 days. Early maturity may result from enhanced physiological activity, efficient nutrient utilization, and accelerated bulb development. Humic substances have been reported to improve metabolic efficiency and crop maturity in horticultural crops (du Jardin, 2015; Rouphael and Colla, 2020). The vit C and E contains in Folergy give strength to plants supporting for normal growth under stress condition also which might have helped early maturity than control.

Bulb Diameter

The equatorial bulb diameter increased significantly with Folergy treatments. The maximum bulb diameter (6.59 cm) was recorded in T₇ compared to 5.42 cm in the control. Larger bulb size can be attributed to improved root activity, nutrient uptake, and translocation of photosynthates towards bulb development. Similar improvements in bulb size due to humic acid-based biostimulants were reported by Anwar et al. (2016) and El-Nemr et al. (2012) in onion.

Neck Thickness

Neck thickness was significantly reduced by Folergy application. The thinnest neck (0.72 cm) was recorded in T₇ compared to 1.36 cm in the control. Thin necks are considered desirable because they indicate better bulb maturity and improve storage quality. Improved bulb maturation due to enhanced physiological processes may have contributed to reduced neck thickness. Similar observations were reported by El-Desuki et al. (2011) in onion.

Average Bulb Weight

The highest average bulb weight (102.27 g) was recorded in T₇ compared to 75.00 g in the control. Increased bulb weight is a consequence of improved photosynthetic activity, nutrient uptake, and assimilate partitioning towards bulb development. Treatment T₆ was statistically at par with T₇, indicating that foliar application of FOLERGY at 1.5 g L⁻¹ may be sufficient to achieve optimum bulb weight. Similar positive effects of humic substances on bulb weight have been reported by Khaled and Fawy (2011) and Canellas et al. (2015). Significantly higher bulb weight over control can be attributed to presence of Myo- inositol in Folergy which acts as plant health regulators helping in different physiological processes in plants.

Bulb Yield

The highest bulb yield (313.30 q ha⁻¹) was recorded in T₇, representing a yield increase of 28.77% over the control (243.31 q ha⁻¹). Treatment T₆ (303.30 q ha⁻¹) remained statistically at par with T₇, indicating that the lower foliar dose may provide comparable yield benefits with reduced input cost. The increase in bulb yield can be attributed to enhanced root development, nutrient use efficiency, improved vegetative growth, and greater bulb size and weight. Onion crop removed 2.7 kg N, 1.3 kg P and 3.9 kg K to produced 1 ton of bulbs (Tandon 2012.) as increased bulb yield removed more nutrient the Folergy help to increased uptake nutrient from soil indicating this effect through improved root activity and nutrient use efficiency. Similar yield improvements due to humic and fulvic acid-based bio stimulants have been reported by Calvo et al. (2014), Rouphael and Colla (2020), and Anwar et al. (2016).

Grade A Bulbs

The proportion of Grade A bulbs (>60 mm diameter) increased significantly with Folergy application. Treatment T₇ recorded 81% Grade A bulbs compared to only 50% in the control. Treatments T₆ and T₅ were statistically at par with T₇. The higher percentage of marketable bulbs may be attributed to improved bulb enlargement resulting from enhanced nutrient uptake and photosynthetic activity. Similar improvements in marketable yield have been reported in onion following bio stimulant application by (Rouphael and Colla, 2020).

Total Soluble Solids (TSS)

The TSS content varied from 10.0 to 11.0%, with the highest value observed in T₇. However, differences among treatments were statistically non-significant. Although TSS is primarily governed by genotype, slight improvements due to enhanced physiological activity and carbohydrate accumulation have been reported with bio stimulant application (du Jardin, 2015). Similar trends have been reported in onion and other bulb crops.

The beneficial response of Folergy can be attributed to the synergistic action of its key bioactive components. The presence of humic and fulvic acids likely contributed to improved soil structure, enhanced root-zone conditions, and greater root activity, thereby facilitating better nutrient acquisition and utilization. The stronger response observed with the combined soil and foliar application suggests that supplying the bio stimulant through both pathways may have provided complementary benefits—improving the root environment while simultaneously supporting physiological processes in the foliage.

The vitamin components present in Folergy may have further supported plant performance by contributing to antioxidant protection and maintaining normal physiological activity under environmental stress. This was particularly relevant during the bulb initiation stage, when the crop experienced 63 mm rainfall in a single day followed by a prolonged dry spell. Such abrupt changes in soil moisture can impose substantial physiological stress and disturb nutrient uptake and assimilate partitioning. The antioxidant-supporting role of vitamins may therefore have helped the plants maintain better physiological functioning during these fluctuating environmental conditions.

Myo-inositol, a naturally occurring plant metabolite involved in several cellular and physiological processes, may have additionally contributed to maintaining healthy plant growth and development. Its presence in Folergy could have supported normal cellular metabolism, nutrient utilization, and physiological balance, which may explain the improved crop growth and nutrient-use efficiency observed in the treated plots.

Overall, the present investigation clearly demonstrated that the combined soil and foliar application of Folergy significantly improved plant growth, bulb development, yield, and marketable bulb recovery in Kharif white onion. The results indicate that Folergy functioned not only as a bio stimulant but also provided an additional plant-health-supporting effect, owing to the presence of humic and fulvic acids along with vitamin components and myo-inositol. The combined action of these constituents may have enhanced root development, nutrient acquisition, photosynthetic efficiency, stress tolerance, and translocation of assimilates towards developing bulbs.

These findings are consistent with the established understanding of bio stimulants, particularly humic substances, which can influence root growth, nutrient acquisition, plant metabolism, photosynthesis, and tolerance to environmental stresses (Canellas and Olivares, 2014; Calvo et al., 2014; du Jardin, 2015; Rouphael and Colla, 2020). The present results further suggest that the effectiveness of Folergy is enhanced when soil and foliar applications are integrated, thereby addressing both root-zone and above-ground physiological requirements of the crop.

Under the conditions of the present investigation, soil application of Folergy @ 1250 g ha⁻¹ at 15 and 30 DAP, combined with foliar application @ 1.5–2.0 g L⁻¹ at 25 and 45 DAP, was found to be an effective treatment strategy for improving productivity, bulb development, and marketable yield of Kharif white onion. Thus, the integrated soil-plus-foliar application of Folergy offers a promising approach for improving crop performance and resilience of Kharif onion under fluctuating rainfall and moisture-stress conditions.

Economic Evaluation

The economic viability of Folergy was assessed by considering the cost of the product and its application against the additional returns generated from increased bulb yield. The additional yield over the untreated control was valued at an average onion market price of ₹15 kg⁻¹, and the net returns were calculated after deducting the additional cost of Folergy application. Treatment T₇ recorded an additional bulb yield of 69.99 q ha⁻¹, resulting in additional gross returns of approximately ₹1,04,985 ha⁻¹, demonstrating the economic

potential of Folergy in Kharif white onion production. Moreover, Folergy is compatible with commonly used fertilizers and plant-protection products, which facilitates its integration into existing crop-management practices and can help minimize additional application costs. Although profitability may vary depending on prevailing market prices, location, season, and crop response, the substantial additional yield and returns observed in T7 indicate that Folergy has good economic viability and can be a profitable component of integrated crop management in Kharif white onion.

LIMITATIONS

The present investigation was conducted at a single location, during one season, and using one variety of white onion; therefore, the magnitude of response to Folergy may vary with differences in variety, soil type, climatic conditions, crop season, and management practices. Multi-location and multi-season trials involving diverse white onion varieties would provide further validation of its consistency and adaptability under varying agro-climatic conditions. Nevertheless, based on the performance observed in the present study and the data generated, Folergy demonstrated a positive and economically promising bio stimulant effect on growth, bulb development, yield, and marketable bulb recovery, indicating its potential to improve productivity and profitability for Kharif onion growers under similar production conditions.

CONCLUSION

The present investigation demonstrated that the application of bio stimulant Folergy significantly influenced the growth, yield, and yield-attributing parameters of Kharif onion. Among the different treatments evaluated, the application of Folergy Bio stimulant as the soil application i.e. 1250 g/ha and foliar sprays i.e. 1.5-2.0 ml/lit water consistently recorded superior performance with respect to plant stand, plant height, number of leaves, leaf colour, bulb diameter, bulb weight, marketable yield, and overall bulb quality compared to the control and soil application or foliar sprays alone. The improved performance may be attributed to enhanced root development, efficient nutrient uptake, increased photosynthetic activity, and better translocation of assimilates resulting from the combined action of humic acid, fulvic acid, amino acids, and vitamins present in the bio stimulant Folergy.

The use of bio stimulant folergy also contributed to reduced neck thickness, improved bulb uniformity, and grade of bulbs, indicating their economic viability for onion cultivation. Therefore, the application of Folergy Bio stimulant as sol application have 1250 g/ha at 15 and 30 days after planting and foliar sprays at the rate 1.5 to 2 ml /lit at 25 and 45 days after planting can be recommended as an effective agronomic practice for enhancing productivity and profitability of Kharif onion under adverse climatic conditions.

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