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EFFECT OF INDIVIDUAL AND COMBINED BIOFERTILIZERS WITH RDF ON GROWTH ATTRIBUTES OF ONION (*ALLIUM CEPA* L.) CV. AGRIFOUND LIGHT RED

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ABSTRACT

A field experiment was conducted during the *Rabi* season of 2024–25 at the Experimental Field of Horticulture, College of Agriculture, RVSKVV, Gwalior (M.P.) to evaluate the “Influence of biofertilizers on growth, yield and quality of Onion (*Allium cepa* L.) cv. Agrifound light red. The results revealed that the foliar application of individual dose of 100% RDF + Azotobacter was found the maximum plant height (59.68 cm), number of leaves (9.00), leaf length (53.89 cm), Bolting (2.42%), Width of leaves (1.07 cm). The application of combined 100% RDF + Azotobacter + Azospirillum best resulted in the following measurements: maximum plant height (62.16 cm), number of leaves (10.40), leaf length (57.00 cm), Bolting (1.03%), Width of leaves (1.47 cm). While T_1 -control showed the lowest values for the aforementioned parameters, individual 100% RDF + Azotobacter produced the thickest neck (1.07 cm) and in combined application 100% RDF + Azotobacter + PSB produced the thickest neck (1.30 cm). It is therefore concluded that application of combined 100% RDF + Azotobacter + Azospirillum are recommended to obtain growth parameters of onion bulb.

Key words- Onion, Growth, Yield, Azotobacter, Azospirillum, P.S.B., K.M.B.

Introduction

The onion (*Allium cepa* L.), which has $2n = 16$, is a member of the Alliaceae family and has Central Asia origins. A significant bulb crop worldwide, onions are grown for economic purposes in 175 nations. India is the world's third-largest exporter after the Netherlands and Spain, and it ranks second in both area (26.2%) and output (22.8%) behind China. In India, onions currently occupy 1.91 million hectares, yielding 31.27 million tonnes of produce. In Madhya Pradesh, onions are grown on 196.70 000 hectares of land, yielding 4740.60 000 tonnes of crop. (Anonymous, 2022).

Nitrogen is essential for synthesis of chlorophyll, enzymes and proteins. Phosphorus is essential for root growth, phospho-protein, phospholipids and ATP, ADP formation. Potassium plays an important role of promotion of enzymes activity and enhancing the translocation of assimilates and protein synthesis.

Poor soil health and inconsistent crop yields were

caused by intensive farming and the overuse of chemical fertilizers. Modern civilization has put the ecology at jeopardy. The use of biofertilizers and organic sources as an alternative or supplement to chemical fertilization has gained popularity in recent years as a way to reduce the high costs of inorganic fertilizer in agricultural production.

In addition to biofertilizers like Azotobacter, Azospirillum, Acetobacter, Rhizobium, Azolla, blue green algae, and phosphate solubilizing bacteria, alternate techniques for collecting, processing, composting, and applying organic manure are now necessary. These techniques raise the fertility state of the soil and have become more popular as a sustainable way to boost crop yields in a range of agro-climatic settings (Singh *et al.*, 2017).

Chemical fertilizers such as N, P, and K contributed to a significant rise in plant output and quality in the early 1970s. But in recent years, the selective application of

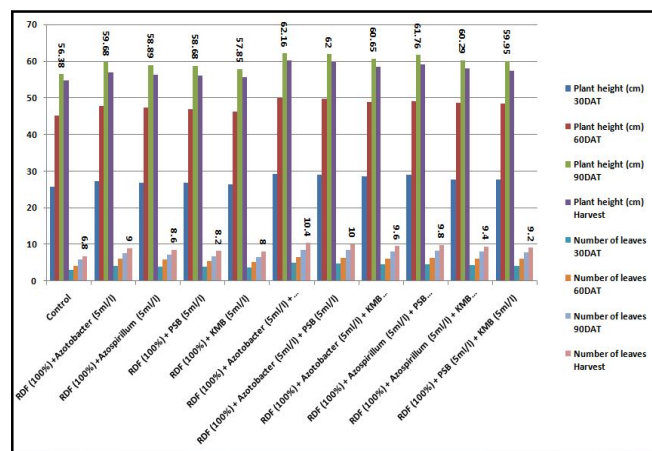
Table 1a: Influence of biofertilizers on growth parameters and harvest of Onion (*Allium cepa* L.) cv. Agrifound light red at 30, 60, 90 DAT.

S. No.	Treatment	Plant height (cm)				Number of leaves			
		30 DAT	60 DAT	90 DAT	Harvest	30 DAT	60 DAT	90 DAT	Harvest
1	Control	25.70	45.17	56.38	54.67	3.00	4.20	5.80	6.80
2	RDF (100%) + Azotobacter (5ml/l)	27.22	47.81	59.68	57.02	4.20	6.00	7.60	9.00
3	RDF (100%) + Azospirillum (5ml/l)	26.93	47.33	58.89	56.33	4.00	5.80	7.20	8.60
4	RDF (100%) + PSB (5ml/l)	26.80	46.86	58.68	56.01	4.00	5.40	6.80	8.20
5	RDF (100%) + KMB (5ml/l)	26.31	46.33	57.85	55.63	3.80	5.20	6.60	8.00
6	RDF (100%) + Azotobacter (5ml/l) + Azospirillum (5ml/l)	29.25	50.02	62.16	60.11	5.00	6.60	8.60	10.40
7	RDF (100%) + Azotobacter (5ml/l) + PSB (5ml/l)	29.05	49.63	62.00	59.78	4.80	6.40	8.40	10.00
8	RDF (100%) + Azotobacter (5ml/l) + KMB (5ml/l)	28.52	48.85	60.65	58.43	4.60	6.20	8.00	9.60
9	RDF (100%) + Azospirillum (5ml/l) + PSB (5ml/l)	28.96	49.00	61.76	59.03	4.60	6.40	8.20	9.80
10	RDF (100%) + Azospirillum (5ml/l) + KMB (5ml/l)	27.74	48.73	60.29	58.08	4.40	6.20	8.00	9.40
11	RDF (100%) + PSB (5ml/l) + KMB (5ml/l)	27.61	48.52	59.95	57.33	4.20	6.00	7.80	9.20
S.E.m±		0.27	0.42	0.27	0.42	0.30	0.33	0.23	0.20
C.D. (5%)		0.79	1.23	0.79	1.23	0.89	0.98	0.69	0.62

chemical fertilizers has been connected to a variety of problems, such as a decline in soil fertility, health, and microbial activity. Thus, the current investigation was conducted with the aforementioned factor in mind.

Materials and Methods

The experiment was carried out during the Rabi season of 2024–2025 at the Horticulture Experimental Field, College of Agriculture, Gwalior, Madhya Pradesh. To determine how RDF, both alone and in combination, affects the growth and yield characteristics of Onion (*Allium cepa* L.) cv. Agrifound Light Red. The sandy loam soil in the experimental field had a consistent texture, good drainage, and very low, medium, and medium NPK status, respectively. Available phosphorus (13.1 kg P₂O₅/ha), available nitrogen (195 kg N/ha), pH (7.2), and EC (0.31 dsm-1). Three replications and a Randomized Block design were used to set up the experiment.

**Fig. 1:** Influence of biofertilizers on growth parameters and harvest of Onion (*Allium cepa* L.) cv. Agrifound light red at 30, 60, 90 DAT.

The treatments includes T₁ - Control, T₂ - RDF (100%) + Azotobacter (5ml/l), T₃ - RDF (100%) + Azospirillum (5ml/l), T₄ - RDF (100%) + PSB (5ml/l), T₅ - RDF (100%) + KMB (5ml/l), T₆ - RDF (100%) + Azotobacter (5ml/l) + Azospirillum (5ml/l), T₇ - RDF (100%) + Azotobacter (5ml/l) + PSB (5ml/l), T₈ - RDF (100%) + Azotobacter (5ml/l) + KMB (5ml/l), T₉ - RDF (100%) + Azospirillum (5ml/l) + PSB (5ml/l), T₁₀ - RDF (100%) + Azospirillum (5ml/l) + KMB (5ml/l), T₁₁ - RDF (100%) + PSB (5ml/l) + KMB (5ml/l). The onion variety was used in the experiment “Agri found Light red”. About seven-week-old seedlings having of 12 to 15 cm height were transplanted in evening hours at spacing of 15 × 10 cm in flat beds. The gross plot size was 3 m × 2 m. The five plants were selected from each plot randomly is a unit for observation on growth and yield parameters. Statistical analysis was done using standard procedure given by Panse and Sukhatme.

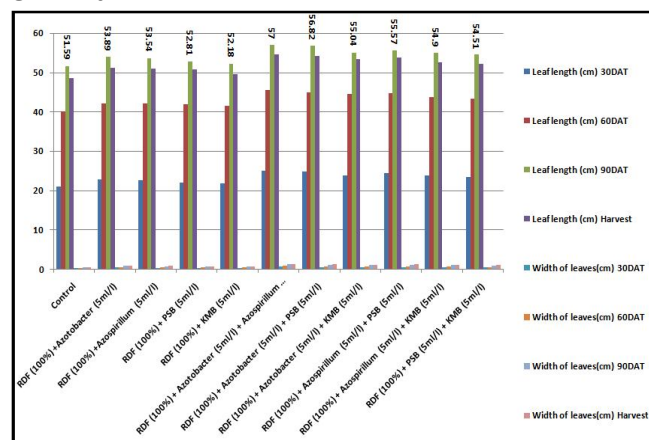
**Fig. 2:** Influence of biofertilizers on growth parameters and harvest of Onion (*Allium cepa* L.) cv. Agrifound light red at 30, 60, 90 DAT.

Table 1b: Influence of biofertilizers on growth parameters and harvest of Onion (*Allium cepa* L.) cv. Agrifound light red at 30, 60, 90 DAT.

S. No.	Treatment	Leaf length (cm)				Width of leaves (cm)			
		30 DAT	60 DAT	90 DAT	Harvest	30 DAT	60 DAT	90 DAT	Harvest
1	Control	21.14	40.17	51.59	48.60	0.33	0.50	0.60	0.62
2	RDF (100%) + Azotobacter (5ml/l)	22.93	42.16	53.89	51.10	0.51	0.67	0.91	1.07
3	RDF (100%) + Azospirillum (5ml/l)	22.75	42.11	53.54	50.90	0.48	0.64	0.83	0.98
4	RDF (100%) + PSB (5ml/l)	22.11	41.85	52.81	50.68	0.46	0.61	0.77	0.86
5	RDF (100%) + KMB (5ml/l)	21.89	41.56	52.18	49.62	0.42	0.59	0.71	0.74
6	RDF (100%) + Azotobacter (5ml/l) + Azospirillum (5ml/l)	25.10	45.62	57.00	54.60	0.76	0.91	1.35	1.47
7	RDF (100%) + Azotobacter (5ml/l) + PSB (5ml/l)	24.88	45.01	56.82	54.13	0.70	0.86	1.30	1.40
8	RDF (100%) + Azotobacter (5ml/l) + KMB (5ml/l)	23.96	44.57	55.04	53.45	0.61	0.76	1.21	1.26
9	RDF (100%) + Azospirillum (5ml/l) + PSB (5ml/l)	24.48	44.65	55.57	53.71	0.67	0.81	1.25	1.35
10	RDF (100%) + Azospirillum (5ml/l) + KMB (5ml/l)	23.78	43.76	54.90	52.61	0.59	0.71	1.15	1.20
11	RDF (100%) + PSB (5ml/l) + KMB (5ml/l)	23.57	43.30	54.51	52.22	0.55	0.68	1.07	1.12
S.E.m±		0.18	0.27	0.23	0.11	0.01	0.02	0.02	0.05
C.D. (5%)		0.54	0.80	0.67	0.34	0.03	0.06	0.05	0.12

Methodology

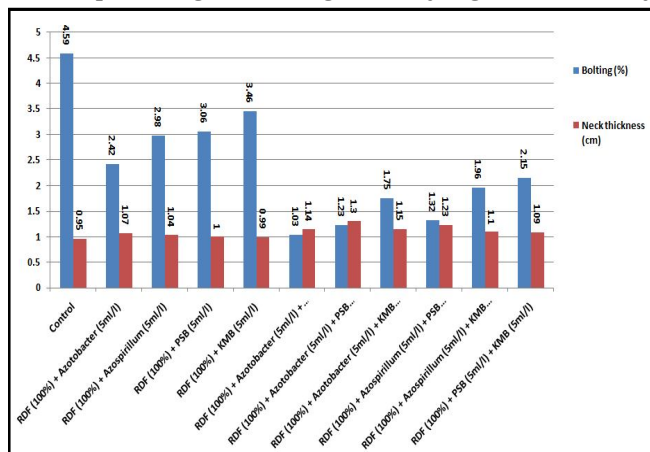
The growth parameters *i.v.*, Plant height (cm), Number of leaves, leaf length (cm), Bolting (%), and Width of leaves (cm) were five plants randomly selected in each plot and tagged. The plant height of each tagged plant was measured from base of the plant to tips of the highest leaf by meter scale and average of five plants was recorded as mean plant height at 30, 60, 90 DAT and harvest.

Results and Discussion

Growth parameters

Plant height (cm)

Various biofertilizers and combinations of biofertilizers with 100% RDF at 30, 60, 90 DAT, and harvest had a significant impact, according to data on gradually increasing plant height (cm). The results showed that the plant heights were significantly higher individually

**Fig. 3:** Bolting (%) at flowering and Neck thickness (cm) of onion at harvest.

in treatment T₂-100% RDF + Azotobacter at 30, 60, 90 DAT, and harvest (27.22 cm, 47.81 cm, 59.68 cm, and 57.02 cm, respectively) and in combined application T₆-100% RDF + Azotobacter + Azospirillum showed maximum plant height at 30, 60, 90 DAT, and harvest (29.25 cm, 50.02 cm, 62.16 cm, and 60.11 cm, respectively), and this difference was significant across all treatments. Comparable results have previously been observed by Jayatilake (2002), Vachan and Tripathi (2018), Solanki *et al.*, (2019), and Yadav *et al.*, (2020).

Table 2: Bolting (%) at flowering and Neck thickness (cm) of onion at harvest.

S. N.	Treatment	B	NT
1	Control	4.59	0.95
2	RDF (100%) + Azotobacter (5ml/l)	2.42	1.07
3	RDF (100%) + Azospirillum (5ml/l)	2.98	1.04
4	RDF (100%) + PSB (5ml/l)	3.06	1.00
5	RDF (100%) + KMB (5ml/l)	3.46	0.99
6	RDF (100%) + Azotobacter (5ml/l) + Azospirillum (5ml/l)	1.03	1.14
7	RDF (100%) + Azotobacter (5ml/l) + PSB (5ml/l)	1.23	1.30
8	RDF (100%) + Azotobacter (5ml/l) + KMB (5ml/l)	1.75	1.15
9	RDF (100%) + Azospirillum (5ml/l) + PSB (5ml/l)	1.32	1.23
10	RDF (100%) + Azospirillum (5ml/l) + KMB (5ml/l)	1.96	1.10
11	RDF (100%) + PSB (5ml/l) + KMB (5ml/l)	2.15	1.09
S.E.m±		0.08	0.06
C.D. (5%)		0.19	0.17
B: Bolting (%); NT: Neck thickness (cm)			

Number of leaves

Individual and combined biofertilizers with 100% RDF had a significant impact on number of leaves. The results showed that the maximum number of leaves were significantly highest individually in treatment T_2 -100% RDF + Azotobacter at 30, 60, 90 DAT, and harvest (4.20, 6.00, 7.60 and 9.00, respectively) and in combined application T_6 -100% RDF + Azotobacter + Azospirillum showed maximum number of leaves at 30, 60, 90 DAT, and harvest (5.00, 6.60, 8.60 and 10.40, respectively), and this difference was significant across all treatments. The results also support those of Solanki *et al.*, (2019), Kuar and Singh (2019), Vachan and Tripathi (2018), Singh and Ram (2014), and Wankhade and Kale (2019).

Leaf length (cm)

Various biofertilizers and combinations of biofertilizers with 100% RDF at 30, 60, 90 DAT, and harvest had a significant impact, according to data on gradually increasing leaf length (cm). The results showed that the leaf length were significantly higher individually in treatment T_2 -100% RDF + Azotobacter at 30, 60, 90 DAT, and harvest (22.93 cm, 42.16 cm, 53.89 cm, and 51.10 cm, respectively) and in combined application T_6 -100% RDF + Azotobacter + Azospirillum showed the maximum leaf length at 30, 60, 90 DAT, and harvest (25.10 cm, 45.62 cm, 57.00 cm, and 54.60 cm, respectively), and this difference was significant across all treatments. Similar findings have been reported by Singh *et al.*, (2017), Kumar *et al.*, (2019), and Yadav *et al.*, (2020).

Width of leaves of plant (cm)

The maximum width of leaves plant⁻¹ (0.51 cm, 0.67 cm, 0.91 cm and 1.07 cm, respectively) were observed individual in treatment T_2 -100% RDF + Azotobacter, and in combined application maximum width of leaves plant⁻¹ (0.76 cm, 0.91 cm, 1.35 cm and 1.47 cm, respectively) were observed in treatment T_6 -100% RDF + Azotobacter + Azospirillum. Whereas, the significantly minimum width of leaves plant⁻¹ (0.33 cm, 0.50 cm, 0.60 cm and 0.62 cm) were recorded in the treatment T_1 -Control at all stage of plant growth (30, 60, 90 DAT and harvest). The results of bio-fertilizers and control values are the findings closely match with Somashekar and Choudhuri (2015).

Neck thickness (cm)

Significantly, the individual treatment T_2 -100% RDF + Azotobacter (1.07 cm) resulted in the largest neck thickness of the plant (cm) and in combined treatment T_7 , 100% RDF + Azotobacter + PSB showed maximum (1.30 cm) neck thickness at harvest. The findings closely match

those of Vachan and Tripathi (2018), Kumar *et al.*, (2019), Solanki *et al.*, (2019), and Wankhade and Kale (2019).

Bolting (%)

The bolting percent is depending on transplanting date of nursery, highly temperature made of bulb and varieties of onion. At flowering stage, significantly lowest bolting (2.42%) was recorded in individual treatment T_2 -100% RDF + Azotobacter and in combined application T_6 100% RDF + Azotobacter + Azospirillum showed lowest bolting (1.03%). However, the significantly maximum value of bolting (4.59%) was observed in the treatment T_1 -Control. The results of bio-fertilizers and control values are the findings closely match with Solanki *et al.*, (2019).

Width of leaves of plant (cm)

The maximum width of leaves plant⁻¹ (0.51 cm, 0.67 cm, 0.91 cm and 1.07 cm, respectively) were observed individual in treatment T_2 -100% RDF + Azotobacter, and in combined application maximum width of leaves plant⁻¹ (0.76 cm, 0.91 cm, 1.35 cm and 1.47 cm, respectively) were observed in treatment T_6 -100% RDF + Azotobacter + Azospirillum. Whereas, the significantly minimum width of leaves plant⁻¹ (0.33 cm, 0.50 cm, 0.60 cm and 0.62 cm) were recorded in the treatment T_1 -Control at all stage of plant growth (30, 60, 90 DAT and harvest). The results of bio-fertilizers and control values are the findings closely match with Somashekar and Choudhuri (2015).

Conclusion

According to the trial, Azotobacter treatment performed better among different individual biofertilizers in terms of all growth parameters including plant height (60.11 cm), number of leaves (10.40), leaf length (54.60 cm), width of leaves (1.47 cm) and bolting (1.03%). The combinations of treatments had a significant effect on the growth of plant. T_6 -100% RDF + Azotobacter + Azospirillum was the most effective overall treatment and produced good results for all parameters tested at every stage of crop growth except neck thickness. The neck thickness (1.30 cm) was noticed much higher with 100% RDF + Azotobacter + Azospirillum. Furthermore, the fertility of the soil is preserved for future increases in agricultural growth. Bio-fertilizers may also improve or maintain the sustainability of production and soil health.

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