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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

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Abstract

A field experiment, entitled “Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on Growth and Yield of Onion (*Allium cepa* L.) In Bilaspur, Chhattisgarh region” was conducted at Instructional Farm, Department of Vegetable Science, College of Agriculture, BTC CARS Bilaspur (Chhattisgarh) during *Rabi* 2019 and 2020. The soil of experimental site was clay in texture, (*Vertisols*) with pH 7.21, low in organic carbon (0.37%), low in available N (219.00 Kg ha⁻¹), medium in available P (14.70 Kg ha⁻¹), and high in K (360.40 Kg ha⁻¹) contents. Temperature and other weather conditions remained favourable throughout the growing season of the crop. The onion variety N-53 was sown on nursery 10 October, 2019 and transplanted on 22 November, 2019 with a spacing of 15 cm x 10 cm using experimental techniques of Randomized block design with three replications. Treatment comprised of twelve different agro input management practices viz., treatments 100 % RDF (T₁), 75% N through RDF + 25% N through FYM (T₂), 50% N through RDF + 50% N through FYM (T₃), 100% RDF + 20 Kg S (T₄), 75% N through RDF + 25% N through FYM + 20 Kg S (T₅), 50% N through RDF + 50% N through FYM + 20 Kg S (T₆), 100% RDF + 30 Kg S (T₇), 75% N through RDF + 25% N through FYM + 30 Kg S (T₈), 50% N through RDF + 50% N through FYM + 30 Kg S (T₉), 100% RDF + 40 Kg S (T₁₀), 75% N through RDF + 25% N through FYM + 40 kg S (T₁₁) and 50% N through RDF + 50% N through FYM + 40 Kg S (T₁₂). Recommended agronomic practices were followed for raising crop. The crop was harvested on 18th April, 2020. Impact of Different Organic and Inorganic Fertilizers With Varying Sulphur Doses had significant effect on growth, yield attributes and yield of onion. 75% N through RDF + 25% N through FYM + 40 kg S (T₁₁) resulted in better growth and yield attributes significantly superior at last observation Highest plant height (56.03 cm), Maximum number of leaves plant⁻¹ (11.43), Length of Leaves (51.60 cm), Total soluble solid (13.02 °Brix).

Keywords: Present status, Problem confrontation, Oilseed cultivation

Introduction

Onion (*Allium cepa* L.) is a short duration and quick growing crop having various uses such as vegetables, spices and medicinal. It is commonly called as “Queen of kitchen” for its unique usage throughout the year in the form of salads, condiments or for cooking with other vegetables. Onion is having pungency character which is due to the presence of a volatile oil ‘allyl-propyl disulphide’ organic compound that rich in sulphur. Onion bulb is a rich source of carbohydrates (11.0g/100g), protein (1.2g/100g), vitamin ‘C’ (11mg/100g) and mineral like phosphorus, calcium and sulphur. Raw onion has medicinal use as an antiseptic value, and reduces blood sugar and to check the deposition of cholesterol in blood vessels, thus protect against heart disease resulting from blockage of arteries. It contains several anti-cancerous agents which prevent cancer. The beneficial compound called ‘quercetin’ present in onion is a powerful antioxidant. It’s used as best remedy against sunstroke during summer. It is

also helpful in fever, dropsy, catarrh and chronic bronchitis. The green leaves and immature and mature bulbs are eaten as raw or used for preparing chutneys, pickles, curries, soups, sauces and seasoning of foods. Now a days, dehydrated bulbs or onion powder is in great demand, which reduces transport cost and storage losses.

Material and Methods

The present investigation entitled “Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on Growth and Yield of Onion (*Allium cepa* L.) In Bilaspur, Chhattisgarh region” was conducted during pre-*rabi* season of 2019-20 at the Agricultural Research Farm of Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur (Chhattisgarh). The detailed information of location, soil, climate and weather recorded during the crop season along with material used and methods employed are described in this chapter.

Table 1: Experimental details

1. Location	:	Horticulture Farm, BTC CARS, Bilaspur (C.G.)
2. Year and Season	:	Rabi 2019-2020
3. Crop and variety	:	Onion (N-53)
4. Recommended dose of Fertilizer	:	80:60:100 kg N, P ₂ O ₅ , K ₂ O ha ⁻¹
5. Irrigation	:	Irrigated condition
6. Planting distance	:	15 cm x 10 cm (Row to Row and Plant to Plant)
7. Seed rate	:	10 kg ha ⁻¹
Experimental Details :-		
1. Design	:	Randomized Block Design
2. Replications	:	03
3. Treatments	:	12
4. Gross plot size	:	2.25 m x 2.00 m
5. Net plot size	:	1.95 m x 1.80 m
6. Total number of plot	:	36

Table 2: Treatment Details

T ₁	100% RDF	Design- RBD
T ₂	75% N through RDF + 25% N through FYM	Gross plot- 2.25 x 2.0 m
T ₃	50% N through RDF + 50% N through FYM	Net plot- 1.95 x 1.80 m
T ₄	100% RDF + 20 Kg S	Replication distance- 1m
T ₅	75% N through RDF + 25% N through FYM + 20 Kg S	Treatment to treatment distance- 0.5 m
T ₆	50% N through RDF + 50% N through FYM + 20 Kg S	
T ₇	100% RDF + 30 Kg S	
T ₈	75% N through RDF + 25% N through FYM + 30 Kg S	
T ₉	50% N through RDF + 50% N through FYM + 30 Kg S	
T ₁₀	100% RDF + 40 Kg S	
T ₁₁	75% N through RDF + 25% through FYM + 40 kg S	
T ₁₂	50% N through RDF + 50% N through FYM + 40 Kg S	

Result and discussion

The significantly maximum plant height of 50.53, 54.07 and 56.03 cm were recorded under 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) at 30, 60 and 90 DAT, respectively. However, the application of 100% RDF + 40 Kg S (T₁₀) and 75% N through RDF + 25% N through FYM + 30 Kg S (T₈) was exhibited at par with application 100% RDF + 30 Kg S (T₇).

Number of leaves plant⁻¹

The number of leaves plant⁻¹ was significantly higher under 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) as compared to rest of the treatments except the application of 100% RDF+30 Kg S (T₇) and 75% N through RDF + 25% N through FYM + 30 Kg S (T₈) at 30, 60 and 90 DAT.

Length of Leaves (cm)

The maximum length of leaf *i.e.* 44.70, 49.60 and 51.60 were noted at 30, 60 and 90 DAT under 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) which was found statistically at par with 100% RDF + 40 Kg S (T₁₀) and 75% N through RDF + 25% N through FYM + 30 Kg S (T₈).

Quality parameter

Total soluble solid (⁰Brix)

The total soluble solids of onion bulb differed non-significantly and ranged from 10.06 % to 13.02 %. The maximum total soluble solids 13.47 % was noted in 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) and the minimum total soluble solids 10.06% was noted in 50% N

through RDF + 50% N through FYM (T₃).

Yield and Yield components

Weight of fresh bulb (g)

The weight of fresh bulb varied significantly and ranged from 47.90 g to 89.73g Application of 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) recorded maximum Weight of fresh bulb (89.73 g) which was at par with the application of 100% RDF+40Kg S (T₁₀) and 75% N through RDF + 25% N through FYM + 30 Kg S (T₈). Whereas, the minimum Weight of fresh bulb were recorded under application of 50% N through RDF + 50% N through FYM (T₃).

Bulbs yield (t ha⁻¹)

Application of 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) recorded maximum bulb yield (31.27 t ha⁻¹), which was at par with application of 100 % RDF + 40Kg S (T₁₀) and 75% N through RDF + 25% N through FYM + 30 Kg S (T₈). Whereas, the minimum total bulb yield were recorded under application of 50% N through RDF + 50% N through FYM (T₃).

Neck length (cm)- The maximum Neck thickness of bulb *i.e.* 1.90 were noted at 30,60 and 90 DAT under 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) which was found statistically at par with 100% RDF + 40 Kg S (T₁₀) and 75% N through RDF + 25% N through FYM + 30 Kg S (T₈)

Diameter of bulb (cm)

The diameter of bulb was ranged from 4.83 to 6.18 cm. The

significantly maximum diameter (6.18cm) was obtained under application of 75% N through RDF + 25% through FYM + 40 kg S (T₁₁). However, application of 50% N through RDF + 50% N through FYM (T₃) produced minimum diameter (4.83cm) of onion.

Benefit cost

The economics of different integrated nutrient management treatments based on net profit and total cost of cultivation showed that 75% RDF + 50% Vermicompost has calculated highest B:C ratio (2.03) followed by 100% RDF + Azotobacter + PSB (1.96). The lowest B: C ratio was recorded in control plot (1.29).

Table 3: Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on plant Effect of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on leaf length (cm) at different growth stages of onion

Treatment	length of leaves (cm plant ⁻¹)			
	30 DAT	60 DAT	90 DAT	
T ₁	100% RDF	37.00	41.03	43.00
T ₂	75% N through RDF + 25% N through FYM	37.67	42.27	44.10
T ₃	50% N through RDF + 50% N through FYM	32.70	36.00	38.07
T ₄	100% RDF + 20 Kg S	38.07	43.17	45.43
T ₅	75% N through RDF + 25% N through FYM + 20 Kg S	39.03	44.50	47.27
T ₆	50% N through RDF + 50% N through FYM + 20 Kg S	34.60	38.90	40.13
T ₇	100% RDF + 30 Kg S	40.57	46.73	49.80
T ₈	75% N through RDF + 25% N through FYM + 30 Kg S	41.80	47.10	52.23
T ₉	50% N through RDF + 50% N through FYM + 30 Kg S	35.57	40.07	41.20
T ₁₀	100% RDF + 40 Kg S	43.13	48.27	50.00
T ₁₁	75% N through RDF + 25% through FYM + 40 kg S	44.70	49.60	51.60
T ₁₂	50% N through RDF + 50% N through FYM + 40 Kg S	36.03	40.53	41.87
SEm±		0.63	0.68	0.72
CD (P=0.05)		1.83	1.98	2.08

Table 4: Plant height (cm) at different growth stages of onion

Treatment	Plant height (cm)			
	30 DAT	60 DAT	90 DAT	
T ₁	100% RDF	42.20	43.60	48.00
T ₂	75% N through RDF + 25% N through FYM	43.07	45.57	52.50
T ₃	50% N through RDF + 50% N through FYM	35.57	38.00	40.07
T ₄	100% RDF + 20 Kg S	45.83	46.70	51.40
T ₅	75% N through RDF + 25% N through FYM + 20 Kg S	46.17	48.00	52.00
T ₆	50% N through RDF + 50% N through FYM + 20 Kg S	38.90	40.23	42.67
T ₇	100% RDF + 30 Kg S	46.43	48.27	52.43
T ₈	75% N through RDF + 25% N through FYM + 30 Kg S	47.20	49.50	53.47
T ₉	50% N through RDF + 50% N through FYM + 30 Kg S	40.23	41.30	43.50
T ₁₀	100% RDF + 40 Kg S	48.75	52.17	56.80
T ₁₁	75% N through RDF + 25% through FYM + 40 kg S	50.53	54.07	58.03
T ₁₂	50% N through RDF + 50% N through FYM + 40 Kg S	41.47	43.00	45.67
SEm±		0.71	0.77	0.93
CD=P (0.05)		2.05	2.24	2.70

Table 5: Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on weight of Fresh bulb (g) of onion

Treatment	Weight of fresh bulb (g)
T ₁ :100% RDF	68.54
T ₂ :75% N through RDF + 25% N through FYM	71.23
T ₃ :50% N through RDF + 50% N through FYM	47.90
T ₄ :100% RDF + 20 Kg S	73.20
T ₅ : 75% N through RDF + 25% N through FYM + 20 Kg S	74.36
T ₆ : 50% N through RDF + 50% N through FYM + 20 Kg S	57.81
T ₇ :100% RDF + 30 Kg S	80.17
T ₈ : 75% N through RDF + 25% N through FYM + 30 Kg S	82.72
T ₉ : 50% N through RDF + 50% N through FYM + 30 Kg S	57.96
T ₁₀ : 100% RDF + 40 Kg S	88.07
T ₁₁ : 75% N through RDF + 25% through FYM + 40 kg S	89.73
T ₁₂ : 50% N through RDF + 50% N through FYM + 40 Kg S	63.40
SEm±	1.09
CD(P=0.05)	3.15

Table 6: Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on Bulbs yield (t ha⁻¹) of onion

Treatment	Bulbs yield (t ha ⁻¹)
T ₁ :100% RDF	23.93
T ₂ :75% N through RDF + 25% N through FYM	25.50
T ₃ :50% N through RDF + 50% N through FYM	20.03
T ₄ : 100% RDF + 20 Kg S	26.00
T ₅ : 75% N through RDF + 25% N through FYM + 20 Kg S	27.73
T ₆ : 50% N through RDF + 50% N through FYM + 20 Kg S	20.60
T ₇ : 100% RDF + 30 Kg S	28.17
T ₈ : 75% N through RDF + 25% N through FYM + 30 Kg S	29.13
T ₉ : 50% N through RDF + 50% N through FYM + 30 Kg S	21.20
T ₁₀ : 100% RDF + 40 Kg S	30.50
T ₁₁ : 75% N through RDF + 25% through FYM + 40 kg S	31.27
T ₁₂ : 50% N through RDF + 50% N through FYM + 40 Kg S	22.00
SEm±	0.43
CD (P=0.05)	1.24

Table 7: Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on Neck thickness of bulb (cm) of onion

Treatment	Neck thickness of bulb (cm)
T ₁ 100% RDF	1.30
T ₂ 75% N through RDF + 25% N through FYM	1.31
T ₃ 50% N through RDF + 50% N through FYM	1.10
T ₄ 100% RDF + 20 Kg S	1.31
T ₅ 75% N through RDF + 25% N through FYM + 20 Kg S	1.42
T ₆ 50% N through RDF + 50% N through FYM + 20 Kg S	1.13
T ₇ 100% RDF + 30 Kg S	1.50
T ₈ 75% N through RDF + 25% N through FYM + 30 Kg S	1.60
T ₉ 50% N through RDF + 50% N through FYM + 30 Kg S	1.20
T ₁₀ 100% RDF + 40 Kg S	1.87
T ₁₁ 75% N through RDF + 25% through FYM + 40 kg S	1.90
T ₁₂ 50% N through RDF + 50% N through FYM + 40 Kg S	1.10
SEm±	0.3
CD(P=0.05)	0.7

Table 8: Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses on economics of onion

Treatment	Cost of cultivation (Rs ha ⁻¹)	Gross return (Rs ha ⁻¹)	Net return(Rs ha ⁻¹)	B:C ratio
T ₁ : 100 % RDF	58007	239333	181326	3.13
T ₂ : 75% N through RDF + 25% N through FYM	58802	255000	196198	3.34
T ₃ : 50% N through RDF + 50% N through FYM	59566	206000	143934	2.32
T ₄ : 100% RDF + 20 Kg S	60507	260000	199493	3.30
T ₅ : 75% N through RDF + 25% N through FYM + 20 Kg S	61302	277333	216031	3.52
T ₆ : 50% N through RDF + 50% N through FYM + 20 Kg S	62066	200333	140767	2.36
T ₇ : 100% RDF + 30 Kg S	61757	281667	219910	3.56
T ₈ : 75% N through RDF + 25% N through FYM + 30 Kg S	62552	291333	22878	3.67
T ₉ : 50% N through RDF + 50% N through FYM + 30 Kg S	63316	212000	148684	2.35
T ₁₀ : 100% RDF + 40 Kg S	63007	305000	247993	3.84
T ₁₁ : 75% N through RDF + 25% through FYM + 40 kg S	63802	312667	248865	3.90
T ₁₂ : 50% N through RDF + 50% N through FYM + 40 Kg S	64566	220000	155434	2.41

Conclusions

On the basis of observations and result of the present investigation, the following conclusion could be drawn, for the cultivation of onion (*Allium cepa* L.) in Chhattisgarh plains. Impact of Different Organic and Inorganic Fertilizers with Varying Sulphur Doses had significant effect on growth, yield attributes and yield of onion. 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) resulted in better growth and yield attributes significantly superior highest plant height, maximum number of leaves plant⁻¹, Length of Leaves, Weight

of fresh bulb, bulb yield, Neck length and Diameter of bulb over other treatments but was at par with 100% RDF + 40 Kg S (T₁₀) showed superiority in term of higher net returns (Rs 248865ha⁻¹). However, B: C ratio was obtained highest with the application of 75% N through RDF + 25% through FYM + 40 kg S (T₁₁). This it could be concluded that application of 75% N through RDF + 25% through FYM + 40 kg S (T₁₁) onion. If sufficient quality of FYM is net available then 100% RDF + 40 Kg S (T₁₀) could be recommended for better yield and net profit for onion.

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