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Research Article

Study the Effect of Organic and Inorganic Fertilizers on Growth and Yield Attributes of Kharif Onion (*Allium cepa* L.)

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ABSTRACT

The field experiment was conducted to study the "Study the effect of organic and inorganic fertilizers on growth and yield attributes of kharif onion(Allium cepa L.)." in medium black soils of the Fruit Research SatationEntkhedi Farm, Rajmata Vijayaraje Scindia Krishi Vidyalaya, Bhopal, (M.P.). during kharif 2015-16 .It was observed that the plant height and number of leaves per plant was significantly increased by various treatments of organic manure and inorganic fertilizers at all the growth stages (i.e. at 30, 60, and 90 DAT). Significantly maximum plant height and number of leaves per plant was recorded in treatment T_{11} (RDF 75% 112.5: 60: 45kg NPK/ha + Vermicompost 4 t/ha) followed by T_{10} (RDF 75%112.5: 60: 45kg NPK/ha + Vermicompost 4t/ha) at 30, 60, and 90 DAT, While the minimum plant height and number of leaves per plant was observed under the treatment T_1 (Vermicompost 3 t/ha) for the same. The experiment was laid out in the Randomized Completely Block Design with three replications. Each replication was comprised of 12 treatment.

Key words: *Organic, Growth, Manure, Height.*

INTRODUCTION

Onion (*Allium cepa* L.) is a biennial or perennial herb belongs to family Alliaceae. It is one of the most important cash vegetable crop among bulb crops and semi-perishable in nature. Onion is rich in protein, calcium, phosphorus and carbohydrates[5]. India is second largest producer of onion after china in the world, cultivating onion over an area of 1320 thousand hectare with total production of 20931 thousand metric tonnes[3]. India is the second largest producer of onion in the world, next to China, with 70% of the total production comes as winter crop and remaining 30% as kharif onion as off season crop, accounting for 11.40 per cent of the area and 10.40 per cent of the world production and 16 per cent of productivity. In India, onion is being grown in an area of 3.64 million hectares with production of 68.45 million tonnes and the average productivity is 18.82 tonnes per hectare.

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China, India, U.S.A., Pakistan, Turkey, Iran, Brazil, Mexico and Spain are the major onion producing countries in the world. Maharashtra is the leading onion growing state of India[2]. India is the second largest producer of onion in the world and occupies 756200 ha area with a production of 12.15 MT and productivity of 16.1 tons/ha[1]. The application of different doses of sulphur improves plant height, number of leaves, bulb diameter, bulb weight and yield of onion[8].The application of organic manures like FYM and poultry manure alone and in combination with NPK have been reported to decrease the bulk density, improve the soil porosity and increase water holding capacity[10].Use of bio fertilizers not only supplement the nutrients but also improve the efficiency of applied nutrients[6].There is a good scope of increasing onion yield and quality for which nutrient management is one of the most important considerations under organic production system[9].The organic manures contain nutrients in small quantities as compared to the chemical fertilizers, also it contain growth promoting substances like enzymes and hormones, besides improvement of soil fertility and productivity[4]. Organic materials such as poultry manure, green manures and farmyard manure (FYM) can substitute for inorganic fertilizers to maintain productivity and environmental quality[7].

MATERIAL AND METHODS

The present experiment was laid out in the field of Fruit Research Satation Entkhedi Farm, Rajmata Vijayaraje Scindia Krishi Vidyalaya, Bhopal, (M.P.). Bhopal is Situated on 23^0 15 north latitude and 77^0 24 east longitude at an altitude of 427 meters from mean sea level in Vindyan Plateau of Madhya Pradesh and enjoy sub tropical Climate. The average rainfall Varies from 945.3 mm concentrated mostly from the month of last july to January (Crop period) less rainfall occurs during the winter season also. The average maximum temperature is 46^0C and minimum temperature 6.8 ^{0} C the average annual relative humidity is 74%. The soil of the experiment field was medium black with 37% clay, 38% salt and 25% send with P^H ranging 7.2. The soil was low in Available nitrogen, medium in available phosphorus and high in available potassium.The 12 treatments were replicated three times in randomized block design in 1.5m × 1.2m plots. The statistical analysis was done as per the standard procedure for analysis of variance for RCBD.Least significant difference was employed for mean comparison.

RESULTS AND DISCUSSION

The present experiment was carried out to study "growth, yield" of kharif onion *(Allium cepa* L.) as influenced by organic and inorganic nutrition".

Growth parameter

1. Plant height

The mean plant height of kharif onion plant as influence by different treatment of organic manures and inorganic fertilizers is given in Table 1. plant height was recorded at 30,60,90, days after transplanting. The plant height increased significantly with the different treatments of organic manures and inorganic fertilizers up to 90DAT. The significantly maximum plant height 35.63, 53.47 and 63.80 cm were recorded in treatment t_{11} (RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 5 t/ha) followed by T_{10} (RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 4 t/ha) 33.40, 50.17 and 60.80 cm at 30,60 and 90 DAT, respectively and which were at par at 30DAT only. While the minimum plant heights (26.87, 40.47 and 50.93 cm) were observed under the treatment T1 (Vermicompost 3 t/ha) at 30,60 and 90 DAT, respectively.

Tsble 1: Plant height (cm) as affected by different treatment of organic manure and inorganic fertilizers on Kharif onion at 30, 60 90 DAT

Treat.Symb.	Treatments	plant height (cm)at		
		30DAT	60DAT	90DAT
T_1	**Vermicompost 3 t /ha**	26.87	40.47	50.93
T_2	**Vermicompost 4 t /ha**	27.57	41.20	52.00
T_3	**Vermicompost 5 t /ha**	27.60	42.43	52,68
T_4	**RDF 50%**	27.70	45.57	54.93
T_5	**RDF 75%**	31.70	46.73	57.33
T_6	**RDF 50% + Vermicompost 3 t /ha**	29.70	46.00	55.20
T_7	**RDF 50% + Vermicompost 4 t /ha**	30.67	46.07	56.20
T_8	**RDF 50% + Vermicompost 5 t /ha**	31.53	46.20	56.47
T_9	**RDF 75% + Vermicompost 3 t /ha**	31.73	48.53	58.60
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	33.40	50.17	60.80
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	35.63	53.47	63.80
T_{12}	**RDF 100% (check)**	32.90	49.17	60.20
SEm±		**0.87**	**0.97**	**0.62**
C.D. at 5%		**2.56**	**2.85**	**1.83**

2. Number of leaves per plant

The average number of leaves per plant at 30, 60 and 90 DAT is depicted in Table 2.The data clearly indicated that the number of leaves per plant of Kharif onion plants responded significantly to various treatments of organic manures and inorganic fertilizers under study. The significantly maximum 5.42, 8.56 and 11.74 leaves per plant were recorded in the treatments T_{11} (RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 5 t/ha) followed by T_{10} (RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 4 t/ha) (5.36, 8.49 and 11.40 leaves per plant) and T_{12} (RDF 100% 150: 80: 60 kg NPKha (check) (5.29, 8.41 and 11.15 leaves), respectively and which were at per with each other.However, the minimum 4.47, 7.14 and 8.80 leaves per plant was noted in T_1 (Vermicompost 3t /ha) 30,60 and 90 DAT, respectively.

Table 2: Effect of different reatment of organic manure and inorganic fertilizers on number of leaves per plant of Kharif onion at 30, 60, 90 DAT

Treat.Symb.	Treatments	Plant height (cm)		
		30DAT	60DAT	90DAT
T_1	**Vermicompost 3 t /ha**	4.47	7.14	8.80
T_2	**Vermicompost 4 t /ha**	4.61	7.28	9.66
T_3	**Vermicompost 5 t /ha**	4.88	7.34	9.93
T_4	**RDF 50%**	5.02	7.64	10.00
T_5	**RDF 75%**	5.22	8.01	10.80
T_6	**RDF 50% + Vermicompost 3 t /ha**	5.03	7.81	10.25
T_7	**RDF 50% + Vermicompost 4 t /ha**	5.07	7.94	10.58
T_8	**RDF 50% + Vermicompost 5 t /ha**	5.15	8.00	10.65
T_9	**RDF 75% + Vermicompost 3 t /ha**	5.29	8.15	10.84
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	5.36	8.49	11.40
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	5.42	8.56	11.74
T_{12}	**RDF 100% (check)**	5.29	8.41	11.15
SEm±		**0.18**	**0.21**	**0.29**
C.D. at 5%		**0.54**	**0.63**	**0.85**

3. Number of bolting per plot

The number of bolting per plot was recorded and has been presented in Table 3. The number of bolting per plot in kharif onion as influenced with the different treatment of organic manures and inorganic fertilizers. Significantly minimum (6.02, 6.67 and 7.34) bolters per plot were observed due to application of T_{11} (RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 5 t/ha) T_{10} (RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 4 t/ha) and T_{12} (RDF 100% 150: 80: 60 kg MPK/ha (check), respectively and which were at par with each other. Maximum (13.67) number of bolting per plot were noted in T_1 (Vermicompost 3t/ha).

Table 3: Effect of different treatment of organic manure and inorganic fertilizers on number of bolting per plot and bolting percentage of Kharif onion

Treat. Symb.	Treatments	Number of bolting per plot	Bolting percentage
T_1	**Vermicompost 3 t /ha**	13.67	17.08
T_2	**Vermicompost 4 t /ha**	13.34	16.67
T_3	**Vermicompost 5 t /ha**	10.38	12.97
T_4	**RDF 50%**	10.03	12.53
T_5	**RDF 75%**	8.68	10.85
T_6	**RDF 50% + Vermicompost 3 t /ha**	9.35	11.68
T_7	**RDF 50% + Vermicompost 4 t /ha**	9.34	11.68
T_8	**RDF 50% + Vermicompost 5 t /ha**	9.03	11.29
T_9	**RDF 75% + Vermicompost 3 t /ha**	8.35	10.44
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	6.67	8.34
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	6.02	7.52
T_{12}	**RDF 100% (check)**	7.34	9.18
SEm±		**0.71**	**0.89**
C.D. at 5%		**2.10**	**2.63**

4. Bolting percentage

The bolting percentage has been presented in Table 3. Significantly minimum (7.52, 8.34 and 9.18) bolting per cent were observed due to application of T_{11}**(**RDF 75% 112.5: 60: 45kg NPK/ha+ Vermicompost 5 t/ha) T_{10} (RDF 75% 112.5: 60: 45kg NPK/ha+ vermicompost 4 t /ha) T_{12} (RDF 100% 150: 80: 60 kg MPK/ha (check), respectively and which were at per with each other. Therefore, it treatment T_1 (Vermicimpost 3 t/ha).

1.2 Yield parameters

6. Neck thickness of bulb (cm)

The average neck thickness was recorded and has been presented in Table 4.

Table 4: Effect of different treatment of organic manure and inorganic fertilizers on neck thickness of bulb (cm) of kharif onion

Treat. Symb.	Treatments	Neck thickness of bulb (cm)
T_1	**Vermicompost 3 t /ha**	0.87
T_2	**Vermicompost 4 t /ha**	0.89
T_3	**Vermicompost 5 t /ha**	0.92
T_4	**RDF 50%**	0.93
T_5	**RDF 75%**	0.97
T_6	**RDF 50% + Vermicompost 3 t /ha**	0.94
T_7	**RDF 50% + Vermicompost 4 t /ha**	0.94
T_8	**RDF 50% + Vermicompost 5 t /ha**	0.96
T_9	**RDF 75% + Vermicompost 3 t /ha**	1.01
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	1.14
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	1.18
T_{12}	**RDF 100% (check)**	1.03
SEm±		**0.04**
C.D. at 5%		**0,12**

The neck thickness was significantly influenced by various treatments of organic manures and inorganic fertilizers. The significantly minimum 0.87 and 0.89cm neck thickness was recorded in treatment T_1 (Vermicompost 4t/ha), respectively and which were at par with each other, while, the highest 1018 cm neck thickness was recorded with treatment T_{11} (RDF 75% 112.5:60:45kg NPK/ha + Vermicompost 5t /ha).

7. Polar diameter of bulb (cm)

The polar diameter of bulb was recorded treatment wise. The data have been depicted in Table 5.

Table 5: Polar diameter and equatorial diameter of bulb (cm) as influenced by different treatment of organic manure and inorganic fertilizers in kharif onion

Treat. Symb.	Treatments	Polar diameter of Bulb (cm)	Equatorial diameter of bulb (cm)
T_1	**Vermicompost 3 t /ha**	3.98	5.01
T_2	**Vermicompost 4 t /ha**	3.98	5.23
T_3	**Vermicompost 5 t /ha**	4.12	5.31
T_4	**RDF 50%**	4.15	5.63
T_5	**RDF 75%**	4.31	5.87
T_6	**RDF 50% + Vermicompost 3 t /ha**	4.19	5.66
T_7	**RDF 50% + Vermicompost 4 t /ha**	4.27	5.70
T_8	**RDF 50% + Vermicompost 5 t /ha**	4.31	5.77
T_9	**RDF 75% + Vermicompost 3 t /ha**	4.33	6.05
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	4.42	6.24
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	4.68	6.54
T_{12}	**RDF 100% (check)**	4.39	6.12
SEm±		**0.06**	**0.16**
C.D. at 5%		**0.18**	**0,48**

It is obvious from the Table 4.6 that the average polar diameter of bulb was significantly influenced by the different treatment of organic manures and inorganic fertilizers in onion. Significantly maximum 4.68 cm polar diameter of bulb was recorded

in treatment T_{11} (RDF 75% 112.5: 60: 45kg NPK/ha + Vermicompost 5 t/ha). T_{10} (RDF 75% 112.5: 60: 45kg NPK/ha + Vermicompost 4t/ha) and T_{12} (RDf 100% 150: 80: 60 kg NPk /ha (check)(4.39cm), and which were at par with each other. The lowest polar diameter of bulb (3.98cm) was recoded in T_1 (Vermicompost 3 t/ha) and T_2 (Vermicompost 4 t/ha).

8. Equatorial diameter of bulb (cm)

The means equatorial diameter of bulb was recoded treatment wise. The data have been depicted in Table 5. The equatorial diameter of bulb increased significantly due to different treatment of organic manures and inorganic fertilizers. Significantly maximum 6.54, 6.24 and 6.12 cm equatorial diameter of bulb were exhibited in the treatment T_{11} (RDF 75% 112.5: 60: 45kg NPK/ha + Vermicompost 5 t/ha),T_{10} (RDF75% 112.5: 60: 45kg NPK/ha + Vermicompost 4 t/ha) and T_{12} (RDF 100% 150: 80: 60kg NPK/ha (check), respectively and which were at par with each other.However, the minimum equatorial diameter of bulb was observed in T_1 (Vermicompost 3 t/ha) (5.01 cm).

9. Fresh weight of bulb per plant (g)

The mean fresh weight of bulb per plant in different treatments of organic manures and inorganic fertilizers is given in Table 6. Significantly maximum 130.09 and 117.09 freesh weight of bulb per plant were exhibited in the treatment T_{11}(RDF75% 112.5: 60 45kg NPK/ha + Vermicompost 5 t/ha) and T_{10} (RDF 75% 112.5: 60: 4KG NPK/HA + Vermicompost 4 t/ha), respectively and which were at par with each other. Whereas, the minimum fresh weight of bulb per plant was observed in T_1(Vermicompost 3 t/ha) (70.0g).

Table 6: Fresh weight and dry weight of bulb (g) as influenced by different treatment of organic manure and inorganic fertilizers in kharif onion

Treat. Symb.	Treatments	Bulb weight (g) / bulb	
		Fresh	Dry
T_1	**Vermicompost 3 t /ha**	70.00	6.40
T_2	**Vermicompost 4 t /ha**	75.00	7.68
T_3	**Vermicompost 5 t /ha**	75.33	8.00
T_4	**RDF 50%**	93.00	8.64
T_5	**RDF 75%**	100.00	11.52
T_6	**RDF 50% + Vermicompost 3 t /ha**	94.00	10.93
T_7	**RDF 50% + Vermicompost 4 t /ha**	96.67	11.20
T_8	**RDF 50% + Vermicompost 5 t /ha**	96.97	11.36
T_9	**RDF 75% + Vermicompost 3 t /ha**	108.33	11.68
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	117.00	13.44
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	130.00	14.08
T_{12}	**RDF 100% (check)**	114.67	12.80
SEm±		**4.93**	**0.08**
C.D. at 5%		**14.48**	**0.25**

10. Number of doubles bulb per plot and percentage

The mean number of doubles bulb per plot and percentage of different treatments of organic manures and inorganic fertilizers is given in Table 7. Treatment T_1 (Vermicompost 3 t/ha) was observed minimum number of double bulbs as compared to other treatments. While maximum number of double bulbe 1.66/plot was noted in treatment T_{11}(RDF 75% 112.5: 60 45kg NPK/HA +Vermicompost 5 t/ha).

Table 7: Effect of different treatment of organic manure and inorganic fertilizers on number of doubles/plot and percentage double bulb/plot in kharif onion

Treat. Symb.	Treatments	Number of doubles/plot	Percentage of double bulb/plot
T_1	**Vermicompost 3 t /ha**	0.330	0.41
T_2	**Vermicompost 4 t /ha**	0.655	0.82
T_3	**Vermicompost 5 t /ha**	0.660	0.82
T_4	**RDF 50%**	0.660	0.82
T_5	**RDF 75%**	0.661	0.83
T_6	**RDF 50% + Vermicompost 3 t /ha**	0.661	0.82
T_7	**RDF 50% + Vermicompost 4 t /ha**	0.661	0.83
T_8	**RDF 50% + Vermicompost 5 t /ha**	0.662	0.83
T_9	**RDF 75% + Vermicompost 3 t /ha**	1.000	1.25
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	1.330	1.66
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	1.660	2.08
T_{12}	**RDF 100% (check)**	1.003	1.25
SEm±		**0.030**	**0.037**
C.D. at 5%		**0.08**	**0.11**

11. Total bulb yield q/ha

The data was analyzed statistically and the analysis of variance. The total bulb yield per hectare as affected by different treatment is presented in table 8.

Table 8: Total bulb yield (q/ha) as influenced by different treatment of organic manure and inorganic fertilizers inkharif onion

Treat.Symb.	Treatments	Total bulb yield (q/ha)
T_1	**Vermicompost 3 t /ha**	154.98
T_2	**Vermicompost 4 t /ha**	166.87
T_3	**Vermicompost 5 t /ha**	212.20
T_4	**RDF 50%**	216.48
T_5	**RDF 75%**	223.53
T_6	**RDF 50% + Vermicompost 3 t /ha**	277.92
T_7	**RDF 50% + Vermicompost 4 t /ha**	292.19
T_8	**RDF 50% + Vermicompost 5 t /ha**	329.19
T_9	**RDF 75% + Vermicompost 3 t /ha**	342.08
T_{10}	**RDF 75% + Vermicompost 4 t /ha**	366.80
T_{11}	**RDF 75% + Vermicompost 5 t /ha**	381.24
T_{12}	**RDF 100% (check)**	348.85
SEm±		**29.07**
C.D. at 5%		**85.27**

Treatment T_{11} (RDF 75% 112.5: 60: 45kg NPK/ha + Vermicompost 5 t/ha) was recoreded the significantly maximum 381.24 q/ha total bulb yield followed by T_{10} (RDF 75% 112.5: 60: 45kg NPK/ha +Vermicompost 4 t/ha) (360.80 q/ha), T_{12} (RDF 100% 150: 80: 60kg NPK/ha(check) (348.85q/ha), T_9 (RDF 50% 112.5: 75: 45kg NPK.ha + Vermicompost 3 t/ha) (342.08 q/ha) and T_8(RDF 50% 75: 40: 30kg NPK/ha + Vermicompost 5 t/ha) (329.19q/ha) and which were at par with each other. However, lowest 159.98q/ha total bulb yield was noted in T_1(Vermicompost 3 t/ha)

CONCLUSION

On the basis of present investigation, it is concluded that the onion variety Agrifound Dark Red. It is revealed from the data obtained that a significantly maximum bulb yield of (370.69q/ha) was obtained in onion variety Agrifound Dark Red. The highest net return of (Rs308933/ha) along with cost benefit ratio 1:6:0 was obtained in treatment T_{11}(RDF 75% 112.5: 60: 45kg NPS/ha + Vermicompost 5t/ha) but maximum cost benefit ratio 1:6:79 was observed under the treatment T_{12} due to low cost of cultivation.

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