Effect of Vermicompost and Bio-stimulants for improving the growth, yield and quality of onion (*Allium cepa* L.)

ABSTRACT

In order to bring this to practical experiment was conducted during in *rabi* season of 2022-23 and 2023-24 at Horticulture Research Center, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut, Uttar Pradesh to studied the effect of Vermicompost and Bio-stimulates *i.e.*beejamrit and jeevamrit for improving the growth, yield and quality of onion. The experiment was laid out in a randomized block design with 3 replications. Application of Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray recorded the maximum number of leaves per plant (5.87), plant height (27.54 cm), leaf length (28.48 cm), crop duration (152.57 days).The maximum bulb wreight (6.66 g), yield per plot (31.08kg), bulb yield (346.35q/ha), marketable yield per plot (28.39 kg) and marketable yield (310.75 q/ha)recorded under the application of Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray. The foliar application of Vermicompost (3ton) with 10% concentration of Beejamrit and Jeevamrit led to improve yield and yield related attributes of onion.

Keywords: Vermicompost, bio-stimulants, organic manures, Beejamrit, Jeevamrit

INTRODUCTION

Onion (*Allium cepa* L.) is an important bulbous crop that belongs to the Alliaceae family having somatic chromosomes2n=16**(Kumar *et al.*, 2024)**. Onion is an important crop under vegetable and spice crops grown in India**(Singh *et al.*, 2020)**. India is the second largest producer of onion in the world after China**(Sharma and Chauhan, 2021)**. The total area under onion in India in the year 2021-22 is about 1.91 million hectares, production was 31.27 million tonnes and yield was 16339 kg/hectare**(Anonymous, 2022)**. Maharashtra is the leading state in onion production in India and other important states are Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan, Haryana, Uttar Pradesh and Tamil Nadu **(Singh *et al.*, 2020)**. Onion is popularly called as "Queen of the Kitchen" due to the presence of proteins, carbohydrates, energy, vitamins, phosphorus and calcium**(Wabalepatil*et al.*, 2024)**. Onion is a good source of antioxidants and apart from medicinal values, it also has preservative values **(Padmini *et al.*, 2007; Tyagi and Yadav, 2007)**.Onions are pungent due to volatile oil (allyl-propyl disulphide) **(Singh *et al.*, 2020)**. Onions are highly nutritive, which increasing haemoglobin in blood, elimination of hypertension, reduces heart diseases, cancer, diabetes **(Wabalepatil*et al.*, 2023)**. Vermicompost and bio-stimulants (beejamrit and jeevamrit) are organic substances helpful in plant growth and development. These are considered as the replacement of fertilizers and help in

improving crop and soil quality **(Kumar *et al.*, 2024)**. These compounds can amplify the root biomass, nutrients translocation, enzymatic activities, crop yield, physiology, and nutrient uptake **(Joslin *et al.*, 2023)**. Organic farming uses organic matter along with beneficial microbes to release nutrients to crops for sustainable production in a living, healthy, eco-friendly, pollution-free environment **(Yedake*et al.*, 2020)**. Keeping these points in view, the systematic investigation has been planned to the effect of Vermicompost and Bio-stimulates has been tested in the onion crop based on organic farming.

MATERIALS AND METHODS

The present study was carried out duringtwo seasons 2022-23 and 2023-24 at the Horticulture Research Center of Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut, U.P., to studied the effect of Vermicompost and Bio-stimulates *i.e.*beejamrit and jeevamrit for improving the growth, yield and quality of onion. Onion variety NHRDF Red-3 was selected for this experiment. The experiment was conducted in sandy soil using surface irrigation system through tubewell. Onion seed were sowed on 07th and 06th of November for 2022-23 and 2023-24 seasons, respectively and transplanted 40 days after of seed sowing. Before transplanting seedling was treated with Beejamrit @ 8&10 percent solution as per treatments. The bio-stimulates Jeevamrit Solution @ 8 and 10 Percent were applied as foliar spray 35 and 45 days after Transplanting. The experimental design was a randomized block design with 3 replications for each treatment. The plot area was 36.00 m^2. The experiment included the treatments as T1: RDF (100:50:50, NPK), T2: Vermicompost 2 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray, T3: Vermicompost 2 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray, T4: Vermicompost 2 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray, T5: Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray, T6: Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray, T7: Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray, T8: Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray, T9: Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray and T10: Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray. The data recorded of 10 parameters as: number of leaves /plant, height of the plant (cm), leaf length (cm), duration of crop (days), shelf life in normal room (days), bulb weight (gm), yield per plot (kg), yield (q/ha), marketable yield per plot (kg) and marketable yield (kg/ha). All obtained data were subjected to the statistical analysis and means were compared according to 5% level of significance described by **Gomez and Gomez (1984)**.

RESULT AND DISCUSSION

Effect of Vermicompost and Bio-stimulants on growth and shelf life

The data recorded on number of leaves per plant, height of the plant (cm), leaf length (cm), duration of crop (days), shelf life in normal room (days) during both years apart from pooled data have been given in Table-1.Based on average mean data of both of the yearsclearlyshow that the maximum number of leaves per plant,height of the plant, leaf length and duration of crop recorded in T_{10}(Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10%

Two Spray)followed by T_9(Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray)and T_7(Vermicompost 3 Ton + Beejamrit 10% +Jeevamrit 10% Two Spray). While minimum number of leaves per plant, height of the plant, leaf length and duration of crop recorded in T_2(Vermicompost 2 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray). The maximum pooled data of shelf life observed in T_7(Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray) followed by T_6**(**Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray) and T_{10}**(**Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray). While minimum number of shelf life in normal room recorded in T_1(RDF; 100:50:50, NPK).

The treatment T_{10} (Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray) enhance various aspects of plant physiology, such as elevated chlorophyll levels, increased photosynthetic activity, enhanced translocation of nutrients and increased respiratory activity. These combined effects likely facilitated rapid cell division and elongation, ultimately resulting in a substantial increase in number of leaf, plant height, leaf length and crop duration. This result is consistent with the previous findings of Singh *et al*. (2023) in onion, Bhandari *et al*. (2021) in kohlrabi and Yusuf *et al.* (2020) in shallot.The shelf life of onion at room temperature was significantly influenced by different treatments. Maximum shelf life in the treatment T_7 (Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray) might be due to an inadequate supply of nutrients for proper growth and development stages of onion.The findings of Sankar *et al.* (2009) revealed that application of organic treatment combination of M1S2 (3% panchakavya + 50% farmyard manure + 50% poultry manure) registered the lowest total loss 42.65 and 45.78% in 'Phule Suvarna' during crop I and crop II respectively at 120 days after storage.

Effect of Vermicompost and Bio-stimulants onyield of Onion

The data recorded on bulb weight, yield per plot, Yield, marketable yield per plot and marketable yield during both years apart from pooled data have been given in Table-2. Based on average mean data of both of the years clearly show that the maximum bulb weight (gm), yield per plot (Kg), Yield (q/ha), marketable yield per plot (kg) and marketable Yield (kg/ha) recorded in T_7(Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray) followed by T_6(Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray) and T_{10}(Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray). The treatment T_7 (Vermicompost 3 Beejamrit 10% + Jeevamrit 10% Two Spray) application of vermicompost and spraying of bio stimulant Beejamrit (10%) and Jeevamrit(10%) gave the maximum bulb weight (6.66 g). Increase in bulb yield was mainly attributed to positive association between yield and yield contributing parameters like bulb weight and size of bulb. The bulb weight is important character that increase yield of aggregatum onion (Thingalmaniyan*et al.,* 2017; Joslin *et al.,* 2023).

Regarding the treatment of T_7 (Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray), being the most effective in bulb yield and its components of onion. The important role of Vermicompost, Beejamrit and Jeevamrit are increased the biological activities and consequently, it increased the bulb yield and its components. These results are in accordance

with those obtained by Ali (2017), Mohamed *et al*. (2020) and Upadhyay *et al.* (2023).Joslin *et al.*(2023) revealed that spray of bio stimulant seaweed extract (0.1%) gave the maximum bulb yield (9.40 t ha^{-1}). Gopakkali and Sharanappa, S. (2014) reported thatapplication of enriched biodigested liquid manure (EBDLM) at 100 kg N equivalent/ha + 3 sprays of panchagavya (3%) recorded the highest bulb yield (42.8 tonnes/ha).

Table-01: Effect of vermicompost and bio-stimulants on growth and shelf life of onion of onion (*Allium cepa* L.)

Treatment	Number of Leaves /plant			Height of the plant (cm)			Leaf length (cm)			Duration of crop (days)			Shelf life in normal room (days)		
	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average
T_1: RDF (100:50:50, NPK)	4.13	4.27	4.20	23.69	25.11	24.40	22.35	22.13	22.24	144.33	144.60	144.47	68.33	73.33	70.83
T_2: Vermicompost 2 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray	2.40	3.07	2.73	20.12	20.67	20.40	17.64	17.18	17.41	139.33	139.93	139.63	82.00	86.67	84.33
T_3: Vermicompost 2 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray	2.87	3.40	3.13	20.89	21.62	21.25	18.53	17.98	18.25	140.67	141.27	140.97	93.67	93.00	93.33
T_4: Vermicompost 2 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray	3.13	3.60	3.37	21.77	22.67	22.22	19.24	18.39	18.81	142.13	142.83	142.48	108.67	113.67	111.17
T_5: Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray	3.60	4.07	3.83	22.05	24.21	23.13	20.90	20.28	20.59	142.87	143.40	143.13	103.00	102.67	102.83
T_6: Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray	4.60	4.53	4.57	24.67	25.87	25.27	23.98	23.90	23.94	145.53	145.73	145.63	138.00	141.33	139.67
T_7: Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray	5.13	5.13	5.13	25.93	26.75	26.34	26.44	26.37	26.41	148.73	149.23	148.98	143.00	149.33	146.17
T_8: Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray	4.87	4.87	4.87	24.92	26.37	25.65	25.73	25.35	25.54	146.87	146.87	146.87	120.67	123.00	121.83
T_9: Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray	5.47	5.73	5.60	27.04	27.42	27.23	27.44	27.42	27.43	148.93	149.47	149.20	128.67	130.33	129.50
T_{10}: Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray	5.73	6.00	5.87	27.30	27.77	27.54	28.63	28.34	28.48	152.53	152.60	152.57	134.67	135.33	135.00
C.V.	4.72	4.20	2.98	1.67	1.82	1.05	3.69	3.15	3.28	0.51	0.39	0.42	3.28	1.65	2.16
C.D.	**0.34**	**0.32**	**0.22**	**0.69**	**0.78**	**0.44**	**1.47**	**1.24**	**1.30**	**1.27**	**0.98**	**1.06**	**6.35**	**3.27**	**4.23**

Table-02: Effect of vermicompost and bio-stimulants on yield and yield related attributes of onion of onion (*Allium cepa* L.)

Treatment	Bulb weight (g)			Yield per plot (Kg)			Bulb yield (q/ha)			Marketable yield per plot (kg)			Marketable Yield (q/ha)		
	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average	Rabi-2023	Rabi-2024	Average
T_1: RDF (100:50:50, NPK)	5.57	5.57	**5.57**	24.70	23.87	**24.28**	269.70	264.92	**267.31**	22.48	21.63	**22.06**	248.74	241.08	**244.91**
T_2: Vermicompost 2 Ton + Beejamrit 8% +	4.61	4.68	**4.65**	20.03	19.07	**19.55**	223.73	211.70	**217.72**	18.30	17.10	**17.70**	198.11	191.25	**194.67**

Jeevamrit8% Two Spray															
T_3: Vermicompost 2 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray	4.88	4.90	**4.89**	21.40	19.80	**20.60**	238.54	219.84	**229.19**	19.54	17.75	**18.65**	209.97	195.66	**202.82**
T_4: Vermicompost 2 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray	5.34	5.39	**5.36**	23.20	22.73	**22.97**	257.53	252.41	**254.97**	20.58	20.09	**20.34**	225.06	219.70	**222.38**
T_5: Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray	5.11	5.17	**5.14**	22.43	21.67	**22.05**	249.43	240.57	**245.00**	19.81	19.15	**19.48**	218.39	212.56	**215.47**
T_6: Vermicompost 3 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray	6.51	6.56	**6.53**	29.47	28.37	**28.92**	327.65	314.97	**321.31**	26.92	25.72	**26.32**	292.55	282.43	**287.49**
T_7: Vermicompost 3 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray	6.63	6.69	**6.66**	31.47	30.70	**31.08**	351.81	340.88	**346.35**	28.74	28.05	**28.39**	313.53	307.96	**310.75**
T_8: Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 8% Two Spray	5.95	6.05	**6.00**	25.50	24.77	**25.13**	281.62	274.99	**278.30**	22.53	21.88	**22.21**	247.36	241.13	**244.24**
T_9: Vermicompost 5 Ton + Beejamrit 8% + Jeevamrit 10% Two Spray	6.07	6.15	**6.11**	26.93	25.90	**26.42**	297.96	287.58	**292.77**	23.61	22.53	**23.07**	261.31	248.25	**254.78**
T_{10}: Vermicompost 5 Ton + Beejamrit 10% + Jeevamrit 10% Two Spray	6.34	6.45	**6.40**	28.13	27.50	**27.82**	313.81	305.34	**309.58**	24.29	23.65	**23.97**	274.02	260.56	**267.29**
C.V.	**3.11**	**2.02**	**2.54**	**3.83**	**3.36**	**2.65**	**4.16**	**3.37**	**2.55**	**4.20**	**3.76**	**2.95**	**3.57**	**3.84**	**2.66**
C.D.	**0.31**	**0.20**	**0.25**	**1.68**	**1.42**	**1.14**	**20.23**	**15.80**	**12.20**	**1.65**	**1.41**	**1.13**	**15.34**	**15.95**	**11.22**

CONCLUSION:

Present study concludes that Vermicompost @ 5 Ton along with spray of Beejamrit (10%) and two spray of Jeevamrit (10%) induced positive effects on growth of onion, but Vermicompost @ 3 Ton with spray of Beejamrit (10%) and two spray of Jeevamrit (10%) give superior effect on storability and bulb yield. The foliar application of different concentration of Beejamrit and Jeevamrit led to improve vegetative growth and yield of onion.

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