



EFFECT OF INORGANIC AND ORGANIC MANURES ON GROWTH, YIELD AND QUALITY OF ONION CV. 'PUSA MADHVI' UNDER VALLEY CONDITION OF GARHWAL HIMALAYA

K. Naseeruddin Shah*, V. Singh and D. K. Rana

Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand, 246 174

*Corresponding Author's E-mail: naseer.ahmed56@gmail.com

ABSTRACT : An experiment was conducted to find out the combined effect of inorganic fertilizers (NPK) and organic manures [vermicompost, poultry manure and farm yard manure (FYM)] on growth, yield and quality of onion cv. Pusa Madhvi in a Randomized Block Design with three replications. The results showed that maximum plant height (73.18 cm), leaf length (56.10 cm), leaf width (4.51 cm), root length (8.02 cm), fresh weight of leaves (55.27 g) and dry weight of leaves (19.61 g) was recorded under the [Recommended dose of fertilizers (RDF) 75% + poultry manure 25%]. While the neck length (5.08 cm), neck diameter (2.04), total sugar (6.60) and specific gravity (1.47) was recorded maximum in T₁ (RDF 100%). The maximum number of leaves (13.60), number of roots/ plant (159.40), bulb diameter (6.59 cm), fresh weight of bulb (159.79 g), number of scale/ bulb (6.56), yield/ hectare (41.88 q) and Vit- C (17.27) was recorded highest under T₃ (RDF 75% + vermicompost 25%). The fresh weight of root (4.24 g) and dry weight of root (2.02 g) was recorded maximum in T₁₀ (RDF 50% + FYM 50%). Therefore, T₃ (RDF 75% + vermicompost 25%) treatment combination was adjudged best for onion cultivation under valley conditions.

Keywords : Onion, vermicompost, poultry manure, vitamin-C, total sugar.

Onion (*Allium cepa* L.) is one of the most important commercial vegetables as well as spice crops cultivated extensively in India and world. It is a short duration and quick growing crop having various uses such as vegetables, spices and medicinal. Onion is liked for its flavour and pungency 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 carbohydrate, protein, vitamin C and minerals like phosphorus, calcium and sulphur. The main edible portion of onion is the bulb, which is a modified organ consisting of thickened fleshy scale leaves and stem plate Jones and Mann (8). In all over world and especially in Indian, onion is a major spice that's use in every food dishes, without this no one amazing the Indian foods, because they provide flavor, and play an integral part of the people's daily diet. Onion is used in several ways as fresh, frozen and dehydrated bulbs. India is the second largest producer of onion in the world, next to China, accounting for 22.18 % of the world area and 18.78 % of the world production. In India, onion is being grown in an area of 0.83 mha with production of 13.57 million tone and the productivity is 16.30 t/ha. Maharashtra is the leading onion growing state and other important states are Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan, Haryana, Uttar Pradesh and Tamil

Nadu. Besides meeting the demand for internal consumption. Onion production is greatly influenced by agronomic practices Mondal *et al.* (10). The hectare⁻¹ yield of onion can be increased by efficient use of manures and fertilizers Katwale and Saraf (9). Organic manure improves soil physical chemical properties that are important for plant growth Snyman *et al.* (14). Organic fertilizers has positive effect on root growth by improving the root rizosphere conditions (structure, humidity, etc) and also plant growth is encouraged by increasing the population of microorganisms Shaheen *et al.* (13). Organic acids which occur in decomposition of organic matters increase the benefits of nutrients. Combined use of organic and inorganic nutrients provides excellent opportunities to overcome all the imbalances, besides improve the soil health and enhancing crop production. This optimizes the benefit from all possible sources of plant nutrients in an integrated manner. Hence, this investigation was planned to identify the best combination for soil health and onion production.

MATERIALS AND METHODS

The experiment was carried out at Horticultural Research Centre, Chauras Campus, H.N.B Garhwal University, Srinagar (Garhwal), Uttarakhand during rabi season, 2013-2014. Srinagar (Garhwal) is located in the Alaknanda valley (78° 47' 30" E longitude and 30° 13' 0" N latitude and at an elevation of 540 m above

Article's History:

Received : 05-08-2016

Accepted : 10-09-2016

MSL), a semi-arid, subtropical climate with dry summer and rigorous winters with occasional dense fog in the morning hours from mid December to mid February. The experiment consist of three organic and three inorganic manures, viz., Nitrogen, Phosphorus, Potassium, Vermicompost, Poultry and Farmyard manure and their combinations viz. NPK (100: 50: 70), vermicompost (10 tonnes/ ha), RDF (75%) + vermicompost (25%), RDF (50%) + vermicompost (50%), poultry (15 tonnes/ ha), RDF (75%) + poultry (25%), RDF (50%) + poultry (50%), FYM (35 tonnes/ ha), RDF (75%) + F.Y.M (25%), RDF (50%) + F.Y.M (50%) and Control. The experiment was laid out in Randomized Block Design with three replications. The entire experimental field was divided into three blocks of equal size and each block possessed 20 plots. The seed of onion cv. Pusa Madhvi was collected from IARI, New Delhi; and nursery was raised on flat beds. The eight week old seedling of onion cv. Pusa Red was transplanted in flat beds during the last week of December, 2013-2014. Each plot measured $3.60 \times 1.80 \text{ m}^2$ area with $15 \text{ cm} \times 10 \text{ cm}$ spacing. All the intercultural operations and plant protection measures recommended for the successful crop growth were followed and weekly irrigation was given to maintain the proper moisture in the field for better growth and development of the plants. Randomly five plants from each plot were selected to record the data on the following observations viz., plant height (cm), number of leaves/ plant, leaf width (cm), leaf length (cm), neck length (cm), neck diameter (cm), root length (cm), number of roots/ plant, fresh weight of leaves (g), fresh weight of roots (g), dry weight of root (g), dry weight of leaves (g), fresh weight of bulb (g), bulb diameter (cm), number of scale/ bulb, yield per ha (q), specific gravity (g/cm^3), total sugar (%), ascorbic acid content ($\text{mg}/100\text{g}$) and TSS ($^\circ\text{Brix}$). The obtained data were analyzed using analysis of variance (ANOVA) under RBD following the procedure as stated by Panse and Sukhatme (12).

RESULTS AND DISCUSSION

The data presented in Table 1 & 2 showed the maximum plant height (73.18 cm) was observed in T₆ [Recommended dose of fertilizers (RDF) 75% + poultry manure 25%] and minimum (50.26 cm) in T₁₁ (control). The data showed that the maximum number of leaves (13.60) were recorded in T₃ (RDF 75% + vermicompost 25%) followed by T₄ (12.32) and minimum (7.42) under T₁₁ (control). Maximum leaf length (56.10 cm) was recorded in T₆ (RDF 75% + poultry manure 25%) followed by T₃ (55.56 cm) and T₇ (54.40 cm). Whereas, minimum leaf length (39.22 cm) was observed under

T₁₁ (control). Similar result was also observed by Brinjh et al. (1). Maximum leaf width (4.51 cm) was observed in T₆ (RDF 75% + poultry manure 25%) followed by T₇ (4.06 cm) and minimum (2.49 cm) in T₁₁ (control). The maximum neck length (5.08 cm) was recorded in T₁ (RDF 100%) followed by T₅ (4.94 cm). Whereas, minimum in T₁₁ (control). Maximum neck diameter (2.04 cm) was observed in T₁ (RDF 100%) followed by T₈ (1.99 cm) and minimum (1.65 cm) in T₁₁ (control). Maximum number of root/ plant (159.40) was recorded in T₃ (RDF 75% + vermicompost 25%) followed by T₅ (158.12) and minimum (110.69) under T₁₁ (control). Maximum root length (8.02 cm) was recorded in T₆ (RDF 75% + poultry manure 25%) followed by (7.75 cm). Whereas, minimum root length (5.04 cm) was recorded under T₁₁ (control). The highest fresh weight of root (4.24 g) was observed in T₁₀ (RDF 50% + FYM 50%) followed by T₂ (4.14 g) and minimum (2.90 g) in T₁₁ (control). Whereas, maximum dry weight of root (2.02 g) was recorded in T₁₀ (RDF 50% + FYM 50%) followed by T₄ (1.99 g) and T₂ (1.99 g) and minimum (1.48 g) under T₁₁ (control). The result showed that the maximum diameter of bulb (6.59 cm) was recorded in T₃ (RDF 75% + vermicompost 25%) followed by T₃ (5.98 cm). Whereas, minimum (3.99 cm) in T₁₁ (control). The number of scales per bulb was counted after harvesting of crops, from sampled bulbs. The maximum number of scales/ bulb (6.56) was recorded in T₃ (RDF 75% + vermicompost 25%) followed by T₄ (6.01) and minimum (4.54) in T₁₁ (control). The maximum T.S.S. (14.03 $^\circ\text{Brix}$) was recorded in T₁₀ (RDF 50% + FYM 50%) followed by T₆ (13.60 $^\circ\text{Brix}$). Whereas, minimum T.S.S. (9.79 $^\circ\text{B}$) was recorded in T₁₁ (control). Ethel et al. (4) recorded 2.1 per cent higher T.S.S. (14.31%) with FYM application @ 30 t/ha compared to control (12.2%). The maximum ascorbic acid (17.27 mg) was observed in T₃ (RDF 75% + vermicompost 25%) followed by T₉ (17.09 mg) and minimum under T₁₁ (control). Maximum total sugar (6.60) was recorded in T₁ (RDF 100%) followed by T₉ (5.64) and minimum (3.64) in T₁₁ (control). The maximum specific gravity (1.47 g/cm^3) was recorded in T₁ (RDF 100%) followed by T₈ (1.37 g/cm^3) and T₉ (1.37 g/cm^3). Whereas, minimum (0.87 g/cm^3) in T₁₁ (control). It was observed that the maximum fresh weight of bulb (159.79 g) was recorded in treatment T₃ (RDF 75% + vermicompost 25%) followed by T₈ (151.63 g) and minimum in T₁₁ (110.56 g). Fresh weight of bulb is directly correlated with yield of crop. The maximum yield/ ha (41.88 q/ha) was obtained in T₃ (RDF 75% + vermicompost 25%) followed by T₅ (40.24

Table 1 : Effect of different inorganic and organic manures on growth, yield and quality of onion cv. 'Pusa Madhvi'.

Treatments	Plant height (cm)	No. of leaves	Leaf length (cm)	Leaf width (cm)	Neck length (cm)	Neck diameter (cm)	No. of roots/plant	Root length (cm)	Fresh weight of roots (g)	Dry weight of roots (g)
T ₁ (RDF 100%)	63.12	10.72	53.34	3.90	5.08	2.04	140.41	6.72	3.33	1.54
T ₂ (Vermicompost 100%)	60.24	8.61	45.70	2.65	4.55	1.96	144.57	6.98	4.14	1.99
T ₃ (RDF 75% + Vermicompost 25%)	65.74	13.60	55.56	3.83	3.15	1.88	159.40	6.59	3.59	1.56
T ₄ (RDF 50% + Vermicompost 50%)	58.51	12.32	48.74	3.48	2.61	1.89	155.06	7.45	4.01	1.99
T ₅ (Poultry manure 100%)	57.84	10.36	44.81	3.07	4.94	1.67	158.12	7.73	4.06	1.90
T ₆ (RDF 75% + Poultry manure 25%)	73.18	11.54	56.10	4.51	4.19	1.87	152.46	8.02	3.92	1.75
T ₇ (RDF 50% + Poultry manure 50%)	69.52	10.53	54.40	4.06	3.65	1.93	150.59	7.85	3.98	1.69
T ₈ (FYM 100%)	53.61	8.07	40.53	2.50	3.98	1.99	151.13	6.98	4.11	1.97
T ₉ (RDF 75% + FYM 25%)	59.55	11.84	45.75	3.54	4.03	1.98	148.31	5.90	4.13	1.98
T ₁₀ (RDF 50% + FYM 50%)	61.22	11.54	45.33	3.62	3.99	1.72	125.70	7.05	4.24	2.02
T ₁₁ (Control)	50.26	7.42	39.22	2.49	2.15	1.65	110.69	5.04	2.90	1.48
C.D. (P=0.05)	0.48	0.41	0.39	0.26	0.75	0.84	0.68	0.18	0.79	0.34

Table 2 : Effect of different inorganic and organic manures on growth, yield and quality of onion cv. 'Pusa Madhvi'.

Treatments	Fresh weight of leaves (g)	Dry weight of leaves (g)	Bulb diameter (cm)	Fresh weight of bulb (g)	No. of scale/bulb	Yield q/ha	T.S.S (° Brix)	Vit. C (mg/100g)	Total sugar	Specific gravity (cm ³)
T ₁ (RDF 100%)	55.11	17.25	4.84	146.87	5.10	39.79	12.70	16.59	6.60	1.47
T ₂ (Vermicompost 100%)	54.84	17.22	5.98	145.29	4.99	38.73	12.40	15.85	5.22	1.11
T ₃ (RDF 75% + Vermicompost 25%)	53.60	17.87	6.59	159.79	6.56	41.88	10.73	17.27	5.46	1.22
T ₄ (RDF 50% + Vermicompost 50%)	54.66	18.20	5.91	125.33	6.01	39.70	11.95	16.55	4.75	0.98
T ₅ (Poultry manure 100%)	53.28	18.54	5.05	131.05	5.76	40.24	12.59	15.98	3.98	1.12
T ₆ (RDF 75% + Poultry manure 25%)	55.27	19.61	4.99	142.33	5.91	38.57	13.60	14.54	4.65	0.96
T ₇ (RDF 50% + Poultry manure 50%)	54.26	19.15	4.54	150.56	5.56	37.57	11.72	13.57	5.53	1.01
T ₈ (FYM 100%)	54.23	17.82	5.58	151.63	5.15	39.83	12.63	16.18	4.54	1.37
T ₉ (RDF 75% + FYM 25%)	53.55	17.24	5.07	149.39	5.06	30.39	11.05	17.09	5.64	1.37
T ₁₀ (RDF 50% + FYM 50%)	54.85	17.85	4.99	147.72	5.17	32.42	14.03	12.57	5.01	1.13
T ₁₁ (Control)	45.58	12.71	3.99	110.56	4.54	29.86	9.79	11.29	3.64	0.87
C.D. (P=0.05)	0.21	0.14	0.54	0.65	0.12	0.31	0.19	0.22	0.12	0.89

q/ha). Whereas, minimum (29.86 q/ha) in T₁₁ (control). The maximum fresh weight of leaves (55.27 g) was observed in T₆ (RDF 75% + poultry manure 25%) followed by T₁ (RDF 100%) and minimum (45.58 g) in

T₁₁ (control). The maximum dry weight of leaves (19.61 g) was observed in T₆ (RDF 75% + poultry manure 25%) followed by T₇ (19.15 g) and minimum (12.71 g) under T₁₁ (control).

According to Ewais *et al.* (5), El-Shatanofy (3), Yoldas *et al.* (16), Fatideh and Asil (6), Soleymani and Shahrajabian (15), Dina *et al.* (2) and Salem and Nourgehan (11) the inorganic manures increases the neck length, neck diameter, total sugar and specific gravity over the organic manures might be attributed to the role of nitrogen on chlorophyll, enzymes and protein synthesizes and the role of phosphorous on root growth and development as well as they optimize enzymes activity and enhancing the translocation of assimilates. Beside the role of organic manures which are valuable as a source of many essential macro and micronutrients to plants and serves as a good natural soil texture conditioner being rich in organic matter and increase availability and uptake of nitrogen, phosphorus and potassium which positively reflected on plant cell elongation and division as well as stimulate photosynthesis and metabolic processes of organic compounds in plant, thus increasing total bulbs yield/ha. The result revealed that vermicompost is an effective source of nutrients in combination with inorganic fertilizers. The highest growth and yield response were achieved with RDF 75% + vermicompost 25%. This positive performance of the reduced rate of inorganic fertilization with vermicompost might be due to vermicompost worked as supplements to inorganic fertilizers. Mineralization of vermicompost aids in soil nutrient build up that in turn leads to improved nutrient availability to growing crop. Vermicompost has been reported to contain several plant growth hormones, enzymes, beneficial bacteria and mycorrhizae (Gupta, 7). The crop grown under irrigated condition, the beneficial effect of organic manure with inorganic fertilizer results in greater and longer availability of nutrients as per demand of the crop. The combined effect of (organic + inorganic fertilizer) significantly increases maximum characters viz., plant height, number of leaves, leaf length, leaf width, root length, fresh weight of leaves, dry weight of leaves, number of root/ plant, fresh weight of root, dry weight of root, bulb diameter, fresh weight of bulb, number of scales, yield/ha except neck length, neck diameter, total sugar and specific gravity.

CONCLUSION

On the basis of present investigation, it may be concluded that the application of (RDF 75% + vermicompost 25%) and (RDF 75% + poultry manure 25%) increased growth, yield and quality of onion cv. Pusa Madhvi under riverside of Alakhnanda, Uttarakhand conditions.

REFERENCES

1. Brinjh, S., Kumar, S., Kumar, D. and Kumar, M. (2014). Effect of integrated nutrient management on growth, yield and quality in onion cv. Pusa Madhvi. *Plant Arch.*, **14** (1) : pp. 557-559.
2. Dina, M.S., Shafeek, M.R. and Abdallah, M.M.F. (2010). Effect of different nitrogen sources and soil solarization on green onion productivity for exportation. *Ann. Agric. Sci.*, **55** (1) : 97-106.
3. El-Shatanofy, M.M.E. (2011). Influence of organic manure and inorganic fertilizers on growth, yield and chemical contents of onion (*Allium cepa*, L.). *M.Sc. Thesis*, Faculty of Agriculture, Alex Univ.
4. Ethel, N., Singh, A.K. and Singh, V.B. (2009). Effect of organic manures and biofertilizers on growth, yield and quality of onion. *Environ. Bio.*, **27** (1A) : 313- 315.
5. Ewais, M.A., Mahmoud, A.A. and Khalil, A.A. (2010). Effect of nitrogen fertigation in comparison with soil application on onion production in sandy soils. *Alex. J. Agric. Res.*, **55** (3) : 75-83.
6. Fatideh, M.M. and Asil, M.H. (2012). Onion yield, quality and storability as affected with different soil moisture and nitrogen regimes. *South Western J. Hort. Bio & Env.*, **3**(2) : 145-165.
7. Gupta, P.K. (2005). Vermicomposting for sustainable agriculture. *Agrobios*, pp. 210.
8. Jones, H.A. and Mann, L.K. (1963). *Onion and Their Allies*. Leonard Hill (Books) Ltd., London, pp: 32.
9. Katwale, T.R. and Saraf, R.K. (1994). Studies on response of onion to varying levels of fertilizer doses during monsoon season in Satpura plateau. *Orissa J. Hort.*, **22** (1-2) : 95- 97.
10. Mondal, M.F., Brewster, J.L., Morris, F.E.L. and Butler, H.A. (1986). Bulb development in onion (*Allium cepa* L.). Effect on plant density and sowing date in field conditions. *Ann. Bot.*, **58** (2) : 187-195.
11. Salem, N.M.I.M. (2012). Effect of organic and mineral fertilization and some foliar treatments on onion yield and quality. *M Sc Thesis* Fac. of Agric Mansoura Univ Egypt.
12. Panse, V.G. and Sukhatme, P.V. (1967). *Statistical Methods for Agriculture Workers*. II Ed ICAR New Delhi.
13. Shaheen, A., Fatma, M., Rizk, A. and Singer, S.M. (2007). Growing onion plants without chemical fertilization. *Res J. Agr. Biol. Sci.*, **3**(2) : 95-104.

14. Snyman, H.G., Jong, D.E. and Aveling, T.A.S. (1998). The stabilization of sewage sludge applied to agricultural land and the effects on maize seedlings. *Water Sci Tech.*, **38** (2) : 87-95.
15. Soleymani, A. and Shahrajabian, M.H. 2012. Effects of different levels of nitrogen on yield and nitrate content of four spring onion genotypes. *Inter J. Agric and Crop Sci.*, **4**(4) : 179-182.
16. Yoldas, F.S., Ceylan, N. and Mordogan Esetlili B.C. (2011). Effect of organic and inorganic fertilizers on yield and mineral content of onion (*Allium cepa* L.). *African J. Biotech.*, **10**(55) : 11488-11492. □

Citation : Shah K.N., Singh V. and Rana D.K. (2016). Effect of inorganic and organic manures on growth, yield and quality of onion cv. 'Pusa Madhvi' under valley condition of Garhwal Himalaya. *HortFlora Res. Spectrum*, **5**(3) : 233-237.