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Studies on the effect of integrated nutrient management and bio enhancer on growth and economics of *Rabi* onion (*Allium cepa* L.)

Manju Sahu and SS Singh

Abstract
The present investigation entitled "Studies on Effect of integrated nutrient management and bio enhancer on productivity of Onion (*Allium cepa* L.)" was carried out during the year 2015-16 in *Rabi* season at present investigation was carried out at the Agricultural Farm Razaula, M.G.C.V.V. Chitrakoot (M.P.) The experiment was laid out in randomized block design with 14 treatments and three replications. Significantly higher values were recorded for plant height (52 cm), number of leaves (8.85), leaf length (39.27 cm), leaf width (1.96 cm), collar thickness (6.38 cm), fresh weight of leaves (86.44 g) and dry weight of leaves (11.44 g) in the treatment T_1 consisting of 100 per cent of recommended RDF (100:80:80 kg/ha) which was at par with T_{13} (51.68 cm), While lowest growth was recorded in T_{14} (45.83 cm). The highest net return and benefit: cost ratio was found in T1 of Rs 135669.05/ha and 4.5 respectively and lowest net returns were found in T_{14} of Rs 75979.80/ha and lowest benefit: cost ratio (2.37) was found under T_3.

Keywords: Onion, INM, nitrogen, phosphorus, potash, growth, economics

Introduction
Onion (*Allium cepa* L.) is the most common member of the family Amaryllidaceae (*Alliaceae*) (Hanlet, 1990) [5]. It is one of the most important vegetable crops grown throughout the world, that being said to be native of Central Asia and Mediterranean region (McCollum, 1976) [7]. It is widely grown herbaceous biennial vegetable crop with cross-pollinated and monocotyledonous behaviour having diploid chromosomes number 2n=16 (Bassett, 1986).
Onion can be used as green or scallion or as a mature bulb. The outstanding characteristic of onion is its pungency, which is due to a volatile oil known as (*Allyl–propyl-disulphide*). In India, it covers an area of 1203.6 thousand ha with a production of 19401.7 thousand MT (Anonymous, 2014) [1]. Farmers also gain good returns from *rab*i season crop. Use of inorganic fertilizers and organic manures play a vital role in various physiological activities of plant like NPK are essential nutrients for integral part of chlorophyll, nucleic acid, increased vigour and disease resistant to plant. In fact, organic agriculture is a holistic way of farming with an aim of conserving the natural resources through the agronomic practices and the use of locally available low cost inputs in order to maintain soil fertility and conserve the rich bio-diversity to provide safe clean water, air and to achieve economical sustainability.
Due to the prohibitive cost of chemical fertilizers, majority of Indian farmers who are mostly marginal and small, do not apply the recommended dose of fertilizers. They are using indigenous organic manures as sources of nutrients. These organics are bulky in nature but, contain reasonable amount of nutrients. Our experiences reveal that the supply of nutrients through organics alone has failed to maintain yield level in a short period. The combined application of organics such as FYM, compost, green leaf manure, vermicompost *etc*. and liquid organics *viz.,* Jeevamrut, Beejamrut, Panchagavya, Gomutra, Angara, Vermiwash *etc*., which contain microbial count and plant growth promoting substances (PGPR) stimulate growth, yield and quality of crops.
Further it helps to build soil organic matter status besides minimizing the cost of cultivation. Panchagavya promising natural liquid manure is being used by many organic farmers in many crops in different parts of our country (Anon., 2005). Various traditional inputs such as Panchagabya, Enriched Panchgabya, jivamrit, Amrit Pani, Cow Urine, and Vermiwash,

Shady soil of banyan tree, liquid manure - *Dasparni*, neem seed kernel extract, garlic, ginger and chilly, tobacco extract, and *Tricoderma viride* etc well working in organic farming.

Materials and Methods

The present investigation entitled "Studies on the effect of integrated nutrient management and bio enhancer on growth and economics of *rabi* onion (*Allium cepa* L.)" was carried out during the year 2015-16 in *Rabi* season at present investigation was carried out at the Agricultural Farm Razaula, M.G.C.V.V. Chitrakoot (M.P.) The materials used and methodology adopted in the investigation are described below. Chitrakoot is situated in the Northern part of Madhya Pradesh, agro- climatologically known as "Kymore Plateau " and lies between latitude 24º' 31 N', longitude 81º 15 E' Longitude with an altitude of 306 m above the mean sea level. Chirakoot comes under dry, sub-humid agro-climatic region. Climate of Chitrakoot region is semi-arid and sub-tropical having hot and dry summer followed by rainy season and cold winter. In general the highest and lowest temperature reaches above 47 ºC and below 20 ºC, respectively. The average rainfall varies from 3.5 mm to 79.96 mm. The rainfall is observed mainly from July to September and sometimes winter showers are also received.

The experiment was laid out in Randomized Block Design having 14 treatments comprising of organic manures (farmyard manure and vermicompost), inorganic fertilizers (nitrogen, phosphorus and potassium) and foliar spray of Panchgavya, Matka Khad applied either alone or in combination, each replicated three times, making a total of 42 plots. Treatments were randomly arranged in each replication. The treatment description is presented in, T_1 RDF (100:80:80 kg/ha), $T_2$50% RDF+ FYM @15 t/ha, T_3 50% RDF + VC@5t/ha, T_4 25% RDF+ FYM @20 t/ha, T_5 25% RDF + VC@7.5t/ha, T_6 FYM @ 30 t/ha T_7Varmi compost @ 10 t/ha, T_8 FYM @ 10 t/ha + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP, T_9 Varmi compost @ 5 t/ha + FYM @ 10 t/ha + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP, T_{10}FYM @ 10 t/ha + Madka khad + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP, T_{11}Varmi compost @ 5 t/ha + FYM @ 10 t/ha +Matka Khad+ foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP T_{12}Varmi compost @ 2.5 t/ha+ Seed treatment + Bijamrit+ irrigation with Jevamrit+ foliar spray of Panchgavya, T_{13}Varmi compost @ 2.5 t/ha+ Seed treatment + Bijamrit+ irrigation with Jevamrit+ foliar spray of Panchgavya + Varmi wash T_{14} Farmer practice NPK 80:60:60 kg/ha The growth parameters were measured by randomly selecting five plants from each net plot. All the cultural and management practices like hoeing, weeding, irrigation and sprays for insect pests and disease control etc were carried out uniformly for all treatments. The benefit: cost ratio was calculated with the help of following formula (Reddy *et al.*, 2004) [11]:

$$\text{Benefit: cost ratio} = \frac{\text{Gross return (Rs.)}}{\text{Total cost of cultivation (Rs)}}$$

Results and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads

A. Growth parameters

Plant height (cm)

The data recorded on height of plant at case of 90 days after transplanting, the plant height was maximum in T1 (52.28 cm) which was at par with T13 (51.68 cm). While, minimum plant height was obtained in T14 (45.83 cm). The plant height was recorded maximum under T1 (100% of recommended dose of fertilizer) with found at par with T1 that give the full opportunity to plant for optimum growth and development might be due to the increase in cell size and enhancement of cell division, which ultimately resulted in increased plant height. Similar finding were also reported by Pall and Padda (1972) [9], Chakrabarti *et al.* (1980) [2], Nehra *et al.* (1988) [8] and Mathankar *et al.* (1990) [6].

Number of leaves/plant

The number of leaves/plant found significant difference but on the basis of mean the maximum number of leaves/plant were counted in T13 (8.85) followed by T1 (8.73) Whereas, minimum number of leaves/plant in T14 (7.22). The onion plants nourished with inorganic fertilizers (N, P and K) and organic substance gave maximum values in growth parameters, this boosted vegetative growth might be due to ensured higher number of green leaves. Similar results have been reported by Reddy *et al.* (2002) in tomato and Yadav *et al.* (2003) [14]

Leaf length (cm)

The leaf length of different treatments ranged from 30.85cm to 39.27 cm. The maximum leaf length was recorded in T1 (39.27cm), which was at par with other treatments i.e. T13 (39.00 cm) and T12 (37.61cm). Whereas, minimum leaf length was recorded in T14 (30.85 cm). The higher leaf length might be due to the adequate availability and supply of nutrients in appropriate proportion. Similar results have reported by Singh and Chuore (1999) [13] and Gore and Sreenivasa (2011) [4].

Leaf width (cm)

The leaf width of different treatments ranged from 1.19 cm to 1.89 cm. The maximum leaf width was recorded in T1 (1.96 cm), which was found at par with other treatments i.e. T13 (1.90 cm) and T3 (1.89 cm). Whereas, minimum leaf width was recorded in T14 (1.19 cm), Similar finding were also reported by Sadanandan and Drand (2005), Chandrakala (2005) and Gore and Sreenivasa (2011) [4].

Collar thickness (cm)

The collar thickness is one of the important growth parameter which indicates the vigour of plant and it was significantly influenced by the different treatments of organic substances. In case of 90 days after transplanting, the maximum collar thickness (6.38 cm) was recorded under T1 and it was found at par with T3 (6.28 cm) and T13 (6.26 cm). While, the minimum collar thickness was recorded under T14 (4.44 cm). The collar thickness was maximum in recommended fertilizer dose might be due to availability of optimum quantity of essential nutrients, resulting better photosynthesis. Similar result were also obtained by Chandrakala (2005) and Gore and Sreenivasa (2011) [4]. Application of organic substance with 75% of recommended dose of fertilizers also influenced the collar thickness and it may be due to increased growth parameters.

Fresh and dry weight of leaves

The fresh and dry weight of leaves found significant maximum fresh weight of leaves (86.44 g) and dry weight of leaves (11.44 g) were recorded in T1 followed by T3. Whereas, minimum fresh and dry weight of leaves in T14. The onion plants nourished with inorganic fertilizers (N, P and K) and organic substance gave maximum values in growth parameters, this boosted vegetative growth might be due to ensured higher number of green leaves. Similar results have been reported by Reddy *et al.* (2002) in tomato and Yadav *et al.* (2003) [14]

Economics

The economics of all the treatments are given in Table 4.10 and Appendix II. The net profit/ha ranged from Rs. 75979.80/ha to Rs. 135669.05/ha. The maximum net profit/ha was recorded under T1 (Rs. 135669.05/ha). While minimum net profit/ha was obtained in T14 (Rs. 75979.80/ha).

The gross profit/ha ranged from Rs. 107200.00/ha to Rs. 174350.00/ha. The maximum gross profit/ha was recorded in T1 (Rs. 174350.00/ha). Whereas, minimum gross profit/ha was recorded in T14 (Rs. 107200.00/ha). Thus, the maximum income (both gross and net) was obtained with T1 and the lowestincome (both gross and net) was obtained with T0

Table 1: Effect integrated nutrient management and bio enhancer on growth parameter of onion

Treatment	Plant height (cm)	Number of leaves /plant	Leaf length (cm)	Leaf width (cm)	Collar thickness (cm)	Fresh weight of leaves(g)	Dry weight of leaves(g)
T_1: RDF (100:80:80 kg/ha)	52.28	08.73	39.27	1.92	06.38	86.44	11.44
T_2:50% RDF+ FYM @15 t/ha	45.15	08.40	35.60	1.86	06.18	82.34	10.33
T_3:50% RDF + VC@5t/ha	46.72	08.40	36.00	1.89	06.28	84.32	11.26
T_4:25% RDF+ FYM @20 t/ha	43.26	08.46	34.80	01.62	06.12	83.23	11.40
T_5:25% RDF + VC@7.5t/ha	44.87	08.16	34.92	01.69	6.20	82.88	11.25
T_6 :FYM @ 30 t/ha	39.07	08.83	30.85	00.62	4.79	82.07	11.02
T_7 : Varmi compost @ 10 t/ha	39.91	08.26	32.34	00.87	4.88	81.77	10.92
T_8: FYM @ 10 t/ha + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	44.29	08.36	30.76	01.64	05.87	81.24	10.82
T_9 :Varmi compost @ 5 t/ha + FYM @ 10 t/ha + FS of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	45.23	7.88	32.89	01.72	05.52	82.22	11.01
T_{10}: FYM @ 10 t/ha + Madka khad + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	46.94	8.12	35.60	01.66	05.87	80.05	10.62
T_{11}: Varmi compost @ 5 t/ha + FYM @ 10 t/ha +Matka Khad+ foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	48.71	08.61	35.84	01.69	05.98	79.98	10.52
T_{12} :Varmi compost @ 2.5 t/ha+ Seed treatment + Bijamrit+ irrigation with Jevamrit+ FS of Panchgavya	50.34	08.24	37.61	01.75	06.01	79.68	10.22
T_{13}: Varmi compost @ 2.5 t/ha+ Seed treatment + Bijamrit+ irrigation with Jevamrit+ foliar spray of Panchgavya + Varmi wash	51.68	8.85	39.00	1.90	06.26	79.24	10.22
T_{14}: Farmer practice NPK 80:60:60 kg/ha	45.83	7.22	30.85	1.19	04.44	78.08	10.09
SEm±	01.09	00.40	00.85	00.12	00.29	00.20	00.25
CD (P=0.05)	03.31	NS	02.58	00.37	00.90	00.60	00.75

Table 1: Effect integrated nutrient management and bio enhancer on growth parameter of onion

Treatment	Gross income(Rs ha^{-1})	Net income(Rs ha^{-1})	B:C ratio
T_1 : RDF (100:80:80 kg/ha)	173450.00	135669.05	2.37
T_2:50% RDF+ FYM @15 t/ha	140240.00	57245.00	1.69
T_3:50% RDF + VC@5t/ha	173400.00	135490.02	2.30
T_4:25% RDF+ FYM @20 t/ha	121728.00	38733.00	1.47
T_5:25% RDF + VC@7.5t/ha	111848.00	29603.06	1.36
T_6 :FYM @ 30 t/ha	122712.00	39717.00	1.48
T_7 : Varmi compost @ 10 t/ha	173200.00	135550.02	2.27
T_8: FYM @ 10 t/ha + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	122712.00	39717.00	1.48
T_9 :Varmi compost @ 5 t/ha + FYM @ 10 t/ha + FS of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	165920.00	82925.00	2.00
T_{10}: FYM @ 10 t/ha + Madka khad + foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	157528.00	75283.10	1.92
T_{11}: Varmi compost @ 5 t/ha + FYM @ 10 t/ha +Matka Khad+ foliar spray of Panchgavya @ 3% at 30, 45, 60,75 and 90 DAP	122224.00	39979.05	1.49
T_{12} :Varmi compost @ 2.5 t/ha+ Seed treatment + Bijamrit+ irrigation with Jevamrit+ FS of Panchgavya	108000.00	135700.04	0.79
T_{13}: Varmi compost @ 2.5 t/ha+ Seed treatment + Bijamrit+ irrigation with Jevamrit+ foliar spray of Panchgavya + Varmi wash	136792.00	54547.00	1.66
T_{14}: Farmer practice NPK 80:60:60 kg/ha	107200.00	135669.00	0.80

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