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Research Article

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF ONION (*ALLIUM CEPA* L.) *CV.* BHIMA SUPER

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Abstract: A field study was conducted in *rabi* season of year 2014-15 and 2015-16 at experimental plot of RRTTS, Mahisapat, Dhenkanal to study the Effect of integrated nutrient management on growth and yield of onion (*Allium cepa* L.) *cv*. Bhima Super. The field was laid out in randomized block design with seven treatments and three replications. The treatment detail is as T_1-Soil Test Based Fertilizer Recommendation (STBFR), T_2-STBFR+FYM (10t/ha), T_3-STBFR + Vermicompost(5t/ha), T_4-STBFR +PSB (5 kg/ha), T_5-STBFR+*Azotobacter* (5 kg/ha), T_6-STBFR+*Azospirillum* (5 kg/ha), T_7 - STBFR +*Azotobacter* (5 kg/ha) + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha). It was observed that the treatment applied with STBFR along with *Azotobacter* (5 kg/ha) + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha) showed the highest yield (231.3q/ha) followed by the treatment applied with STBFR+Vermicompost (226.57q/ha). It was also observed that the treatment applied with STBFR+ *Azotobacter* (5 kg/ha) + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha) showed the highest bulb length of 5.47 cm, bulb diameter of 6.37 cm resulting the highest yield with B:C ratio of 2.78 and having 29.21 % more yield than that of the treatment applied with STBFR only. However, the treatment applied with STBFR along with FYM gives the lowest benefit-cost ratio (2.10).

Keywords: INM, Yield, Onion, Biofertilizer

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Introduction

Onion (*Allium cepa* L.) belongs to family Alliaceae, is one of the most important commercial vegetable crops cultivated extensively in India. Onion bulb is a rich source of minerals like phosphorus, calcium and carbohydrates, protein and vitamin C etc. It is being used in several ways as a fresh, frozen, dehydrated bulbs and green bunching types. It is an indispensable item in every kitchen as spice, vegetable as well as salad. Onion is preferred for its flavour and pungency which is due to the presence of a volatile sulphur compound allyl propyl disulphide. It contains several anti-cancer agents which have shown to prevent cancer in animals. The beneficial compound called 'quercetin' present in onion has shown to be powerful antioxidant. As Onion is a heavy feeder of mineral elements, nutrient management practices play an important role for good crop of onion like other crops. Intensive cropping, imbalanced fertilization and minimal usage of micronutrients and limited application of organic manures have resulted in the depletion of soil fertility in India [1]. Recently organic nutrient management has got rapid momentum due to consciousness of health hazard and environmental safety [2]. Organic fertilizers have positive effect on root growth by improving the root rhizosphere conditions (structure, humidity, etc.) and also plant growth is encouraged by increasing the population of microorganisms [3]. Among the organics, vermicompost is a rich source of macro and micro nutrients, vitamins, growth hormones *etc* [4]. It optimizes the benefits from all possible sources of plant nutrients in an integrated manner. Hence, this investigation was carried out to identify the ideal integrated nutrient management package for onion at Odisha condition.

Materials and Methods

The experiment was laid out during Rabi season at experimental plot of RRTTS, Mahisapat, Dhenkanal, Odisha, India during the year 2014-15 and 2015-16. The experimental area was under sub-tropical climatic condition having hot summer with maximum temperature 45°C, minimum temperature ranging from 15°C to20°C in winter and relative humidity ranging from 60-70 percent in different seasons of the year. The soil of experimental field was sandy loam in texture and having low in Nitrogen in available N (250kg/ha), and K_2O (190 kg/ha) and high in available P_2O_5 (16 kg kg/ha) having acidic soil reaction with soil pH (5.58). Seeds of onion *cv*. Bhima super were sown in nursery beds prepared two months earlier. The soil of seed bed was prepared with compost and mulching was done with straw to protect the young seedlings from adverse climatic condition. Covering materials were removed from the bed after seed germination (5-6 days after sowing) for optimum growth of the seedlings. 45 DAS seedlings were ready for transplanting. The main field was prepared by ploughing with disc plough and subsequent ploughing was done with cultivator followed by levelling. The soil of the experimental site was irrigated before transplanting for optimum moisture in the field. The healthy seedlings having uniform growth were selected and transplanted on well prepared field in the afternoon hours at a spacing of 10 x 15 cm. The treatments were T_1 - STBFR (Soil Test based Fertilizer Recommendation), T_2 - STBFR + FYM (10 t/ha), T_3 – STBFR +Vermicompost (5 t/ha), T_4– STBFR + PSB (5 kg/ha), T_5 – STBFR+ *Azotobacter* (5 kg/ha), T_6 – STBFR + *Azospirillum* (5 kg/ha), T_7 - STBFR + *Azotobacter* (5 kg/ha) + *Azospirillum* (5 kg/ha) + PSB (5 kg/ha).

Table-1 Yield and yield attributing characters of Onion *cv* Bhima Super

	Treatments detail	Plant height (cm)	No. of leaves / plant	length of leaves (cm)	bulb diameter (cm)	bulb length (cm)	Yield (q/ha)	% Increase in yield over T1	B:C Ratio
T_1	STBFR (Soil Test based Fertilizer Recommendation)	49.00	5.67	53.00	3.83	3.50	179.0	-	2.18
T_2	STBFR + FYM (10t/ha)	50.67	7.00	53.63	4.40	4.07	204.1	14.02	2.10
T_3	STBFR +Vermicompost (5t/ha)	56.10	7.33	59.03	5.93	5.03	226.6	26.57	2.62
T_4	STBFR + PSB (5 kg/ha)	54.10	6.63	54.73	4.27	4.20	214.1	19.59	2.28
T_5	STBFR+ *Azotobacter* (5 kg/ha)	54.73	6.00	55.70	4.50	3.53	218.8	22.23	2.32
T_6	STBFR + *Azosprillium* (5 kg/ha	55.63	6.67	56.43	4.77	3.77	219.6	22.68	2.44
T_7	STBFR + *Azotobacter* (5 kg/ha) +*Azosprillium* (5 kg/ha) + PSB (5 kg/ha)	58.03	8.67	60.60	6.37	5.47	231.3	29.21	2.78
	CD (5%)	0.983	1.606	0.754	0.573	0.663	0.519	2.023	-

Table-2 Post harvest soil chemical properties of trial plots

Treatments	pH	Org. C (%)	Av. N (kg ha^{-1})	Av. P (kg ha^{-1})	Av. K (kg ha^{-1})
T1	5.50	0.56	242.6	14.4	176.8
T2	6.0	0.68	262.5	15.8	183.9
T3	6. 5	0.70	265.1	17.8	188.3
T4	6.35	0.60	254.4	15.8	186.5
T5	6.38	0.62	252.3	15.2	182.5
T6	6.35	0.60	255.7	15.5	184.8
T7	6.40	0.65	258.0	16.7	186.0

Five plants were randomly selected from each plot for recording observations. The observations were recorded for plant height, leaf length, number of leaves, diameter of bulb, bulb length, yield. The bulb yield per hectare was calculated based on plot yield. Vegetative observations were recorded at 90 DAT. The recorded data were statistically analyzed using analysis of variance as formulated at 5% level of significance [5].

Effects on growth of Plant

The treatment T_7 resulted in the tallest plant height (58.03 cm) as affected by different organic and inorganic fertilizer application to different treatments on onion crop and was followed by T_3 (STBFR+ Vermicompost). Similarly, significantly higher plant height in onion with application of vermicompost was reported by Reddy and Reddy (2005) [6]. The maximum number of leaves per plant was also found to be the highest in T_7 (8.67) which was at par with T_3(7.33) and T_2 (7.00). However, the lowest number of leaves per plant was observed in the treatment applied with sole application of STBFR only. The highest leaf length was also found in the treatment T_7 (60.6 cm). The increase in plant height and other vegetative growths like number of leaves and leaf length with application of STBFR along with biofertilizers (*Azotobacter*, *Azospirillum* and PSB 5kg/ha each) may be ascribes due to sustained availability of balanced nutrient throughout the growing period, which resulted increased vegetative growth [7].

Effects on Yield

Integrated application of STBFR (chemical Source) along with biofertilizers (*Azotobacter*, *Azospirillum* and PSB 5kg/ha each) to onion crop produced bigger size bulbs with average bulb length (5.47 cm) and bulb diameter (6.37 cm) resulting the highest bulb yield 231.30 q/ha high is superior to rest other treatments. Among the INM treatments, application of STBFR along with any one of the organic manures (T_2, T_3, T_4, T_5, T_6) also produced higher bulb yield over sole application of STBFR. However, the percentage increase in yield over T_1 is the highest (26.57%) when the plot is applied with STBFR along with vermicompost(5t/ha). Improvement in bulb yield with integrated use of organic manures and inorganic fertilizers might be due to control release of nutrients in soil through mineralization of organic manures which might have facilitated better crop growth [8,9].

Economics

The highest B:C ratio (2.78) from the onion crop were obtained at T_7 (STBFR+ *Azotobacter* (5kg/ha) + *Azospirillum* (5kg/ha) + PSB (5kg/ha)) followed by T_3 (STBFR + vermicompost 5 t/ha) with B:C ratio of 2.62. However, the lowest B:C ratio was found under the treatment applied with STBFR + FYM @ 10t/ha (2.10).

Effect on chemical properties of soil

The application of NPK alone was found to a decrease in soil pH (T_1) but in contrary in other treatments it was found that the application of FYM, vermicompost and Biofertilizers enhance the soil pH. So, in other treatments the pH tends to neutrality. When the organic products like FYM, Vermicompost and biofertilizers applied to the soil the pH was slightly decreased initially. It was mainly due to the acidifying effect of organic acids produced during the course of decomposition of organic amendments and increased permeability and leaching of salts [10]. The soil pH was improving at the later stage of crop as the organic amendments act as buffering agent to the soil. The deficiency in OC reduces the storage capacity of soil nutrients and reduction of soil fertility. Vasanthi and Kumarswamy (1999) and Srikanta *et al*.,(2000) reported that the incorporation of various enriched compost, FYM and vermicompost have been shown to increase the soil OC % [11]. In the present study, it was clear that OC % was increased in all the treatments from initial soil status except T_1, where only NPK was applied. The highest value shown in T_3 followed by T_2 & T_7. So, in this study the highest OC content in the soil in T_3 was mainly due to higher OC content in vermicompost. It was also found that available N,P,K content was significantly increased in all treatments except T1. Bhattacharya *et al*. (2001) reported that application of vermicompost reduces the loss of nutrients through leaching from the soil by changing the soil physicochemical properties [12]. Increased available NPK in the soils was observed where the soils were treated, respectively with FYM, vermicompost and other biofertilizers [13]. Magdoff (1992) and Sahi (2004) reported that organic products served as reservoir of different types of nutrients which are essential for plant growth [14,15]. According to Sudhakar *et al*. (2002) vermicompost contains microsites rich in available rich in available carbon and nitrogen [16]. Worm cast injected soils also are rich in water soluble phosphorus and contains two to three tones more available potassium than surrounding soils, which encourages better plant growth.

Application of research: Study of integrated nutrient management on growth and yield of onion.

Research Category: Nutrient management

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Study area / Sample Collection: Regional Research and Transfer Technology Station, Mahisapat, Dhenkanal

Cultivar / Variety name: *Allium cepa* L. *cv*. Bhima Super

Conflict of Interest: None declared

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