HortFlora Research Spectrum, 1(4): 367-370 (2012) ISSN : 2250-2823

EFFECT OF CHEMICAL AND BIO-FERTILIZERS ON QUALITY OF ONION

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ABSTRACT: The present investigation comprising the supplementation of chemical and bio-fertilizers for onion crop was carried out under field conditions at Babasaheb Bhimrao Ambedkar University, Lucknow during *rabi* season of 2010-2011. The experiment comprised of four levels of chemical fertilizers and six levels of biofertilizers. The maximum ascorbic acid, reducing sugar and total sugars were found with the application of T_{11} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*). The maximum TSS, non-reducing sugar, phosphorus and calcium were found under the treatment T_{12} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM). The minimum values were found under the control i.e. T_1. Results obtained by the application of inorganic fertilizers with biofertilizers exhibited significant effect on various parameters studied under the investigation.

Keywords: *Azotobacter, phosphobacteria, VAM, chemical fertilizers, onion.*

Onion (*Allium cepa* L.), belonging to the family Alliaceae, is a herbaceous annual for the edible bulb production and biennial for the seed production. Onion is one of the most important crop grown in India and worldwide. Moreover, onion is the only vegetable in which India figures prominently in the world for production and export. Raw onion has an antiseptic value through the alimentary canal. It promotes bile production and reduces blood sugar. It is rich in minerals like phosphorus and calcium, vitamin C, protein and carbohydrates. In order to meet the increasing demand of the consumers and fill the gap in off-season, onion is now gaining popularity as *kharif* season crop too. Crop production of onion is affected by several factors. Biofertilizers have recently gained with momentum for affecting the sustainable increase in crop yield under various agro climatic conditions. Biofertilizers are live carrier based microbial preparations used in agriculture as low input resources to enhance the availability of plant nutrients or promote the growth by way of synthesizing growth factors (Subba Rao *et al.,* 5). They are low cost effective, inexpensive and ecofriendly sources of nutrient. Role of biofertilizer on the crop growth and yield was documented by Yogita and Ram (6). *Azotobacter* fixes atmospheric nitrogen independently near the root zone, thus, enhancing the available nitrogen to the soil, whereas phosphobacteria solublize the soil phosphorus and make them easily available for the plants. Vesicular-Arbuscular Mycorrhizae (VAM) play a vital role in development of stronger root system, improved growth (Zandavalli *et al.,* 7), nutrient uptake, increase tolerance of host roots to soil borne pathogens (Nelson and Achar, 3).

Uses of biofertilizers in onion production, to at least partially supplement its nutrient demand and to improve soil fertility by way of the integration of different sources of plant nutrients is desired. Onion has a good response for biofertilizer inoculation due to real nature of their root morphology. Keeping in view the above facts, present study was undertaken on quality parameters of onion applying various biofertilizers and graded level of chemical fertilizers.

MATERIALS AND METHODS

The present investigation was carried out at the Horticultural Research Farm of Babasaheb Bhimrao Ambedkar University, Lucknow during the *rabi* season of 2010-2011. The experiment comprised of four levels of inorganic fertilizers viz. 1. $N_0P_0K_0$ (Without inorganic fertilizers) C_0, 2.

Received : 29.8.2012 *Accepted : 28.9.2012*

$N_1P_1K_1$ (100 kg N + 50 kg P + 70 kg K/ha) C_1, 3. $N_2P_2K_2$ (75 kg N + 37.5 kg P + 52.5 kg K/ha) C_2, and 4. $N_3P_3K_3$ (50 kg + 25 kg P + 35 kg K/ha) C_3; and six levels of biofertilizers *viz.* 1. Uninoculated (Without biofertilizers) B_0, 2. *Azotobacter* (2 kg /ha) B_1. 3. *Phosphobacteria* (PSB) (2 kg/ha) B_2, 4. Vesicular-Arbuscular Mycorrhizae (VAM) (1900 kg/ha) B_3, 5. *Azotobacter* (2 kg/ha) + Phosphobacteria (2 kg/ha) B_4, and 6. Azotobacter (2 kg/ha) + VAM (1900 kg/ha) B_5. Thus, having a total of 24 treatment combinations *i.e.* T_1 (C_0B_0), T_2 (C_0B_1), T_3 (C_0B_2), T_4 (C_0B_3), T_5 (C_0B_4), T_6 (C_0B_5), T_7 (C_1B_0), T_8 (C_1B_1), T_9 (C_1B_2), T_{10} (C_1B_3), T_{11} (C_1B_4), T_{12} (C_1B_5), T_{13} (C_2B_0), T_{14} (C_2B_1), T_{15} (C_2B_2), T_{16} (C_2B_3), T_{17} (C_2B_4), T_{18} (C_2B_5), T_{19} (C_3B^0), T_{20} (C_3B_1), T_{21} (C_3B_2), T_{22} (C_3B_3), T_{23} (C_3B_4) and T_{24} (C_3B_5), respectively. The quantity of fertilizers was given as per treatment. The entire amount of phosphorus and potassium along with half dose of nitrogen were applied as basal dose during the field preparation and rest amount of nitrogen was applied as top dressing in two- equal split doses at 30 and 60 days after transplanting. *Azotobacter, Phosphobacteria* and Vesicular-Arbuscular Mycorrhizae were applied at the time of transplanting i.e. *Azotobacter* and PSB as seedling root treatment and VAM as soil application. The seedling transplanting was done in the last week of December 2010 in the evening at 10 x 15 cm spacing. The experiment was laid out in R.B.D with twenty four treatments and replicated thrice. All the standard package of practices and plant protection measures were timely adopted to raise the crop successfully. Five randomly selected bulbs from each replication were utilized for recording observations on TSS, ascorbic acid, reducing sugar, non-reducing sugar, total sugars, phosphorus and calcium. Statistical analysis of the data was done as per standard method.

RESULTS AND DISCUSSION

The observations recorded on TSS, ascorbic acid, reducing sugar, non-reducing sugar, total sugars, phosphorus and calcium maturity was significantly influenced by the interaction of inorganic fertilizers and biofertilizers. Table 1 clearly indicates that the maximum TSS (13.27 °Brix) was recorded with the application of T_{12} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM) which remained at par with treatment T_{11} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*) followed by T_{18} (75 kg N +37.5 kg P + 52.5 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM) and T_{17} (75 kg N +37.5 kg P + 52.5 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*). Whereas, the minimum TSS (9.67 °Brix) was recorded under control. These results are in confirmity with the findings of Gurubathem *et al.* (1). Higher ascorbic acid was obtained with the application of T_{11} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*) which remained at par with treatment T_{12} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM). Whereas, the lower ascorbic acid was obtained under control treatment. The highest reducing sugar (14.23%) and total sugars (43.81 %) were recorded with the treatment T_{11} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*) which was at par with T_{17} (75 kg N +37.5 kg P + 52.5 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*) followed by T_{12} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM), respectively over the control treatment. The highest non-reducing sugar (29.87 %) was recorded with the treatments T_{17} (75 kg N +37.5 kg P + 52.5 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*) which were at par with T_{12} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM), T_{18} (75 kg N +37.5 kg P + 52.5 kg K/ha + 2 kg/ha *Azotobacter* + 1.9 kg/ha VAM) and T_{11} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*), respectively over the control treatment. Similar results were also corroborated by Ram and Rajput (4). The maximum phosphorus content (35.00 mg/100g) and calcium content (24.33 mg/100g) was found under the treatment T_{12} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter*

Table 1: Effect of chemical and bio-fertilizers on different bio-chemical parameters of onion.

Treatments	T.S.S (%)	Ascorbic acid (%)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugars (%)	Phosphorus (mg/100g)	Calcium (mg/100g)
T_1	9.67	7.37	10.63	24.86	35.49	26.33	18.00
T_2	9.93	7.59	11.12	25.94	37.06	28.33	18.33
T_3	10.13	7.66	11.45	25.83	37.28	28.00	19.00
T_4	10.47	7.92	11.28	26.42	37.70	29.00	20.33
T_5	10.67	7.85	11.38	26.51	37.89	29.33	20.67
T_6	10.93	7.92	11.61	26.81	38.48	29.33	20.33
T_7	12.00	8.14	11.88	27.12	39.01	30.00	21.33
T_8	12.13	8.18	12.22	26.92	39.14	30.67	21.33
T_9	12.13	8.36	12.13	28.21	40.34	30.33	20.67
T_{10}	12.33	8.32	12.28	28.59	40.87	31.33	20.67
T_{11}	13.07	10.34	14.23	29.57	43.81	33.00	23.00
T_{12}	13.27	10.19	13.00	29.80	42.80	35.00	24.33
T_{13}	12.07	8.32	12.48	26.19	38.67	30.00	20.33
T_{14}	11.60	8.29	12.42	26.33	38.76	29.67	20.67
T_{15}	12.00	8.47	12.32	27.34	39.33	30.00	20.33
T_{16}	11.93	8.36	12.43	28.00	40.42	30.33	20.67
T_{17}	12.80	9.46	13.33	29.87	43.20	33.00	22.67
T_{18}	12.80	9.90	12.78	29.80	42.69	32.33	22.33
T_{19}	10.80	8.07	11.81	26.52	38.33	29.33	20.33
T_{20}	11.20	8.10	11.34	26.93	38.27	30.00	20.00
T_{21}	11.60	8.43	11.70	27.97	39.67	30.33	20.67
T_{22}	11.47	8.47	12.17	27.17	39.33	30.67	20.00
T_{23}	12.07	9.20	12.63	28.71	41.33	32.33	22.00
T_{24}	12.20	9.31	12.53	29.03	41.55	31.67	21.67
C.D. (P=0.05)	0.37	0.13	0.45	0.91	0.75	1.03	0.77

+ 1.9 kg/ha VAM) followed by T_{11} (100 kg N + 50 kg P + 70 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*) and T_{17} (75 kg N +37.5 kg P + 52.5 kg K/ha + 2 kg/ha *Azotobacter* + 2 kg/ha *Phosphobacteria*), respectively. Whereas, minimum phosphorus content (26.33 mg/100g) and calcium content (18.00 mg/100g) were found under the control *i.e.* T_1 confirming the report of Kumar and Mangal (2).

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