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Effect of Organic Manures and Biofertilizer on Growth Yield and Quality of Onion

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Abstract

A field experiment was conducted during 2005-06 to study the effect of organic manures and biofertilizer on the growth, yield and quality of onion (*Allium cepa* L.) under humid tropical climate of Nagaland. Data showed significantly higher plant height with FYM at 30 tonnes/ha (30.3—45.2 cm) compared to FYM at 30 tonnes/ha + *Azotobacter* (26.3—41.7 cm) or pig manure at 20 tonnes/ha (25.0—41.7 cm). Following observations taken at 15-day intervals up to 75 days after planting. Individual bulb weight and bulb yield were significantly higher with FYM at 30 tonnes/ha (40.0 g/bulb and 140.0 tonnes/ha) compared to rest of the treatments (24.5—34.9 g/bulb and 85.7—122.1 tonnes/ha) and control (19.9 g/bulb and 69.8 tonnes/ha). The total soluble solids (14.3%) with FYM at 30 tonnes/ha were higher by 2.1% over control (12.2%) compared to treatments either with other bulky manures (11.6—13.4%) or manures plus bioinoculants (12.3—12.1%).

Key words : Onion, Organic manures, Biofertilizer, Yield, Quality.

Onion is one of the most important spice and vegetable crop grown in India and rank second in area (0.46 million hectare) and production (6.22 million tonnes) next to China. Onion is grown on a wide range of climatic conditions. However, the requirement of onion in north eastern region is met from Maharashtra and northern states of India due to multiple production constraint. Onion is a heavy feeder of mineral nutrients (1). Farmer's of Nagaland are reluctant in application of inorganic fertilizers. So, use of organic manures as a source of plant nutrient is of prime importance. Most of the organic manures contain many essential nutrients and is a balanced source of nutrients, increasing humus content of soil at least temporarily and the water holding capacity of sandy soil and drainage in clayey soils are improved. Organic matter improves the physical properties of the soil and is important in arable land. Lal et al. (2) and Dimri and Singh (3) reported that application of organic manure significantly increased plant height, number of leaves, root length and bulb circumference of onion. Nowadays, use of beneficial micro-organisms in the form of biofertilizers is emerging as promising component of nutrient supply system. Being environment friendly and low cost, biofertilizer i.e. *Azotobacter* or *Azospirillum* can play significant role in nitrogen supplementation. *Azotobacter* is a free-living non-symbiotic micro-organism capable of fixing atmospheric nitrogen and making it available to plants. Besides, nitrogen supply, it also synthesizes growth promoting substances like indole acetic acid, gibberellic acid and chemicals which are inhibitory to certain root pathogens. By virtue of those attributes, *Azotobacter* can play nutritional and therapeutic role for the benefit of plant growth. Preliminary observation indicates that there is possibility of growing rainfed onion under terraced conditions of Nagaland as off-season crop from August to December. The cultivation of onion by bulblets could be better than the seedlings due to quick establishment and better survivability in field condition (4). But no such work has been carried out in Nagaland. Therefore, an investigation was undertaken to study the effect of organic manures and biofertilizer on the growth, yield and quality of onion.

Methods

A field experiment was conducted during 2005-06 at the experimental farm of School of Agricultural

Table 1. Effect of organic manures and biofertilizer on the growth attributes, bolting and doubles of onion.

Treatments	Height 75 DAP	Leaves 75 DAP	Neek thickness 45 DAP	Bolting (%)	Doubles (%)
T_1	30.14	10.30	2.13	0.28	0.21
T_2	45.16	13.66	3.46	0.48	0.38
T_3	41.72	11.25	3.21	0.41	0.36
T_4	38.06	11.00	2.91	0.40	0.32
T_5	36.62	10.93	2.80	0.38	0.32
T_6	41.76	12.16	3.26	0.63	0.34
T_7	40.43	11.25	3.13	0.53	0.40
T_8	39.61	11.23	3.12	0.49	0.33
CD at 5%	NS	NS	0.46	NS	NS

Sciences and Rural Development, Nagaland University, Medziphema. The field is located at an altitude of 304.8 m above mean sea level with geographical location of 25° 45′ 43′′ N latitude and 93° 53′ 04′′ E longitude. The soil of the experimental site is sandy loam having pH 5.1, organic carbon 1.04%, available N 238.38 kg/ha, P 10.34 kg/ha and K 162.20 kg/ha. The experiment was conducted in randomized block design with three replications. The treatments were T_1—Control, T_2—FYM at 30 tonnes/ha, T_3—Pig manure at 20 tonnes/ha, T_4—Vermicompost at 5 tonnes/ha, T_5—*Azotobacter*, T_6—FYM at 30 tonnes/ha + *Azotobacter*, T_7—Pig manure at 20 tonnes/ha + *Azotobacter* and T_8—Vermicompost at 5 tonnes/ha + *Azotobacter*. Raised beds of size of 1 m × 1 m were prepared on terrace to avoid water accumulation. The soil was treated with *Trichoderma*. Full dose of all organic manures were applied and mixed properly 2 weeks ahead of planting the bulblets. The bulblets were treated with *Azotobacter* prior to planting at 10 g/kg bulblets. The bulblets were planted during first week of October at a spacing of 15 cm × 10 cm. Weeding and harrowing were carried out from time to time. The observation of plant height, number of leaves and bolting were recorded 75 days after planting. The neck thickness of the tagged plants was measured with the help of Verneer calliper after 45 days. The number of doubles, fresh weight of bulb (g/bulb) and yield after harvest were recorded. Dry matter of onion was estimated by cutting 100 g of onion bulb and dried in the oven at 60 C temperature. For estimating the total soluble solids, the onion bulb was cut, grinded and squeezed thoroughly to extract the juice and 2 drops of the juice was taken in the specimen chamber of the hand refractrometer with the help of a glass rod and the reading of the transaction point between the light and shaded portion is recorded as total soluble solids.

Results and Discussion

Growth Attributes

The aplication of organic manures and biofertilizer was found to increase the height of the plant, number of leaves and neck thickness (Table 1). The application of FYM at 30 tonnes/ha caused maximum plant height (45.16 cm), number of leaves (13.66) and neck thickness (3.46 cm) followed by FYM + *Azotobacter*. Dimri and Singh (3) also reported similar observation with 10 t FYM/ha. The other treatments were found to be better than control with regard to influencing the growth parameters of onion. However, no significant effects were observed by application of organic manures and biofertilizer with regard to height of plant and number of leaves. The increased vigor of the plants by the application of farm yard manure at 30 tonnes/ha might be due to its beneficial effects as it enhanced the water holding capacity and the microbial activities, which in turn helped to convert the unavailable plant nutrients into available form. Mengistu and Singh (5) observed maximum plant growth characters in onion with the application of *Azospirillum* + VAM + 50 kg N. No significant effect of organic manures and biofertilizer was observed on the bolting and doubles in onion. Maximum bolting (0.63%) and doubles (0.40%) were recorded with FYM at 30 tonnes/ha + *Azotobacter* and pig manure + *Azotobacter*, respectively. However, minimum bolting and doubles were recorded in control. Significantly, lowest bolting and doubles in onion were recorded in the treatments, where no manure and basal dose of nitrogen were applied (6).

Yield Attributes

The application of FYM at 30 tonnes/ha recorded maximum bulb diameter (5.99 cm), fresh weight (40.0 g) and projected yield (140.0 q/ha) of onion (Table 2). This might be due to dual role of FYM as nutrient source and amendment. Ngullie et al. (7) reported significantly higher yield of onion by application of FYM

Table 2. Effect of organic manures and biofertilizer on the bulb diameter, yield and quality of onion.

Treatments	Bulb Diameter (cm)	Fresh weight of bulb (g)	Projected yield (q/ha)	Dry matter content (%)	TSS (°Brix)
T_1	3.00	19.93	67.76	7.66	12.20
T_2	5.99	40.00	140.00	9.00	14.26
T_3	5.51	34.90	122.13	9.33	13.43
T_4	4.76	28.30	99.00	6.50	11.63
T_5	4.37	24.50	85.70	10.00	12.50
T_6	5.57	36.00	114.33	11.33	13.06
T_7	5.42	31.00	108.50	8.66	12.76
T_8	4.73	30.20	105.66	8.50	12.26
CD at 5%	0.47	8.61	30.08	1.81	NS

under rainfed condition. Pig manure at 20 tonnes/ha was found second best treatment with regard to projected yield/ha. This might be due to the favorable effect of organic manure in supplying essential nutrients in balanced ratio, improved water holding capacity, which resulted in enhanced yield of the crop. Singh et al. (8) reported increased gross and marketable yield of onion and the highest net return by application of FYM combined with 10 kg N + 25 kg P + 25 kg K/ha. Singh and Singh (9) recorded highest fresh yield of ginger by the application of pig manure followed by FYM and poultry manure under Nagaland condition, which is in close conformity with the present findings.

Quality Analysis

The treatments FYM at 30 tonnes/ha + *Azotobacter* recorded maximum dry matter content (11.33%) followed by *Azotobacter* treatment. However, treatment difference was found to be at par between FYM at 30 tonnes/ha + *Azotobacter* and *Azotobacter.* All the treatments recorded significantly higher dry matter percentage compared to vermicompost at 5 tonnes/ha. Devi and Limi (10) observed higher dry matter production by application of biofertilizers. Maximum dry matter production was observed by Patil et al. (11) in onion with 30 tonnes/ha FYM followed by 5 tonnes/ha FYM and no FYM application.

Organic manures and biofertilizer failed to exert any significant influence on the total soluble solids in the onion bulb. However, highest total soluble solids (14.26° Brix) were recorded in treatment 30 tonnes/ha of FYM followed by 13.43° Brix in treatment 20 tonnes/ha of pig manure. Singh et al. (6) found the highest TSS by application of nutrients through integrated nutrient supply system in onion.

These results suggested that better agronomic efficiency of onion could be harnessed through application of FYM. However, pig manure being locally available in most part of NEH states, it may also be used as a better source of nutrients for cultivation of off-season onion.

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