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IMPACT OF ORGANIC CULTIVATION PRACTICES FOR AUGMENTING THE YIELD ATTRIBUTES OF CLUSTER ONION (*ALLIUM CEPA* L. VAR. AGGREGATUM DON)

T. Uma Maheswari* and M. Rajkumar

Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar -608 002 (T. N.), India.

Abstract

An experiment was conducted to find out suitable organic cultivation practices for augmenting the productivity of cluster onion by adopting organic practice involving solarization with various amendments and nutrient management through various bulky organic manures, concentrated oil cakes, biofertilizers and foliar organic nutrition. The experiment was laid out in a randomized block design with 14 treatments replicated thrice. The treatments include a combination of solarization for four weeks with three different amendments *viz*., Vermicompost, Farm Yard Manure (FYM), and neem cake along with non solarized control and solarization without amendment. At the end of treatment period, inoculation with Consortium Bio Fertilizers (CBF) was done for specific treatments. The results of the experiment revealed that the yield attributes of cluster onion were superior under treatment combination involving solarization for 4 weeks with vermicompost @ 5 t ha^{-1}, neem cake @ 1 t ha^{-1}, CBF @ 2 kg ha^{-1} and foliar application of panchakavya @ 4 % sprayed 4 times. This was closely followed by the solarization with FYM @ 12.5 t ha^{-1}, neem cake @ 1 t ha^{-1}, CBF @ 2 kg ha^{-1}, foliar application of panchakavya @ 4% sprayed 4 times.

Key words : Cluster onion, solarization and organic amendments.

Introduction

Organic vegetables fetch 20-30% higher price value than the vegetables from conventional farming. Organic farming provides better and balanced environment, better pesticide free food and living conditions to the human beings. It also provides low-cost agriculture development in the long run. Organic farming reduces the cost of production by utilization of organic wastes or its byproducts against chemical fertilizers, which potentially reduces pollution unless they are used in productive and efficient way. Onion is one of the most important bulb vegetable crops grown in India and around the globe. The demand for onion is worldwide. It is used both in raw and mature bulb stage as vegetable and spices. The pungency in onion is due to a volatile oil known as allyl-propyldisulphide. It is rich in vitamin A, thiamine and riboflavin. Combining organic amendments with soil solarization is a developmental approach for the control of soil borne plant diseases (Jeffschalan, 2003). Although, the major benefit of solarization is reduction of soil borne pathogens by soil-heating effects, there are many other possible additional beneficial effects that can result in an increased growth response (IGR) of plants. Such additional effects include control of weeds and insect pests and release of plant nutrients (Stapleton, 1997). Hence, an investigation was conducted to study the impact of solarization with organic amendments and bioregulators on the yield attributes of cluster onion.

Materials and Methods

The experiment was conducted to find out suitable organic practices for augmenting the productivity of cluster onion by adopting organic practice involving solarization with various amendments and nutrient management through various bulky organic manures, concentrated oil cakes, biofertilizers and foliar organic nutrition. The experiment was laid out in a randomized block design with 14 treatments replicated thrice. The

***Author of correspondence:** E-mail : umahorti2003@gmail.com

treatments include a combination of solarization for four weeks with three different amendments *viz*., Vermicompost (VC), Farm Yard Manure (FYM) and neem cake(NC) along with non solarized control and solarization without amendment. The treatment details are Conventional farming practices (60: 60: 30 kg NPK ha^{-1}) without solarization (T_1); Conventional farming practices (60: 60: 30 kg NPK ha^{-1}) + Solarization (T_2); FYM (12.5 t ha^{-1}) + CBF (2 kg ha^{-1}) + No solarization (T_3); FYM (12.5 t ha^{-1}) + Consortium Bio Fertilizers (2 kg ha^{-1}) + Solarization (T_4); Vermicompost(5 t ha^{-1}) + CBF (2 kg ha^{-1}) + No solarization (T_5); Vermicompost(5 t ha^{-1}) + CBF (2 kg ha^{-1})+ Solarization (T_6); FYM+ CBF+ Neemcake (1 t ha^{-1})+ No solarization(T_7); FYM+ CBF+ Neemcake (1 t ha^{-1})+ Solarization(T_8); VC + CBF+ Neemcake (1 t ha^{-1})+ No solarization($T_{9);}$ VC + CBF+ Neemcake (1 t ha^{-1}) + Solarization(T_{10}); FYM+ CBF+ NC+Panchakavya (4%)+ No solarization (T_{11}); FYM+ CBF+ NC +Panchakavya(4 %)+ Solarization (T_{12}); VC + CBF+ NC + Panchakavya (4%) + No solarization (T_{13}); VC + CBF+ NC + Panchakavya (4%)+ Solarization (T_{14}).

The plots were irrigated to field capacity to encourage exothermic fermentation process. After irrigation, the plots were covered with the low density poly ethylene sheet of 0.05 mm thickness and the sides were tucked into the soil. The plots were solarized for a period of four weeks and monitored carefully. After the solarization period was over, the polyethylene sheets were removed and Consortium Bio Fertilizers (CBF) was applied in the respective treatments as band application after 2 days of sheet removal. In onion, the popular cultivar used in this experiment was Co 5. Panchakavya @ 4% was given as a foliar spray for 4 times.

Results and Discussion

Number of bulbs per plant was the highest (6.45) in T_{14} (solarization with vermicompost, neemcake, BFC and panchakavya 4% spray). This was followed by T_{12} (6.14). The next best result was recorded in T_{10} (5.84). The lowest bulb number per plant was recorded in non solarized control (2.50). The maximum bulb diameter was registered in the treatment T_{14} (7.95 cm). This was followed by the treatment T_{12} (7.54 cm), T_{10} (7.12 cm) in order. Non solarized control registered the lowest value of 2.65 cm for bulb diameter. The mean value for weight of bulbs per plant was the highest (6.51 g) in $T_{14,}$ which was followed by T_{12} (6.20 g) and T_{10} (5.89 g). The least mean value for weight of bulbs per plant was registered in T_1 (2.55 g). Among the various organic sources of nutrition with solarization tried, the highest bulb per plant (37.01 g) was recorded in T_{14}, this was followed by the treatment T_{10} recorded the next best value for bulb yield per plant (35.81 g), followed by T_{10} (24.93 g). The lowest value for bulb yield per plant was recorded in T_1 (5.12 g) when compared to other treatments. The value for bulb yield per hectare was the highest in T_{14} (22.48 t ha^{-1}), followed by T_{12} (19.30 t ha^{-1}). The next best result was obtained in T_{10} (18.03 t ha^{-1}) in order. The least value was recorded in T_1(4.22 t ha^{-1}) when compared to other treatments. The highest value (10.01 g) for bio mass production was recorded in T_{14}. This was followed by T_{12} which registered the next best value for bio mass production (9.70 g), followed by T_{10} (9.42 g) in order. With reference to absolute control (T_1), the minimum value (6.36 g) was recorded for bio mass production (table 1).

Yield is a complex trait influenced by many factors. Among this, nutrient management system plays a crucial role on yield. Yield per plant is the combination of the interplay of morphological and yield parameters. Though the identified yield characters like number of bulbs per plant, single bulb weight, weight of bulbs per plant, bulb yield and biomass production are controlled genetically, they are greatly influenced by the availability of nutrients to the crop. In the present study, the yield attributes and bulb yield were maximum in the treatment which received application of vermicompost and neem cake, CBF and panchakavya with solarization registered the maximum bulb yield and yield attributing characters. This might be due to the higher nutrient uptake from vermicompost than FYM and from neem cake. The superiority of vermicompost over FYM might be due to higher P fertilization by a symbiotic mycorrhizal association presence of N fixers, growth substances and other essential nutrients as reported by Kale *et al*. (1987). Similarly, Bagyaraj and Powell (1985) revealed that N uptake in plants grown with vermicompost was significantly more than that with FYM due to higher availability of N in the vermicompost, which was attributed to the higher activity of nitrogen fixers. Similarly uptake of P was also more with vermicompost treated plants due to the symbiotic mycorrhizal association with vermicompost.

As reported by Vadiraj *et al*. (1998) improved nitrogen metabolism particularly an increase in nitrate reductase activity has been proposed as a predictive test for crop yield. Here there is a relationship between nitrate reductase activity and protein synthesis. Earth worm casts are known to increase protein synthesis in plants which have definite influence in plant growth and yield. Furthermore, vermicompost is not only supplying the

Table 1 : Impact of organic cultivation practices for augmenting the yield attributes of cluster onion.

Treatments	Number of bulbs $Plant^{-1}$	Bulb diameter (cm)	Mean single bulb weight (g)	Bulb yield $Plant^{-1}$(g)	Bulb yield per hectare(t ha^{-1})	Biomass production (g $plant^{-1}$)
T_1	2.50	2.65	2.55	5.12	4.22	6.36
T_2	2.80	3.05	2.85	7.23	5.47	6.64
T_3	3.11	3.46	3.16	8.20	6.72	6.91
T_4	3.70	4.27	3.76	10.15	9.23	7.46
T_5	3.41	3.86	3.46	9.18	7.98	7.18
T_6	4.01	4.68	4.07	13.34	10.48	7.74
T_7	4.31	5.09	4.38	14.31	11.74	8.02
T_8	5.54	6.71	5.59	23.97	16.77	9.14
T_9	4.62	5.49	4.68	15.27	13.00	8.30
T_{10}	5.84	7.12	5.89	24.93	18.03	9.42
T_{11}	4.92	5.90	4.98	16.23	14.26	8.59
T_{12}	6.14	7.54	6.20	35.81	19.30	9.70
T_{13}	5.23	6.30	5.29	23.00	15.51	8.86
T_{14}	6.45	7.95	6.51	37.01	22.48	10.01
S.Ed.	0.15	0.20	0.15	0.45	0.63	0.16
CD(p=0.05)*	0.29	0.40	0.30	0.95	1.25	0.27

nutrients, but also supplies the enzymes, vitamins and growth hormones like IAA which are highly responsible for the prevention of flowers and fruit drop along with higher fruit set percentage as reported by Anand *et al*. (1997). Alongwith that, *Azospirillum* might have fixed higher amount of nitrogen in soil which have also been made available to the plants resulting in better uptake of N by plants. Phosphobacteria would have caused more mobilization and solubilization of insoluble P in soil and improve the availability of phosphorus which would have caused an increased uptake of phosphorus by plants. Further increased growth rate might have helped in increasing photosynthates mobilization as reported by Thilagavathy and Ramaswamy (1999).

The improvement in yield attributes with *Azospirillum* could also be because of production of growth substances like IAA and GA3 by microbial inoculants, which in turn might have increased the availability and uptake of nutrients through plant roots, thus higher yield would have been realized as reported by Chatto *et al*. (1997) in knol khol. The increased nutrient availability and growth hormones from vermicompost, neem cake, biofertilizers and Panchakavya might have increased the endogenous hormonal level in the plant tissue responsible for the enhanced pollen germination and the tube growth, which ultimately would have increased the fruit set, number of fruits and thereby increased the yield as reported by Rajagopal and Rao (1974). The present result is in alignment with Rajeswari and Kader Mohideen (2004) in moringa. Panchakavya is the fermented organic manure with high microbial load with effective micro organism (EMO) and methylotrophs profile bacteria. These EMO in panchakavya would have enhanced the productivity of phytohormones like auxins and gibberellins that might have in turn, stimulated the growth and yield parameters as reported by Long *et al*. (1997).

Another reason for improved yield might be due to the fact that, panchakavya supplies all growth regulators, micro and macro nutrients. The proportion and activity of beneficial microbes would have been at the higher rate during fermentation and thus helping in synthesis of growth promoting substances. This is in accordance with findings of Natarajan (2006). The pronounced increase in yield with panchakavya might also be due to the sustained availability of N throughout the growing phase and also due to enhanced carbohydrate synthesis and effective translocation of photosynthesis to the developing sink i.e., fruit. This is in line with the work of Sarma and Anandaraj (2003). The direct application of growth regulators and nutrients as foliar spray might have been absorbed by plant quickly and increased the yield attributes.

Moreover, the destruction of harmful micro organisms like the spores of fungi, bacteria, actinomycetes and nematodes by the production of bio toxic volatiles might have also helped in the better growth and yield of plants. This might also be attributed to the reduction in the competition between the seedlings and the weeds that have been destroyed. This is supported by Stevens *et al.* (2003) in nursery vegetable crops.

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