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Short communication

Effect of microsprinkler fertigation on growth and yield of Rabi onion

M. Prabhakar, S.S. Hebbar and A.K. Nair
Division of Vegetable Crops
Indian Institute of Horticultural Research
Hessarghatta Lake Post, Bangalore-560089, India
E-mail:mpkar@iihr.ernet.in

ABSTRACT

A field experiment was conducted during *rabi* 2005-2006 at Indian Institute of Horticultural Research, Bangalore, to study the performance of onion cv. Arka Niketan as influenced by microsprinkler fertigation using different sources and levels of fertilizers. Results indicated that crop growth in terms of leaf production, plant height, radial and equatorial diameter was not significantly influenced by the treatments. Fertigation treatments were superior for marketable bulb yield as compared to soil application of fertilizer. Also bulb yield through soil application of fertilizer increased by changing over from surface-irrigation to microsprinkler irrigation. However, bulb yield did not significantly decrease by applying just 75% of the recommended NPK fertilizers, using common or water soluble fertilizers supplied through fertigation. For achieving maximum yield, however, it is recommended to apply 100% recommended dose of fertilizers through sprinkler fertigation using water soluble fertilizers.

Key words: Onion, microsprinkler, fertigation, growth and yield

Onion (*Allium cepa*) is an important commercial vegetable crop of India. It is grown predominantly in Kharif and Rabi seasons in the country. The onion is grown under 0.76 million hectares with a production of 12.16 million tonnes and productivity of 16.1 tonnes hectare^{-1} (NHB, 2010). Productivity of this crop is quite low in the country, which could be attributed to improper and inadequate nutrient management, higher disease incidence, non availability of critical inputs, particularly water, lack of adoption of new improved production technologies, etc. (Saxena *et al*, 2008). Over the last few years, emphasis has been laid on enhancing productivity by applying irrigation water and fertilizer. In India, it is a common practice to use surface irrigation for an irrigated onion crop. Water productivity or irrigation efficiency in surface irrigation is low (< 44%) due to higher percolation, distribution and evaporation losses (Locascio, 2005). Modern systems of irrigation such as through drip and sprinklers ensure better irrigation and water use efficiency. Sprinkler irrigation system has become popular under undulating topography, particularly, for light textured soils in a variety of horticultural crops. This system is ideally suited for closely spaced vegetable crops as it maintains optimum soil moisture for shallow rooted crops like onion (Satyendra Kumar *et al*, 2006). For intensive and economical crop production, and for achieving higher yield with quality bulbs in onion, the best solution is fertigation, as both water and fertilizers are delivered in time and in small amounts to growing crops through micro irrigation system (Neeraja *et al*, 1999). Fertigation also saves time and lobour, making it profitable. Experiments have proved that this system economizes use of fertilizer and water to a tune of 40-60 per cent. Information on combined use of fertilizers with sprinklers is limited in a closely spaced crop like onion in our country. Hence, a trial was conducted to study the effect of various fertilizers applied through fertigation using sprinklers in onion crop.

The experiment was conducted during *rabi* season of 2005-2006 at Indian Institute of Horticultural Research, Hessaraghatta Lake, Bangalore. Mean annual temperature range of Hessaraghatta was 27-35^{o}C and 14-20^{o}C during day and night with annual average rainfall of 850 mm. The soil was well drained sandy loam with an initial organic carbon (0.55%), pH (6.75), available N (160 kg/ha), available P (88 kg/ha), available K (280 kg/ha) and electrical conductivity (0.23 dsm^{-1}). The available water holding capacity was 153 mm for one meter soil depth. Seedlings (35 days old) of cultivar Arka Niketan were planted at a spacing of 15 x 15 cm during the first week of November.

The experiment was laid out in Randomized Block Design with eleven treatments and three replications. A uniform dose of fertilizer at the rate of 125:75:125 kg N, P_2O_5 and K_2O per hectare was applied through different treatments, along with a basal application of Farm yard manure (25 tonnes hectare^{-1}.) In soil application treatments (T_1 and T_2), the entire amount of P, and half of N and K were given as basal dose and the remaining half was side dressed 30 days after transplanting. In N and K fertigation (T_3 to T_7) treatments, all the P was applied to the soil as basal dose. All fertigation treatments, were applied through a fertilizer pump at weekly intervals starting three weeks after transplanting, for twelve weeks. Micro sprinkler irrigation was done on alternate days to replenish 90 per cent of the pan evaporation losses. All other recommended practices were followed for crop growth and plant protection. Treatment details are given under Table1.

Table 1. Treatment details for onion cultivar Arka Niketan under fertigation

Treatment	Treatment details
T_1	Application of common fertilizer to soil with furrow/bed irrigation
T_2	Application of common fertilizer to soil with microsprinkler irrigation
T_3	50-0-50% fertigation using Urea and Muriate of potash
T_4	50-0-50% fertigation using water soluble solid fertilizers (Specialty fertilizers*)
T_5	50-0-50% fertigation using specialty fertilizers
T_6	100-0-100% fertigation using specialty fertilizers
T_7	100-0-100% fertigation using common fertilizers
T_8	100% NPK fertigation using specialty fertilizers
T_9	100% NPK fertigation using common fertilizers
T_{10}	75% NPK fertigation using specialty fertilizers
T_{11}	75% NPK fertigation using regular fertilizers

* Specialty fertilizers used were 19:19:19 NPK, potassium nitrate and calcium nitrate

There were no significant differences among treatments with reference to crop growth characters like plant height, number of leaves and leaf dry weight per plant. However, application of 100-0-100 per cent fertigation using common fertilizers (T_7) and 100-0-100 per cent fertigation using specialty fertilizers (T_6) recorded the highest (57.7cm) and lowest (54.1cm) values respectively for plant height (Table 2). Treatment T_6 recorded the highest value (10.4) for number of leaves per plant. Though application of 100 per cent NPK fertigation using common fertilizers (T_9) recorded lower number of leaves per plant (9.6), it recorded higher leaf dry weight per plant (5.9 g) compared to other treatments. This may be attributed to vigorous growth of leaves available on the plant. The same treatment recorded significantly higher (233.9 cm^2) leaf area per plant than T_1, T_3, T_{10} and T_{11}. Application of common fertilizers to soil with furrow irrigation (T_1) recorded the lowest (191cm^2) leaf area per plant.

Different treatment combinations did not differ significantly with respect to radial and equatorial bulb diameter among yield and yield attributing characters studied. However, T_9 and T_2 recorded higher values than other treatments for radial (6.59 cm) and equatorial (6.14 cm) diameter, respectively. Application of 75% NPK fertigation using specialty fertilizers (T_{10}) recorded minimum radial (6.05 cm) and equatorial (5.76 cm) diameter. Treatment, T_9 recorded significantly higher total soluble solids (11.8°Brix) than most of the other treatments except T_5, T_6, T_8 and T_{10}, while, the minimum was recorded with T_1 and T_2 (10.7° Brix). Similarly individual bulb weight (84.1g) was significantly higher in T_9 compared to T_1, T_2, T_3, T_4 and T_{11} treatments. Second highest bulb weight (82.4 g) was

Table 2. Effect of sprinkler fertigation on crop growth and yield in *rabi* onion

Treatment	Plant height (cm)	No.of leaves per plant	Leaf area per plant (cm^2)	Leaf dry weight per plant (g)	Radial diameter (cm)	Equatorial diameter (cm)	TSS (°Brix)	Bulb weight (g)	Marketable bulb yield (t/ha)
T_1	55.5	9.7	191.0	5.3	6.27	5.92	10.7	74.7	25.8
T_2	57.2	9.8	211.3	5.4	6.21	6.14	10.7	77.3	29.5
T_3	56.6	9.7	210.0	5.6	6.08	5.82	10.8	78.3	30.3
T_4	57.3	9.7	212.9	5.5	6.24	6.11	11.0	76.7	31.1
T_5	55.0	9.4	218.9	5.5	6.33	5.98	11.2	81.2	31.8
T_6	54.1	10.4	223.8	5.7	6.14	5.92	11.3	82.4	33.8
T_7	57.7	9.9	225.9	5.7	6.43	6.05	11.0	82.0	32.7
T_8	56.3	10.0	226.5	5.8	6.08	5.79	11.6	81.8	32.2
T_9	54.2	9.6	233.9	5.9	6.59	6.08	11.8	84.1	33.9
T_{10}	54.7	9.6	209.4	5.4	6.05	5.76	11.6	80.4	31.5
T_{11}	54.8	9.7	205.9	5.1	6.21	5.79	11.0	78.3	30.6
S.Em±	1.4	0.3	7.9	0.2	0.7	0.5	0.2	1.9	1.5
CD (P=0.05)	NS	NS	22.7	NS	NS	NS	0.7	5.4	4.3

recorded with T_6, while T_1 had lowest bulb weight of 74.7 g. There were significant differences for marketable bulb yield among almost all fertigation treatments, recording higher bulb yield compared to soil application treatment with furrow irrigation treatment. Sprinkler irrigation also gave higher bulb yield as compared to furrow irrigation. Treatment T_9 recorded significantly higher mean bulb weight (84.1g) and higher bulb yield (33.9 t ha^{-1}). This may probably be due to higher leaf area, resulting in greater photosynthetic surface, leading to higher carbo-hydrate synthesis and translocation to the sink, coupled with marginally higher total soluble sugars. Higher bulb yields obtained with fertigation compared to soil application could result in saving in fertilizer (25 %) and higher nutrient productivity. This is in conformity with earlier findings of Murali Krishnasamy *et al* (2006).

From the present study, it can be inferred that 100% application of recommended dose of nitrogenous, phosphorus and potassium fertilizers (125:75:125 kg ha^{-1}) via fertigation through microsprinklers has a positive effect on plant growth characters and improves marketable bulb yield in onion. Hence, fertigation using microsprinklers can be recommended for onion to attain improved growth and marketable bulb yield in locations where it is traditionally grown under irrigation.

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