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RESEARCH PAPER

Influence of fertigation on growth, yield and quality of onion var. Bhima Shakti

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Abstract: The results of the two years (2017-18, 2018-19) revealed that the fertigation at 100 % RDF the most effective for the growth parameters studied but was on par with 80% RDF and superior over control. Similar trend was observed for yield parameters wherein 100 % RDF recorded the highest equatorial diameter, polar diameter, marketable yield and total yield which was on par with 80 % RDF with equatorial diameter. The bulbs produced with 100 % RDF were found better storer with minimum loss in weight of bulbs and rotten bulbs and was on par with 80 % RDF. The control recorded lower values for all the yield parameters. 80 % fertigation helps in improving the growth, yield and quality of Bhima Shakti.

Key words: Fertigation, Growth, Onion, Yield

Introduction

Onion is an important spice cum vegetable crop which earns nearly 4000 crores foreign exchange annually. It is extensively used in processing industry now a days for the preparation of dehydrated onion flakes and powder. Onion is used in homeopathic, unani and ayurvedic medicines. Besides, the more pungent onions manifest strong anti-platelet and blood thinning activities in human blood, potentially adding protection against arteriosclerosis, cardiovascular disease, stroke, diabetes, osteoporosis and heart attack. It is extensively used in Indian kitchen in one or the other form hence, it is regarded as "Queen of Kitchen". Central Asia is the primary centre of origin and the area near East and Mediterranean region is the secondary centre of origin for onion. Many virtues have been attributed in Charaka-Samhita and the references of onion have also been found in Quran and Bible (Jones and Mann, 1963). Onion requires intensive supply of plant available nitrogen (N), phosphorus (P) and potassium (K) to attain maximum yield of bulbs because the plants have a shallow, sparsely branched root system. Inefficient use of fertilisers may result in considerable residuals of these plant nutrients in soil following harvest Brewster (2008).

Fertigation is a new technology that is being adopted in several horticultural crops. Inorganic fertilizers were probably the first chemicals to be injected into drip system. Fertigation also ensures high efficiency of fertilizers application by uniform and proper distribution of irrigation water into the soil, flexibility of nutrient ratios also avoids nitrogen volatilization from soil surface. Fertigation not only increase the efficiency in the application of fertilizers and water it is also reducing the amount of fertilizers applied. This in turn reduces the cost of production and also ground water pollution which causes ecological disturbances and health risk by fertilizers leaching and accumulation of nitrates. As such, use of fertigation could really prove as blessing for Indian farming and may pave the way for another green revolution and provide coveted support to boost horticulture and agricultural production. Adoption of advanced and efficient method of application of water and fertilizes through drip irrigation system would go a long way in economizing the scares inputs thus realizing increased productivity. In this regard an investigation was conducted on fertilizer scheduling through drip irrigation in onion variety Bhima Shakti. The details of the experiment and outcome is discussed below.

Material and methods

An investigation on fertilizer scheduling through drip fertigation on growth and yield parameters of onion variety Bhima Shakti was conducted at Main Agricultural Research Station, UAS, Dharwad with four treatments and five replications in randomized block design. The plot size followed was 44 m x 1.2 m on raised beds with spacing of 15 cm x 10 cm. The seeds were sown in the nursery bed during November 2017 and 2018 (*rabi)* and transplanting was done during December month and all the cultural practices were carried out during the course of investigation according to Directorate of Onion and Garlic Research recommendations. The fertigation was carried out at weekly interval, fifteen days after transplanting and it was stopped fifteen days before harvest of the crop.

Observations on growth parameters like plant height, number of leaves and leaf width were recorded 75 days after transplanting. Yield parameters like bulb size & yield were recorded after harvesting and curing. Equatorial and polar bulb diameter were recorded from 5 randomly selected bulbs using vernier calipers and expressed in centimeter. Marketable bulb yield was recorded by separating rotted, sprouted and very small bulbs (<2.5 cm diameter) and weight was recorded. For

storage studies, initially 5 kg bulbs in each treatment are kept for storage and loss in weight was recorded 3 months after storage. Statistical analysis was done using Fisher and Yates (1967) method.

Treatment details

T_1. Surface irrigation at 50 mm CPE : RDF : 110:40:60:30 kg NPKS/ha+5 t compost /ha: 30% N, full of PKS and organic manure as a basal before transplanting: 70% N in two equal splits at 30 and 45 days after transplanting as a top dressing

T_2. Drip irrigation at 100% PE through drip system-Irrigation at alternate day: 100% RDF (110:40:60:30 kg NPKS/ha) + 5 t compost /ha at 6 days interval: Full dose of organic manure should be applied as a basal before transplanting

T_3. Drip irrigation at 100% PE through drip system-Irrigation at alternate day: 80% RDF (88:32:48:24 kg NPKS/ha) + 5 t compost /ha at 6 days interval: Full dose of organic manure should be applied as a basal before transplanting

T_4. Drip irrigation at 100% PE through drip system-Irrigation at alternate day: 60% RDF (66:24:36:18 kg NPKS/ha) +5 t compost /ha at 6 days interval.

Results and discussion

The data on fertigation studies revealed that at 75 days after transplanting, the fertigation treatment T2 (100% RDF) had great influence on the plant height (43.34, 51.70 and 47.52 cm),number of leaves (8.00, 7.60 and 7.80) and leaf width (1.03, 0.81 and 0.92 cm) and was on par with T_3 (80 % RDF) with plant height (41.68, 52.60 and 47.14 cm), number of leaves (7.70, 7.10 and 7.40) and leaf width (0.83, 0.99 and 0.91 cm), respectively during 2017-18, 2018-19 and over the years. The lowest values were obtained in control (T_1) with plant height (33.18, 36.66 and 34.92 cm), number of leaves (6.00, 5.00 and 5.50) and leaf width (0.78, 0.48 and 0.63 cm), respectively (Table 1). Significantly highest equatorial bulb diameter (5.44, 5.49 and 5.47 cm) , Polar bulb diameter **(**4.98, 5.34 and 5.16 cm), marketable yield (34.68, 30.31 and 32.50 t/ha) and total yield (37.72, 33.48 and 35.60 t/ha) and was on par with T3 (80 % RDF) with equatorial diameter (5.25, 5.25 and 5.25 cm), polar diameter (4.78, 4.97 and 4.88 cm), marketable yield (32.20, 29.15 and 30.68 t/ha) and total yield (39.30, 30.92 and 35.11 t/ha), respectively during 2017-18, 2018-19 and over the years (Table 2 & 3). During storage, least loss in weight of bulbs (4.60 4.88 and 4.74 %) and number of rotten bulbs (4.80, 5.00 and 4.90 %) were noticed in T2 (100 % RDF) followed by 80 per cent fertigation level (T_3) with lowest total weight loss (5.20, 5.40 and 5.30 per cent) and least number of rotten bulbs (5.60, 6.40 and 6.00), respectively (Table 4). Yield parameters showed lowest values in control treatment (T_1) with Equatorial bulb diameter 4.20, 4.44 and 4.32 cm), Polar bulb diameter (3.66, 4.29 and 3.98 cm), marketable yield (23.22, 21.58 and 22.40 t/ha), total yield (28.72, 24.90 and 26.81 t/ha) and highest total weight loss (8.60, 10.12 and 9.36 %) and rotten bulbs (7.40, 7.80 and 7.60), respectively during 2017-18, 2018-19 and over the years.

The highest values with respect to all the parameters like plant height, number of leaves and yield parameters was observed in onion variety Bhima Shakti in the treatment T_2:100 per cent RDF through fertigation followed by T_3:80 per cent RDF through fertigation and this might be due to the effective utilization of the fertilizers by the onion crop and response of plants to added nutrients. The increased values for these parameters might be due to increased uptake of primary nutrients and more production of dry matter (Kumar *et al*., 2001, Khan *et al*., 2002 and Savitha *et al*., 2010 and Jeevitha *et al*., 2018). This might also attributed to the fact that there is a better utilization of the nutrients by the crop due to less leaching effect and through drip irrigation the water requirement by the plants will be met out from time to time which helps in better growth. The vigorous growth in onion was observed due to production of more leaves, with broader size which helped in the synthesis of more

Table 1. Effect of fertigation on growth parameters at 75 days after transplanting of onion variety: Bhima Shakti

Treatments	Plant height (cm)		Pooled	No. of leaves		Pooled	Leaf width (cm)		Pooled
	2017	2018		2017	2018		2017	2018	
T_1	33.18	36.66	34.92	6.00	5.00	5.50	0.78	0.48	0.63
T_2	43.34	51.70	47.52	8.00	7.60	7.80	1.03	0.81	0.92
T_3	41.68	52.60	47.14	7.70	7.10	7.40	0.83	0.99	0.91
T_4	39.58	42.64	41.11	6.54	5.54	6.04	0.70	0.50	0.60
S.Em±	1.37	1.28	1.91	0.29	0.39	0.15	0.05	0.05	0.10
C.D. @ 5%	4.22	3.95	8.61	0.89	1.20	0.68	0.15	0.16	0.46

Table 2. Equatorial and polar diameter of onion bulbs as influenced by different levels of Fertigation

Treatments	Equatorial Diameter (cm) of the bulb		Pooled	Polar diameter (cm) of the bulb		Pooled
	2017	2018		2017	2018	
T_1	4.20	4.44	4.32	3.66	4.29	3.98
T_2	5.44	5.49	5.47	4.98	5.34	5.16
T_3	5.25	5.25	5.25	4.78	4.97	4.88
T_4	4.06	4.52	4.29	3.80	4.10	3.95
S.Em±	0.14	0.30	0.10	0.07	0.12	0.09
C.D. @ 5%	0.43	0.92	0.47	0.22	0.36	0.42

Table 3. Influence of fertigation levels on yield parameters of onion

Treatments	Marketable yield (t/ha)		Pooled	Total yield(t/ha)		Pooled
	2017	2018	2017	2018	2018	
T_1	23.22	21.58	22.40	28.72	24.90	26.81
T_2	34.68	30.31	32.50	37.72	33.48	35.60
T_3	32.20	29.15	30.68	39.30	30.92	35.11
T_4	25.70	22.20	23.95	27.70	26.34	27.02
S.Em±	0.71	1.80	0.57	0.76	1.46	1.46
C.D. @ 5%	2.91	5.54	2.57	2.33	4.49	6.55

Table 4. Influence of fertigation levels on storage of onion

Treatments	Total weight loss (%)		Pooled	Number of rotten bulbs		Pooled
	2017-18	2018-19		2017-18	2017-18	
T_1	8.60	10.12	9.36	7.40	7.80	7.60
T_2	4.60	4.88	4.74	4.80	5.00	4.90
T_3	5.20	5.40	5.30	5.60	6.40	6.00
T_4	6.00	6.00	6.00	6.80	7.20	7.00
S.Em±	0.41	0.21	0.35	0.43	0.35	0.13
C.D.@ 5%	1.25	0.64	1.15	1.33	1.09	0.57

photosynthates and thus resulting in increased accumulation of carbohydrates and other metabolites, which ultimately determined the size and weight of bulbs. Similar findings are also obtained by Kahsay *et al*. (2010), Savitha *et al*. (2010), Sankar *et al.* (2008),Tripathi *et al.* (2010) and Yadav *et al.* (2010) in onion.

Conclusions

From this investigation it can be concluded that since 100 per cent RDF & 80 per cent RDF treatments were on par with each other for all the parameters the 80% RDF treatment can effectively be adopted which helps in saving fertilizer cost nearly 20 per cent with out compromising the parameters studied.

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