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RESEARCH ARTICLE :

Drip fertigation effects on nutrient and water use by *Rabi* onion (*Allium cepa* L.): A climatological approach

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SUMMARY : At AICRP on Irrigation Water Management, VNMKV, Parbhani, Maharashtra, India, irrigation and fertigation requirements of *Rabi* onion through drip was optimized during three years of field studies in split plot design with three replications wherein irrigation schedules as main treatments and nitrogen levels as sub-treatments were undertaken. Irrigation schedules comprised of drip irrigation I_1 (0.75 ETc), I_2 (1.0 ETc), I_3 (1.25 ETc) and conventional check basin irrigation at 1.2 IW/CPE with 60 mm depth of irrigation. Nitrogen levels included N_1 (75 kg/ha N), N_2 (100% kg/ha N) and N_3 (125% kg/ha N). Drip irrigation treatments (I_1, I_2 and I_3) were scheduled at an alternate day as desired by the treatments and depending on crop evapo-transpiration rate whereas surface irrigation was scheduled when CPE reached to 50 mm. Texturally, the soil was clay with field capacity of 36% and permanent wilting point of 17%. The results showed that onion bulb yield and yield contributing characters under drip irrigation schedules were significantly higher than the conventional surface irrigation schedule. Under drip, irrigation depth at 1.25 ETc (I_3) recorded significantly higher onion bulb yield than I_1 (0.75 ETc), but it was on par with I_2 (1.0 Etc) during all the seasons and in pooled analysis. The nitrogen level N_2 (100 kg ha^{-1}) gave significantly higher onion bulb yield than N_3 (125% kg/ha), but it was at par with N_1 (75 kg/ ha). Moreover, highest water use efficiency was observed under treatment I_1 (drip with 0.75 ETc), whereas highest nitrogen use efficiency was under treatment I_3N_1 (drip irrigation with 1.25 ETc depth and 75 kg/ha N). All drip irrigated treatments recorded higher nitrogen use efficiency, as compared to surface irrigated plots.

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BACKGROUND AND OBJECTIVES

Onion (*Allium cepa* L.) is one of the most important commercial vegetable crops grown all over the world. In India, onion occupies about 1.17 million hectare area having 18.92 million metric tonnes of production and average productivity of 16.1 metric tonnes ha^{-1}. Although India has largest area under onion in the world, its productivity is less compared to many other countries. In Maharashtra, it is grown over an area of 4.4

million hectare with total production of 5.36 million metric tonnes with average productivity of 12.1 metric tonnes ha^{-1} (Anonymous 2014-15). Onion has culinary, dietary and medicinal importance in daily life of Indian people and due to its export trade, it is a major vegetable crop to gain foreign currency. Water is not only a vital input itself, but also a mean of making other inputs available to the plant and thereby capable of increasing yield tremendously. Onion has a relatively shallow root zone crop and hence requires more frequent irrigations, as compared to other vegetable crops. The traditional irrigation method fails to supply the required quantity of water to the crop at proper time and thus, large quantity of water is lost by seepage and deep percolation. The increasing gap between the created irrigation potential and it's utilization indicate the inefficient use of water. The areas which offer considerable promise for increasing water use efficiency in irrigated agriculture are improved irrigation scheduling and improved water application methods. The use of fertilizer through drip irrigation not only improves the fertilizer use efficiency; but also saves the fertilizer input cost, prevents nutrient and is also environmentally safe. Therefore, a field experiment was aimed at determining appropriate drip irrigation schedule for onion and to assess the impact of irrigation schedules and nitrogen levels on water and nitrogen use efficiency at AICRP on Irrigation Water Management, VNMKV, Parbhani, Maharashtra, India.

RESOURCES AND METHODS

The field experiments were conducted in split plot design with irrigation schedules as main treatments and nitrogen levels as sub-treatments. Irrigation schedules comprised of drip irrigation I_1 (0.75 ETc), I_2 (1.0 ETc), I_3 (1.25 ETc) and conventional check basin irrigation at 1.0 IW/CPE with 60 mm depth of irrigation. Nitrogen levels included N_1 = 75% recommended dose of fertilizer of N, N_2 (100% RD of N) and N_3 (125% RD of N). The nursery beds were prepared a month before transplanting and seedlings of onion variety 'N-53' were grown. The seedlings were transplanted in experimental plots at a spacing of 15 cm x 10 cm. Texturally the soil was clay with field capacity of 36% and permanent wilting point of 17%. Irrigation with drip treatments (I_1, I_2 and I_3) was scheduled at an alternate day as desired by the treatments and depending on crop evapo-transpiration rate. The growth stage wise crop co-efficient was used for calculating the ETc from reference ET in case of drip irrigated plots. The crop co-efficient curve was developed using the Kc values as 0.7, 0.88, 1.05 and 0.75 for initial, crop development, mid season and late-season stage, respectively. The drip irrigation system consisted of 12 mm laterals with in-line drippers of 4.0 lph discharge spaced at 60 cm distance. Five laterals were laid in each plot. Separate arrangement of valves was provided for each treatment. For conventional irrigation, water was applied when CPE reached to 50 mm. The recommended dose of fertilizers as N: P: K (100:50:50 kg/ha) was applied through drip irrigation. Fertilizers were applied in splits through irrigation water in drip irrigated plots, while in surface irrigated plots they were conventionally applied in soil. Nitrogen was applied at 15, 30, 45, 60 and 75 days after planting (DAP) in equal splits, whereas P in two splits each of 25 kg/ha at 15 & 30 DAP. K was applied in three splits of 10: 20 and 20 kg/ ha at 15, 45 and 75 DAP. There was no serious problem of incidence of pests and diseases. However, two sprayings of *Bavistin* were taken up as preventive measures during all seasons.

OBSERVATIONS AND ANALYSIS

Data on onion bulb and stalk yields and average weight of onion bulb during three crop seasons was subjected to pooled analysis. The error of seasons was tested with Barlett's test of homogeneity. The error was homogeneous with respect to all the parameters. Hence, simple pooled means are presented. The results of analysis are presented in Table 1. The data indicate that the mean onion bulb yield (t/ha) under all drip irrigation schedules was significantly higher than the surface irrigated plots. In drip, irrigation scheduled at 1.25 ETc produced significantly higher bulb yield (t/ha), as compared to 0.75 Etc, but it was at par with 1.0 ETc during all the seasons and in pooled analysis. Likewise, application of nitrogen through fertigation in five equal splits at 100% of recommended dose of nitrogen (RDN) resulted in significantly higher bulb yield (t/ha), as compared to 125% of RDN. However, it was at par with 75% of RDN. The interaction effect of irrigation schedule and nitrogen application on onion bulb yield was not significant. Similar trend of results were also observed in respect of average weight of onion bulb (g) and stalk yields (t/ha). On the other hand, the effect of nitrogen levels on onion bulb yield (t/ha) was also significant. The nitrogen level N_2

(100% of N dose) gave significantly higher bulb yield than N_3 (125 % of N dose), but it was at par with N_1 (75% of N). The effect of nitrogen levels on average weight of onion bulb (g) was also significant, however, nitrogen level N_3 (125% N) was significantly superior to N_1 and was at par with N_2. Whereas, the effect of nitrogen level on onion stalk yield (t/ha) was non-significant. The interaction effect of irrigation schedules and nitrogen levels on onion bulb yield was significant wherein the treatment I_3 N_2 (drip irrigation at 1.25 ETc and 100 % N) gave highest onion bulb yield (68.14 t/ha) and was significantly superior to all surface and drip irrigation treatments, but it was at par with I_2N_2 (62.54 t/ha) and I_3N_1 (65.16 t/ha). Interaction effect of irrigation schedules and nitrogen level on average weight of onion bulb (g) and onion stalk yield (t/ha) was non-significant. Moreover, the highest water use efficiency was noted under irrigation schedule I_1 (drip with 0.75 ETc), followed by I_2 schedule (drip with 1.0 ETc), while the lowest was observed under I_4 (surface irrigation). On the contrary, highest nitrogen use efficiency (NUE) was observed under treatment I_3N_1 (drip irrigation with 1025 Etc depth and 75 kg/ha N), followed by I_2N_1, while the lowest was noticed under I_4N_3 treatment. All drip irrigated treatments recorded higher NUE than surface irrigated plots (Table 2).

Conclusion :

Thus, the present study indicates that in-line drip irrigation system for *Rabi* onion is better, as compared to surface irrigation system in regards to onion bulb yield, water and nitrogen use efficiency. The drip irrigation scheduled at alternate day with depth of water application as 1.25 times the crop water requirement (ETc) based on pan evaporation and crop co-efficient gives more yield than the 0.75 and 1.0 ETc. The nitrogen application through fertigation at 100 kg/ha gives significantly higher yield than 125 and 75 kg/ha both applied through fertigation.

Table 1 : Effect of irrigation schedules and nitrogen levels on onion bulb yield (Pooled)

Factors	Treatments		Onion bulb yield (t/ha)	Avg. wt. of onion bulb (g)	Onion stalk yield (t/ha)	Total water use (mm)	WUE (kg/ha-mm)
Main :							
Irrigation	I_1	Irrigation of 0.75 ETc mm by drip	61.68	128.33	6.97	302.38	20.40
schedule (I)	I_2	Irrigation of 1.00 ETc mm by drip	65.84	139.78	8.34	383.17	17.18
	I_3	Irrigation of 1.25 ETc mm by drip	69.17	140.97	9.56	463.97	14.91
	I_4	Surface irrigation of 60 mm depth at 1.0 IW/CPE	44.57	106.87	6.72	720.0	6.19
	S.E. ±		1.52	4.10	0.47	-	-
	C.D. (P=0.05)		4.45	12.02	1.38	-	-
Sub :							
Nitrogen level	N_1	75 % N (RD)*	60.71	120.18	7.11	-	-
(N)	N_2	100 % N (RD)	62.94	131.68	8.29	-	-
	N_3	125 % N (RD)	57.30	135.10	8.30	-	-
	S.E. ±		1.32	3.55	0.41	-	-
	C.D. (P=0.05)		3.86	10.41	NS	-	-
Interactions :							
(I x N)	S.E. ±		2.63	7.10	0.82	-	-
	C.D. (P=0.05)		NS	NS	NS	-	-

*RD – Recommended dose WUE – Water use efficiency NS=Non-significant

Table 2 : Nitrogen use efficiency (NUE) of onion (kg/kg of N) under different treatments

Treatments	N_1	N_2	N_3	Mean
I_1	706.3	574.7	398.4	559.8
I_2	722.4	624.5	455.7	600.9
I_3	868.8	681.4	429.0	659.7
I_4	626.4	428.1	313.1	455.9
Mean	731.0	577.2	399.1	569.1

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REFERENCES

Anonymous (2015). *Economic Survey of Maharashtra 2014-15*. Directorate of Economics and Statistics, Planning Dept., Government of Maharashtra, Mumbai, M.S. (INDIA).

Bhonde, S.R., Chougule, A.B. and Singh, N.B. (2001). Studies on the effect of age of seedlings and date of harvesting on yield and quality of onion during late *Kharif* season. *Newsletter* National Horticultural Research Development Foundation, **21**(1) : 24-26.

Charjan, Y.D., Jyothi Hadi and Prarthana Sarode (2001). Nutrient uptake and yield of onion as influenced by fertilizer levels. *J. Soils & Crops*, **11**(2): 276-277.

Chopade, S.O., Bansode, P.N., Hiwase, S.S. and Bhuyar, R.C. (1997). Effect of drip irrigation on physiological growth of onion. *Ann. Plant Physiol.*, **11**(1): pp 45-48.

Doorenbos, J. and Pruitt, W.O. 1975. Guidelines for predicting crop water requirements. *FAO Irrigation and Drainage Paper:* **24**, FAO, United Nations, Rome: 30-35.

Hussain, J. and Singh, P.N. (1994). Effect of spacing, nutrition, irrigation, interaction on lipid metabolism of onion (*Allium cepa* L.). *J. New Agriculturist*, **5**(2): 135 -140.

Kumar, Dhramendra, Kumar, Sanjay and Kumar, Ajay (2001). Effect of different levels nitrogen on growth and yield of onion (*Allium cepa* L.). *Agril. Sci.*, **21**(2): 121-123.

Maher, D.P. (1991). Studies on efficiency of liquid fertilizer through drip and surface irrigation for garlic. Unpublished M.Sc. (Ag.) Thesis, Mahatma Phule Krishi Vishwavidyala, Rahuri, Ahmednagar, M.S. (INDIA).

Patel, J.J. and Patel, A.T. (1980). Effect of N and P rate on growth and yield of onion. *Gujrat Agril. University Res. J.*, **15** (2):1-5.

Singh, D. and Sharma, R.P. (1991). Effect of soil moisture regimes and nitrogen fertilization on onion. *Indian J. Agron.*, **36**(1): 125-126.