Environment & Ecology 29 (2A) : 873—876, 2011
 ISSN 0970-0420

Effect of Different Time Lags of First Irrigation on Yield and Quality of Onion (*Allium cepa* L.)

GURTEG SINGH*, PRITPAL SINGH AND SAT PAL SAINI

Krishi Vigyan Kendra (PAU), Ropar 140001, Punjab, India
E-mail : gur_hort@rediffmail.com
**Correspondence*

Abstract

On-farm trials (OFTs) at seven different farmer's field locations in Ropar (Punjab) district were conducted during *rabi* of 2009-10 to investigate the effect of time of first irrigation on yield and yield attributes viz. seedling mortality rate, bolting and bulb weight of onion (*Allium cepa.* L.) var Punjab-Naroya. The treatments thus consisted of application of first irrigation, immediately after seedling transplantation (T_1), 2 days after transplantation (DAT) (T_2), 4 DAT (a practice prevalent among farmers, FP_1) (T_3) and 6 DAT (FP_2) (T_4). The seedling mortality rate increased significantly with increase in time lag of first irrigation to crop after sowing. Results revealed that seedling mortality rate was 3.5 and 3.3-times higher in plots irrigated at 4 and 2 DAT, respectively over T_4 (FP_2). The average bulb weight also differed significantly among different treatments. There was significant yield decline by 14.2 and 17.2% with first irrigation to crop after 4 and 6 DAT (FP_1 and FP_2), respectively over plots receiving irrigation immediately after transplanting (T_1). Results revealed that bulb yield also differed significantly among treatments, with highest bulb yield from T_1 and lowest from FP. However, the effect of different time lags of first irrigation on onion bolting was non-significant. It can be concluded that irrigating onion crop immediately after seedling transplanting helps in reducing seedling mortality and results in significantly higher bulb yield.

Key words : Bolting, Bulb yield, Bulb weight, Time lag, Onion.

Onion (*Allium cepa* L.) is an important vegetable crop in Punjab (India) grown during both *rabi* and *kharif* seasons. Punjab produces about 174 thousand tons of onion bulb from nearly 8.12 thousand ha area during 2008-09 (1). Onion production is governed by several factors viz. variety specified for a season (*rabi / kharif*), irrigation, nutrients, insect-pests quality seed, growing methods, irrigation scheduling and adoption of appropriate plant protection measures and time of first irrigation to crop after sowing. Application of first irrigation immediately after its sowing leads to bolting of onion at ripening, is the common misconception among farming community. Onion yield has been reported to be directly related to irrigation application at a particular phonological stage (2, 3) that ensures negligible losses in terms of quality and quantity (4, 5). Reduced foliage growth of onion as a consequence of prolongation of irrigation interval has also been reported (2). Therefore, on-farm trials (OFTs) were conducted at seven different farmer's field locations, characterized by irrigated sub-tropical climate to assess the effect of time of first

Table 1. Important physico-chemical characteristics of surface soils of different experimental sites.

Sites	pH (1 : 2)	EC (dS/m)	SOC (%)	Av-P (kg/ha)	Av-K (kg/ha)	Soil texture
Rasidpur (S_1)	8.05	0.231	0.415	14.6	145.5	Loamy sand
Rasidpur (S_2)	8.09	0.244	0.425	15.9	152.8	"
Sandhuan (S_3)	7.92	0.415	0.325	15.9	165.0	Sandy loam
Gopalpur (S_4)	7.85	0.214	0.445	18.2	175.0	Loamy sand
Phool (S_5)	8.23	0.333	0.355	20.8	156.5	Sandy loam
Fatehgarh Viran (S_6)	8.01	0.889	0.425	16.3	185.5	Loamy sand
Kotli (S_7)	7.72	0.225	0.455	15.2	165.5	Sandy loam

Table 2. Effect of different time lags of first irrigation on mortality rate and bulb weight at different locations.

Treat-ments	Seedling mortality rate (%)								Bulb weight (g)							
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	Mean	S_1	S_2	S_3	S_4	S_5	S_6	S_7	Mean
T_1	3.3	5.0	1.6	6.6	5.0	3.3	5.0	4.25	60	58	63	64	62	58	52	59.6
T_2	6.6	3.3	3.3	1.0	11.6	10.0	10.0	7.82	63	59	59	61	64	62	58	60.9
T_3 (FP)	15.0	13.0	16.6	16.6	15.0	13.3	16.0	15.1	59	61	62	58	60	65	63	61.1
T_4 (FP)	18.0	15.0	13.3	13.3	11.6	15.0	18.3	14.9	52	27	53	57	56	62	58	56.4
LSD (0.05)								0.9								1.8

irrigation on yield and yield attributes viz. bulb size, seedling mortality rate.

Methods

Study Area and Soil Analysis

On-farm trials (OFTs) at seven different farmer field locations were conducted during *rabi* of 2009-10 to assess the effect of time of first irrigation on onion. The description of surface (0—15 cm) soil physico-chemical characteristics of selected seven locations has been given in Table 1. Soil reaction (pH) and electrical conductivity (EC) were determined by using 1 : 2 soil : water (wt/vol basis) ratio (6). Soil organic carbon (OC) content was determined by method of Walkley and Black (7). The Olsen-P (Av-P) content in the soil samples was determined as described by Olsen et al. (8). Available-K was determined using 1N, CH_3COONH_4 (pH=7.0) followed by flame photometric estimation. The climate of different places is sub-tropical with mean maximum temperature of 42± 2 C during summer and cod winter with mean minimum temperature of 5 ± 2C during winter. The average annual rainfall in the study area varied from 600—1,200 mm, of which nearly 80% is received in monsoon months during summer season extending from July to September and rest during the winter season. The physical properties of the soil are however, favorable for crop production.

Treatment Details

Four different treatments of application of first irrigation viz., T_1 = immediately after seedling transplantation, T_2 = days after transplantation (DAT), T_3 = 4 DAT (farmers practice, FP_1) and T_4 = 6 DAT (FP_2) were compared at all seven locations. The onion var Punjab-Naroya was transplanted during January on a plot size of 5.0 × 5.0 m (25 m^2). The healthy onion seedlings were transplanted at 15.0 × 7.5 cm between and within the rows. The general recommended dose of fertilizer viz. 100 kg N, 50 kg P_2O_5 and 50 kg K_2O/ha (only in deficient soils) was applied in all the four treatments. The recommended P and K and one-half of N were applied during seedling transplantation and remaining half N, one month after transplanting. All other production and practices adopted were in accordance with the latest recommendations of Punjab Agricultural University, Ludhiana.

Plant Population and Yield Attributes

The total plants population at the time of seedling transplanting was measured at all locations. Af-

Table 3. Effect of different time lags of first irrigation on bulb yield at different locations.

Treatments	Bulb yield (q/ha)							
	S_1	S_2	S_3	S_4	S_5	S_6	S_7	Mean
T_1	400	380	376	408	376	356	364	380.0
T_2	402	392	372	392	380	344	368	378.5
T_3 (FP)	336	344	332	312	328	312	320	326.2
T_4 (FP)	328	324	316	304	300	308	324	314.8
LSD (0.05)								4.5

Table 4. Effect of different time lags of first irrigation on percent increase in yield and benefit : cost (B : C) ratio in onion.

Treatments	Average yield (q/ha)	Per cent increase over T_4	Average cost of cash inputs (Rs/ha)	Average gross returns (Rs/ha)	Average net returns (Rs/ha)	B : C ratio
T_1	380	20.71	38,000.0	133,000.0	95,000	3.50
T_2	378.5	20.23	38,000.0	132,475.0	94,475	3.48
T_3 (FP)	326.2	3.62	38,000.0	114,170.0	76,170	3.00
T_4 (FP)	314.8	–	38,000.0	110,180.0	72,180	2.89

ter 30 days interval number of plants / m^2 from each treatment plot were also counted for working out the seedling mortality rate. Bulb weight was measured on randomly selected 100 bulbs per treatment at the time of harvesting. The crop yield was taken on whole plots basis.

Statistical Analysis

Statistical analysis of crop yield was carried out by analysis of variance in randomized block design. Mean separation for different treatments was performed using least significant difference (LSD) test at 0.05 level of probability.

Results and Discussion

Seedling Mortality Rate

The effect of different time lags of first irrigation on seedling mortality measured after 30 days of transplanting at different locations has been shown in Table 2. The results revealed that seedling mortality rate in plots irrigation immediately after seedling transplanting varied from 1.6 to 6.6% at different sites with an average of 4.3%, in comparison to plots irrigated at 2 DAT (T_2) where seedling mortality rate varied from 3.3 to 11.6% with an average of 7.8% (Table 2). The comparison of average (n = 7) seedling mortality rate was significantly ($P \leq 0.05$) higher in T_3 and T_4, (15.1 and 14.8%, respectively) over T_1 and / or T_2. However, the effect of applying first irrigation to onion immediately after seedling transplanting (T_1) in reducing seedling mortality was significantly ($P \leq 0.05$) higher than applying first irrigation 2 DAT (T_2) (Table 2). The desiccation of roots in dry soil can be the reason for higher seedling mortality rate in T_3 and T_4, as compared to another two treatments where crop received irrigation water immediately after transplanting. Further, the surface evaporation of soil moisture over a period of time leads to desiccation of tender roots and results in seedling mortality. Thus, it can be concluded that seedling mortality rate in *rabi* onion can significantly ($P \leq 0.05$) be reduced by applying irrigation to onion, immediately after seedling transplanting.

Bulb Weight

Bulb weight measured from different treatments at the time of harvesting the crop varied at different sites, depending upon the fertility of soil. The variation in bulb weight from different treatment plots at different locations was statistically significant ($P \leq 0.05$) and followed the reverse trend to seedling mortality rate (Table 2). Averaging (n = 7) across the different experimental sites, the bulb weight was 58.6 g/bulb from plots irrigated immediately after seedling transplanting (T_1), that was 2.2% and 2.6% lower than plots irrigated 2 DAT (T_2) and 4 DAT (T_3), respectively. The results thus revealed that irrigating the field between 2 to 4 DAT facilitates seedling establishment and rapid growth of bulb. Such effect may be attributed to the influence of adequate moisture content in the surface layer of soil that facilitates optimum nutrient uptake from basal applied fertilizer.

Plant Bolting and Bulb Yield

The results on plant bolting observed at the time of crop harvesting revealed non-significant

($P \leq 0.05$) difference among different compared treatments at all locations (data not given). Average (n = 7) bulb yield differed significantly among different treatment (Table 3). However, highest bulb yield was recorded from plots irrigated immediately after first irrigation (T_1), that reflects an increase of 14.5 and 20.7% higher average yield over T_3 (FP_1) and T_4 (FP_2), respectively. Significant reduction in foliage growth and bulb yield as a result of prolongation of irrigation interval in onion reported by Abu-Gareb (2) and Koriem et al. (9) supports our results.

Economic Returns

The comparison of economics related to different production and protection practices adopted in different treatments has been given in Table 4. Average cost of cash inputs incurred for the different treatments was similar, because the irrigation water interval was the varying factor, and that has been the free of cost input in Punjab agriculture. However, because of variation in average bulb yield in different treatments, average gross returns to the growers were higher from T_1 as compared to other treatment plots (Table 4). Average gross returns were linearly elated to the average bulb yield obtained from specific treatments. Additionally, average net returns for specific treatments was worked out by subtracting the average cost incurred also reflects positive effect of applying irrigation to *rabi* onion immediately after transplanting. Further, higher benefit cost (B : C) ratio worked out by dividing average gross returns by average cost of cash inputs than either (T_3 and / or T_4) of the compared FP, demarcates the superiority of applying first irrigation to onion immediately after transplanting (Table 4).

References

1. Anonymous. 2010. *Package of practices for vegetable crops.* Punjab Agric. Univ., Ludhiana, Punjab, India.
2. Abu Gerab O. S. 1987. *Effect of same cultural treatments on onion* (*Allim sepa*, L.). Ph. D. thesis. Fac. Agric. Minufiya Univ., Egypt.
3. Abu Awwad A. M. 1996. Irrigation water management for onion trickle irrigated with saline drainage water. Dirasat series-B. Pure and Appl. Sci. 23 : 46—54.
4. Battilani A., P. Mannini and I. Pietrosi. 1986. Sperimentazione irrigua sulla cipolla in emilia Raniaga Tai del. 1^0. Convego Nazional sulla Cipola, Bolagna, Gennaio. 28—29 pp.
5. Hedge D. M. 1988. Effect of irrigation and nitrogen fertilization on yield, quality, nutrient uptake and water use of onion (*Allium cepa* L.). *Singapore J. Prim. Indust.* 16 : 111—123.
6. Jackson M. L. 1967. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi, India.
7. Walkley A. and C. A. Black. 1934. An examination of the digestion method for determining soil organic matter and a proposed modification of the Chromic acid titration method. *Soil Sci.* 37 : 29—38.
8. Olsen S. R., C. V. Cole, F. S. Watanabe and L. A. Dean. 1954. *Estimation of available phosphosrus by extracting with sodium carbonate.* USDA Circular 939, US Govt. Printing Office, Washington DC, USA.
9. Koriem S. O., M. M. A. EL-Koliey and M. F. Wahba. 1994. Onion bulb production from "Shandweel" sets as affected by soil moisture stress. *Assiut J. Agric. Sci.* 25 : 185—193.