Indian Journal of Weed Science **44**(3): 151–158, 2012

Performance of onion under weed and fertilizer management

T.U. Patel*, C.L. Patel, D.D. Patel, J.D. Thanki, M.K. Arvadia and H.B. Vaidya
Department of Agronomy, N.M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat 396 450

Received: 17 May 2012; Revised: 28 August 2012

ABSTRACT

In the new alluvial soil of Navsari (Gujarat), a field experiment was conducted in *Rabi* season to study the yield, quality and post harvest life of onion (*Allium cepa* L.) cv. '*Gujarat Onion White-1'* as affected by weed management and fertilizer levels during two conjunctive years of 2008-09 and 2009-10. Weed population were decreased significantly with application of pendimethalin 1 kg/ha or oxyfluorfen 0.24 kg/ha supplement with one hand weeding at 40 DAT during both the season of investigation. *Echinochloa* spp., *Trianthema portulacastrum, Digera arvensis*. *Physalis minima*. and *Cynodon dactylon*. were found as major weeds in experiment field. Further, pendimethalin 1.0 kg/ha followed by one hand weeding produced higher onion bulb yield of 39.3, 36.6 and 38.0 t/ha during both years as well as in pooled, respectively and found at par with oxyflourfen 0.24 kg/ha + one hand weeding at 40 DAT and weed free treatments. In pooled, increasing fertilizer rate from 75% to 125% of RDF was found effective and the higher level of fertilizer (125% RDF) gave the highest bulb yield, which was 10.52 and 19.43% more than of the F_2 and F_1 levels respectively. Regarding post harvest life of bulbs, weight losses (%), black mould development (%) and sprouting (%) were remained unaffected by weed management and fertilizer levels except significantly higher weight losses (%) was observed under weed management treatment. On the basis of interaction, it is inferred that the treatment combination of (pendimethalin 1 kg/ha *fb* one hand weeding at 40 days after transplanting supplement with 100% RDF) found most appropriate (39.86 t/ha) and profitable not only to secure the net return of ₹ 2,69,422/ha with 7.85 BCR per unit cost of onion production but also save 25% of fertilizer.

Key words: Fluazifop-p-butyl, Pendimethalin, Quality, Onion, Oxyfluorfen, Weed management

Onion (*Allium cepa*) is one of the most important bulb crop having huge export potential, growly in country. With export earning worth ₹ 1816.14 crores, onion and garlic become major foreign exchange earners for India among vegetables standing second rank in the world. India produces 7729.13 MT of onion from 554.15 ('000 ha) of area (Anon. 2010). In spite of being a major onion producing country , India has very low productivity as compared to many other countries. Among several factors, weed and fertilizer management are two important aspects for proper growth and yield of the crop. Onion has very poor comparative ability with weeds due to its inherent characteristics such as short stature, non branching habit, sparse foliage, shallow root system and extremely slow growth during initial stage. Yield losses due to weeds infestation in onion were as high as 82.2% (Tewari *et al.* 2003). Hand weeding, is effective, but it is time consuming and uneconomical. Further, onion requires higher levels of N, P and K fertilizer for maximum yields then most of other vegetable crops. The shallow root and dense population of onion make them responsive to fertilizers. Since fertilizer is a major input in the production process, there is a need to rationalize its use as an underutilization can lead to sub optimal yield. Moreover, the recommendation is based on several factors such as previous cropping, soil type, fertility level and variety to be grown. On the other hand, when used excessively, it can reduce yield, affect post harvest quality and constitute a threat to the environment with respect to surface and ground water pollution. This study was undertaken to assess the need for developed effective weed and fertilizer management strategies for onion bulb crop.

***Corresponding author:** tushagri.ank@nau.in

MATERIALS AND METHODS

A field experiment was conducted during 2008-09 and 2009-10 at the research farm of Navsari agricultural University, Navsari (20^o 57' N latitude, 72^o 54' E longitude) Gujarat. The soil was clay in texture, having 0.59% organic C, medium in available nitrogen (224 kg/ha) and phosphorus (40 kg/ha), fairly rich in available potassium

(362 kg/ha) and slightly alkaline in reaction (pH 7.6) with normal electrical conductivity. There were thirty treatment combinations consisting of ten treatments of weed management, *viz.* W_1: Pendimethalin 1 kg/ha as pre-emergence, W_2: Oxyfluorfen 0.24 kg/ha as pre-emergence, W_3: Pendimethalin 1 kg/ha pre-emergence + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_4: Oxyfluorfen 0.24 kg/ha pre-emergence + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_5: Pendimethalin 1 kg/ha pre-emergence + one hand weeding at 40 DAT, W_6: Oxyfluorfen 0.24 kg/ha pre-emergence + one hand weeding at 40 DAT, W_7: Hand weeding at 20 DAT + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_8: Two hand weeding at 20 and 40 DAT, W_9:Weed free control (hand weeding at 20, 40 and 60 DAT), W_{10}: Weedy check and three treatments of fertilizer levels, *viz.* F_1: 75% RDF (75:37.50:37.50, N:P_2O_5:K_2O kg/ha), F_2: 100% RDF (100:50:50, N:P_2O_5:K_2O kg/ha), F_3:125 % RDF (125:62.5:62.5, N:P_2O_5:K_2O kg/ha). These treatment combinations were laid out in randomized block design with factorial having three replications.

Common application of well decomposed FYM 10 t/ha was uniformly applied to all the experimental units before transplanting. The basal dose of fertilizers, consisting of full dose of P_2O_5 through SSP and K_2O through MOP, half dose of N through urea as per the treatment was applied manually. The remaining dose of N was supplied at 30 days after transplanting. The onion cv '*Gujarat Onion White-1*' was sown on 21st may and 23rd may, 2009 and 2010, respectively. Row-to-row spacing was maintained at 15 cm, whereas plant-to-plant spacing was 10 cm. All the agronomic management practices were followed as per the standard recommendations. Herbicide was spray according to treatment. All the herbicides were applied as pre-emergence using knapsack sprayer fitted with flat fan nozzle attached with the hood of sprayer by mixing in 500 L of water/ha as per treatment. Onion was harvested when the tops begin to fall and the bulbs were mature. The concentration of various nutrients like N, P, K and S in onion bulb crop was estimated by methods as given by Prasad *et al.* (2006). The nutrient uptake was determined by multiplying the concentration with their dry matter accumulation.

Data on weeds population were recorded at 20 and 40 days after sowing. The observations of weed density and their dry matter were taken randomly from 1.0 m^2 quadrate from net plot area. Same were harvested and then oven dried for 48 hours at 70 ^{0}C. Weed control efficiency (WCE) was calculated on the basis of formula suggested as per bellowed.

Biometric observations on onion bulb crop *viz.*, weight, volume and diameter of bulb and dry weight of weeds were recorded at harvest of the crop and weed count at 40 days after transplanting. Sale price of output was: onion bulb, ₹ 8/kg; input price (kg): FYm, ₹ 1; Pendimethalin, ₹ 360; oxyfluorfen, ₹ 480; fluziffop-p-butyl, 1330; urea, ₹ 5.57; SSP, ₹ 4.21 and MOP, ₹ 5.34; labour wage, ₹ 100/man/day.

Data on weed density and dry weight was subjected to square root transformation before analysis. Treatment effects in both years were same so pooled analysis of data was made. The data recorded were statistically analyzed using MSTATC Software. The purpose of analysis of variance was to determine the significant effect of treatments on weeds and maize. LSD test at 5% probability level was applied when analysis of variance showed significant effect for treatments (Steel and Torrie 1980).

RESULTS AND DISCUSSION

Effect on weeds

The dominant weeds identified in the experimental plots during the course of investigation were *Echinochloa crusgalli* and *Echinochloa colonum*, *Eleusine indica*, *Eragrostis major* among monocots, while *Trianthema* ssp., *Amaranthus* spp., *Eclipta alba*, among dicot weeds. *Cyperus rotundus* was the only sedge found throughout the growing season. Grasses, broad-leaved weeds and sedges accounted about 67, 29 and 4% of the total weeds in weedy plot at 40 days after sowing

Implementation of various weed management treatments had greater influenced over the total weed population during the crop growth. Among the treatment tested the W_{10}: (weedy check) treatment recorded the highest weed density and dry matter of weeds (Table 1). The maximum dry weight of weeds may be due to the increased weed population and continuous growth and may also be due to the higher amount of nutrient removal. Application of either pendimethalin at 1.0 kg/ha or oxyfluorfen at 0.24 kg/ha supplement with one hand weeding at 40 days after transplanting recorded the least weed population. All the treatments applied with herbicides conjunction with one hand weeding resulted in significantly reduce dry weight of weeds. The population of sedge weed (*Cyperus rotundus*) was not influenced more due to different weed management treatments. Because, perennial nature and under ground net-work of this weed. Effectiveness of various herbicides against different weed species in onion crop has been reported by many workers including Kathiresan *et al.* (2004) and Tripathi *et al.* (2008).

Different fertilizer levels had significant effect on total weed population. At 40 days after transplanting, increased rates of fertilizer simultaneously increased the total weeds population being lowest with F_1 (75% RDF) and highest with F_3 (125% RDF) during both years of experimentation. Moreover, dry weight of weeds was significantly influenced by fertilizer levels at 40 DAT and at harvest. Dry weight remained lowest in F_1 treatment (Table 1). Data clearly indicated that increasing the fertilizer rate, increased the availability of nutrients for growth and development of weeds ultimately dry weight of weeds was increased.

Effect on onion

Significantly the highest weight, volume and diameter of onion bulb was recorded under treatment W_5 (pendimethalin 1.0 kg/ha + one hand weeding at 40 DAT) which was remained at par with treatment W_6 (oxyfluorfen 0.24 kg/ha + one hand weeding at 40 DAT) during both the years. While weedy check (W_{10}) recorded the lowest weight and volume of onion bulb during both the years (Table 2). The superiority of all these yield attributing characters under W_5 or W_6 may be due to timely and effective control of broad spectrum of weeds in the critical stage of competition which reduce crop-weed competition for space, light, moisture and nutrients. However, treatment W_{10} had suppressing effect on onion crop because higher weed population and dry weight of weeds leads to more crop-weed competition for nutrients, space, light and water.

All the weed management treatments produced significantly higher bulb yield than weedy check. The highest onion bulb yield (39.33, 36.60 and 37.97 t/ha, respectively) were obtained under treatment W_5 (pendimethalin 1 kg/ha supplement with one hand weeding) followed by treatments W_6 and W_9 during both the years as well as in pooled analysis, respectively (Table 2). These because of the fact that the weed population and weed growth remain low from initial crop growth as compared to weedy check. The reduced crop-weed competition provide better environment for proper development of growth as well as and yield attributes, *viz.* bulb diameter, bulb volume and bulb weight, ultimately leading to the enhanced bulb yield. This might be due to proper weed management treatments controlled weeds effectively, reduced the competition from the weeds to a greater extent and thus helped in faster growth and development of onion bulb crop, resulting in obtaining higher values of all yield attributing characters. The findings are in closely vicinity of those reported by Warade *et al.* (2006) and Saraf (2007) with respect to onion yield.

Yield obtained from weed free treatment (W_9) was lower as compared to treatments W_5 and W_6 due to disturbance of shallow root system by repeated hand weeding, being narrow spacing crop, manual hand weeding also damaged the leaves and plant parts, ultimately reduced the photosynthetic actively of plants. This finding is in conformity with those of Singh *et al*. (2001).

Different levels of RDF significantly altered the bulb weight, volume of bulb and diameter of bulb thereby increased the yield of onion (Table 1). The data regarding bulb yield showed that F_3 (125%) levels of RDF proved their superiority by producing significantly higher bulb yield to tune of 19.43 and 10.52%, respectively over F_2 and F_1. The increase in bulb yield could be attributed to increase in equatorial diameter of bulb recorded with the same level (F_3) of fertilizer and thereby increase in average bulb weight and volume. The better development of almost all yield parameters under F_3 treatment ultimately resulted into higher bulb yield. Higher dose of N promoting growth parameters might be due to fact that the net assimilation rate of the N fed to plants was accelerated due to increase in chlorophyll content and the absorbed N helped in formation of food reservoir due to higher photosynthetic activity, which increases the diameter of bulb. Further, P also influences the cellular activity in the roots and leaves which resulted in to increased yield. Similarly, the increased in growth and yield attributes may be due to encourageous effect of potassium on root development, formation of carbohydrates, regulation of water and translocation of photosynthates (Singh *et al*. 2004). The results of present investigation are also in agreement with the findings reported by Jayathilake *et al*. (2002).

Nutrient removal by weed and crop

More quantum of nutrients were taken up by weeds resulting in the reduction of availability of nutrients to the crop, which adversely affected the crop growth by creating greater competition and finally the reduction in yield of onion bulb and this was evidenced from the poor yield obtained in weedy check (W_{10}). The result of nutrient removed by weeds and crop are presented in Table 4.

Nitrogen, phosphorus, potassium and sulphur content of onion bulb and weeds did not differ significantly due to different weed management practices during both the years. Contrary to this, significantly the lowest uptake of nitrogen, phosphorus, potassium and sulphur by weeds were noted under treatment W_5 (pendimethalin 1 kg/ha + one hand wedding at 40 DAT) and found on same bar with treatments W_6, W_9, W_3 and W_4 during both the years of

Table 1. Weed growth and weed control efficiency as influenced by weed management and fertilizer levels

Treatment	Weed population/m^2				Dry weight of weeds (g/m^2)				WCE (%)		WCI (%)	
	At 20 DAT		At 40 DAT		At 40 DAT		At harvest					
	08-09	09-10	08-09	09-10	08-09	09-10	08-09	09-10	08-09	09-10	08-09	09-10
Weed management												
W_1	2.3 (4.6)	2.3 (4.4)	5.6 (30.2)	5.8 (32.33)	10.7	11.5	42.7	67.7	51.8	46.3	15.0	13.1
W_2	2.7 (6.6)	2.6 (5.8)	5.5 (30.0)	6.2 (36.78)	11.0	13.7	51.8	76.8	41.6	39.1	17.1	16.5
W_3	2.4 (4.9)	2.2 (3.9)	5.5 (30.0)	5.7 (30.89)	10.5	11.0	23.9	38.9	73.0	69.1	2.5	5.3
W_4	2.5 (5.6)	2.4 (4.7)	5.7 (32.0)	5.7 (31.78)	11.5	11.6	28.1	40.1	68.3	68.2	2.7	6.2
W_5	2.2 (3.9)	2.1 (3.9)	5.6 (30.0)	5.5 (28.89)	10.5	10.7	17.2	32.2	80.6	74.5	-5.2	-4.2
W_6	2.4 (4.9)	2.4 (5.0)	5.7 (31.3)	5.9 (34.22)	11.1	12.5	23.6	35.9	73.4	71.5	-4.1	-1.7
W_7	7.9 (60.8)	9.0 (80.2)	7.5 (57.9)	8.4 (70.67)	19.8	24.5	63.7	91.8	28.2	27.2	3.0	8.2
W_8	8.0 (62.6)	9.3 (86.2)	7.3 (53.3)	8.8 (77.11)	18.2	27.0	55.5	85.5	37.3	32.2	11.7	16.5
W_9	7.9 (61.0)	9.3 (86.6)	7.5 (55.7)	8.6 (73.78)	19.6	26.0	25.5	37.7	71.2	70.1	-	-
W_{10}	8.1 (64.1)	9.4 (87.8)	10.2 (103.2)	11.9 (142.0)	32.6	44.9	88.6	126.1	-	-	36.7	52.0
LSD P=0.05)	0.41	0.63	0.67	0.54	3.51	107.87	3.21	125.52				
Fertilizer levels												
F_1	4.5 (27.4)	4.8 (33.3)	6.2 (39.10)	6.9 (50.2)	13.5	17.5	36.8	56.7				
F_2	4.5 (26.9)	5.1 (37.4)	6.5 (43.3)	7.3 (57.0)	14.7	19.5	42	64.8				
F_3	4.8 (29.4)	5.4 (39.9)	7.1 (53.7)	7.5 (60.3)	18.5	21.0	47.4	68.3				
LSD P=0.05)	0.23	0.35	0.36	0.30	1.92	1.76	59.08	68.75				

Data in parentheses indicate actual values and outside parentheses indicate ($\sqrt{X+1}$) transformed values

WCE: weed control efficiency, WCI: weed control index

W_1: Pendimethalin 1 kg/ha as pre-emergence, W_2: Oxyfluorfen 0.24 kg/ha as pre-emergence, W_3: Pendimethalin 1 kg/ha pre-emergence + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_4: Oxyfluorfen 0.24 kg/ha pre-emergence + Fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_5: Pendimethalin 1 kg/ha pre-emergence + One hand weeding at 40 DAT, W_6: Oxyfluorfen 0.24 kg/ha pre-emergence + One hand weeding at 40 DAT, W_7: Hand weeding at 20 DAT + fluazifop-p-butyl 0.25 kg/ha at 40 DAT, W_8: Two hand weeding at 20 and 40 DAT, W_9: Weed free control (Hand weeding at 20, 40 and 60 DAT), W_{10}: Weedy check

F_1: 75% RDF (75:37.50:37.50, N:P_2O_5:K_2O kg/ha), F_2: 100% RDF (100:50:50, N:P_2O_5:K_2O kg/ha), F_3: 125% RDF (125:62.5:62.5, N:P_2O_5:K_2O kg/ha).

experimentation, except W_4 during second year. The highest uptake of nutrients, *viz.* N, P, K and S by weeds and lowest by crop were registered under treatment weedy check (W_{10}) because of maximum dry weight of weeds may be due to the higher weed population and continuous growth of weeds throughout crop period. Nutrients depletion was decreased with the adoption of weed control programme might be due to lower dry matter production.

In majority of the cases the different levels of RDF failed to produce any significant effect on macronutrient content (N, P, K and S) in weeds during both the years. On an average, uptake of major nutrients by weeds was found significantly and the highest and lowest value was noted under treatment F_3 and F_1, respectively. This was because increase in the rate of fertilizer simultaneously increased

Table 2. Yield attributes, yield and economics of onion bulb crop as influenced by weed management and fertilizer levels

Treatment	Volume of bulb (cm^3)		Diameter of bulb (cm)		Bulb yield (t/ha)			Net realization ($x10^3$ ₹/ha)	B:C ratio
	08-09	09-10	08-09	09-10	08-09	09-10	Pooled		
Weed management									
W_1	50.13	41.09	5.85	4.82	31.8	30.2	31.0	215.66	6.67
W_2	49.36	39.81	5.92	4.76	31.0	29.0	30.0	208.45	6.59
W_3	56.14	48.47	6.52	6.01	36.5	32.9	34.7	242.00	6.83
W_4	55.58	47.44	6.28	5.90	36.4	32.6	34.5	240.05	6.72
W_5	58.29	52.01	7.42	6.36	39.3	36.6	38.0	269.42	7.85
W_6	57.56	51.40	7.17	6.31	38.9	35.3	37.1	263.41	7.83
W_7	55.46	46.27	6.06	5.63	36.3	31.9	34.1	236.89	6.63
W_8	54.49	44.26	5.93	5.17	33.0	29.0	31.0	213.43	6.16
W_9	56.44	48.81	7.00	6.08	37.4	34.8	36.1	251.91	6.87
W_{10}	38.36	26.34	4.73	2.90	23.7	16.7	20.2	130.71	4.26
LSD P=0.05)	3.40	3.52	0.46	0.48	2.60	2.35	1.76		
Fertilizer levels									
F_1	50.19	38.75	5.66	4.82	31.9	27.9	29.9	206.32	6.28
F_2	53.47	44.91	6.36	5.41	34.1	30.5	32.3	224.86	6.69
F_3	55.88	50.10	6.85	5.95	37.3	34.2	35.7	251.32	7.31
LSD P=0.05)	1.86	1.93	0.25	0.26	1.42	1.29	0.94		

Table 3. Interaction effect of weed management and fertilizer levels on onion bulb yield (t/ha)

Fertilizer level	Weed management									
	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	W_9	W_{10}
Weight of bulb (g/bulb)										
2008-2009										
F_1	63.0	53.9	75.1	67.8	71.0	73.1	65.4	63.4	69.0	44.3
F_2	72.1	63.8	76.6	77.0	82.9	80.4	72.3	64.1	80.1	45.0
F_3	58.8	72.1	77.9	81.4	86.2	84.4	80.2	75.3	84.2	46.2
LSD (P=0.05)					8.46					
2009-2010										
F_1	56.5	48.0	68.9	61.4	64.7	67.3	59.4	57.4	61.8	38.3
F_2	66.1	57.8	70.3	71.0	76.6	74.4	66.3	58.2	72.8	39.0
F_3	52.8	65.9	71.7	75.4	80.2	78.0	73.8	68.8	77.1	40.2
LSD (P=0.05)					8.62					
Bulb yields (t/ha)										
2008-09										
F_1	31.47	26.54	35.86	33.34	33.57	36.34	33.10	31.57	33.59	23.60
F_2	27.74	29.67	36.48	36.21	41.24	39.38	36.92	31.27	38.63	23.26
F_3	36.14	36.73	37.03	39.52	43.19	41.04	38.77	36.20	39.92	24.09
LSD (P=0.05)					4.50					
2009-10										
F_1	28.63	25.42	32.80	29.93	31.48	31.24	28.01	26.12	28.92	16.59
F_2	27.91	27.69	32.23	32.48	38.47	36.47	32.13	27.01	36.17	16.17
F_3	34.13	34.02	33.71	35.38	40.09	38.31	35.58	33.92	39.18	17.30
LSD (P=0.05)					4.07					
Pooled										
F_1	30.05	25.98	34.33	31.63	32.52	33.79	30.55	28.84	31.26	20.10
F_2	27.83	28.68	34.35	34.34	39.86	37.93	34.53	29.14	37.40	19.72
F_3	35.14	35.37	35.37	37.45	41.64	39.67	37.17	35.06	39.55	20.70
LSD (P=0.05)					2.85					

Table 4. Nutrient uptake (kg/ha) by weed and crop as influenced by weed management and fertilizer levels

Treatment	2008-09				2009-10			
	N	P	K	S	N	P	K	S
Weeds								
Weed management								
W_1	4.70	0.86	5.57	2.22	7.47	1.42	8.98	3.62
W_2	5.67	1.05	6.67	2.70	8.56	1.61	10.16	4.07
W_3	2.70	0.50	3.18	1.26	4.33	0.79	5.28	2.11
W_4	3.14	0.57	3.71	1.47	4.53	0.82	5.38	2.17
W_5	1.98	0.37	2.32	0.94	3.76	0.69	4.42	1.74
W_6	2.69	0.50	3.16	1.29	4.13	0.77	4.94	1.92
W_7	7.04	1.32	8.52	3.39	10.29	1.90	12.56	5.06
W_8	6.00	1.13	7.19	2.99	9.22	1.77	11.28	4.59
W_9	2.85	0.54	3.44	1.39	4.21	0.80	5.12	2.07
W_{10}	9.69	1.77	11.26	4.62	13.89	2.55	16.57	6.72
LSD (P=0.05)	1.14	0.23	1.40	0.56	1.61	0.32	1.94	0.76
Fertilizer levels								
F_1	3.94	0.73	4.71	1.90	6.13	1.14	7.38	2.98
F_2	4.66	0.86	5.55	2.22	7.27	1.35	8.76	3.47
F_3	5.34	0.99	6.25	2.57	7.71	1.45	9.27	3.76
LSD (P=0.05)	0.62	0.13	0.77	0.31	0.88	0.18	1.06	0.41
Crop								
Weed management								
W_1	62.16	16.16	72.67	32.58	53.50	14.10	63.47	28.75
W_2	60.20	16.14	70.93	32.13	51.98	13.64	61.26	27.80
W_3	85.90	22.35	100.24	44.95	71.35	18.62	85.55	38.56
W_4	84.10	22.13	99.04	44.70	70.84	18.97	83.87	37.92
W_5	101.18	27.24	118.73	52.39	88.73	22.10	101.97	45.97
W_6	99.50	26.60	114.87	51.89	84.09	21.45	99.02	43.90
W_7	81.36	21.03	96.42	43.81	65.39	18.05	79.63	35.66
W_8	66.72	17.76	78.53	36.78	54.64	14.87	65.02	29.73
W_9	91.17	23.44	105.94	47.97	76.70	20.91	92.07	41.47
W_{10}	32.17	8.29	36.97	17.06	19.52	5.21	23.18	10.52
LSD (P=0.05)	11.70	3.11	11.18	5.80	10.11	3.31	11.91	5.51
Fertilizer levels								
F_1	63.26	16.57	74.07	32.66	50.81	13.02	60.15	26.99
F_2	76.88	20.18	90.15	40.35	64.17	16.95	75.94	34.13
F_3	89.19	23.60	104.07	48.27	76.05	20.40	90.42	40.95
LSD (P=0.05)	6.41	1.70	6.12	3.17	5.54	1.81	6.53	3.02

availability of these nutrients in soil solution, resulting in higher absorption of nutrients. Similarly, the higher levels of fertilizer application (125% RDF) exerted its superiority in recording the higher uptake of NPK and S by onion bulb crop as well as weeds during both years of experimentation.

Interaction effect

Significantly increased in onion bulb yield was observed with increasing levels of fertilizers applied to onion bulb crop coupled with weed management treatment of pre emergence application of pendimethalin at 1.0 kg/ha supplemented with one hand weeding at 40 DAT. On pooled basis, the treatment combination of W_5F_3 recorded higher onion bulb yield over rest of the treatment combinations except treatment combinations of W_6F_3, W_9F_3 and W_5F_2.

Post-harvest life

At 30, 60 and 90 days after harvest, the highest weight losses were observed with treatment W_5 but it did not differ statistically with treatments W_6, W_9, W_3 and W_4 at different stages of storage. The lowest weight loss was recorded with unwedded control (W_{10}) at all the storage stages during both the years (Table 5). Black mould development was found non significant due to weed management. Fertilizer levels did not altered post harvest life of onion bulb. In case of sprouting, there was no sprouting of onion bulb during storage period of both the years of investigation.

Table 5. Post-harvest losses of onion bulb as influenced by weed management and fertilizer levels

Treatment	Weight losses during storage (%)					
	2008-09			2009-10		
	30 DAH	60 DAH	90 DAH	30 DAH	60 DAH	90 DAH
Weed management						
W_1	11.46 (3.97)	13.87 (5.76)	14.71 (6.46)	13.40 (5.39)	16.33 (7.96)	20.48 (12.36)
W_2	11.54 (4.04)	13.95 (5.83)	14.78 (6.53)	13.48 (5.45)	16.44 (8.08)	20.64 (12.49)
W_3	12.66 (4.83)	14.91 (6.64)	15.70 (7.34)	14.48 (6.27)	18.10 (9.70)	21.81 (14.10)
W_4	12.28 (4.64)	14.62 (6.45)	15.43 (7.15)	14.16 (6.08)	17.54 (9.31)	21.98 (13.72)
W_5	12.99 (5.08)	15.25 (6.94)	16.02 (7.64)	14.82 (6.57)	18.59 (10.21)	22.50 (14.64)
W_6	12.70 (4.87)	15.00 (6.72)	15.79 (7.42)	14.57 (6.35)	18.19 (9.81)	21.67 (14.22)
W_7	10.59 (3.53)	13.27 (5.35)	14.16 (6.05)	12.79 (4.99)	15.13 (7.14)	19.74 (11.53)
W_8	11.33 (3.91)	13.79 (5.72)	14.64 (6.42)	13.28 (5.31)	16.19 (7.86)	20.29 (12.22)
W_9	12.53 (4.78)	14.84 (6.61)	15.64 (7.31)	14.39 (6.24)	17.93 (9.63)	22.17 (14.02)
W_{10}	10.77 (3.51)	13.27 (5.29)	14.14 (5.99)	12.76 (4.90)	15.29 (7.00)	19.70 (11.41)
LSD (P=0.05)	1.41	1.14	1.08	1.20	2.03	1.66
Fertilizer levels						
F_1	11.59 (4.10)	13.98 (5.88)	14.82 (6.58)	13.51 (5.51)	16.51 (8.20)	20.46 (12.60)
F_2	11.73 (4.23)	14.16 (6.04)	14.99 (6.74)	13.71 (5.68)	16.75 (8.51)	21.33 (12.92)
F_3	12.34 (4.62)	14.69 (6.47)	15.49 (7.17)	14.23 (6.08)	17.67 (9.31)	21.50 (13.70)
LSD (P=0.05)	NS	NS	NS	NS	NS	NS

Data in parentheses refer to actual per cent bulb weight losses, DAH - Days after harvestz
Black mould development (%) was not affected due to various treatments
In case of sprouting (%), there was no sprouting of onion bulb during storage period

Economicas

From the economics point of view, the highest net profit of ₹ 2,69,422/ha was obtained from treatment W_5 (pendimethalin 1 kg/ha + one hand weeding at 40 DAT) with CBR value of 7.85 followed by treatments W_6 (₹ 263410/ha) and W_9 (₹ 2,51,910/ha) with CBR values of 7.83 and 6.87, respectively.

Different levels of fertilizer produced significant effect on economics of onion and the maximum net return of ₹ 2,51,317/ha with B:C ratio of 7.31 were registered with treatment F_3 (125 % RDF). The 75 % RDF (F_1) treatment shows lowest monitory return and BCR (Table 1).

On the basis of interaction, maximum net realization and B: C ratio was recorded with W_5F_3 followed by W_6F_3, W_9F_3 and W_5F_2. Whereas, minimum net realization and B: C ratio was recorded with $W_{10}F_2$. It is inferred that the application of pendimethalin at 1.0 kg/ha followed by one hand weeding at 40 DAT and fertilized crop with 100:50:50 kg NPK/ha (100% RDF) treatment combination found most appropriate and profitable not only to secured the net return per unit cost of onion production but also save 25% of fertilizer.

The result of the study undertaken to find out the effective weed and fertilizer management strategies in onion bulb crop revealed that pre-emergence application of either pendimethalin at 1.0 kg/ha or oxyfluorfen at 0.24 kg/ha supplement with one hand weeding at 40 days after transplanting prove efficient weed management strategies. Further, application of fertilizer at 125:62.5:62.5 kg NPK/ha gave higher and profitable onion bulb yield.

REFERENCES

Anonymous. 2010. http://www.msamb.com/english/export/canalising.htm

Jayathilake RSK, Reddy IP, Shihari D, Neeraja G and Reddy R. 2002. Effect of nutrient management on growth, yield and yield attributes of *Rabi* onion. *Vegetable Science* **29**(2): 184–185.

Kathiresan RM, Gnanavel I, Jayakanth UV, Arulchezhian MP, Anbhazhagan R and Padmapriya S. 2004. Bio-efficacy and phytotoxicty of oxidiargyl in onion (*Allium cepa* L.va. *aggregatum*). *Indian Journal of Weed Science* **36**(3&4): 236–238.

Singh R, Nanadal TR and Shukla YR. 2001. Weed intensity and onion bulb yield as influnced by different weed management practices. *Crop Research* **22**(1): 32–37.

Saraf RK. 2007. Herbicidal weed control in *Kharif* onion. *Asian Journal of Horticulture Science* **2**(1): 1–5.

Singh S, Yadav PK and Singh B. 2004. Effect of nitrogen and potassium on growth and yield of onion (*Allium cepa* L.) cv. *Pusa Red*. *Haryana Journal of Horticultural Sciences* **33**(3&4): 308–309.

Tewari AN, Tiwari SN, Rathi JPS, Singh B and Tripathi AK. 2003. Studies on crop weed competition in *Kharif* onion (*Allium cepa* L.). *Indian Journal of Weed Science* **35**: 156–158.

Tripathi PC, Sankar V and Lawande KE. 2008. Weed management in directly sown onion. p. 146. In: *ISWS Biennial Conference on Weed Management in Modern Agriculture* : *Emerging Challenges and Opportunities*, February 27-28, held at Bihar Veternary College, Patna (Rajenra Agricultural University, Pusa, Bihar).

Warade AD, Gonge VS, Jogdande ND, Ingole PG and Karunakar AP. 2006. Integrated weed management in onion. *Indian Journal of Weed Science* **38**(1&2): 92–95.