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Influence of Weed Management Practice on Yield and Quality of Onion under Sub-Tropical Condition of Jammu

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A B S T R A C T

For yield and quality enhancement production techniques play a critical role. Among the various crop management strategies, weed management is an important practice which significantly contributes to yield and quality improvement of onion. The present study was conducted to compare the efficacy of various herbicides treatments on yield and quality attributing traits of onion. Five herbicides such as pendimethalin, oxyflurofen, alachlor, butachlor and quizalofop ethyl were used alone or in different combinations. All the different weed control practices significantly influenced the yield and quality attributing traits. Among the herbicidal treatments, highest yield was obtained with application of oxyfluorfen 0.15 kg/ha followed by one hand weeding and pre emergence application of oxyfluorfen 0.15 kg /hafollowed by post emergence quizalofop ethyl 0.05 kg/ha. Further, highest values were recorded in same treatments for quality traits such as pyruvic acid and total soluble solids (TSS). Therefore, pre emergence application of oxyfluorfen 0.15 kg/ha followed by post emergence quizalofop ethyl 0.05 kg/ha can be effectively used for weed control in onion under sub-tropical region of Jammu

Introduction

Onion is an economically important vegetable crop, because of its huge demand all over the World. It is earning valuable foreign exchange of about 70% annually (Panse *et al.*, 2014). Onions are primarily consumed for their nutritional value, unique flavor or for their ability to enhance the flavor of other foods.

India is the 2nd largest producer of onion in the world after china, covering an area of 1306.0 thousand ha with a production of 22.4 million tons (Anonymous, 2016-2017a). In Jammu and Kashmir state onion occupies an area of 2.8 thousand ha, with the production of 65.2 thousand MT. (Anonymous, 2016-2017b). Its productivity is very less as compared to the national average due to number of factors but the main constraint is weed infestation which competes with the crop for nutrients, space and light thus, reducing the yield and quality of the crop through increased production and harvesting costs. Depending upon the nature of intensity and duration of weed competition, weed infestation can reduces bulb yield to the tune of 40-80% (Sharma *et al.*, 2009 and Vishnu *et al.*, 2014).

Pungency and total soluble solids are important quality traits of onion bulbs and its enhancement is very important for export and processing purposes. Therefore emphases need to be given on production techniques of the crop which significantly contributes to the yield and quality. The pungent flavor of onions is produced by hydrolysis of the flavor precursor compounds, like, S-alk (en) l-L-cysteine sulfoxides, when the cells are mechanically ruptured, such as by cutting or macerating (Dhumal *et al.*,2005 and Teare Ketter and Randle 1998). It was reported earlier that the growing environmental conditions of the crop can greatly influence flavor intensity, pungency and others yield attributing traits. The factors affecting flavor intensity are sulfate availability, growing temperature, and water availability. Among the various production techniques, the weed management strategies are important and contribute for maintenance of its productivity and quality of onion.

Therefore, study was undertaken to determine the influence of herbicidal weed management practices on the yield and quality attributing traits.

Materials and Methods

Field experiment was carried out during rabi season of 2015-16 at Chatha, Jammu, located at 32^0-40^0 N latitude, 74^0-53^0 E longitude and 300 m above mean sea level. The experiment was laid out in Randomized Block Design with three replications and 14 treatments. It comprised of pre plant application of pendimethalin 1.0 kg/ha and oxyflurofen 0.15 kg/ha, Pre emergence application of pendimethalin 1.0 kg/ha, oxyflurofen 0.15 kg/ha, alachlor 1.5 kg/ha and butachlor 1.0 kg/ha, combined application of pre-emergence followed by post emergence (40DAT) herbicides such as pendimethalin 1.0 kg/ha followed by quizalofop ethyl 0.05 kg/ha, oxyflurofen 0.15 kg /ha followed by quizalofop ethyl 0.05 kg/ha, alachlor 1.5 kg /ha followed by quizalofop ethyl 0.05 kg/ha and butachlor 1.0 kg/ha followed by quizalofop ethyl 0.05 kg/ha, DOGR recommendation oxyflurofen 0.15 kg /ha (Pre emergence) followed by one hand weeding 40-60 DAT, three hand weeding at 20, 40 & 60 DAT. (Farmers practice), weedy check and weed free (Continues manual weeding) respectively.

The experimental field was ploughed properly and then divided in plots size of 6.0 m^2. Eight week old healthy seedlings of onion cv. N-53 were transplanted at a spacing of 20 cm x 10 cm. All cultural operations and plant protection measures were adopted to maintain uniform plant population and ideal condition for proper growth and development of the crop. Five plants were randomly selected from each replication per treatment for recording the yield attributing traits at 60 days after transplanting and after harvesting. The quality parameters such as pungency and TSS were assessed after harvesting and uniform drying of the bulbs. Pungency was determined by measuring the enzymatic development of pyruvic acid according to the procedure given by Teare Ketter and Randle (1998). TSS was determined with use of refractometer.

Results and Discussion

Effect on weed control efficiency

The weed control efficiency (WCE %) of different treatments varied at different stages of the crop and it ranged from (18.86 - 71.08 %) at 60 days after transplanting and (18.36 - 62.82%) at harvesting stage. It was found higher at 60 DAT than at harvesting it might be due to various factors such as leaching, volatile movement and decomposition of different herbicides which ultimately decrease its efficiency with passage of the time. Similar

results were reported by Kolse *et al.,* (2010) and Sampat *et al.,* (2014). Among different herbicidal treatments, treatments such as three hand weeding, pre emergence application of oxyflurofen followed by one hand weeding and pre emergence application of oxyflurofen followed by post emergence quizalofop ethyl at 40 DAT were found equally effective at both stages of the crop after weed free plots presented in Figure 1. These results are in conformity with the studies conducted by Kalhapure *et al.,* (2014), Panse *et al.,* (2014) and Sampat *et al.,* (2014). The chemical weed control in onion is a better practice supplemented to conventional methods and forms an integral part of the modern crop production practices. The combine application of pre and post emergence herbicide is one of the options left with the farmers to eliminate crop weed competition at the early and later stages of the crop and to achieve higher weed control efficiency.

Effect on yield attributing traits

The yield attributing traits viz. neck thickness, average bulb weight, bulb yield per plot and total bulb yield were significantly influenced by different herbicidal treatments. Maximum values for yield attributing traits were recorded in weed free plots followed by others herbicidal treatments due to the favorable environmental conditions created by the clean crop culture resulted in more absorption of solar radiation and plant nutrients which ultimately resulting in more photosynthetic rates and dry matter accumulation. Among the herbicidal treatments highest yield contributing traits values were recorded in three hand weeding plots, which is closely followed by pre emergence application of oxyflurofen0.15 kg/ha followed by one hand weeding, pre-emergence application of oxyflurofen 0.15 kg/ha followed by post-emergence application of quizalofop-ethyl 0.05 kg/ha which were significantly at par with each other presented in Table 2 and Figure 2. The findings are in close proximity to that of Panse *et al.,* (2014) and Tripathy *et al.,* (2013). The lowest yield attributes were recorded in weedy check plots owing to low chlorophyll content and photosynthetic rate due to unchecked weed growth there by reducing the availability of moisture, light and nutrients to the crop thus resulting in loss of yield (Table 1) (Channappagoudar and Biradar, 2007).

Effect on quality traits

The onion contributes significantly to the human diet and has therapeutic properties, and primarily consumed for its ability to enhance the flavor of the other foods.

Pungency level and total soluble solids are important quality attributes of onion bulbs especially for processing and export quality. The effect of different herbicides treatments on the total soluble solids content of onion bulb presented in Table 3.

Table.1 Analysis of variance for yield and quality attributing traits (n = 14)

Traits	Mean sum of square	F- cal
Number of leaves	0.28	0.84
Neck thickness	0.26*	2.67
Average bulb weight (g)	14863.96*	188.77
Bulb yield/plot(g)	121101288.0*	302.56
Pyruvic acid	53.38*	14.33
TSS	22.66*	2.72

* Significant at $p \leq 0.05$

Table.2 Influence of different herbicidal treatments on number of leaves, neck thickness (cm), average bulb weight (g) and bulb yield/plot (g) in onion crop

Treatments	Numbers of leaves	Neck thickness	Avg. Bulb weight	Bulb yield/plot
Pendimethalin 1.0 kg/ha PP	9.13	1.31	34.17	6375.47
Oxyflurofen 0.15 kg/ha PP	9.50	1.31	35.00	6484.52
Pendimethalin 1.0 kg/ha PE	9.63	1.24	43.87	7136.85
Oxyflurofen 0.15 kg/ha PE	8.93	1.30	48.73	7436.94
Alachlor 1.5 kg/ha PE	9.20	1.24	33.37	6383.60
Butachlor 1.0 kg/ha PE	9.07	1.29	31.67	6292.24
Pendimethalin 1.0 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	9.20	1.13	69.50	9003.59
Oxyflurofen 0.15 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	9.03	1.16	70.78	9172.86
Alachlor 1.5 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	9.70	1.19	64.40	8634.32
Butachlor 1.0 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	9.30	1.18	58.33	8197.59
Oxyflurofen 0.15 kg/ha PE *fb* 1 HW 40-60 DAT	9.57	1.23	72.47	9284.43
Three HW 20, 40 & 60 DAT	9.40	1.16	73.33	9411.05
Weedy check	8.93	1.31	24.23	3768.98
Weed free	9.93	1.03	84.10	10375.03
C.D. (5%)	N.S	0.15	4.15	296.12
S.E. (m)	0.34	0.05	1.42	101.30

Table.3 Influence of herbicidal treatments on pyruvic acid (µmoles pyruvate /g) and total soluble solids (TSS; ^{o}Brix) in onion crop

Treatments	Pyruvic acid	TSS (^{0}Brix)
Pendimethalin 1.0 kg/ha PP	6.43	13.90
Oxyflurofen 0.15 kg/ha PP	7.08	12.08
Pendimethalin 1.0 kg/ha PE	7.10	13.20
Oxyflurofen 0.15 kg/ha PE	7.01	13.60
Alachlor 1.5 kg/ha PE	6.60	13.98
Butachlor 1.0 kg/ha PE	6.95	13.00
Pendimethalin 1.0 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	8.37	14.00
Oxyflurofen 0.15 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	8.61	13.98
Alachlor 1.5 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	7.48	14.17
Butachlor 1.0 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT	7.02	12.95
Oxyflurofen 0.15 kg/ha PE *fb* 1 HW 40-60 DAT	9.29	13.79
Three HW 20, 40 & 60 DAT	9.59	14.10
Weedy check	6.73	12.00
Weed free	9.78	14.38
C.D. (5%)	0.90	1.35
S.E. (m)	0.31	0.46

PP= pre-plant, PE= pre emergence, HW= hand weeding and DAT= days after transplanting, *fb* = followed by

Fig.1 Effect of weed control practices on weed control efficiency (%) in onion crop

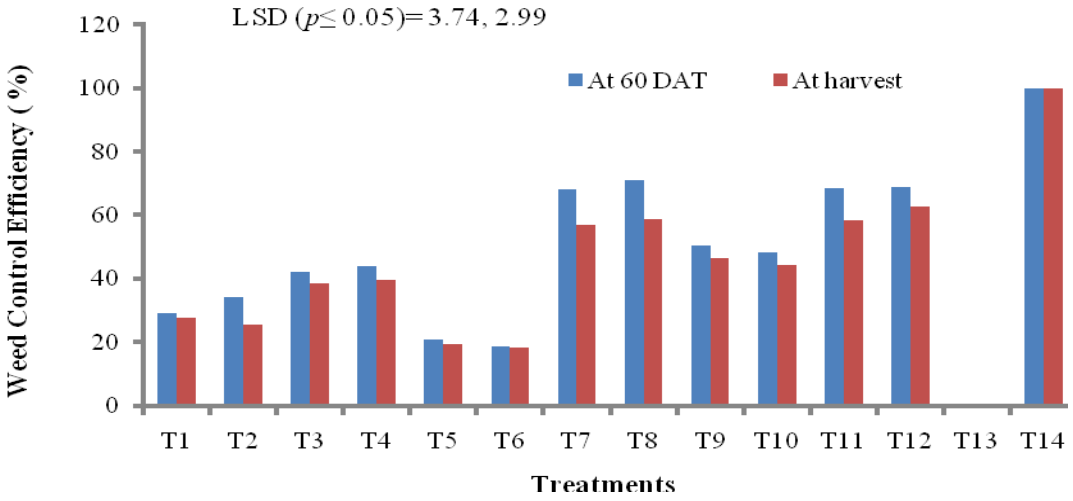
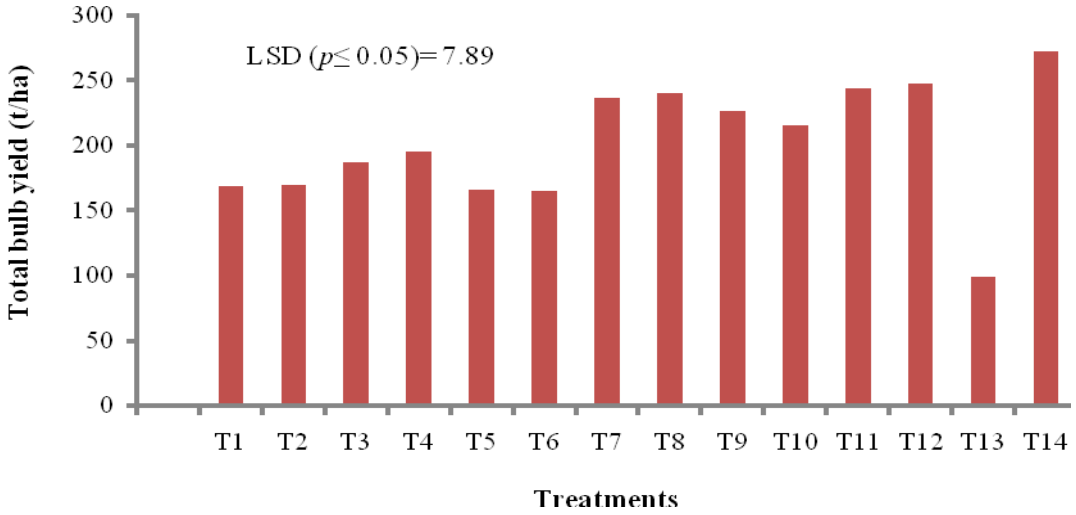


Fig.2 Effect of weed control practices on total bulb yield (t/ha) in onion crop



T1	=	**Pendimethalin 1.0 kg/ha PP**	**T8**	=	**Oxyflurofen 0.15 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT**
T2	=	Oxyflurofen 0.15 kg/ha PP	T9	=	Alachlor 1.5 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT
T3	=	Pendimethalin 1.0 kg/ha PE	T10	=	Butachlor 1.0 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40 DAT
T4	=	Oxyflurofen 0.15 kg/ha PE	T11	=	Oxyflurofen 0.15 kg/ha PE *fb* 1 HW 40-60 DAT
T5	=	Alachlor 1.5 kg/ha PE	T12	=	Three HW 20, 40 & 60 DAT
T6	=	Butachlor 1.0 kg /ha PE	T13	=	Weedy check
T7	=	Pendimethalin 1.0 kg/ha PE *fb* quizalofop ethyl 0.05 kg/ha at 40DAT	T14	=	Weed free

Pungency is important attributes of onion bulb quality for processing and storage. Onion bulb pungency is an indicator of the hotness of the onion. Sweetness in onion is a balance between single sugar and pungency. The data presented in Table 3. revealed that the pyruvic acid levels in cultivar N-53 ranged from (6.73-9.78) µmoles pyruvate/g of fresh weight.

Significantly highest pyruvic acid content was recorded in weed free plots followed by in three hand weeding and with the application pre emergence application of oxyfluorfen 0.15 kg/ha followed by quizalofop ethyl 0.05 kg/ha 40 DAT these two treatments were statistically at par with weed free.

Significantly the lowest pyruvate/g was recorded in weedy check plots. This might be due to effect of dryness during the growing period of the crop (higher temperature) which leads to accumulation of more sulfates. Teare Ketter and Randle (1998).

The above results and discussion revealed that the use of pre and post-emergence herbicides was found highly profitable for getting higher bulb yield and quality due to effective weed control.

Therefore, pre emergence application of oxyfluorfen 0.15 kg /ha followed by post emergence quizalofop ethyl 0.05 kg/ha can be effectively used for weed control in onion under sub-tropical condition of Jammu.

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