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RESEARCH PAPER

Efficacy of herbicides on weed growth and bulb yield in onion under kymour plateau region of Madhya Pradesh, India

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Abstract : Onion (*Allium cepa* L.) belonging to family Alliacea is one of the most important and export oriented crop grown all over the world including India. The production of onion in Madhya Pradesh is not as much as compared to Maharashtra. Application of herbicides offer a suitable method for weed control by producing maximum sized bulbs and higher yield. The present investigation was carried out during *Rabi* 2014-15 with the objective to study the effect of herbicides on growth, yield and its attributing traits of onion at Horticulture complex, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur with twelve treatments in Randomized Completely Block Design and three replications. Maximum weed control efficiency was recorded in the treatment Pendimethalin @ 2.5-3 l/ha for all type of weeds observed in the field while maximum growth and yield traits were recorded in weed free check (Hand weeding). On the basis of one year data it is concluded that the maximum reduction in weeds and increase in yield obtained in the onion by the application of herbicide of Pendimethalin 2.5-3 L/ha.

Key Words : Growth, Herbicide, Kymore plateau, Madhya Pradesh, Onion, WCE, Yield

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INTRODUCTION

Onion (*Allium cepa* L.) belonging to family Alliacea is one of the most important and export oriented crop grown all over the world including India. It is a condiment crop and consumed as fresh salad and added as a spice while cooking dishes. The production of onion in Madhya Pradesh is not as much as that compared to Maharashtra. It may be due to less area of cultivation as well as number of factors which can be related to production. Under cultivation a routine practice of providing frequent irrigation and fertilizer application for the crop growth and development but the slow growth rate at initial stage of crop due to its inherent characteristics such as short stature, non- branching habit, sparse foliage, shallow root system, favors the congenial environment for the weed growth and weed compete with crop plants for moisture, nutrients, light and space. Under such circumstances application of herbicides offer

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a suitable method for weed control by producing maximum sized bulbs and higher yield. The conventional method of weed control (hoeing and manual weeding) is laborious, expensive and insufficient. Moreover, weeding during critical growth stage is not possible due to increased cost of human labour and their unavailability during peak period of operation. Whereas, post-emergence herbicides kill weeds and keep the hardy weeds under control by arresting there growth through various kind of deformities in foliage and growing point. Hence, this leads to the congenial environmental conditions for significant increase in the yield.

MATERIAL AND METHODS

In order to study the effect of different herbicides for controlling weeds in onion an experiment was conducted at Horticulture Complex,Dept. of Horticulture, Maharajpur, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during the year 2014. The variety Agrifound light red was sown in the month of October. The fertilizers were used as per standard recommendation. The experiment was laid out in Randomized Block Design with three replications. Each replication consists of twelve treatments like control (T_1), Quizalofop-p-tefuryl4.41%EC@20g a.i./ha (T_2), Quizalofop-p-tefuryl4.41%EC@40g a.i./ha (T_3), Quizalofop-p-tefuryl4.41%EC@60g a.i./ha (T_4), Quizalofop-p-tefuryl4.41%EC@80g a.i./ha (T_5) Quizalofop-p-ethyl 5% EC@50g a.i./ha (T_6), Quizalofop-p-ethyl 5% EC@ 100g a.i./ha (T_7), Quizalofop-p-ethyl 5% EC@ 150g a.i./ha (T_8), Quizalofop-p-ethyl 5% EC@ 200g a.i./ha (T_9) as post emergence, Pendimethalin 30% EC @2.5-3 l /ha (T_{10}), Pendimethalin 30% EC 50 g a.i/ ha (T_{11}) as post emergence and hand weeding at 20 and 40 DAT (T_{12}). Each replication consisted of 5 rows with row to row distance is 15 cm and plant to plant distance is 10 cm.

RESULTS AND DISCUSSION

The data recorded on weed control efficiency, growth, yield and quality of onion were statistically analyzed and results are presented and discussed as under:

Associated *Rabi* weeds and weed control efficiency in onion:

The mean data of dry weight and weed control efficiency percentage of *Dynebra retroflexa* are depicted in the Table 1. The data revealed that herbicides had the marked effect on dry weight of weed (*Dynebra retroflexa*). The treatment T_{12} (Hand weeding) had the minimum dry weight (1.30 g/m^2) followed by T_{10} (Pendimethalin 2.5-3 L/ha) (1.63 g/m^2), T_9 (Quizalofop-P-ethyl 200g a.i. /ha) (2.19 g/m^2) and T_7 (Quizalofop-P-ethyl 100g a.i./ha) (2.73 g/m^2). While, maximum 5.53 g/m^2 dry weight was noted in treatment T_1 (Control). Treatment T_{12} weed free check (Hand weeding) recorded maximum weed control efficiency 76.81%

Table 1 : Weed control efficiency of different weeds associated with *Rabi* onion

Treatments	*Dynebra retroflexa*		*Cyperus rotundus*		*Cynodon dactylon* Pers.	
	Mean dry weight	Weed control efficiency (%)	Mean dry weight	Weed control efficiency (%)	Mean dry weight	Weed control efficiency (%)
T_1 Control	5.53	-	7.56	-	6.31	-
T_2 Quizalofop-P-tefuryl 20ga.i./ha	4.47	19.02	6.20	18.12	5.31	16.00
T_3 Quizalofop-P-tefuryl 40g a.i./ha	3.86	30.07	4.80	36.77	3.58	43.10
T_4 Quizalofop-P-tefuryl 60g a.i./ha	3.16	42.75	4.00	47.08	2.71	57.05
T_5 Quizalofop-P-tefuryl 80g a.i./ha	4.22	23.73	5.03	33.33	3.85	38.82
T_6 Quizalofop-P-ethyl 50g a.i./ha	4.32	21.92	5.82	23.01	4.22	33.12
T_7 Quizalofop-P-ethyl 100g a.i./ha	2.73	50.54	3.16	58.06	2.44	61.33
T_8 Quizalofop-P-ethyl 150g a.i./ha	3.63	34.23	4.28	43.38	3.08	51.18
T_9 Quizalofop-P-ethyl 200g a.i./ha	2.19	60.50	2.83	62.43	2.20	65.13
T_{10} Pendimethalin 2.5-3 L/ha	1.63	70.47	2.22	70.50	2.04	67.67
T_{11} Pendimethalin 50g a.i./ha	3.70	32.97	4.46	41.13	3.40	46.11
T_{12} Hand weeding	1.30	76.81	1.22	83.86	1.07	83.04
S.E.±	–	–	–	–	–	–
C.D.(P=0.05)	–	–	–	–	–	–

followed by T_{10} (Pendimethalin 2.5-3 L/ha), T_9 (Quizalofop-P-ethyl 200g a.i./ha) and T_7 (Quizalofop-P-ethyl 100g a.i./ha) which gave 70.47%, 60.5% and 50.54% weed control efficiency. The treatment T_{12} (Hand weeding) gave minimum 1.22 g/m^2 dry weight of *Cyperus rotundus* L. followed by T_{10} (Pendimethalin 2.5-3 L/ha) (2.22 g/m^2), T_9 (Quizalofop-P-ethyl 200g a.i./ha) (2.83 g/m^2) and T_7 (Quizalofop-P-ethyl 100g a.i./ha) (3.16 g/m^2). However, the maximum 7.56 g/m^2 dry weight was recorded in treatment T_1 (Control). The data revealed that T_{12} Weed free check (Hand weeding) was recorded maximum 83.86% weed control efficiency followed by T_{10} (Pendimethalin 2.5-3 L/ha), T_9 (Quizalofop-P-ethyl 200g a.i./ha) and T_7 (Quizalofop-P-ethyl 100g a.i./ha), which gave 70.5%, 62.43% and 58.06% weed control efficiency. The minimum 1.07 g/m^2 dry weight was observed in T_{12} (Hand weeding) followed by T_{10} (Pendimethalin 2.5-3 L/ha) (2.04 g/m^2), T_9 (Quizalofop-P-ethyl 200g a.i. /ha) (2.20 g/m^2) and T_7 (Quizalofop-P-ethyl 100g a.i. /ha) (2.44 g/m^2). The treatment T_1 (Control) was found with maximum 6.31 g/m^2 dry weight of *Cynodon dactylon* Pers. The maximum 83.04% weed control efficiency was observed in T_{12} (Hand weeding) followed by T_{10} (Pendimethalin 2.5-3 L/ha) (67.67%), T_9 (Quizalofop-P-ethyl 200g a.i./ha) (65.13%) and T_7 (Quizalofop-P-ethyl 100g a.i./ha) (61.33%). *Cyperus rotundus, Denebra retroflexa, Cynodon dactylon, Chinopodium album, Eclipta alba, Melilotus alba* and *Parthenium hysterophorous* were the most dominant weed and *Cyperus rotundus* recorded the highest weed population indicated that weed crop competition and stress on onion crop. Similar findings have been reported by Wilson and Scheffer (1981); Kachare *et al*. (2005); Bhutia *et al*. (2005); Ghadage *et al*. (2006) and Channappagoudar and Biradar (2007).

Weed index and yield (q/ha):

The weed index was worked out in various treatments and is given in Table 2. It is evident from the Table that minimum weed index was observed in the treatment T_{12} (Hand weeding) followed by T_{10} (Pendimethalin 2.5-3 L/ha) (3.39%), T_9 Quizalofop-P-tefuryl (40g a.i. /ha) (4.45%). Yield was significantly influenced by various treatments of herbicides. Significantly maximum 153.32 q/ha yield was recorded under the treatment T_{12} (Hand weeding) followed by T_{10} (Pendimethalin 2.5-3 L/ha) (146.65 q/ha) and T_9 (Quizalofop-P-ethyl 200g a.i. /ha) (132.76 q/ha) which were at par with each other. Whereas, the lowest 78.32 q/ha yield was observed in T_1 (Control). Manual weeding was equally effective over the weedy check in alleviating weed competition and increasing the bulb yield. The Weed index also indicates that the yield reduction caused would be due to competition of major weeds under weedy check. The maximum reduction in weeds and increase in yield was noted in application of Pendimethalin 2.5-3 L/ha. The findings are in close proximity to that of Ghosh *et al*. (2004); Bhutia *et al*. (2005); Qasem (2006); Jilani *et al*. (2007); Murthy *et al*.

Table 2: Effect of different treatments of herbicides and hand weeding on weed index (%), yield and its attributing traits

Treatments	Weed index (%)	Yield (q/ha)	Bulb neck thickness (cm)	Bulb diameter (cm)	Average weight of bulb (g)
T_1 Control	26.88	78.32	1.11	3.46	45.44
T_2 Quizalofop-P-tefuryl 20ga.i./ha	16.78	88.65	1.25	3.70	47.68
T_3 Quizalofop-P-tefuryl 40g a.i./ha	12.36	106.10	1.30	3.99	48.91
T_4 Quizalofop-P-tefuryl 60g a.i./ha	9.11	126.65	1.32	4.14	52.80
T_5 Quizalofop-P-tefuryl 80g a.i./ha	14.44	104.99	1.29	3.92	48.60
T_6 Quizalofop-P-ethyl 50g a.i./ha	16.12	101.65	1.25	3.83	48.29
T_7 Quizalofop-P-ethyl 100g a.i./ha	6.55	129.98	1.35	4.27	52.83
T_8 Quizalofop-P-ethyl 150g a.i./ha	11.10	113.32	1.39	4.10	50.10
T_9 Quizalofop-P-ethyl 200g a.i./ha	4.45	132.76	1.48	4.41	54.36
T_{10} Pendimethalin 2.5-3 L/ha	3.39	146.65	1.43	4.31	53.13
T_{11} Pendimethalin 50g a.i./ha	11.22	106.65	1.40	4.04	49.07
T_{12} Hand weeding	-	153.32	1.62	4.74	56.13
S.E.±	-	10.56	0.05	0.08	1.50
C.D. (P=0.05)	-	30.98	0.16	0.24	4.42

(2007); Warade *et al*. (2007); Sharma and Khandwe (2008) and Hussain *et al*. (2008).

The yield of crop is the final index of the experiment which indicates the success or failure of any treatments. Significant variations were also observed for average bulb weight and total bulb yield in onion. Weeds seriously affected average bulb weight and drastically reduced yield. The variability is due to effectiveness of weed control methods which ultimately increased the nutrient availability for the crop (Marwat *et al*., 2005). The results also showed that treatment effect were significant in case of total bulb yield in onion. The results clearly indicated the adverse effect of weed infestations in onion crop, which in term affected the bulb yield. On the other hand, significantly the lowest yield of 78.32 q/ha was recorded in T_1 non-weeded control. It indicated the increase yield over weedy check because of reduced the weed population without causing severe injury to the crop and reduction in competitional stress. The results are in agreement with Halmagean *et al*. (2008); Marwat *et al*. (2005) and Dudi *et al*. (2011).

Bulb neck thickness and diameter (cm):

The data on bulb neck thickness and diameter has been depicted in Table 2. Significantly the maximum 1.62, 1.48, 1.43 and 1.40 cm bulb neck thickness were recorded in the treatment T_{12} Weed free check (Hand weeding), T_9 Quizalofop-P-ethyl (200g a.i./ha), T_{10} Pendimethalin 2.5-3 L/ha and T_{11} Pendimethalin (50 g a.i./ha), respectively and which were at par with each other. While it was noted minimum 1.11 cm in the treatment T_1 (Control). The data for various treatments with respect to the bulb diameter are summarized in Table 2. The maximum bulb diameter 4.74 cm was recorded under the treatment T_{12} weed free check (Hand weeding), followed by T_9 (Quizalofop-P-ethyl 200g a.i./ha) (4.41 cm), T_{10} Pendimethalin 2.5-3 L/ha (4.31 cm) and T_4 (Quizalofop-P-tefuryl 60g a.i./ha) (4.14 cm) as compared to other treatments. However, the minimum (3.46 cm) bulb diameter was recorded for the treatment T_1 (Control). The increased bulb size and reduction in small size bulb may be due to effective herbicidal effect to control the weed and reduce crop-weed competition. These findings are in confirmation with findings of Ghosh *et al*. (2004); Bhutia *et al*. (2005); Bani *et al*. (2006); Nargis and Jilani (2006); Ghadage *et al*. (2006) and Jilani *et al*. (2007).

Average bulb weight (g):

The highest average bulb weight 56.13 g was recorded under the treatment T_{12} weed free check (Hand weeding), followed by T_9 (Quizalofop-P-ethyl 200g a.i./ha) (54.36 g), T_{10} Pendimethalin 2.5-3 L/ha (53.13 g) and T_4 (Quizalofop-P-tefuryl 60g a.i./ha) (52.80 g). However, the lowest (45.44 g) average bulb weight was recorded in the treatment T_1 (Control).

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