International Journal of Advance Research in Science and Engineering
Volume No.06, Special Issue No.(01), Nov 2017
www.ijarse.com
IJARSE
ISSN: 2319-8354

Integrated Weed Management Studies in Onion

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ABSTRACT

The present study was entitled "Integrated weed management studies in onion (Allium cepa L.)" variety (N-53) was carried out at CSKHPKV, Hill Agri. Research and Extension centre, Dhaulakuan (Sirmour), during Rabi season 2013-14 with the objectives to find out the efficacy of different treatments on the growth, yield and yield attributing characters. All herbicides were applied as post emergence except pendimethalin which was applied as pre-emergence. In this study, 13 treatments viz. Clodinofop @ (0.06 kg ha^{-1}) fb one hand weeding (60 DAT), Imazethapyr @ (0.06 kg ha^{-1}) fb one hand weeding (60 DAT), Imazethapyr @ 0.08 kg ha^{-1}, Imazethapyr @ 0.10 kg ha^{-1}, Oxyfluorfen @ (0.10 kg ha^{-1}) fb one hand weeding (60 DAT), Oxyfluorfen @ 0.20 kg ha^{-1}, Oxyfluorfen @ 0.30 kg ha^{-1}, Pendimethalin @ 1.5 kg ha^{-1}, Quizalofop @ (0.06 kg ha^{-1}) fb one hand weeding (60 DAT), two hand weeding (40 and 60 DAT), farmer practice (three hand weeding at 30, 60, 90 DAT), weed free and weedy check were compared in a Randomized Block Design (RBD) having three replications with a plant spacing of 20 cm x 10 cm. All the treatments were found significant for different characters. Maximum value for plant height, average weight of bulb (80 g), diameter of bulb (6.34 cm), plant population (276.33) and bulb yield (272.22 q ha^{-1}) were recorded with weed free treatment followed by Oxyfluorfen @ 0.30 kg ha^{-1} among all herbicidal treatments. Maximum benefit: cost ratio (2.92) was recorded in Oxyfluorfen @ 0.30 kg ha^{-1}. Hence, among herbicidal application Oxyfluorfen @ 0.30 kg ha^{-1} was found most effective for most of the character studied.

***Key Words*:** *Randomized block design, Hand weeding, weed management*

I. INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetable crops in all over the world including India. It is most widely grown and popular vegetable crop among the *alliums*, globally it is considered to be the second most important vegetable after tomatoes. It is an indispensible item in every kitchen as vegetable. It is consumed as fresh salad and / or added as a spice while cooking dishes. Apart from furnishing nutrition, it also provides relishing flavors to our diets. Therefore, onion is popularly referred as 'Queen of the kitchen'. Onion contains carbohydrates (11.0g), proteins (1.2g), fiber (0.6 g), moisture (86.8 g) and several vitamin like vitamin A (0.012 mg), vitamin C (11 mg), thiamin (0.08 mg), riboflavin (0.01 mg) and niacin (0.2 mg) and also some minerals like phosphorus (39 mg), calcium (27 mg), sodium (1.0 mg), iron (0.7 mg) and potassium (157 mg). According to Vavilov (1951), the primary center of origin lies in Central Asia. The near east and Mediterranean is the

secondary centre of origin. Globally, onion is grown in an area of 44.43 lakh hectares with annual production of 856.10 lakh tonnes. India is the second largest producer and third largest exporter of onion in the world. Maharashtra is the leading producer of onion in India. In India onion is grown over an area of 12.03 lakh hectares with a production of 194.01 lakh tonnes and in Himachal Pradesh onion is grown over an area of 2340 hectares with a production of 43710 metric tonnes (Anonymous, 2014). Weeds pose production problems in onion fields. The weeds problem is becoming worse in irrigated areas where cropping intensity is rapidly increasing and weed management through cultivation practices has become a challenge. The fixed crop rotation has encouraged the establishment of permanent weed flora with large seed reserves in the soil. They compete with onion for light, nutrient, water space and also host plant of several harmful insects and pathogens and considerably reduce the yield, quality and value of the crop through increased production and harvesting cost (Uygur et at. 2010). Weeds interferes development of onion bulbs thereby reducing bulbs yield to the extent of 40-80% (Singh et al. 1992). Being a slow growing crop and having erect tubular leaves, it suffers heavily from weed competition during establishment of seedlings. Onion has very poor competitive ability with weeds due to its inherent characteristics such as short stature, non-branching habit, sparse foliage, shallow root system and extremely slow growth in initial stages which cause rapid growth of weeds. In addition, their cylindrical upright leaves do note shade the soil to block weed growth (Ramalingam et al. 2013). Weed control is one of the most important production practices in farm management. Weeds not only reduce the crop yield but also affect the quality of crop produce. Weeds reduce crop yield because they compete with the crop plants for nutrients, water and light. In addition, weed also hinder with the crops harvesting and increase the cost of production (Khatam et al. 2012). Weeds can be controlled by cultural, mechanical, chemical methods and the use of organic and inorganic mulch. There is no doubt that cultural weed control methods are still useful but they need more labor, consume more time and are more costly. The relative cost involved, higher labor cost as a result of tediousness of operations due to closer spacing, emergence of weeds at different crop growth stages and mechanical injury to the crop during mechanical operations. On the other hand, herbicides are important tool for weed control, but are not effective in controlling the entire weed present in the crop. Similarly, late emerging weeds hinder bulb development and create the problems in digging operations. Hence, it becomes necessary to control the weed during the later period of crop growth. Use of herbicide and cultural practices as an integrated approach may provide economically acceptable weed control. Herbicides can be safely applied in crop rows where manual interculture operations are difficult. Pre-emergence herbicides provide early season weed control which is very beneficial as weed competition is maximum at early stages of crop growth. They reduce cost of production and increase the yield. Keeping in view the significance of above aspects in obtaining higher yields of better quality bulbs, the proposed studies entitled “Studies on integrated weed management in onion (*Alium cepa* L.)” were undertaken.

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II. MATERIAL AND METHODS

The present investigation on "Integrated weed management studies in onion *(Allium cepa* L.)" was conducted at the Regional Research Station, Dhaulakuan district Sirmour during Rabi 2013-14. The experimental site is located at 30.4^{o} N latitude and 77.5^{o} E longitude at an elevation of 464 meters above mean sea level. The climate of Dhaulakuan, Himachal Pradesh is generally sub-temperate to sub-tropical; May and June are the hottest months and December and January are the coldest ones. In the year 2014, during the cropping season i.e. January to May, maximum mean weekly temperature ranged from 17.6 to 40.9 ^{0}C and minimum from 4.9 to 19.1 ^{0}C while relative humidity varied from 51.9 to 85.4 per cent. The crop experienced well distributed rainfall of 182.2 mm during the crop season. The highest weekly rainfall of 33.2 mm was received during meteorological week 9. The sunshine duration ranged from 1.5 to 10.8 hrs. The present investigation was conducted in randomized block design with three replications. Including weedy check and weed free there were in all 13 treatments. The details of treatments have been given here as below:

Table:1 Details of treatments

Sr.No	Treatment	Dose (kg ha^{-1})	Time of application
1.	Clodinofop *fb* one hand weeding	0.06	Post emergence (40 DAT) and hand weeding at 60 (DAT)
2.	Imazethapyr *fb* one hand weeding	0.06	Post - emergence (40 DAT) and hand weeding at 60 (DAT)
3.	Imazethapyr	0.08	Post - emergence (40 DAT)
4.	Imazethapyr	0.10	Post - emergence (40 DAT)
5.	Oxyfluorfen *fb* one hand weeding	0.10	Post emergence and hand weeding at 60 (DAT)
6.	Oxyfluorfen	0.20	Post - emergence (40 DAT)
7.	Oxyfluorfen	0.30	Post - emergence (40 DAT)
8.	Pendimethalin	1.5	Pre emergence
9.	Quizalofop *fb* one hand weeding	0.06	Post- emergence (40 DAT) and hand weeding at 60 (DAT)
10.	Two hand weeding	_	(40 and 60 DAT)

11.	Farmer practice (three hand weeding)	_	30, 60 and 90 (DAT)
12.	Weed free	_	20 DAT onwards
13.	Weedy check	_	_

III. RESULTS AND DISCUSSION

Weed dry weight

At harvest of the crop oxyfluorfen @ 0.30 kg ha^{-1} recorded significantly less dry weight of weeds (1.32 g m^{-2}). The minimum dry weight of weeds was observed in weed free (1.00 g m^{-2}) treatment. The maximum dry weight of weed was recorded in weedy check (15.87 g m^{-2}) treatment. The minimum dry weight of weeds at all the stages of plant growth was recorded when oxyfluorfen @ 0.30 kg ha^{-1} was applied among herbicidal treatments and in weed free treatment among hand weeding. Rahman et al. (2012) also found manual weeding very effective in crop to control weed biomass. The results are also in agreement with the finding of Nandal and Ravinder (2002). According to Patel et al. (2012) 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 uptake.

Plant Height

All the weed control treatments recorded maximum plant height when compared with weedy check. The maximum plant height (55.88 cm) was recorded in weed free treatment followed by two hand weeding (37.95 cm). Among herbicidal treatments oxyfluorfen @ 0.30 kg ha^{-1} recorded the maximum plant height (53.35 cm) and it was significantly higher from all other herbicidal treatments. The minimum plant height (13.69 cm) was recorded in weedy check treatment. The same results were found by Anisuzzaman et al. (2009). According to Patel et al. (2012) it was due to favorable environment in the root zone resulting in absorption of more water and nutrient from soil and good control of weed competition throughout the different growth stages of the crop.

Plant population

Plant population recorded at harvest varied significantly with different weed control treatments. The numbers of plants were significantly higher in all the treatments when compared with weedy check. The maximum plant stand was recorded in weed free plot (276.33 per plot) and significantly higher among manual as well as herbicidal treatments. Oxyfluorfen @ 0.30 kg ha^{-1} (258.33 per plot) recorded maximum plant stand which was statistically at par with oxyfluorfen @ 0.20 kg ha^{-1} (251.67 per plot) and imazethapyr @ 0.10 kg ha^{-1} (253.00 per plot). The minimum plant stand was recorded in weedy check (204.33 per plot). This is may be due to the presence of higher number of weeds which competed with onion bulb for light, water, space and nutrients.

Weed free treatment was responsible for better plant growth and development which resulted in better plant stand. Similar results were obtained by Jilani et al. (2007).

Bulb Yield (q ha^{-1})

The yield data (q ha^{-1}) was recorded during 2014. The yield (q ha^{-1}) was significantly higher in all the treatments as compared to weedy check. In weed free treatment maximum bulb yield (272.22 q ha^{-1}) was recorded which was significantly higher from other treatments. Oxyfluorfen @ 0.30 kg ha^{-1} significantly recorded maximum yield (258.33 q ha^{-1}) and significantly higher from other treatments. The minimum bulb yield was recorded in weedy check treatment (84.17 q ha^{-1}). This might be due conservation of nutrients, increased soil temperature, prevention of water evaporation from soil and sustained adequate soil moisture at outer soil surface, where most onion root occur 0 to 30 cm. Therefore, searching for moisture to further soil depths is not required which in turn source sink assimilate for the vegetative growth and yield.

IV. ECONOMICS

Maximum gross returns (Rs 2,99,444) and net income (Rs 2,05,894) and benefit: cost ratio (2.20) was recorded in weed free treatment. Among herbicidal treatments maximum gross returns (Rs 2,84,166) and net income (Rs 2,11,661) and benefit: cost ratio (2.92) was observed when application of oxyfluorfen @ 0.30 kg ha^{-1} was done. Pramanick et al. (2007) and Jamatia (2013) also observed similar results. Minimum gross returns (Rs. 92,587), net income (Rs. 21,537) and benefit: cost ratio (0.30) was recorded in weedy check. Low yield of bulb may be attributed due to the fact that no weed were removed in these plots and hence crop growth was very poor resulting into weak plants and smaller size bulbs which were unmarketable. Kashyap (2010) also observed similar results. Hence application of oxyfluorfen @ 0.30 kg ha^{-1} was found to be superior among herbicidal treatments for profitable production of onion.

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Table:2 Effect of treatments on weed dry weight, plant height, plant population, bulb yield, B:C ratio.

Treatments	weed dry weight (g m^{-2})	Plant Height (cm)	Plant population	Bulb yield q ha^{-1}	Gross return (Rs.)	Net Return (Rs.)	B:C ratio
Clodinofop *fb* one HW (0.06 kg ha^{-1})	3.85	15.24	228.00	129.94	142938	67257.	0.89
Imazethapyr *fb* one HW (0.06 kg ha^{-1})	3.68	28.93	231.00	120.83	132916	57253.	0.76
Imazethapyr (0.08 kg ha^{-1})	4.40	32.14	235.00	163.61	179972	108021	1.50
Imazethapyr (0.10 kg ha^{-1})	2.25	47.16	253.00	195.06	214561	142573	1.98
Oxyfluorfen *fb* one HW (0.10 kg ha^{-1})	3.42	26.33	232.67	148.61	163472	87687	1.16
Oxyfluorfen (0.20 kg ha^{-1})	1.90	41.88	251.67	226.61	249272	177002	2.45

Oxyfluorfen (0.30 kg ha^{-1})	1.32	53.35	258.33	258.33	284166	211661	2.92
Pendimethalin (1.5 kg ha^{-1})	3.78	17.31	228.33	174.44	191888	119518	1.65
Quizalofop *fb* one HW (0.06 kg ha^{-1})	4.52	23.58	231.67	128.33	141166	65502	0.87
Two hand weeding	2.85	37.95	230.33	120.94	133038	54488	0.69
Farmer practice (Three HW)	1.35	33.61	241.33	218.89	240777	158477	1.93
Weed free	1.00	55.88	276.33	272.22	299444	205894	2.20
Weedy check	15.87	13.69	204.33	84.17	92587	21537	0.30
CD (P=0.05)	0.54	3.47	11.21	17.94	19740	19738	0.26