

Original Research Article

Herbicide Mixture for Enhancing Weed Control Efficiency and Yield of Onion (*Onion cepa* L.)

Sangeeta kumari*, Shivnath Das, Rajesh Kumar and Kavita¹

Agricultural Research Institute, Patna (BAU, Sabour), India

*Corresponding author email id: sangeeta6b@gmail.com

ABSTRACT

Field experiment was conducted to compare various weed management practices in onion at Agricultural Research Institute ,Patna under Bihar Agricultural University ,Sabour (Bhagalpur) during *rabi* 2015-16 and 2016-17 . The experiment consisted of eight different treatments replicated thrice designed in RBD. The study revealed that effective weed control was recorded under combined application of-Glyphosate 1 kg ai/ha 15 days before transplanting fb Pendimethalin 1 kg ai/ha (PE) fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT) .The same treatment (T₇) recorded significantly highest yield(275.11 q/ha) and the highest B:C ratio (2.86) than rest of the treatments.The result indicated that significantly highest dry weight of weeds (43.53 g)was recorded in weedy check plot (T₈).The weed control efficiency varies from 34.27 to 77.44.

Keywords

Onion, Herbicide mixture, Economics, WCE

Introduction

Weed is creating the havoc all over the world and it alone contributes about 37% yield loss in India which accounts for nearly loss of Rs. 2799 crores per annum. It is a silent killer of crop.Productivity goes down making the farmers baffled. So, use of herbicide becomes inevitable in the present day intensive agricultural system to minimize the yield loss due to weeds. In India, productivity of onion is 14.20 tons per hectare which is quite low (Anonymous, 2012). .Recent research has suggested that onions in the diet may play vital role in preventing coronary heart diseases and other ailments (Sangha and Bariag,2003).Its poor competitive ability with its slow initial growth and lack of adequate foliage makes onion weak against weeds. Due to weed infestation there was reduction of 40 to 80% yield of onion (Angiraset *al.*, 2008). Hand

weeding is a common method of weed control adopted by farmers in Bihar but comparatively this method is costly and time consuming. Whereas, use of herbicides alone does not prove effective for weed control because of their selectivity and environmental hazards with its continuous use.Thus researchers shifted towards herbicide mixture (combination of two herbicides). To manage the dynamic and complex weed flora in onion, there is need to evaluate different herbicides alone and in mixtures for broad spectrum weed control. Keeping all these in view the present experiment regarding appropriate method of weed management in onion under Agro-climatic zone III-B of Bihar has been conducted.

Materials and Methods

Field experiment was conducted to compare various weed management practices in onion under Agricultural Research Institute, Patna for two consecutive years (2015-16 & 2016-17). The experiment was laid out in randomised block design and replicated thrice comprising of eight treatments [T1 - Weed free plot, T2 - Two hand weeding at 20 and 40 DAT, T3 - Glyphosate 1 kg ai/ha 15 days before transplanting, T4 - Pendimethalin 1 kgai/ha (PE), T5 - Oxyfluorfen 250 g ai / ha (POE at 20 DAT), T6 - Pendimethalin 1 kgai/ha (PE) fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT), T7 - Glyphosate 1 kg ai/ha 15 days before transplanting fb Pendimethalin 1 kg ai/ha (PE) fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT)]. The Site of the experimental plot is in subtropical climate and the experimental plot was clay loam in texture. It is tenaciously sticky when wet and hard when dry having pH 7.5. Two months old onion seedlings of variety, Nasik Red were transplanted in the plot on 25-1- 2015 and 28-1-2016 with a spacing of 15 X 10 cm and the plot size being 9 square metre. All the recommended package of practices were given to raise healthy crop. NPK were applied at recommended rates just before transplanting and half of the nitrogen was applied after four weeks of transplanting. The specific treatments during the course of experiment were also followed.

Results and Discussion

Effect on weeds

The prominent weed species in the experiment plot were *Physalis micrantha*, *Cyperus rotundus*, *Chenopodium album*, *Cynodon dactylon*, *Melilotus spp* etc. All the treatments showed significant reduction in total weed density and dry weight of weeds

as compared to unweeded control during both the years. Weed dry weight is the most important parameter to assess the weed competitiveness of the crop growth and productivity. Sparse weeds with high biomass might be more competitive for crops than dense weeds with lesser dry matter. Weed control efficiency which indicates the comparative magnitude of reduction in weed dry matter, was highly influenced by different weed control treatments. All the weed management treatments caused significant reduction in dry matter of weeds as compared to unweeded plot (Table 2). Significantly lower dry matter of weeds and higher weed control efficiency were observed under the plot which was kept weed free by hand weeding which was closely followed by application of Glyphosate 1 kg ai/ha 15 days before transplanting fb Pendimethalin 1 kg ai/ha (PE) fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT). This might be due to effective control of weeds under these treatments as a result of less number of weeds and lower weed biomass. The unweeded plot exhibited highest dry matter of weeds and lowest weed control efficiency. This was due to uncontrolled condition that favoured luxurious weed growth leading to increase in dry matter accumulation. These findings were in conformity with those reported by Nandal and Singh (2002), Channappagouder and Biradar (2007), Yadav *et.al* (2009).

Effect on crop growth and yield attributes

Weed management treatments under investigation showed significant superiority over control in respect of all the growth and yield parameters of onion during both the year of experimentation (Table 2). Highest growth attributes (viz. Plant height, neck thickness, bulb weight and bulb diameter) were observed when the plot was kept weed free throughout the crop season by hand

weeding. However application of glyphosate @ 1.0 kg/ha 15 days before transplanting fb pendimethalin 1 kg ai/ha (PE) fb oxyfluorfen 250 g ai/ha (POE at 20 DAT) was registered next highest treatment in respect of all these attributes. Similar trend was observed in respect of dry weight of weeds. This was due to the fact that lesser crop–weed competition was found at earlier stage of growth. Thus, providing favourable

environment to crop for better expression of growth and yield. Suppression of weed competition by pre and post emergence herbicide was convenient, which offers efficient and prolonged weed control and kept the crop weed free during the critical periods of competition. A similar findings were also reported by Khokhar *et al.* (2006) and Chandrika *et al.* (2009).

Table.1 Effect of weed management practices on growth and yield parameters of onion

Treatments	Plant height (cm)	No.of leaves plant ⁻¹	Neck thickness (cm)	Equatorial diameter (cm)	Weight bulb ⁻¹ (g)
T ₁ -Weed free plot	23.45	7.13	2.7	5.46	61.9
T ₂ -Two hand weeding at 20 and 40 DAT	20.35	6.27	1.6	4.56	61.4
T ₃ -Glyphosate 1 kg ai/ha 15 days before transplanting	19.30	7.60	1.5	3.89	57.3
T ₄ -Pendimethalin 1 kgai/ha (PE)	20.35	6.80	1.7	5.04	58.1
T ₅ -Oxyfluorfen 250 g ai / ha (POE at 20 DAT)	21.80	9.80	1.8	4.88	59.0
T ₆ -Pendimethalin 1 kgai/ha (PE) fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT)	22.0	7.60	1.7	5.20	59.99
T ₇ -Glyphosate 1 kg ai/ha 15 daysbefore transplanting fb Pendimethalin 1 kg ai/ha (PE) fb Oxyfluorfen 250 gai / ha (POE at 20 DAT)	23.0	9.87	2.6	5.46	62.5
T ₈ -Control (Weedy check)	18.25	5.80	0.8	2.0	13.33
S E _m (±)	0.160	0.42	0.14	1.11	0.60
CD (p=0.05)	1.3	1.27	0.30	3.37	1.29

Table.2 Effect of different weed management practices on dry matter of weeds, weed control efficiency, bulb yield and economics

Treatments	Total dry weight of weeds (g)	WCE (%)	Bulb yield (q/ha)	Gross return (Rs/ ha)	Net return (Rs/ha)	B:C ratio
T ₁ -Weed free plot	9.82	77.44	285.11	399155	281280	2.19
T ₂ -Two hand weedings at 20 and 40 DAT	23.43	46.17	171.77	23968	158090	1.05
T ₃ -Glyphosate 1 kg ai/ha 15 days before transplanting	28.62	34.27	143.33	200666	140410	1.06
T ₄ -Pendimethalin 1 kgai/ha (PE)	18.72	56.99	182.88	256032	181208	1.65
T ₅ -Oxyfluorfen 250 g ai / ha (POE at 20 DAT)	17.52	59.75	187.33	252262	195046	1.59
T ₆ -Pendimethalin 1 kgai/ha (PE)fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT)	17.35	60.14	233.33	326662	269720	2.30
T ₇ -Glyphosate 1 kg ai/ha 15 days before transplanting fb Pendimethalin 1 kg ai/ha (PE) fb Oxyfluorfen 250 g ai / ha (POE at 20 DAT)	11.25	74.15	275.11	385154	302524	2.86
T ₈ -Control (Weedy check)	43.53	-	48.88	68432	-38080	-0.27
S E _m (±)	5.11	-	0.61	-	-	-
CD (p=0.05)	10.97	-	1.30	-	-	-

Effect on yield and economics

The highest bulb yield (285.11 qha⁻¹) was obtained in weed free plot whereas, the next best treatment was T7 [application of glyphosate 1 kg ai /ha at 15 days before transplanting fb pendimethalin 1 kg ai /ha (PE) and post emergence application of oxyfluorfen 250 g ai /ha 20 days after transplanting] with yield of 275.11 qha⁻¹. This treatment exhibited increase in yield because weed population and weed growth remain less during the entire crop growth which leads to increase in various growth parameters of crop and the increase in bulb

yield .This supports with the findings of Sukhadia *et al*,(2002) and Chopra and Chopra (2007).

From the economic point of view ,the highest net monetary return of Rs. 30252 was obtained with the application of glyphosate 1 kg ai /ha at 15 days before transplanting fb pendimethalin 1 kg ai /ha as pre-emergence and post emergence application of oxyfluorfen 250 g ai /ha after 20 days transplanting with benefit cost ratio of (2.86). This was due to reduction of human labours for controlling with the application of herbicide mixture. Though

hand weeding treatment where the plot was kept weed free, exhibited highest WCE and bulb production but its cost of cultivation was more due to higher human labour consumption. Therefore, combined application of different herbicides seems to be the best for the control of weeds and also feasible and economic to the farmers.

From the present investigation it could be concluded that the combined effect of glyphosate 1 kg a.i./ha at 15 days before transplanting followed by pre-emergence application of pendimethalin 1 kg a.i. /ha and post emergence application of oxyfluorfen 250 g a.i. /ha can keep the weed density and dry weight reasonably at lower level and enhance the productivity of *rabi* onion resulting in higher economic returns.

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