Evaluation of Pre-Emergence Applied Herbicides for Their Effect on Weeds and Yield of Transplanted Bulb Onion (*Allium cepa L*)

Qayum Nawaz*, Misbahuddin**, Waheedullah** and Ghulam Sarwar Khan***

ABSTRACT

The pre-emergence applied herbicides such as pendimethalin [N-(1-Ethylproply) 3, 4-dimethyl-2, 6 dinitorobenzenamine] methabenzthiazuran (1,3-dimethyl-3(2-benzothiazolyl) Urea] were investigated during 1984-85 and 1985-86 for their effect on weeds and yield of onions at the Agricultural Research Institute, Tarnab (Peshawar). Hand weeding controlled the weeds and increased the bulb yield of onion significantly. Application of pendimethalin (1.5 kg ai/ha) and methabenzthiazuron (1.4 kg ai/ha) resulted in yields comparable to the hand weeded control. These herbicides gave an excellent control of grasses and broad-leaved weeds. Methabenzthiazuron gave the highest cost/benefit ratio as compared to rest of the weed control treatments.

INTRODUCTION

Weed control is an unavoidable need for successful production of vegetable crops. Production losses increase with the increase in weed infestation. Such losses arise mainly from the competition between crops and weeds for light, water, space and nutrients. As reported by Upadhaya and Viashyampayan(1960), economic losses in crops due to weeds are greater than the combined damage caused by insects and plant disease.

Weeds compete with the crop plants more at very early stages. Usually, farmers do not weed early enough to prevent major damage due to this competition. To benefit from weed control inputs, farmers must either cultivate or hand weed very early or use pre-emergence herbicides (Furtick, 1970). Bleasdale (1959) and Wicks *et al* (1973) also reported that early weeding unfailingly produces better yields. They further stated that weeds, even if present for only two weeks following crop emergence, can retard crop growth. Other studies have shown that the crop requires freedom from weeds for the first one-third of the growing season (Palmblade, 1968).

Onions exhibit greater suceptability to weed competition than most of the other crops. Without weed control, onion yield shrinks near to zero. Because of slow rate of early growth in onions and the absence of dense foliage, initial competition tends to be severe (Hewson and Roberts, (1971) and Roberts (1973).

To prevent yield losses, the researchers concluded that onions need to be kept weed-free for 12 weeks after emergence due to lack of vigrous crop foliage, and inability to recover from competition (Roberts, 1973 and Shadbolt and Holm,

*Plant Physiology Section, Agric. Res. Inst. Tarnab (Peshawar).

**Vegetable Section, Agric. Res. Inst. Tarnab (Peshawar).

***Director, Sugarcrop Research Institute, Mardan.

1956). Numerous research reports have indicated that many herbicides can be used effectively and selectively to control weeds in onion (Bhan, *et al.* 1976, Biroli, *et al* 1980, Sandhu and Randhawa, 1980).

Farmers are frequently restrained by the immensity of the task of manual weeding, particularly in vegetable crops. These studies were undertaken to find out the efficacy of two pre emergence applied herbicides for their effect on weed control and bulb yield of transplanted onion.

MATERIALS AND METHODS

Field trials were conducted at Agricultural Research Institute Tarnab, Peshawar, during 1984-85 and 1985-86. The experimental field was loamy clay in texture with pH of 7.8. Treatments included pendimethalin (1.5 kg a.i/ha) pre-emergence applied, methabenzthiazuron (1.4 kg ai/ha) pre-emergence applied, hand weeding and weedy check. The experiment was laid out in a randomised complete block design with four replications.

Onion seedlings at the two-three leaf stage were transplanted in the first week of February in rows on ridges 60 cm. apart. Net plot size harvested was 3.0 m x3.0 m. Nitrogen at a rate of 100 kg/ha, phosphorus at 50 kg P_2O_5/ha and potash at 50 kg K_2O/ha were used. Half nitrogen and full phosphorus and potash were applied before transplanting during land preparation and remaining Nitrogen dose was side-dressed four weeks after transplanting.

Pendimethalin (Stomp 330 E) and methabenzthiazuron (Tribunil 70 WP) were sprayed one day after transplanting using a knapsack sprayer with a spray volume discharge of 300 lit/ha.

Treatment effects on weeds were assessed by counting the individual weed species after 35 days of herbicide application using a quadrat of 1 m^2 randomly placed in each treatment at two places.

The crop was harvested five months after transplanting. The data recorded on weed density and fresh weight of bulb onion were subjected to appropriate statistical analysis. Computations for cost/benefit ratio of various treatments were also made.

RESULTS AND DISCUSSION

The data regarding weed density indicated that the weed infestation was dominated by *Poa annua* L. the most common weed of onion crop of Peshawar Valley. Among the broad-leaved weeds, *Melilotus parviflorus* Desf and *Medicago denticulata* willd. were the dominant weed species (Table 1-2).

All the weed control treatments significantly reduced the weed density as compared to control (weedy check), which had the highest number i.e 239 and 509 weed plants per unit area in the year 1984-85 and 1985-86, respectively. Among the three treatments/i.e, pendimethalin, methabenzthiazuron and hand weeding, there was no significant difference in their performance as far as weed density was concerned. However, in both the years, hand weeding produced the best weed control, followed by pendimethalin and methabenzthiazuron. Both the herbicides controlled *Poa annua* L. and broad-leaved weeds, such as *Cheno-*

Table 1 Effect of weed control treatments on weed density in transplanted onion (1984-85).

Weeds	*Weed density* (N/m²)			
	Weedy check	Hand weeding	Pendimethalin	Methabenzthiazuron
Poam annua L.	125	10	21	34
Melilotus parviflorus Desf	50	3	9	15
Medicago denticulata Willd	32	3	13	14
Coronopus didymus (L) Sm	11	4	1	3
Chenopodium album L.	9	1	1	3
Rumex dentatus Linn	6	1	1	2
Convolvulus arvensis L.	6	1	3	1
	—	239	23	49
Total	239	23	49	72

S.E. for treatments 5.45
L.S.D. 5% 12.33
do 1% 17.72

Table 2 Effect of weed control treatments on weed density in transplanted onion (1985-86)

Weeds	Weed density (N/m²			
	Weedy check	Hand weeding	Pendimethalin	Methabenz thiazuron
1 *Poa annua* L.	208	12	17	21
2 *Melilotus parviflorus*	124	6	19	24
3 *Medicago denticulata* Willd	93	6	13	16
4 *Coronopus didymus*(L) Sm	29	2	3	3
5 *Chenopodium album* L.	22	2	4	4
6 *Rumex dentatus* Linn.	14	1	2	3
7 *Convolvulus arvensis* L.	11	0	1	3
8 *Veronia* Schreb	8	1	0	1
Total	509	30	59	75

S.E. for treatments = 0.44
L.S.D. 5% = 1.40
do 1% = 2.01

podium album L. *Convolvulus-arvensis* L.*Coronopus didymus* (*L.*)sm.*Medicago denticulata willd Rumex dentatus Linn.* and *Melilotus parviflorus Desf.* effectively. (Table 1 and 2).

None of the herbicides produced apparent damage to the crop, suggesting that these chemicals are quite safe and suitable for control. Similar observations were reported by Sandhu and Randhawa, (1980), and Bhan *et al* (1976), indicating that these herbicides can be used effectively, and selectively to control weeds in onion.

In both the years, different treatments showed significant differences with

regard to bulb yield of onion. Hand weeding out yield rest of the treatments and gave the highest bulb yield. It was followed by pendimethalin and methabenzthiazuron, respectively. Yields obtained from weedy check were significantly lower than the other treatments (Table 3).

The results obtianed clearly indicate that weed infestation has positive correlation with the yield of onion. It showed that onion plants are highly susceptable to weed infestation as the yield in weedy check was reduced to about 1/2 of that of hand-weeding. These results are closely related with the findings of Hewson and Roberts (1971) and Roberts (1973) who reported that onion yield is drastically reduced due to weeds because of the slow germination and early growth of onion and hence the crop canopy during the critical period of weed crop competition.

These studies also suggest that pendimethalin (Stomp 33 E) and methabenzthiazuron (Tribunil 70 WP) were the most effective and safe herbicides when applied at pre-emergence stage.

Computations on cost/benefit ratio of the treatments revealed that methabenzthiozuron gave the highest cost/benefit ratio of 1:46.00 which is nearly double than the cost/benefit ratio of hand weeded treatment, although it gave the highest bulb yield. Pendimethalin also gave the highest cos/benefit ratio than hand weeding (Table 4). It is evident from these data that farmers would be willing to invest on chemical weed control as compared to hand weeding.

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Table 3. Effect of weed control treatments on the bulb yield of transplanted onion

Treatments	1984-85		1985-86	
	Yield t/ha	Increase in yield over check t/ha	Yield t/ha	Increase in yield over check t/ha
Weedy check	9.13	—	9.44	—
Hand-weeding	19.22	10.09	20.50	11.06
Pendimethalin (1.5 kg ai/ha)	18.74	9.61	19.13	9.69
Methabenzthiazuron (1.4 kg ai/ha)	18.33	9.20	18.66	9.22
S.E.	0.743		0.872	
L.S.D. 5%	2.388		2.786	
-do- 1%	3.435		4.007	

Table 4. Cost/benefit ratio of different weed control treatments.

Treatments	Yield t/ha	Income (in Rs)	Cost/treat (in Rs)	Cost/benefit ratio over the check
Weedy-check	9.3	18,600		
Hand-weeding	19.9	39,800	860	24.65
Pendimethalin (1.5 kg ai/ha)	18.9	37,800	585	32.82
Methabenzthiozuron (1.4 kg ai/ha)	18.5	37,000	400	46.00