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Sedges management in bottle gourd with halosulfuron-methyl

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ABSTRACT

A field experiment was conducted to evaluate the efficacy of halosulfuron-methyl for the control of *Cyperus* spp. in bottle gourd. The treatments constituted of halosulfuron-methyl at two doses (52.5 and 67.5 g/ha) applied at 3-4 leaf stages of sedges, which was compared with recommended dose of metribuzin (490 g/ha) as pre-emergence, two hand weeding (20 and 35 DAS) and unweeded check. The results revealed that all the weed control treatments significantly reduced *Cyperus* spp. density as compared to unweeded check except metribuzin 490 g/ha. The lowest weed biomass of *Cyperus* spp. was recorded with application of halosulfuron-methyl at higher dose (67.5 g/ha) which was significantly lower than halosulfuron-methyl 52.5 g/ha and metribuzin 490 g/ha. Significantly highest fruit yield of bottle gourd was recorded with application of halosulfuron-methyl 67.5 g/ha than other treatments. The herbicide tested in this study did not show any adverse effect on germination and grain yield of succeeding wheat crop.

Key words: Bottle gourd, *Cyperus*, Effect on succeeding crop, Halosulfuron-methyl, Weed control efficiency

Bottle gourd (*Lagenaria siceraria*) is a commonly grown vegetable crop of India and belongs to family Cucurbitaceae. It is cultivated in an area of about 0.10 million ha with a production and productivity of 1.82 mt and 18.2 t/ha, respectively (Anonymous 2015). Amongst many other reasons for its lower productivity, poor weed management is one of the crucial factors as due to slower early growth and close canopy structure, the bottle gourd faces severe competition from weeds, particularly from the perennial sedges resulting in huge yield losses. In some studies, losses in fruit yield of bottle gourd due to weeds were estimated up to 37 - 41% (DWSR 2013, Dash and Mishra 2014) as weeds pose a major biotic constraint in the crop culture. Socioeconomic risk in labour cost and availability warrant for alternate effective and economic weed control practices with inclusion of effective herbicides in these vegetable production systems. Infestation of problem weeds like *Cynodon dactylon* and *Cyperus rotundus* among other associated weeds is a major concern in these crops. The effect of these associated weeds has been so devasting in certain cases that leading to complete crop failure. Therefore, weed control at early crop stage is important to enhance the economic yield of the crop. Halosulfuron-methyl, a relatively new molecule is known to be very effective against sedges (Rathika *et al*. 2013). However, no information is available on use of halosulfuron-methyl on the bottle gourd in the state of Jammu and Kashmir; hence the present investigation was carried out.

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MATERIALS AND METHODS

A field experiment was conducted during *Kharif* seasons of 2012 and 2013 at the research farm of Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, (J&K) to evaluate the bio-efficacy of post-emergence halosulfuron-methyl (75% WG) for the control of *Cyperus* spp. in bottle gourd and on succeeding crop wheat. The soil of the experimental field was sandy clay loam in texture. The experiment was laid out in randomized block design with 5 treatments, *viz*. halosulfuron-methyl 52.5 and 67.5 g/ha, pre-emergence metribuzin 490 g/ha, farmer's practice (2 HW at 20 and 35 DAS) and untreated control with four replications. The dose of halosulfuron-methyl 135 g/ha was applied only for residual study. *Punjab Komal* variety was sown on 9th of June, 2012 in first year and 21st of June, 2013 in second year of experimentation at 45 cm spaced rows within row to row and plant to plant. The recommended dose of N:P:K was applied at 100 kg N, 50 kg P_2O_5 and 50 kg K_2O/ha with source of urea, DAP and MOP. The efficacy of halosulfuron-methyl

was worked out only against *Cyperus* spp. by eliminating other weeds, *viz.* grassy and broad-leaved weeds (BLWs). At 15 days after sowing of crop, *viz.* at 3-4 leaf stage of *Cyperus* spp. halosulfuron-methyl was sprayed on bottle gourd and observations on *Cyperus* spp. *i.e* weed density, weed biomass and weed control efficiency (WCE) were recorded at 20 and 35 days after application of herbicidal treatments. Experimental crop was raised by using recommended package of practices other than weed control. The weed control efficiency was calculated by using formula given by Mishra and Mishra (1997). The values with respect to density and biomass of weed were subjected to square root transformation $(\sqrt{x+1})$ as described by Bartlett (1947) and analyzed statistically.

RESULTS AND DISCUSSION

Effect on weed density and biomass

On the basis of two years study, it was observed that out of the total weed density in weedy plot, *Cyperus rotundus* (43.9%) and *Cyperus iria* (28.5%) were found to be the most dominating weeds comprising of 72.4% of the population (Table 1) followed by narrow-leaf weeds (24%) *viz. Echinochloa crusgalli* (12.2%), *Setaria glauca* (11.8%) and *Commelina benghalensis* (3.6%). At 20 days after application of treatments, all the weed control treatments significantly reduced the density of *Cyperus* spp. than unweeded control except metribuzin 490 g/ha in both the years. Amongst the various weed management treatments, remarkably highest per cent control of *Cyperus* spp. was recorded with application of halosulfuron-methyl at higher dose (67.5 g/ha) in both the years of experimentation (Table 2). Higher dose of halosulfuron-methyl (67.5 g/ha) recorded significantly lowest density of *Cyperus* spp. as compared to rest of the herbicidal treatments. A similar trend was also obtained by the weed control treatments on *Cyperus* spp. at 35 DAT except that weed density slightly increased probably owing to the fact that some weeds might have emerged at later stages. Application of halosulfuron-methyl 67.5 g/ha significantly reduced the dry matter accumulation of *Cyperus* spp. as compared to rest of the herbicidal treatments at both stages 20 and 35 DAT during both the years of experimentations. These results were in close conformity with the findings of Rathika *et al.* (2013) and Meher *et al.* (2013). Application of halosulfuron-methyl at 67.5 g/ha also recorded highest weed control efficiency at both the stages followed by farmer's practice (2 HW) and lower dose of halosulfuron-methyl (52.5 g/ha) (Table 3). This might be due to reducing the population as well as dry matter accumulation of *Cyperus* spp. which resulted increased weed control efficiency with halosulfuron application (Rathika *et al.* 2013).

Table 1. Relative weed density in weedy plot at 20 DAS

Weed species	Weed intensity/m^2			
	2012	2013	Average (no.)	Average (%)
Sedges				
Cyperus rotundus	50	47	48.5	43.9
Cyperus iria	32	31	31.5	28.5
Narrow leaf weeds				
Echinochloa crusgalli	17	10	13.5	12.2
Setaria glauca	20	6	13.0	11.8
Broad leaf weeds				
Commelina benghalensis	05	03	4.0	3.6
Total	124	97	110.5	100.0

Effect on crop

All herbicidal treatments except for metribuzin 490 g/ha in 2013 gave significantly higher fruit yield as compared to unweeded control during both the years. Among different herbicidal treatments, application of halosulfuron-methyl 67.5 g/ha

Table 2. Effect of different herbicides against *Cyperus* spp. in bottle gourd

Treatment	Dose (g/ha)	*Cyperus* spp./m^2							
		Pre-treatment		20 DAA		Mean% control over pre-treatment	35 DAA		Mean% control over pre-treatment
		2012	2013	2012	2013		2012	2013	
Halosulfuron-methyl	52.5	9.12 (82)	9.02 (80)	5.30 (27)	5.13 (25)	67.6	5.39 (28)	5.35 (28)	65.60
Halosulfuron-methyl	67.5	8.89 (79)	8.76 (76)	2.24 (4.1)	2.23 (4.0)	94.8	3.07 (8.5)	3.08 (8.5)	91.98
Metribuzin*	490	9.04 (81)	8.51 (71)	9.6 (92)	9.14 (82)	-14.8	10.08 (101)	9.90 (97)	-30.17
Farmer's Practice (2 hand weeding)	20 and 35 DAS	8.86 (78)	8.62 (73)	6.04 (35)	6.47 (41)	49.3	6.48 (41)	6.08 (36)	49.17
Untreated control	-	9.02 (80)	9.09 (82)	9.95 (98)	9.87 (96)	-20.3	10.63 (112)	10.46 (108)	-36.45
LSD (P=0.05)		NS	NS	2.09	1.21	-	2.38	1.91	-

DAS: Days after sowing, DAA: Days after application of treatment, Figures in parentheses are original values and subjected to square root transformation $(\sqrt{x+1})$, *Before application of halosulfuron-methyl

Table 3. Dry weed biomass, weed control efficiency against *Cyperus* spp. and fruit yield of bottle gourd in different herbicidal treatments

Treatment	Dose (g/ha)	*Cyperus* dry biomass (g/m^2)				Mean weed control efficiency (%)		Fruit yield (t/ha)	
		20 DAA		35 DAA					
		2012	2013	2012	2013	20 DAA	35 DAA	2012	2013
Halosulfuron-methyl	52.5	4.26 (17.31)	4.09 (15.70)	5.15 (25.49)	5.22 (26.27)	68.3	63.9	18.70	16.85
Halosulfuron-methyl	67.5	1.22 (0.53)	1.24 (0.55)	1.95 (2.80)	1.97 (2.89)	99.0	96.0	20.10	19.05
Metribuzin	490	6.71 (44.4)	6.30 (38.77)	7.36 (53.53)	7.37 (53.34)	20.1	25.6	16.00	12.00
Farmer's practice (2 hand weeding)	20 & 35 DAS	2.71 (6.38)	2.67 (6.14)	2.96 (7.79)	2.60 (5.76)	88.0	90.6	18.60	17.00
Untreated control	-	7.21 (51.22)	7.35 (52.98)	8.59 (73.12)	8.46 (70.52)	-	-	14.05	11.50
LSD (P=0.05)		3.01	0.67	3.14	0.60	-		1.31	0.69

DAS: Days after sowing, DAA: Days after application treatment, Figures in parentheses are original values and subjected to square root transformation $(\sqrt{x+1})$.

recorded significantly higher fruit yield than rest of the treatments which was 43 and 65 per cent higher over unweeded control during 2012 and 2013, respectively. The results were in close conformity with Dash and Mishra (2014). However, fruit yield obtained in lower dose of halosulfuron-methyl (52.5 g/ha) was found to be statistically at par with farmer's practice (Table 3). The higher fruit yield in halosulfuron-methyl 67.5 g/ha was due to efficient control of *Cyperus* spp. The results were in agreement with the findings of Singh *et al.* (2011) and Suganthi *et al.* (2013). Among the herbicidal treatments, lowest fruit yield was recorded with pre-emergence application of metribuzin 490 during both the years. Based on visual observations, the herbicidal treatments did not show any phytotoxic in bottle gourd. There was no residual effect on succeeding wheat crop by the herbicidal treatments. Germination of succeeding wheat crop ranged between 87 to 92 per cent. Also herbicides tested in this study produced almost similar grain yield of succeeding wheat crop even at a higher dose of halosulfuron-methyl 135 g/ha (Table 4). The result was also similar with the findings of Rathika *et al.* 2013.

Table 4. Effect of in different herbicidal treatments on wheat sown as follow-up crop

Treatment	Germination (%)		Yield (t/ha)	
	2012	2013	2012	2013
Halosulfuron- methyl 52.5 g/ha	90.0	87.0	2.57	2.65
Halosulfuron-methyl 67.5 g/ha	88.0	88.0	2.52	2.60
Halosulfuron-methyl 135 g/ha	92.0	90.0	2.58	2.70
Metribuzin* 490 g/ha	91.0	89.0	2.49	2.64
Farmer's practice (2 hand weeding) 20 and 35 DAS	89.0	88.0	2.50	2.71
Untreated control	88.0	87.0	2.51	2.69

DAS: Days after sowing; *Before application of halosulfuron-methyl

On the basis of two years of experimentation, it was concluded that post-emergence application of halosulfuron-methyl 67.5 g/ha applied at 3-4 leaf stage of sedges was most promising in controlling *Cyperus* spp.

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