Madras Agric. J., 99 (10-12): 743-746, December 2012
https://doi.org/10.29321/MAJ.10.100185

Residual Effect of Triasulfuron and Other Herbicides against Greengram, Blackgram and Cowpea

Gururaj Sajjan, H.M. Jayadeva* and N. Krishnamurthy
Department of Agronomy, College of Agriculture, Bengaluru - 65, Karnataka

Field experiments were carried during summer 2009 and 2010 at Agricultural Research Station, Kathalagere, district Davangere in the southern transitional zone of Karnataka to know the residual effect of triasulfuron and other weedicides against test crops. The soil of the experimental field was red loamy. The field experiment was laid out in randomized block design with 10 treatments *viz.,* After harvest of rice crop, all the plots were sown with three rows each of test crops *viz.* greengram, blackgram and cowpea. Germination per cent of greengram, blackgram and cowpea did not differ significantly due to residual effect of weed control treatments. At 10 DAS, Pyrazosulfuron @ 25 g a.i. ha^{-1} recorded lower dry weight of greengram (0.026 and 0.040 g plant^{-1} during 2009 and 2010, respectively), blackgram (0.033 and 0.054 g plant^{-1} during 2009 and 2010, respectively) and cowpea (0.072 and 0.121g plant^{-1} during 2009 and 2010, respectively). Hand weeded twice recorded higher dry weight of these test crops. The pyrazosulfuron @ 25 g a.i. ha^{-1} recorded significantly lower seed yield of greengram (182 and 147 kg ha^{-1} during 2009 and 2010, respectively), blackgram (532 and 349 kg ha^{-1} during 2009 and 2010, respectively) and cowpea (1272 and 499 kg ha^{-1}during 2009 and 2010, respectively), followed by almix @ 4 g a.i. ha^{-1}.

Key words: Triasulfuron, Test crops, Germination, Dry matter production, Seed yield

Sulfonylurea herbicides are a unique group of herbicides used for controlling a range of weeds and some grasses in a variety of crops and vegetables. They have been extremely popular worldwide because of their low mammalian toxicity, low use rate, and unprecedented herbicidal activity (Ajit and Jean, 2002). The sulfonylurea herbicides are degraded mainly by non-biological chemical hydrolysis and soil micro-organisms (Sabadie, 1990) and their general tendency to persist longer in soil may be injurious to succeeding crop in the rotation (Beyer *et al.,* 1998).

Residual behavior of any herbicide should be known for different crop rotations. This becomes more important from the farmers' point of view where inappropriate use of these and other herbicides cannot be totally excluded. Accidents may happen most often due to lack of proper knowledge and sometimes out of ignorance (Ashok Yadav *et al.,* 2003). Triasulfuron being a new member of sulfonylurea herbicide group has not been tested in rice in Bhadra command area. Hence keeping these points in mind, an attempt has been made to know the residual effect of Triasulfuron 20 WG on succeeding crops.

Materials and Methods

Field experiment were carried during summer 2009 and 2010 at Agricultural Research Station, Kathalagere, district Davangere in the Southern transitional zone of Karnataka to know the residual effect of triasulfuron and other herbicides against test crops. The soil of the experimental field was red loam. The field experiment was laid out in randomized block design with 10 treatments *viz.,* T_1 = Weedy check, T_2 = Triasulfuron 20 WG @ 8 g a.i. ha^{-1} 12 DAT, T_3 = Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT, T_4= Triasulfuron 20 WG @ 12 g a.i. ha^{-1} 12 DAT, T_5 = Triasulfuron 20 WG @ 24 g a.i. ha^{-1} 12 DAT, T_6 = Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT, T_7 = Almix 4 g a.i. ha^{-1} 12 DAT, T_8 = Handweeding @ 20 and 40 DAT, T_9 = Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT + Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT and T_{10} = Pyrazosulfuron 10 WP @ 25 g a.i. ha^{-1} 3 DAT. The gross plot size of the experiment for rice was 18.0 m^2 (6.0 m x 3.0 m). After the harvest of rice, all the plots were sown with three rows of each test crops *viz.* greengram, blackgram and cowpea during summer 2009 and 2010, keeping the original layout undisturbed. The test crops were sown at 30 cm X 10 cm, 30 cm X 10 cm and 45 cm X 15 cm for greengram, blackgram and cowpea, respectively. All the plots were kept weed free by one manual weeding at initial stage of crop growth (20 days after sowing). Germination percentage of the each test crop was recorded at 10 days after sowing by counting the number of seeds germinated out of 180 sown in each plot. Dry weight of test crops was recorded twice at 10 and 21 DAS. The seeds from corresponding succeeding crops in net plots were

*Corresponding author email: jayadeva98@rediffmail.com

harvested and sun dried. The total seed yield of each test crop was recorded and expressed in kilograms per hectare.

Results and Discussion

Germination of test crops

Germination per cent of greengram, blackgram and cowpea did not differ significantly due to residual effect of weed control treatments (Table 1) . The germination per cent of greengram varied from 98.00 100.00 and 84.00 to 85.33 per cent, in 2009 and 2010, respectively. The higher germination percentage of greengram was recorded in hand weeded twice plot (100 and 85.33 % in 2009 and 2010, respectively). The germination per cent of blackgram varied from 95.33 to 97.33 and 86.00 to 88.00 per cent, in 2009 and 2010, respectively. More number of blackgram seeds germinated in weedy check (99.33 % during 2009) and hand weeded plot (88.00 % during 2010). The germination per cent of cowpea varied from 93.67 to 96.67 and 88.33 to 90.67 per cent, in 2009 and 2010, respectively. The higher germination per cent of cowpea seeds was observed in Pyrazosulfuron 10 WP @ 25 g a.i. ha^{-1} 3 DAT (96.67 %) during 2009 and hand weeded twice (90. 67 %) during 2010. This may be attributed to low residual activity of the herbicides. Narayanan *et al.* (1999) also observed no residual toxicity due to Metsulfuron methyl @ 4 g a.i. ha^{-1} applied to rice crop, on the succeeding blackgram and sesame.

Table 1. Germination per cent of succeeding crops at 10 days after sowing as influenced by residual effect of Triasulfuron 20 WG and other herbicides.

Treatment	Green gram		Blackgram		Cowpea	
	2009	2010	2009	2010	2009	2010
T_1 = Weedy check	99.33	85.00	99.33	87.67	95.33	90.00
T_2 = Triasulfuron 20 WG @ 8 g a.i. ha^{-1} 12 DAT	98.00	85.00	97.00	87.33	96.33	90.00
T_3= Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	99.33	84.67	96.33	87.33	95.67	89.33
T_4= Triasulfuron 20 WG @ 12 g a.i. ha^{-1} 12 DAT	99.33	84.67	96.67	87.00	95.67	89.33
T_5 = Triasulfuron 20 WG @ 24 g a.i. ha^{-1} 12 DAT	99.33	84.33	96.33	86.67	95.33	88.67
T_6= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT	98.00	84.33	95.67	86.00	95.67	88.33
T_7= Almix 4 g a.i. ha^{-1} 12 DAT	98.33	84.00	95.33	86.00	93.67	88.33
T_8 = Handweeding @ 20 and 40 DAT	100.00	85.33	97.33	88.00	94.67	90.67
T_9= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT+ Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	98.00	84.67	96.00	87.00	93.67	89.00
T_{10} = Pyrazosulfuron 10 WP @ 25 g a.i. ha^{-1} 3 DAT	96.00	84.33	94.33	87.00	96.67	89.00
S.Em ±	1.13	0.43	1.511	0.87	2.19	0.88
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Dry matter production of test crops at 10 DAS

Triasulfuron and other herbicides significantly influenced the dry weight of greengram, blackgram and cowpea at 10 DAS (Table 2). Significantly lower dry weight of greengram (0.026 and 0.040 g $plant^{-1}$ 2009 and 2010, respectively) was recorded by Pyrazosulfuron @ 25 g a.i. ha^{-1} while the higher being 0.036 and 0.054 g $plant^{-1}$ during 2009 and 2010 recorded under hand weeding twice. Significantly higher dry weight of blackgram was recorded by hand weeding twice (0.044 and 0.076 g $plant^{-1}$ in 2009 and 2010, respectively) followed by Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT + Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT (0.043 and 0.073 g $plant^{-1}$ during 2009 and 2010, respectively). The significantly lower dry weight of blackgram was recorded under Pyrazosulfuron 10 WP @ 25 g a.i.

Table 2. Dry weight (g $plant^{-1}$) of succeeding crops at 10 days after sowing as influenced by residual effect of triasulfuron 20 WG and other herbicides.

Treatment	Green gram		Blackgram		Cowpea	
	2009	2010	2009	2010	2009	2010
T_1 = Weedy check	0.034	0.046	0.041	0.070	0.083	0.151
T_2 = Triasulfuron 20 WG @ 8 g a.i. ha^{-1} 12 DAT	0.033	0.049	0.040	0.071	0.076	0.155
T_3= Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	0.033	0.045	0.040	0.070	0.075	0.151
T_4= Triasulfuron 20 WG @ 12 g a.i. ha^{-1} 12 DAT	0.031	0.044	0.039	0.070	0.075	0.139
T_5 = Triasulfuron 20 WG @ 24 g a.i. ha^{-1} 12 DAT	0.030	0.043	0.035	0.069	0.074	0.135
T_6= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT	0.035	0.049	0.042	0.072	0.084	0.159
T_7= Almix 4 g a.i. ha^{-1} 12 DAT	0.028	0.043	0.035	0.066	0.074	0.133
T_8 = Handweeding @ 20 and 40 DAT	0.036	0.054	0.044	0.076	0.088	0.182
T_9= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT + Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	0.036	0.052	0.043	0.073	0.087	0.173
T_{10} = Pyrazosulfuron 10 WP @ 25 g a.i. ha^{-1} 3 DAT	0.026	0.040	0.033	0.054	0.072	0.121
S.Em ±	0.004	0.001	0.005	0.002	0.008	0.002
CD (P=0.05)	NS	0.003	NS	0.005	NS	0.007

ha^{-1} 3 DAT (0.033 and 0.054 g plant^{-1} during 2009 and 2010, respectively). Cowpea plants under hand weeding twice recorded significantly higher dry matter production (0.088 and 0.182 g plant^{-1} during 2009 and 2010, respectively) over rest of the treatments. Pyrazosulfuron @ 25 g a.i. ha^{-1} recorded significantly lower dry weight (0.072 and 0.121 g plant^{-1} during 2009 and 2010, respectively) over rest of the treatments. This may be attributed to low residual activity of the herbicides. Narayanan *et al.* (1999) also observed no residual toxicity due to Metsulfuron methyl @ 4 g a.i. ha^{-1} applied to rice crop, on the succeeding blackgram and sesame.

Dry matter production of test crops at 21 DAS

Hand weeding twice recorded significantly higher dry weight of greengram (0.086 and 0.099 g plant^{-1} during 2009 and 2010, respectively) which was on par with Pretilachlor @ 625 g a.i. ha^{-1}, 3 DAT + Triasulfuron @ 10 g a.i. ha^{-1} (0.083 and 0.098 g plant^{-1} during 2009 and 2010, respectively). However, significantly lower dry weight of greengram (0.057 and 0.084 g plant^{-1} during 2009 and 2010, respectively) was recorded by Pyrazosulfuron @ 25 g a.i. ha^{-1} followed by Almix @ 4 g a.i. ha^{-1} (0.064 and 0.086 g plant^{-1} during 2009 and 2010, respectively) which were on par with each other (Table 3). The drastic reduction in shoot height and dry matter production of all test crops (maize, soybean, moong, sorghum) was reported by Randhawa *et al.* (2007) when the Pyrazosulfuron-ethyl was applied at higher concentrations.

Application of Triasulfuron and other herbicides influenced the dry weight of blackgram significantly at 21 DAS. Pyrazosulfuron @ 25 g a.i. ha^{-1} was recorded significantly lower dry weight (0.078 and 0.115 g plant^{-1} during 2009 and 2010, respectively) followed by Almix @ 4 g a.i. ha^{-1} (0.080 and 0.127 g plant^{-1} during 2009 and 2010, respectively) and Triasulfuron @ 24 g a.i. ha^{-1}(0.083 and 0.133 g plant^{-1} during 2009 and 2010, respectively), which recorded on par results with each other. However, significantly higher dry weight was recorded by hand weeding twice (0.096 and 0.153 g plant^{-1} during 2009 and 2010, respectively).

Dry weight of cowpea at 21 DAS was differed significantly among different treatments (Table 3). Hand weeding twice recorded significantly higher dry weight (0.253 and 0.265 g plant^{-1} during 2009 and 2010, respectively) over all the treatments.

Table 3. Dry weight (g plant^{-1}) of succeeding crops at 21 days after sowing as influenced by residual effect of triasulfuron 20 WG and other herbicides.

Treatment	Green gram		Blackgram		Cowpea	
	2009	2010	2009	2010	2009	2010
T_1 = Weedy check	0.082	0.096	0.089	0.142	0.221	0.228
T_2 = Triasulfuron 20 WG @ 8 g a.i. ha^{-1} 12 DAT	0.078	0.097	0.087	0.143	0.205	0.236
T_3 = Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	0.078	0.095	0.086	0.141	0.205	0.218
T_4= Triasulfuron 20 WG @ 12 g a.i. ha^{-1} 12 DAT	0.078	0.093	0.085	0.136	0.201	0.212
T_5 = Triasulfuron 20 WG @ 24 g a.i. ha^{-1} 12 DAT	0.076	0.091	0.083	0.133	0.192	0.208
T_6= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT	0.081	0.097	0.090	0.146	0.211	0.237
T_7= Almix 4 g a.i. ha^{-1} 12 DAT	0.064	0.086	0.080	0.127	0.182	0.201
T_8 = Handweeding @ 20 and 40 DAT	0.086	0.099	0.096	0.153	0.253	0.265
T_9= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT + Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	0.083	0.098	0.091	0.147	0.215	0.252
T_{10} = Pyrazosulfuron 10 WP @ 25 g a.i. ha^{-1} 3 DAT	0.057	0.084	0.078	0.115	0.180	0.194
S.Em ±	0.007	0.002	0.012	0.002	0.024	0.004
CD (P=0.05)	NS	0.006	NS	0.007	NS	0.010

Table 4. Seed yield (kg ha^{-1}) of succeeding crops as influenced by residual effect of triasulfuron 20 WG and other herbicides

Treatment	Green gram		Blackgram		Cowpea	
	2009	2010	2009	2010	2009	2010
T_1 = Weedy check	210	189	616	439	1297	578
T_2 = Triasulfuron 20 WG @ 8 g a.i. ha^{-1} 12 DAT	210	189	615	450	1294	584
T_3 = Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	208	178	611	422	1293	568
T_4= Triasulfuron 20 WG @ 12 g a.i. ha^{-1} 12 DAT	207	167	608	394	1291	544
T_5 = Triasulfuron 20 WG @ 24 g a.i. ha^{-1} 12 DAT	198	167	601	383	1283	534
T_6= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT	212	217	624	472	1299	589
T_7= Almix 4 g a.i. ha^{-1} 12 DAT	194	159	593	378	1282	506
T_8 = Handweeding @ 20 and 40 DAT	220	311	630	587	1312	600
T_9= Pretilachlor 50 EC @ 625 g a.i. ha^{-1} 3 DAT + Triasulfuron 20 WG @ 10 g a.i. ha^{-1} 12 DAT	217	228	625	549	1307	594
T_{10} = Pyrazosulfuron 10 WP @ 25 g a.i. ha^{-1} 3 DAT	182	147	532	349	1272	499
S.Em ±	11	4	61	6	12	4

CD (P=0.05)	NS	13	NS	17	NS	12

Among weed control treatments Pyrazosulfuron @ 25 g a.i. ha^{-1} recorded lower dry weight (0.180 and 0.194 g $plant^{-1}$ during 2009 and 2010, respectively). This may be attributed to low residual activity of the herbicides. Narayanan *et al.* (1999) also observed no residual toxicity due to Metsulfuron methyl @ 4 g a.i. ha^{-1} applied to rice crop, on the succeeding blackgram and sesame.

Seed yield

The pyrazosulfuron @ 25 g a.i. ha^{-1} recorded significantly lower seed yield of greengram (182 and 147 kg ha^{-1} during 2009 and 2010, respectively), blackgram (532 and 349 kg ha^{-1} during 2009 and 2010, respectively) and cowpea (1272 and 499 kg ha^{-1} during 2009 and 2010, respectively), followed by almix @ 4 g a.i. ha^{-1} (Table 4). This was mainly due to the residual effect of these herbicides which resulted in lower germination and lower dry matter accumulation. Randhawa *et al.* (2007) also reported that dry matter accumulation in succeeding crop of maize, soybean and sorghum was reduced with the application of pyrazosulfuron due to residual activity of the herbicide. Application of triasulfuron at higher dose (24 g ha^{-1}) also implies the residual effect on test crops as evidenced by the lower yields. The significantly higher yields obtained with combined application of Pretilachlor @ 625 g a.i. ha^{-1} along with Triasulfuron @ 10 g a.i. ha^{-1} may be due to maximum germination per cent and higher dry matter accumulation owing to low or no residual toxicity of these herbicides.

Based on the above results, it may be inferred that the application of pyrazosulfuron @ 25 g a.i. ha^{-1}, almix @ 4 g a.i. ha^{-1} and triasulfuron at higher dose (24 g ha^{-1}) to rice crop implies the residual effect on test crops *viz.,* greengram, blackgram and cowpea.

References

Ajit, K.S. and Jean, S. 2002. Hydrolysis of sulfonylurea herbicides in soils and aqueous solutions: a review, *J. Agric. Food Chem.,* **50**: 6253-6265.

Ashok Yadav, Mehta, R., Punia, S.S., Hooda, V., Malik, R.K., Rana V. and Bellinder, R.R. 2003. Residual effects of four sulfonylurea herbicides applied in wheat on succeeding crops in the rotation. *Indian J. Weed Sci.,* **35**: 259-261.

Beyer, M., Duffy, J., Hayand, J.V. and Schlueter, D.D. 1998. Sulfonylureas. In: *Herbicide Chemistry, Degradation and Mode of Action,* **3**: 117-189.

Narayanan, A.L., Veerabadran, V. and Poonguzalan, R. 1999. Performance of low dose high efficacy herbicide for weed control in transplanted rice, *Oryza,* **36**: 290-292.

Randhawa, S.K., Tarlok Singh, Surjit Singh, Amandeep Singh Brar and Bhatia, R.K. 2007. Residual effect of pyrazosulfuron-ethyl in rice on succeeding crops, *Indian J. Weed Sci.,* **39**: 36-39.

Sabadie, J. 1990. Chemical acid hydrolysis of metsulfuron-methyl. *Weed Res.,* **30:** 413-419.

Received: April 10, 2012; Accepted: June 11, 2012