

## Studies on the Carry-over Effects of Sulfosulfuron Applied to Wheat on the Succeeding Crops

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### ABSTRACT

Significant reduction in seed yield of raya and winter maize occurred due to carry-over effects of sulfosulfuron applied to wheat at recommended (25 g ha<sup>-1</sup>) and double the recommended dose (50 g ha<sup>-1</sup>) as compared to untreated plots. The reaction of berseem and vegetable pea was found to be variable and in these crops significant reduction in fodder and pod yield, respectively, was observed due to residual effects of sulfosulfuron even at recommended levels during 2004-05 only. The differences in sunflower yield due to carry-over levels of sulfosulfuron were non-significant during both the years. No residues of sulfosulfuron applied to wheat at 25 g ha<sup>-1</sup> and 50 g ha<sup>-1</sup> were detected in soil after wheat harvest.

### INTRODUCTION

Sulfosulfuron is recommended for controlling *Phalaris minor* and broadleaf weeds in wheat at 25 g ha<sup>-1</sup> as post-emergence i. e. 30-35 days after sowing of wheat. Sulfosulfuron belongs to sulfonyleurea group of herbicides, which is known for its long residual effects (Blair and Martin, 1988). The residues of sulfonyleurea may be due to the persistence of active chemical in soil for a longer period or due to the formation of stable and toxic metabolites of sulfosulfuron, which may affect the following sensitive crops (Moyer, 1995). So, these

studies were planned in order to find out residual effects of sulfosulfuron applied to wheat crop on the following **rabi** season crops viz., raya, berseem, sunflower, winter maize and vegetable pea.

### MATERIALS AND METHODS

Experiment was initiated at Research Farm, Department of Agronomy, Agrometeorology and Forestry, PAU, Ludhiana during the **rabi** season of 2002-03 in order to study the residual effect of sulfosulfuron applied to wheat at recommended (25 g ha<sup>-1</sup>) or double the recommended dose (50 g ha<sup>-1</sup>)

Table 1a. Details of treatments for three years

Treatment	Rabi (Wheat) (2002-03)	Kharif (Test crops) (2003)	Rabi (Test crops) (2003-04)	Kharif (Test crops) (2004)	Rabi (Test crops) (2004-05)	Kharif (Test crops) (2005)
T <sub>1</sub>	Leader R	Test crops	Test crops	Test crops	Leader R	Test crops
T <sub>2</sub>	Leader R	Rice	Leader R	Test crops	Test crops	Test crops
T <sub>3</sub>	Leader R	Rice	Leader R	Test crops	Leader R	Test crops
T <sub>4</sub>	Leader 2R	Rice	Leader 2R	Test crops	Test crops	Test crops
T <sub>5</sub>	Leader 2R	Test crops	Test crops	Test crops	Leader 2R	Test crops
T <sub>6</sub>	Unsprayed	Test crops	Test crops	Test crops	Test crops	Test crops

**Kharif** test crops : American cotton, desi cotton, maize, moong and soybean.

**Rabi** test crops : Raya, berseem, sunflower, winter maize, vegetable pea.

Leader at 25 g ha<sup>-1</sup> (R) and 50 g ha<sup>-1</sup> (2R) was applied to wheat crop.

Table 1b. Methodology adopted for **rabi** season test crops

Crop	Variety		Date of sowing		Inputs
	2003-04	2004-05	2003-04	2004-05	2003 to 05
Berseem	BL-10	BL-10	31-10-03	29-09-04	Recommended
Peas	Pea-88	Pea-88	30-10-03	11-11-04	-do-
Raya	RLM-619	RLM-619	30-10-03	11-11-04	-do-
Winter maize	Bulland	Bulland	03-12-03	11-11-04	-do-
Sunflower	SH 3322	PKSFH-118	03-02-04	07-02-05	-do-

on succeeding **rabi** season test crops. Six main plots of wheat with different treatments of sulfosulfuron to wheat during all the three years were kept in order to study the direct or cumulative effects of sulfosulfuron on the following (during next year) **rabi** season crops. The details of the treatments are given in Table 1a. One unsprayed main plot was also kept in order to compare the performance of test crops grown on plots with residues of sulfosulfuron.

Sulfosulfuron was sprayed at 25 and 50 g a. i. ha<sup>-1</sup> either regularly or alternatively in order to study the effect of direct or cumulative residues of sulfosulfuron on the succeeding test crops of **rabi** season. Residual treatments were kept in main plots and test crops in sub-plots.

Soil samples from 0-30 cm soil layer were taken before sowing the **rabi** season crops. The residues of sulfosulfuron were detected in the Residue Lab. of the department with HPLC. All test crops (listed in Table 1a) were raised with their recommended agronomic and plant protection practices. The name of the variety and date of sowing of these crops are given in Table 1b.

## RESULTS AND DISCUSSION

### Effect on Test Crops

#### Sunflower

No adverse effect due to residual toxicity of sulfosulfuron applied to wheat during previous season on the succeeding sunflower was observed as the differences in plant population, plant height, leaf area and head diameter, seed and stover yield

were found to be non-significant during both the years due to different residual treatments.

#### Vegetable Pea

Plant height, dry weight plant<sup>-1</sup>, leaf area and pod weight of field pea were not affected due to residual effect of sulfosulfuron applied to wheat (Table 2). However, significant reduction in plant population was recorded during 2004-05 crop season, due to double the recommended dose of sulfosulfuron to wheat. The number of pods plant<sup>-1</sup> was also found to be significantly less under both sulfosulfuron treatments as compared to untreated conditions. The differences in pod yield during 2003-04 were found to be non-significant. During 2004-05, significantly higher (5769 kg ha<sup>-1</sup>) pod yield was recorded under no residue of sulfosulfuron as compared to its recommended (5135 kg ha<sup>-1</sup>) and double the recommended (4661 kg ha<sup>-1</sup>) dose.

#### Raya

The number of plants of raya per metre row length, leaf area and seeds siliqua<sup>-1</sup> were found to be statistically at par under different residual levels but during 2004-05 raya crop sown under no residual conditions was found to be significantly better as compared to when it was sown after applying sulfosulfuron to wheat specially at double the recommended rates with respect to plant height, branches per plant and siliquae per plant (Table 2). Raya sown after applying double the recommended dose of sulfosulfuron to wheat gave significantly less yield during 2003-04 and after recommended and double the recommended levels during 2004-05

Table 2. Yield and yield attributes of vegetable pea and raya

Tr.	Vegetable pea								
	Plant population m <sup>-1</sup> row length			Pods plant <sup>-1</sup>			Grain yield (kg ha <sup>-1</sup> )		
	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean
Year	10.52	11.77	11.15	6.30	6.82	6.56	5082	5135	5109
R	10.01	10.78	10.40	5.45	6.00	5.73	4920	4661	4791
2R	10.52	12.25	11.39	7.50	7.65	7.58	5543	5769	5656
Control	NS	03.97	-	1.25	NS	-	NS	0812	-
LSD (P=0.05)	NS								

**Raya**

Tr.	Branches plant <sup>-1</sup>						Siliqua plant <sup>-1</sup>						Grain yield (kg ha <sup>-1</sup> )											
	Plant height (cm)			Mean			2003-04			2004-05			Mean			2003-04			2004-05			Mean		
	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean	2003-04	2004-05	Mean			
Year	193.65	126.90	160.28	6.40	6.95	6.68	458.5	395.4	427.0	1713	1130	1422												
R	182.70	120.55	151.63	6.35	5.95	6.15	425.2	290.7	357.9	1647	0993	1320												
2R	195.40	131.85	163.63	7.05	7.85	7.45	483.3	409.5	449.4	1806	1304	1555												
Control	NS	007.88	-	NS	0.67	-	NS	52.95	-	0226	0111	-												
LSD (P=0.05)	NS																							

NS-Not Significant.

Table 3. Yield and yield attributes of berseem and winter maize

Tr.	Berseem						Winter maize								
	Plant population			Fodder yield (t ha <sup>-1</sup> )			Plant height (cm)			Cob weight (g)			Grain yield (kg ha <sup>-1</sup> )		
	03-04	04-05	Mean	03-04	04-05	Mean	03-04	04-05	Mean	03-04	04-05	Mean	03-04	04-05	Mean
Year	402.8	275.0	338.9	50.43	87.83	69.13	109.5	99.0	104.3	87.8	81.2	84.5	6432	5892	6162
R	396.7	239.6	318.2	47.22	80.35	63.63	107.0	98.6	102.8	79.7	76.8	78.2	5404	5472	5438
2R	453.8	288.6	370.7	51.39	85.23	68.31	123.6	107.7	115.6	102.2	87.4	94.8	7052	6153	6603
Control	NS	033.3	-	NS	04.77	-	8.5	7.1	-	12.6	NS	-	1180	0640	-
LSD (P=0.05)	NS														

NS-Not Significant.

as compared to when it was sown under no residue conditions.

### **Berseem**

Berseem was not influenced due to various levels of sulfosulfuron applied to wheat during 2003-04 (Table 3). Plant population and fodder yield of berseem during 2004-05 were significantly less when double the recommended dose of sulfosulfuron (50 g ha<sup>-1</sup>) was applied to wheat as compared to its no application.

### **Winter Maize**

During 2003-04 and 2004-05 crop raised under no residual level resulted in significantly increased plant height and grain yield as compared to when it was sown after applying sulfosulfuron to wheat at double the recommended level (Table 3). During 2003-04, cob weight was found to be significantly lower when maize was grown in the residual plots of sulfosulfuron as compared to no residual condition. On an average of two years, grain yield of 6062, 5438 and 6603 kg ha<sup>-1</sup> was recorded when it was sown after applying recommended and

double the recommended dose of sulfosulfuron and its zero levels, respectively. Yadav *et al.* (2004) also reported residual effect of sulfonylurea applied to wheat on succeeding crop of maize.

### **Persistence in Soil**

Soil samples were collected before sowing **rabi** season test crops i. e. in the month of October after the harvest of **kharif** crops from main plots only. Residues analysis indicated that no residues of sulfosulfuron were detected from soil samples. The phytotoxic effect of sulfosulfuron on test crops may be due to formation of toxic metabolites.

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