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# Efficacy of different post-emergence herbicides application alone and in combination in wheat

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**Abstract**
A field experiment was conducted during rabi season of 2016-17 at Agronomy Research Station of Doon (P.G) College of Agriculture and Allied Sciences, Selaqui, Dehradun. The experimental soil was sandy loam in texture, slightly acidic in nature having medium in available phosphorus (21.7 kg/ha) and potassium (167.4 kg/ha) and low in OC (0.4%). Ten weed management practices, *viz*. clodinafop 60 g/ha, sulfosulfuron 25 g/ha, metribuzin 175 g/ha, carfentrazone 50 g/ha, clodinafop + metribuzin 60 + 105 g/ha, clodinafop + metribuzin 60 + 122.5 g/ha, sulfosulfuron + metribuzin 25+105 g/ha, sulfosulfuron + metribuzin 25+122.5 g/ha, sulfosulfuron + carfentrazone 25+ 40 g/ha, weed free and weedy were laid out in randomized block design with three replications. The results revealed that sulfosulfuron + metribuzin at 25 and 105g/ha application as post-emergence recorded significantly less weed biomass and higher weed control efficiency followed by sulfosulfuron + carfentrazone at 25 and 40 g/ha, clodinafop 60 g/ha along with metribuzin 105 or 122.5 g/ha and compared to the rest of the herbicidal treatments. The higher wheat yield of 5.51 t/ha recorded with the application of sulfosulfuron + metribuzin 25 + 105 g/ha which was at par with sulfosulfuron + carfentrazone 25 + 40 g/ha (5.46 t/ha), clodinafop + metribuzin 60 + 105 g/ha (5.23 t/ha), clodinafop + metribuzin at 60 and 122.5 g/ha (5.17 t/ha) and weed free check (5.61 t/ha), and significantly superior to rest of the treatments. The straw yield, effective tillers and 1000 grain weight followed the trend as wheat grain yield.

**Keywords:** Post-emergence herbicides, Weed biomass, Weed flora, Wheat, Yield

## Introduction
Constipation Wheat is one of the most important food grain crop which is grown in approximately 225 million hectares worldwide and about half of which is in developing countries. India is the second largest producer of wheat in the world contributing about 95.85 million tons of grains with the productivity of 31.45 t/ha from the area of 30.47 million hectares (Anon, 2015). Weed infestation is one of the major barriers in realizing potential yield of wheat. Uncontrolled weeds are reported to cause up to 66% reduction in wheat grain yield (Angiras *et al*. 2008, Kumar *et al.* 2009 and Kumar *et al*. 2011) or even more depending upon the weed density, type of weed flora and duration of infestations. Chemical weed control is a preferred practice due to scarce and costly labour as well as lesser feasibility of mechanical or manual weeding. In order to optimize the weed control efficacy and minimize the application costs, use of pre-and post-emergence herbicides, as well as herbicide mixtures, has become the alternative. This strategy also represents an important tool to avoid problems related to herbicide resistance. Considering above fact, the present experiment was planned to assess the relative bio-efficacy of pre-mix herbicide molecule for broad spectrum weed control.

## Materials and Methods
The present experiment was conducted in *rabi* season of the year 2016-17 at Agronomy Research Station of Doon (P.G.) College of Agriculture and Allied Sciences, Selaqui, Dehradun. The soil was sandy loam in texture, slightly acidic in nature, medium in available phosphorus (21.7kg/ha) and potassium (167.4 kg/ha) and low in OC (0.4%). Ten weed management practices, *viz*. clodinafop 60 g/ha, sulfosulfuron 25 g/ha, metribuzin 175 g/ha, carfentrazone 50 g/ha, clodinafop + metribuzin 60 + 105 g/ha, clodinafop + metribuzin 60 + 122.5 g/ha, sulfosulfuron + metribuzin 25+105 g/ha, sulfosulfuron + metribuzin 25+122.5 g/ha, sulfosulfuron + carfentrazone 25+ 40 g/ha, weed free and weedy were laid out in randomized block design with three replications. The wheat cv. *'DBW-17'* was sown manually keeping the row to row distance of 22.5 cm with the seed rate of 100 kg/ha during 2$^{nd}$ fortnight of November. Full dose phosphorous (60 kg/ha), potassium (40 kg/ha) and half dose of nitrogen (60 kg/ha) in the form of single super phosphate, murate of potash and urea, respectively were applied as basal. Remaining half of nitrogen was applied in two equal split.

Herbicides were applied as post-emergence at 35 days after sowing (DAS) with the help of manually operated Knapsack sprayer using 500 L water /ha. The other package of practices was adopted to raise the crop as per the recommendations. Prior to sowing, a pre-irrigation was applied in the experimental field to ensure optimum moisture at the time of sowing for uniform germination. The crop was harvested on last week of April 2017. The observations on number of weeds and dry matter of weeds were taken from randomly selected four spots by using 0.25 $m^2$ iron quadrate from net plot area of each plot. The weed data were subjected to square root transformation before analysis to normalize the distribution. Weed control efficiency was also calculated on the basis of dry matter production accumulation by weeds. Data on yield attributes and yield were determined at harvest. The data were statistically analyzed by using statistical procedures and comparisons were made at 5% level of significance.

## Results and Discussion

### Weed flora

The most dominant weed species at experimental field were *Phalaris minor, Avena fatua, Cynodon dactylon, Poa annua* in grassy, *Chenopodium album, Anagallis arvensis, Melilotus alba, Fumaria indica* and *Vicia species* under broad-leaved whereas *Cyperus rotundus* in sedges group. Herbicide treatments showed differences in weed control during the period of experimentation in wheat crop.

### Effect on weeds

The weed biomass and weed control efficiency were affected significantly due to weed management treatments (Table 1). Sulfosulfuron + metribuzin 25 + 105 g/ha application as post-emergence recorded significantly less weed biomass (10.0 g/$m^2$) followed by sulfosulfuron + carfentrazone 25+40 g/ha (13.5 g/$m^2$), clodinafop + metribuzin 60 + 122.5 g/ha (15.0 g/$m^2$) and clodinafop + metribuzin 60 + 105.0 g/ha (17.6 g/$m^2$) compared to the rest of the herbicidal treatments. The highest weed biomass (86.4 g/$m^2$) was recorded with uncontrolled weedy check conditions. Reduction in weed biomass under sulfosulfuron + metribuzin 25 + 105 g/ha, sulfosulfuron + carfentrazone 25+40 g/ha, clodinafop + metribuzin 60 + 122.5 g/ha and clodinafop + metribuzin 60 + 105.0 g/ha over weedy check were 76.4, 72.9, 71.4 and 68.8 g/$m^2$, respectively. The reduction in biomass was mainly attributed to lower weed count under these treatments could be attributed to the higher weed control efficiency. The effectiveness under combined application of sulfosulfuron + metribuzin/ carfentrazone and clodinafop + metribuzin might be due to its killing selectivity to both of the grassy and broad-leaved weeds in the field. In general, pre-mixed herbicidal mixture was found effective in reducing both monocot and dicot weeds as compared to sole application of clodinafop-propargyl and sulfosulfuron. The results are in conformity with the findings of Chhokar *et al*. 2007. Among the herbicides highest weed control efficiency (88.4%) registered with the combined post emergence application of sulfosulfuron + metribuzin 25 + 105 g/ha it was closely followed by sulfosulfuron + carfentrazone 25+40 g/ha (84.4%), clodinafop + metribuzin 60+122.5 g/ha (82.6%) and clodinafop +metribuzin 60+105 g/ha (79.6%). Poor control of broadleaf weeds with the application of clodinafop-propargyl in wheat was also observed by Kaur *et al*. (2015).

### Effect on crop

All the herbicide treatments registered significantly improvement in grain and straw yield, effective tillers and 1000 grain weight over weedy check (Table 1). Presence of weeds throughout the crop season reduced wheat grain yield by 31.2% as compared to crop under weed free situation. The higher wheat yield of 5.51 t/ha recorded with the application of sulfosulfuron + metribuzin 25 + 105 g/ha which was at par with sulfosulfuron + carfentrazone 25+40 g/ha (5.46 t/ha) clodinafop + metribuzin 60+105 g/ha (5.23 t/ha), clodinafop + metribuzin 60+ 122.5 g/ha (5.17 t/ha), and weed free check (5.61 t/ha), and significantly superior to rest of the treatments (Table 1). The higher yield might be attributed to more effective tillers produced with sulfosulfuron + metribuzin 25 + 105 g/ha as post-emergence due to their knockdown effect on grassy and broad-leaved weeds which resulted in increased yield attributes and wheat yield. Similar results were also obtained by Sheela *et al.* 2017.

Thus, it may be concluded that post-emergence application of sulfosulfuron + metribuzin 60+105 g/ha recorded significantly less weed biomass, higher weed control efficiency, number of effective tillers and grain yield in wheat which were at par with sulfosulfuron + carfentrazone 25+40 g /ha and clodinafop + metribuzin 60+ 105 g/ha, clodinafop + metribuzin 60+ 122.5 g/ha and weed free check.

**Table 1**: Effect of weed control treatments on weed biomass, weed control efficiency, yield and yield attributes of wheat.

| Treatments | Dose (a.i. g/ha) | Weed biomass (g/$m^2$) | Weed control efficiency (%) | Effective tillers/ $m^2$ | Grain yield (t/ha) | Straw yield (t/ha) | Weed index (%) | Test weight (g) |
|---|---|---|---|---|---|---|---|---|
| Clodinafop | 60 | 6.72 (44.60) | 48.4 | 266.4 | 4.45 | 6.64 | 20.7 | 44.1 |
| Sulfosulfuron | 25 | 6.04 (31.20) | 63.9 | 276.1 | 4.80 | 6.98 | 14.4 | 44.2 |
| Metribuzin | 175 | 5.18 (18.40) | 78.7 | 258.9 | 4.63 | 6.55 | 17.5 | 43.2 |
| Carfentrazone | 50 | 5.67 (27.10) | 68.6 | 249.2 | 4.20 | 6.23 | 25.1 | 42.1 |
| Clodinafop + metribuzin | 60 + 105 | 4.88 (17.60) | 79.6 | 281.2 | 5.23 | 7.42 | 6.8 | 45.3 |
| Clodinafop + metribuzin | 60 + 122.5 | 4.78 (15.00) | 82.6 | 273.4 | 5.17 | 7.31 | 7.8 | 45.1 |
| Sulfosulfuron + metribuzin | 25 + 105 | 4.47 (10.00) | 88.4 | 297.5 | 5.51 | 7.81 | 1.8 | 48.2 |
| Sulfosulfuron + carfentrazone | 25 + 40 | 4.65 (13.50) | 84.4 | 289.3 | 5.46 | 7.59 | 2.7 | 46.2 |
| Weed free | - | 0.70 (0.0) | 100.0 | 313.1 | 5.61 | 7.83 | 0.0 | 50.0 |
| Weedy | - | 12.4 (86.40) | 0.0 | 243.8 | 3.86 | 5.86 | 31.2 | 38.1 |
| LSD(p=0.05) | - | 0.41 | - | 18.6 | 0.32 | 0.50 | - | 5.17 |

Values are in parenthesis are original

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