Effect of Clodinafop-propargyl on *Phalaris paradoxa* L. (awned canary-grass) in wheat crop

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**Abstract** — *Phalaris paradoxa* is problematic weed that decrease considerably wheat crop yields. The aim of this study is to investigate the effect of Clodinafop-propargyl on *Phalaris paradoxa* infestation in a soft wheat crop. The experimental design was Randomized Complete Block Design (RCBD) with three replications. Each block contained 4 elementary plots, 3 plots of which were treated with three rates of application of Clodinafop-propargyl and one untreated control plot. Observations concerned Percentage of *Phalaris paradoxa* density reduction and biomass reduction. Results showed that treatments with Clodinafop-propargyl at 60 g/ha and 80 g/ha gave the best control of *Phalaris paradoxa* infestations recording respectively 96.2% and 98.5% of *Phalaris paradoxa* density reduction and 95.5% and 99.3% of *Phalaris paradoxa* dry biomass reduction. Clodinafop-propargyl at 40 g/ha recorded lower efficacies 77.1% and 82.3% respectively on *Phalaris paradoxa* density reduction, and *Phalaris paradoxa* dry biomass reduction.

**Keywords** — *Phalaris paradoxa*, Clodinafop-propargyl, wheat, density, biomass.

I. **INTRODUCTION**

Weeds are a major problem on wheat production in Morocco as they compete on water, minerals and sunlight and make harvest operation more difficult (Zimadahl & El Brahli, 1992; Boutahar, 1994; Taleb, 1996; Bouhache, 2007; Bouhache, 2017). *Phalaris paradoxa* L. (awned canary-grass) belongs to *Poaceae* botanical Family. It is an annual plant. Upright 20 cm to 1.20 m high (Tanji, 2005). Leaves 10 to 20 cm long and 5 to 10 mm wide. Membrane ligules, 3 to 4 mm long. No auricles. Inflorescence is a compact and rough panicle, sometimes wrapped by the upper leaf, cylindrical, narrowed at the base, 3 to 10 cm long and 1 to 2 cm wide. Palms of the panicle made up of beams of 5 to 7 spikelets (Tanji, 2005). Central spikelets are fertiles, the others steriles. Oval seeds, hairless, shiny, 3 to 4 mm long and 1 to 2 mm wide without chip at the base, usually having 3 long lines on each side. Seedling is hairless, coiled prefoliation. First leaves 5 to 10 cm long and 1 to 2 mm wide. Membrane ligule, 1 to 4 mm. Seed determination makes it easier to recognize the seedling (Tanji, 2005). Plant lying on different types of soil and consumed by animals. Seeds are usually consumed by birds. Clodinafop-propargyl is an herbicide that belongs to Aryloxyphenoxy-propionate ‘FOPs’ family. It is a systemic herbicide absorbed by leaves to control grasses. It causes inhibition of acetyl CoA carboxylase (ACCase) which is an enzyme that catalyzes the fatty-acid synthesis (Ezzahiri & al., 2017). Clodinafop-propargyl inhibits the ACCase enzyme activity, thus blocking the production of phospholipids necessary for synthesizing the lipid bilayer, which is indispensable for cell structure and function. *Phalaris paradoxa* decrease considerably cereal yields in Ouazzan region of Morocco. The aim of this study is to compare the effect of three doses of Clodinafop-propargyl on *Phalaris paradoxa* infestation in a soft wheat crop in the Ouazzan region of Morocco.

II. **MATERIAL AND METHODS**

A weed control trial was conducted in Ouazzane region of Morocco during 2017-2018 growing season. The experimental design was Randomized Complete Block Design (RCBD) with three replications. The distance between the blocks was 2 meters and the distance between plots was 1 meter. Each block contained 4 elementary plots, 3 plots of which were treated with the post-emergence herbicides tested (Table 1) and one untreated control plot. The size of the elementary plots was 2m x 5m (10 m²). Treatments was carried out on January 2, 2018 with a Knapsack herbicide sprayer with nozzle delivering a 3 bar jet. The spray volume per hectare is 200L. Treatments consist on three rates of application of Clodinafop-propargyl (Table 1). Observations were at 60 days after application of herbicides. Observations concerned Percentage of *Phalaris paradoxa* density reduction and biomass reduction. *Phalaris paradoxa* density reduction percentage = [Phalaris paradoxa density in control plots – Phalaris paradoxa density in treated plots] x 100 / [Phalaris paradoxa density in control plots],
Calculation of the density at the experimental level of the plot was made by a quadrant of 1m x 1m. Phalaris paradoxa dry biomass reduction percentage = \( \frac{\text{Phalaris paradoxa dry biomass weight in control plots} - \text{Phalaris paradoxa dry biomass weight in treated plots}}{\text{Phalaris paradoxa dry biomass weight in control plots}} \) x 100 / [Phalaris paradoxa dry biomass weight in control plots].

Calculation of dry Phalaris paradoxa biomass were made by collecting Phalaris paradoxa in each plot using a quadrant of 1m x 1m. Samples were dried in a drying oven at 75 °C for 48 hours. Then, dry plant material in each plot were weighed with a precision balance. Statistical analyzes were performed with IBM SPSS Statistics, version 21.0 using the analysis of variance (ANOVA). The differences among treatment means was compared by Tukey’s test at \( P = 0.05 \).

**Table 1: Applied herbicides in experimental site**

| Herbicide treatments | Herbicide active ingredient | rate of application (g/hectare) |
|----------------------|-----------------------------|---------------------------------|
| Treatment 1          | Clodinafop-propargyl        | 40 g/ha                         |
| Treatment 2          | Clodinafop-propargyl        | 60 g/ha                         |
| Treatment 3          | Clodinafop-propargyl        | 80 g/ha                         |

**III. RESULTS AND DISCUSSION**

**Effect on Phalaris paradoxa density reduction**

Statistical analysis revealed significant differences between treatments (Table 2). Results in Table 2 showed that the best Phalaris paradoxa density reduction was obtained by Clodinafop-propargyl at 60 g/ha and 80 g/ha recording respectively 96.2% and 98.5% of Phalaris paradoxa density reduction. Clodinafop-propargyl at 40 g/ha showed lower efficacy recording 77.1% of Phalaris paradoxa density reduction (fig. 1).

**Table 2: Effect of treatments on Phalaris paradoxa density reduction (%)**

| Doses                | Phalaris paradoxa density reduction (%) |
|----------------------|----------------------------------------|
| Clodinafop-propargyl |                                        |
| at 40 g/ha           | 77.1<sup>a</sup>                     |
| at 60 g/ha           | 96.2<sup>b</sup>                     |
| at 80 g/ha           | 98.5<sup>b</sup>                     |

\( P_a = 0.05 \) <0.001

Significant differences within the same column and means followed by the same letter do not differ at \( P = 0.05 \) according to Tukey’s test.

**Effect on Phalaris paradoxa dry biomass reduction**

Statistical analysis revealed significant differences between treatments (Table 3). Data in Table 3 indicate that the best Phalaris paradoxa dry biomass reduction was achieved by Clodinafop-propargyl at 60 g/ha and 80 g/ha recording respectively 95.5% and 99.3% of Phalaris paradoxa dry biomass reduction. Concerning the effect of Clodinafop-propargyl at 40 g/ha, results showed lower efficacy recording 82.3% of Phalaris paradoxa dry biomass reduction (fig. 2).

**Table 3: Effect of treatments on Phalaris paradoxa dry biomass reduction (%)**

| Doses                | Phalaris paradoxa dry biomass reduction (%) |
|----------------------|---------------------------------------------|
| Clodinafop-propargyl |                                            |
| at 40 g/ha           | 82.3<sup>a</sup>                           |
| at 60 g/ha           | 95.5<sup>b</sup>                           |
| at 80 g/ha           | 99.3<sup>b</sup>                           |

\( P_a = 0.05 \) <0.001

Significant differences within the same column and means followed by the same letter do not differ at \( P = 0.05 \) according to Tukey’s test.
IV. CONCLUSION

This study has shown that the herbicide Clodinafop-propargyl at 60 g/ha and 80 g/ha gave the best control of *Phalaris paradoxa*. Clodinafop-propargyl at 40 g/ha lower control of *Phalaris paradoxa*. Thus, Clodinafop-propargyl at 60 g/ha can be recommended to farmers in Ouazzane region when *Phalaris paradoxa* infestation is dominant.

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