The efficacy of false and stale seedbed in terms of weed management in durum wheat (*Triticum durum* Desf.) and barley (*Hordeum vulgare* L.).

Ioannis Gazoulis [1], Theoni Karaviti [1], Maria Georgakli [1], Niki-Maria Antoniou [1], Katerina Papadopoulou [1]

[1] Agricultural University of Athens, 75, Iera Odos str., GR11855, Athens, GREECE

***Corresponding author e-mail address: giangazoulis@gmail.com**

Introduction

Weed seed banks are the primary source of persistent weed infestations in agricultural fields. Consequently, it is preferable to focus on depleting the seed stock in the soil through time rather than viewing weeds just as an annual threat to agricultural production [1]. False and stale seedbeds aim to reduce weed seedbank's dynamics. The standard tillage practices required for seedbed preparation before crop sowing are followed by irrigation to stimulate weed seeds' germination, and subsequently, weed emergence. Afterwards, weeds can be controlled by shallow tillage and non-selective herbicides in false and stale seedbeds, respectively [2,3]. The present study aimed to evaluate the effects of false and stale seedbeds in on weed density and crop productivity in winter cereals and also investigate the appropriate timing for weed control by shallow tillage operations when a false seedbed is prepared.

Materials and methods

In the field of Agricultural University of Athens, two-year field trials (2018-2020) were conducted in in durum wheat (*Triticum durum* Desf.) and barley (*Hordeum vulgare* L.). The experimental treatments were: direct sowing, direct sowing followed by spraying with 2,4-D at 1200 g ai ha-1, false seedbed where weeds were controlled by shallow tillage 1 week prior to sowing [FSB (1WK)], false seedbed where weeds were controlled by shallow tillage 2 weeks prior to sowing [FSB (2WK)], and stale seedbed where weeds were controlled by glyphosate (GLY; 720 g ae ha-1). Both experiments were conducted in a randomized complete block design with 4 replications. Plot size was 5 m long by 5 m wide. The experimental fields were mainly infested from *Sinapis arvensis* L., *Papaver rhoeas* L., and *Galium aparine* L. Weeds were counted at flowering from two 1 m2 quadrats placed near plot center and away from margins. Total weed density per unit area was measured. Number of spikes per unit area, number of grains per spike and 1000 grain weight were measured at maturity (data not shown) to obtain wheat and barley grain yield values. Data were subjected to ANOVA at a = 0.05 significance level and mean separation was conducted according to Fischer's LSD. A linear regression between grain yield and total weed density was conducted to evaluate the effects of weed competition on both crops' yield performances.

Results and discussion

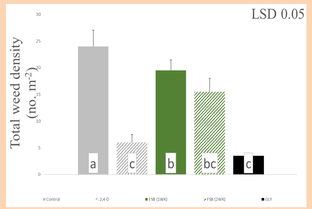

Figure 1. Weed density in wheat.

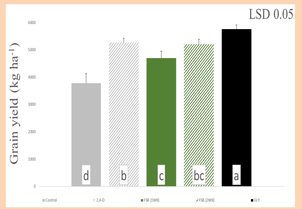

Figure 2. Wheat grain yield.

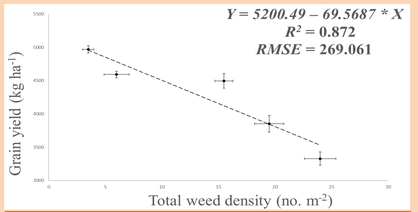

Figure 3. Regression between wheat gain yield and weed density.

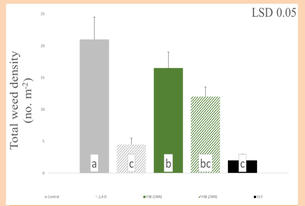

Figure 4. Weed density in barley.

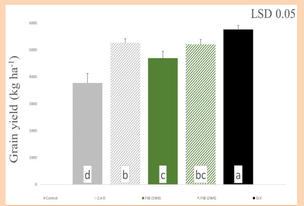

Figure 5. Barley grain yield.

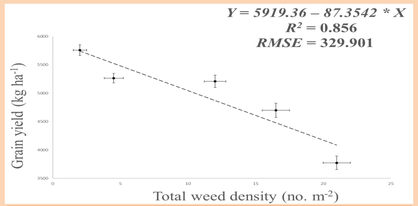

Figure 6. Regression between barley grain yield and weed density.

No significant treatment by year interactions were detected in weed density (Table 1); data were pooled across growing seasons. The effects of treatment on weed density were significant ($p < 0.001$). In particular, FSB 2WK reduced total weed density by 36 and 43% compared to the control, for wheat and barley, respectively (Figures 1, 4). The efficacy of FSB 2WK was comparable to the application of 2,4-D in both crops. The lowest values of weed density were attributed to the adoption of the GLY treatment. These results indicate the high efficacy of false and stale seedbeds on broadleaf weeds in row crops and are in accordance with previous findings in barley and soybean [2,3]. No significant treatment by year interactions were detected in grain yields of both crops (Table 1); data were averaged across years. The effects of treatment on wheat and barley grain yields were significant ($p < 0.001$). FSB 2WK increased wheat and barley grain yield by 35 and 38% compared to the control, respectively. The beneficial effects of FSB 2WK was comparable to the application of 2,4-D in both crops. The highest values of grain yield for both crops were recorded in the plots of GLY treatment (Figures 2, 5). The beneficial effects of false and stale seedbeds the yield performance of winter cereals are in line with previous results observed in barley and soybean crops [2,3]. Negative and strong linear regressions were observed between total weed density and grain yield both for wheat (R^2 = 0.872), and barley (R^2 = 0.856). The detrimental effects of weed competition on the productivity of winter cereals are in agreement with another study carried out in barley where severe *Avena sterilis* L. subsp. *ludoviciana* infestations resulted in 31-40% grain yield losses [2].

Conclusions

False and stale seedbeds can be highly effective as weed management practices in arable crops. The efficacy of false seedbed seems to be dependent on the timing where weeds are controlled before crop establishment. The role of such practices on weed management needs to be further investigated in more row crops in the near future.

References & Acknowledgements

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