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EVALUATION OF WEED SPECIES SUSCEPTIBILITY TO FLAMING

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Summary

Flaming method trial to investigate the efficacy and susceptibility of different weed species was conducted at the Department of Agricultural systems (Slovak Agricultural University in Nitra). The lowest efficacy of flaming was achieved at *Tripleurospermum perforatum*. For more effective of flaming we can recommend at least two treatments at ground speed of 4 km.h^{-1}, angle of burners position adjusted at 40° to ground surface, above ground level of burners 0,14 m, gas pressure of 0,2 MPa at the gas propane doses (consumption) of single treatment of 27 kg.ha^{-1}. At the other weed species very good reduction was achieved at 5 km.h^{-1}, but max. to growth stage of 8 true leaves. We can't recommend ground speed of 6 km.h^{-1}, because at this speed can be controlled only some weed species at growth stage of max. 4 true leaves (*Polygonum aviculare, Chenopodium hybridum, Atriplex patula*).

Key words: weed control, flaming, weed susceptibility, ecological farming.

Introduction

Weeds are a major problem in the agricultural production throughout the world and according to Rasmussen *et al.* (1995) especially in organic farming systems. It is difficult to quantify the impact of weeds on crop yields, a risk of high crop losses (20%) from high weed pressure is possible. Problems with herbicides, including underground and surface water contamination, pesticide residues in food, has sparked public awareness and restrictions of herbicide use. Flame weeding is one of the alternatives to chemical weed control, which relies on heating plants until the cells burst (at 70 - 80ºC). It is used in organic farming for pre-emergence control in slow germinating row crops, in some heat tolerant crops, selective post-emergence flaming is also used. Selectivity in post-em. treatment depends on the differential sensitivity of the crop and the weeds, and timing in relation to the stage of growth of the crop is critical, particularly for overall use in crops such as maize and leeks (Morelle, Thomas, 1994). Although flame weeding has been used for many decades, the method is often associated with problems such as high energy consumption, low driving speed, irregular weed control (Ascard, 1994).
The objectives of this study was to determine the weed susceptibility to flaming and effectiveness of this method on weed regulation.

Material and methods

This study was initiated in 1999 for 2 years period as a pot experiment of Department of Agricultural systems - Slovak Agricultural University in Nitra. The flame treatments were performed with Reinert DA 211/511 tractor mounted gas – propane butane weeder. Chosen weed species were transplanted at defined growth stages (GS) from field conditions to pots and after overcome of replanting shock (cca 5 days) was realized flaming. The treatment efficacy was evaluated visually, 3 days after flaming. Weeds were replanting in monoculture, each species separately in numbers of 7 – 10 pcs at the one pot. Flaming was performed with gas pressure of 0,2 MPa, angle of burners position was adjusted at 40º to ground surface (4 parallel burners), above ground level of burners was 0,14 m. The gas doses of single treatment were regulated by the tractor driving speed (4, 5 and 6 km.h^{-1}) and were 27, 21, and 17 kg.ha^{-1}. Growth stages of weeds were: < 6 true leaves, 6 – 8 true leaves, > 8 true leaves. Weed species: *Amaranthus retroflexus* L. (AMARE), *Chenopodium hybridum* L. (CHEHY), *Chenopodium album* L. (CHEAL), *Tripleurospermum perforatum* (Mérat) M. Laínz (TRIPE), *Thlaspi arvense* L. (THLAR), *Polygonum aviculare* L. (POLAV), *Atriplex patula* L. (ATRPA).

Results and discussion

The lowest efficacy of control was achieved at *Tripleurospermum perforatum*, because there wasn't achieved very good reduction (more than 90%) even at lowest driving speed and GS 2 – 4 true leaves, which is required for satisfactory weed control. After second treatment, at 4 km.h^{-1} was obtained 95 and more percent of reduction. *Polygonum aviculare* was less susceptible species at higher GS (> 8 true leaves) too, and repetition of treatment was needed at each speed. Driving speed of 6 km.h^{-1} and gas dose of 17 kg.ha^{-1} wasn't sufficiently effective even at double treatment. *Thlaspi arvense* was regulated very good at all observed GS at driving speeds of 4 and 5 km.h^{-1} (gas doses 27 and 21 kg.ha^{-1}). Lower gas doses and higher speeds caused it´s insufficient regulation and repetition was necessary. *Chenopodium hybridum* was regulated very good at all speeds, but only to GS of 8 true leaves. Older weeds were regulated insufficiently and those next treatment was necessary. *Amaranthus retroflexus* and *Chenopodium album* were controlled very good (> 90%) at lower driving speeds to GS of 6 – 8 true leaves. Older weeds and higher speed (6 km.h^{-1}) resulted in unsatisfactory weed control. The similar results were achieved at *Atriplex patula*, which was controlled very good, but only to GS of 8 true leaves and at speeds of 4 and 5

km.h^{-1}. Summarised results are presented in graph, which contains averaged data according to weed species regardless of GS. Parish (1989), Thomas and Juncker (1996) mentioned, that efficacy of flaming is variable and depends on weed species and density, crop and weed growth stage, on gas burner design, angle to the horizontal, and the height of the burner above the ground. According to Ascard (1995), the tolerance of different plants towards flaming depends on factors such as the presence of protective layers of hair and wax, lignification, conditions of water status, growth stage, type of plant habit (upright, prostrate, creeping), protection of growth points. *Chenopodium album* L. is considered as sensitive species, with unprotected growth points and thin leaves. This species at a stage of 1 - 4 leaves can be completely killed at rates of 20 - 50 kg.ha^{-1}, but at later stages considerably higher rates are required (50 - 200 kg.ha^{-1}). The weed species with prostrate and creeping habit (*Capsella bursa pastoris*, *Poa annua*, *Chamomilla suaveolens*) at later growth stages (five leaves and more) could not be controlled with one treatment regardless of the gas rate, because of their capacity for regrowth. The propane dose and number of treatments have to be adjusted to the weed flora present, the growth stage of weeds and the desired control level. Similarly (Rifai *et al*. 2000) found that to control weeds at later growth stages (> 6 true leaves), single flame treatment with a propane dose of 40 - 45 kg.ha^{-1} was not sufficient.

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Graph: **Average efficacy of flaming on the different weed species**