Weed control with flaming

Santiago Ulloa* and Stevan Knezevic

Corresponding address: SMULLOA @ BIGRED.UNL.EDU

Introduction

There is an increased interest in organic production due to consumer demand for organic foods (Johnson 2005). Popular physical weed control methods such as hand weeding and cultivation are cost prohibitive, increase the chance for soil erosion and promote the emergence of new flushes of weeds (Wszelaki *et al*. 2007). The use of propane for flame weeding could be an alternative weed control method in organically grown agronomic crops. To optimize the use of propane flaming as a weed control tool, the biologically effective dose (ED) must be determined.

Objective

•To collect base-line information on weed response to broadcast flaming.

•To determine the ED values of propane for control of ten major weed species in northeast Nebraska.

Material and Methods

•Field experiments were conducted during summer of 2007 in a randomize complete block design with 18 treatments (6 propane rates x 3 growth stages), in three replications at two sites in Northeast Nebraska (n=6).

•Total of 16 species were tested including 10 major weeds and 6 row crops (only 6 weed species are presented in this poster).

•The weed species included: Venice mallow (*Hibiscus trionum*), waterhemp (*Amaranthus rudis*), field bindweed (*Convolvulus arvensis*), kochia *(Kochia scoparia*), Ivyleaf morning-glory (*Ipomoea hederacea*), velvetleaf (*Abutilon theophrasti*), redroot pigweed (*Amaranthus retroflexus*), barnyardgrass (*Echinocloa crus-galli*), green foxtail (*Setaria viridis*) and yellow foxtail (*Setaria glauca*).

•The propane rates were: 0, 12.1, 30.9, 49.7, 68.5 and 87.22 kg ha^{-1} (0, 2.5, 6.5, 10.5, 14.4 and 18.4 gal $acre^{-1}$).

•Flaming was conducted utilizing a custom built flamer mounted on an ATV, which was driven across all 16 rows of test species at 6.44 km h^{-1} (4 mph). Flamer had four burners (LT 2x8) mounted 30 cm (18 in.) apart and positioned 18 cm above soil surface at an angle of 30˚.

•Dose response curves were fitted, and ED values based on relative dry matter were determined utilizing the **R** and *drc* software package (Knezevic *et al.* 2007).

Results

Figure 1. Field bindweed control by growth stage (14 DAT)

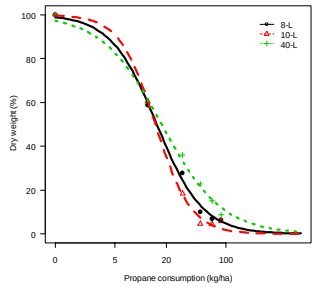

Figure 2. Velvetleaf control by growth stage (14 DAT)

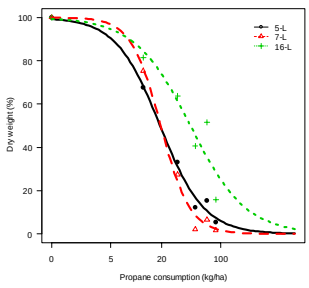

Figure 3. Waterhemp control by growth stage (14 DAT)

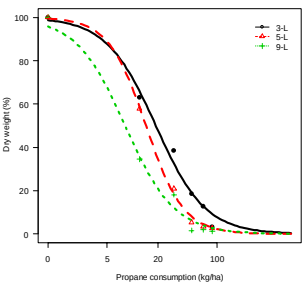

Figure 4. Pigweed control by growth stage (14 DAT)

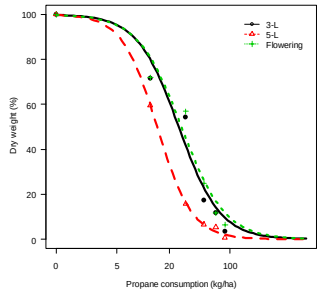

Figure 5. Barnyardgrass control by growth stage (14 DAT)

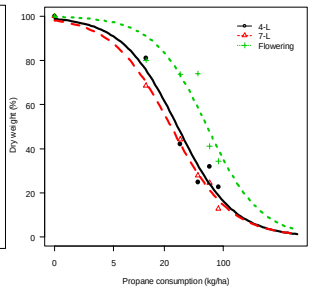

Figure 6. Green foxtail control by growth stage (14 DAT)

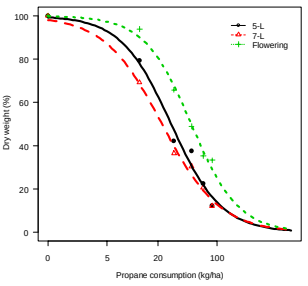

Table 1. Dose of propane needed to obtain 50, 80 and 90% weed control, as indicated by the respective ED values (standard errors), based on dry weight 14 DAT as function of crop growth stage.

Weed species	Growth stage	Effective dose of propane (kg/ha)		
		ED 50	ED 80	ED 90
Field bindweed	8-L	15 (2)	36 (4)	59 (7)
	10-L	15 (1)	29 (2)	42 (4)
	40-L	17 (1)	54 (13)	> 100
Velvetleaf	5-L	19 (2)	44 (10)	71 (25)
	7-L	19 (5)	34 (8)	47 (12)
	16-L	43 (2)	> 100	> 100
Waterhemp	3-L	19 (2)	48 (6)	83 (15)
	5-L	14 (1)	29 (3)	44 (7)
	9-L	8 (2)	20 (3)	35 (8)
Pigweed	3-L	26 (4)	54 (9)	84 (20)
	5-L	14 (2)	27 (5)	39 (12)
	Flowering	27 (5)	61 (10)	97 (25)
Barnyardgrass	4-L	28 (3)	82 (13)	> 100
	7-L	24 (3)	73 (11)	> 100
	Flowering	64 (6)	> 100	> 100
Green foxtail	5-L	28 (3)	73 (10)	> 100
	7-L	22 (3)	66 (11)	> 100
	Flowering	49 (4)	> 100	> 100

Important conversion : 1 gal $acre^{-1}$ = 4.72 kg ha^{-1}

Discussion and Conclusion

- Overall response to flame varied among species, their growth stages and propane rates.
- Broadleaf weeds were more susceptible to flames than grasses.
- To obtain 90% control of most broadleaf species, 39 to 97 kg ha^{-1} of propane was needed.
- Although, 66 to 82 kg ha^{-1} was enough to obtain 80% control in grasses, it was not possible to reach 90% control at the propane rates tested in this experiment.
- Flaming has the potential to be utilized as one of the tools in organic cropping systems.

References

Johnson W.C. (2004). Weed control with organic production. Proceedings of the Southeast Regional Fruit and Vegetable Conference. Savannah, Georgia. pp 13-14.

Knezevic, Streibig and Ritz. 2007. Utilizing R Software Package for Dose-Response Studies: The Concept and Data Analysis. Weed Tech. 21 (3) : 840-848

Wszelaki A. L., Doohan D. J. and Alexandrou A. (2007) Weed control and crop quality in cabbage (*Brassica oleracea* (capitata group)) and tomato (*Lycopersicon licopersicum*) using a propane flamer. Crop Protection. 26:134-144.

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