

Possibilities of weed control with herbicide Basta 150 SL in a young apple tree orchard

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Abstract. The effect of herbicide Basta 150 SL (a.i. ammonium glufosinate) on weed control in a 3–4 year–old apple tree orchard was investigated at the Lithuanian Institute of Horticulture in 2004–2005. Basta 150 SL was applied at the rates 3.0 l ha⁻¹ and 6.0 l ha⁻¹, standard herbicide Roundup 360 SL – at the rate 3.0 l ha⁻¹. Herbicides were applied twice over the growing season: the first application, until beginning of flowering, the second, when weeds had grown to 10–15 cm. Control plots were not treated with herbicides. Apple tree growth, weed species composition, weed number and weed fresh weight were measured.

The most effective for weed control were 6.0 l ha⁻¹ of Basta 150 SL and 3.0 l ha⁻¹ of Roundup 360 SL. They killed respectively 80.4–95.3% and 84.7–87.7% of weeds. Dandelions, (*Taraxacum officinale* L.), the prevailing weeds, were killed successfully with both herbicides. The lowest weed fresh weight was after 6.0 l ha⁻¹ of Basta 150 SL application – 3.2%. Phytotoxic effect of herbicide Basta 150 SL on apple trees was not observed. When herbicides were applied apple tree shoot length increased by 1.4–1.9 times. Weed fresh weight had higher impact on shoot length than the total number of weeds.

Key words: apple trees, growth, herbicides, weed fresh weight, weed biomass

INTRODUCTION

In Lithuania, commercial orchards cover more than 4,000 ha. High orchard weed biomass is one of the most important problems of orchard maintenance. Requirements of integrated fruit and berry production allow application of herbicides that are decomposed in the soil in three–month terms, limiting possibilities of soil herbicide application and promoting use of contact ones. According to Polish researchers, among 26 herbicides registered for use in orchards, 11 were classified as very toxic, 4 – toxic, 5 – unhealthy (Banaszkiewicz, 2005).

For weed control in orchards, systemic herbicides with the active ingredient glyphosate are widely used: Roundup 360 SL, Avans 480 SL (Pasek & Kawecki, 1991; Lisek & Chlebowska, 1993; Lisek, 1995). Prospective new herbicides and their composites with MCPA are being investigated (Bryk, 1991; Lisek, 2001). From an ecological position, it is advisable to use contact herbicides: Basta, Reglone, Tarol etc. (Kawecki & Bieniek, 2001). In general, contact herbicides are less injurious to cultivated plants. In Poland, Basta 150 SL, Agil 100 EC, Fusilade Super 125 EC are allowed for weed control in berry plantations with integrated production.

The objective of our research was to evaluate the efficiency of different action herbicides on weed control.

MATERIALS AND METHODS

The herbicides were investigated in 3–4 year–old apple tree orchard of cv, ‘Mantet’ in 2004–2005 at the Lithuanian Institute of Horticulture. Scheme of the experiment:

1. Control (herbicide untreated);
2. Basta 150 SL 3.0 l ha⁻¹;
3. Basta 150 SL 6.0 l ha⁻¹;
4. Roundup 360 SL 3.0 l ha⁻¹.

Basta 150 SL is a contact herbicide, active ingredient, glufosinate ammonium. Roundup 360 SL is a systemic herbicide with active ingredient glyphosate.

The experiment was designed in random blocks; each experimental field covered 11.25 m² with 5 apple trees in it; number of replications: 4.

The soil in the experimental plot was Epicalcari–Endohypogleic cambisol, clay loam. Often mowed sward was kept in the alleyways; herbicides were applied in 1.5 m width strip in the rows. Herbicides were applied twice over the growing season: first application up to beginning of flowering; the second, when weeds had reached 10–15 cm. Herbicides were sprayed with 300 l ha⁻¹ of water.

Weed mass was recorded before herbicide application and a month afterwards.. Weeds were counted in four locations in each experimental field in account frame of 0.25x1.0 m. The number of annual, perennial, total and prevailing weeds (*Taraxacum officinale* L.) per 1 m². were calculated. Weed fresh weight, total apple tree shoot length and trunk diameter was measured at the end of the growing season in 2005.

Meteorological conditions during the years of the experiment were moderately favourable for apple tree growth and favourable for weed growth. Rainy weather in June and August of 2004 and in May, June and August of 2005 promoted weed growth.

Data were analyzed by analysis of variance using the ‘ANOVA’ statistical program. Data of weed biomass before analyses were transformed using formula $\log(x+2)$. Statistical reliability was evaluated at the probability level $P = 0.05$.

RESULTS AND DISCUSSION

In 2004, after the first herbicide application, the most effective was Roundup 360 SL 3.0 l ha⁻¹. Weed biomass in this treatment was 6.6 times less in comparison with the control. After applying Basta 150 SL 3.0 l ha⁻¹ and 6.0 l ha⁻¹ the total weed number was 70–75% lower in comparison with the control. Rainy weather favoured growth of new weeds. There were 6 times more weeds in control treatment blocks before the second herbicide application. In 2004 after two herbicide applications the most effective were Roundup 360 SL 3.0 l ha⁻¹ and Basta 150 SL 6.0 l ha⁻¹. Weed biomass after these treatments was respectively 84.7% and 80.4% less in comparison with the control. In 2005, after the first application, the most efficient was Roundup 360 SL 3.0 l ha⁻¹. It decreased total weed amount by 84.5% in comparison with the control. After two Basta

6.0 l ha⁻¹ applications, the weed amount was 95.3% less in comparison with the control. After treatment with Roundup 360 SL, the number of weeds was 87.7% less (Table 1).

Table 1. Effect of herbicides on total weed amount in apple tree orchard. LIH, 2004–2005.

Treatment	Year	Weed number (units m ⁻²)			
		before first herbicide application	a month away	before second herbicide application	a month away
1. Control	2004	24.0	65.8	143.4	144.0
	2005	96.0	110.8	116.8	120.2
2. Basta 3.0 l ha ⁻¹	2004	29.7	16.2	97.2	50.7*
	2005	93.6	48.0*	81.3	27.7*
3. Basta 6.0 l ha ⁻¹	2004	30.4	19.7	95.9	28.2*
	2005	155.8	36.0*	81.0	5.6*
4. Roundup 3.0 l ha ⁻¹	2004	24.9	10.0*	78.0	22.0*
	2005	108.2	17.2*	66.7	14.8*

*In this and further tables differences are statistically reliable in comparison with the control at $P = 0.05$.

The efficacy of herbicides is reflected by weight of surviving weeds. The highest efficacy was using Basta 150 SL 6.0 l ha⁻¹. After its application, the fresh weed weight was only 3.2% of the one in the control (Table 2). The use of Basta 3.0 l ha⁻¹ resulted in the lowest efficacy. Dandelions (*Taraxacum officinale* L.) were the prevailing weeds in apple tree orchards, comprising 76% of total weed fresh weight in the control. The most effective for dandelion control was Basta 150 SL 6.0 l ha⁻¹. It decreased dandelion fresh weight up to 3.2% in comparison with the control (Table 2). Roundup 360 SL was somewhat less effective for dandelion control.

Table 2. Effect of herbicides on fresh weight of total weeds and dandelions (*Taraxacum officinale* L.). LIH, 2005.

Treatment	Total weed fresh weight		Dandelion fresh weight	
	g	%	g	%
1. Control	320.8	100	243.7	100
2. Basta 3.0 l ha ⁻¹	70.9*	22.1	31.2*	12.8
3. Basta 6.0 l ha ⁻¹	10.2*	3.2	7.8*	3.2
4. Roundup 3.0 l ha ⁻¹	25.8*	8.0	23.8*	9.8

Basta 3.0 l ha⁻¹ successfully killed annual weeds, whereas Basta 6.0 l ha⁻¹ and Roundup 3.0 l ha⁻¹ were effective for control of both annual and perennial weeds (data not presented).

Phytotoxic herbicide effect on apple trees wasn't observed. Herbicide application had positive effect on apple tree shoot length and trunk diameter. Total shoot length increased up to 90%, trunk diameter, up to 11%. Weed fresh weight had higher impact on shoot length than the total number of weeds.

In a young apple tree orchard with prevailing perennial weeds, application of contact herbicide Basta 150 SL 6.0 l ha⁻¹ is recommended. When annual weeds are

prevalent, the use of Basta 3.0 l ha⁻¹ is satisfactory. Similar results of Basta 150 SL efficacy were established in plantations of strawberries (Kahu, 2003), currants (Buskienė, 2005a) and raspberries (Buskienė, 2005b).

CONCLUSIONS

For weed control in a young apple tree orchard, the most effective herbicides were Basta 150 SL 6.0 l ha⁻¹ and Roundup 360 SL 3.0 l ha⁻¹ applied twice over the growing season: first application until beginning of flowering; the second, when weeds have grown to 10–15 cm. They reduced weed number respectively by 80.4–95.3% and 84.7–87.7% in comparison with herbicide-untreated control.

Application of Basta 150 SL 6.0 l ha⁻¹ resulted in the lowest total fresh weed weight: 3.2% in comparison with the control.

Applied herbicides had positive effect on young apple tree growth.

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