INFLUENCE OF GRASS MULCH APPLICATION ON TUBERS SIZE AND YIELD OF WARE POTATOES

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The aim of the experiment was to investigate the effect of grass mulch and the term of its application on the yield and quality of potatoes and weed biomass under organic system. The experiment with 2 varieties of early potatoes (Finka and Katka), 2 row spacings (28 000 and 38 000 tubers per hectare) and 2 terms of grass mulch application (after planting and after second hoeing) was carried out in the Czech Republic in 2008. Results showed that the yield was influenced mostly by mulching (55.9 %), then by variety (39.2 %) and by growth structure (4.9 %). The highest yield was reached in the variant with grass mulch applicated after planting. The yield of this variant increased statistically about 9.3 t/ha in comparison with control variant (bare soil). Results of the weed control showed a positive effect of grass mulch on weed biomass, where the lowest weed biomass was found out in variant with grass mulch applicated after planting (weed biomass was lower by 67.6 % in comparison with the control variant - bare soil).

Key words*: grass mulch, potatoes, yield, quality, weed biomass*

Covering or mulching the soil surface can prevent weed seed germination or physically suppress seedling emergence, but it is not effective against established perennial weeds. The mulch may take many forms: a living plant ground cover, loose particles of organic or inorganic matter, the plant residues from preceding crops and different plastic sheeting laid along the planted row. Loose materials like straw, bark and composted municipal green waste can provide effective weed control, but the depth of mulch needed to suppress weed emergence is likely to make transpose cost prohibitive unless the material is produced on the farm [MERWIN et al., 1995]. Effects of straw mulch on tuber yield, however, are variable, and this is mainly attributed to differences in climatic conditions. While yield increase through straw mulch was frequently found under hot and dry

summer conditions [BUSHNELL & WELTON, 1931; SINGH et al., 1987], reduced yields under straw mulch have also been reported and were attributed to below-optimum soil temperature [OPITZ, 1948], reduced soil nitrate levels [SCOTT, 1921] and mulching too early [BUSHNELL & WELTON, 1931]. Increasing of the quantity of mulch applied increases the effects on soil moisture and temperature [SCOTT, 1921; RUSSEL, 1940]; therefore, large application rates (10 t/ha and more), which were common in past studies and practice; appear to increase the risk of yield reduction in cooler climates.

MATERIAL AND METHOD

The trial under organic system was conducted at the Experimental station of Department of Crop Production of the Czech University of Life Science Prague-Uhříněves in 2008. The altitude of the site is 295 m a.s.l., the average of annual temperature is 8.4 °C and annual precipitation is 575 mm (detailed information *Table 1*). The type of soil is brown soil with high nutrient reserve. Texture class of soil is clay loam. Organic matter content is 1.74 – 2.12 %.

In the experiment with two varieties of early potatoes Finka and Katka grass mulch was applied on ridges in different terms (grass mulch after planting – GM1 and grass mulch after second hoeing – GM2). As grass mulch, 25 mm high layer of chopped grass was applied (GM1 – 1st and 16th day after planting, GM2 – 14th and 21st day after planting). For the experiment mechanically cultivated control treatment without mulching (bare soil) was used for comparison. All variants were diveded into four parallel determinations (plot trials 7.2 m^2).

Table 1

Temperature and precipitation in experimental periods and longterm average

Longterm average	Month										
	I	II	III	IV	V	VI	VII	VIII	X	XI	XII
Air Temperature (°C)	-2.1	-0.8	3.4	8.2	13.4	16.3	18.2	17.5	8.6	3.2	-0.5
Precipitation (mm)	28	27	31	46	65	74	74	72	41	34	34

At the end of vegetation the weight of weed biomass was measured in all variants. The manual harvest was done 118 days after planting (DAP). Harvested tubers were sorted out into four size fractions (under 40, 40-55, 55-60 and above 60 mm). Post harvest analyses were focused on the determination of the yield and quality of tubers from each variant. Summary statistics of the effect of mulching and variety on tubers yield were obtained by using Statgrafic Plus 5.1. Statistical analyses were performed by using the ANOVA. Means were compared by using Tukey test at the level of significance $\alpha = 0.05$.

RESULTS AND DISCUSSIONS

Weed control

The result showed that grass mulch had a positive effect on the weight of weed biomass (*Figure 1*). Grass mulching was even more effective way of the weed reduction than mechanical cultivation (in control variant). Weed biomass was also influenced by the term of application of grass mulch, where the lowest weight

of weed biomass was found out in GM1 (reduction by 67.6 % than in control variant), while GM2 reduced the weight of weed biomass less (reduction by 39.2 % than in control variant).

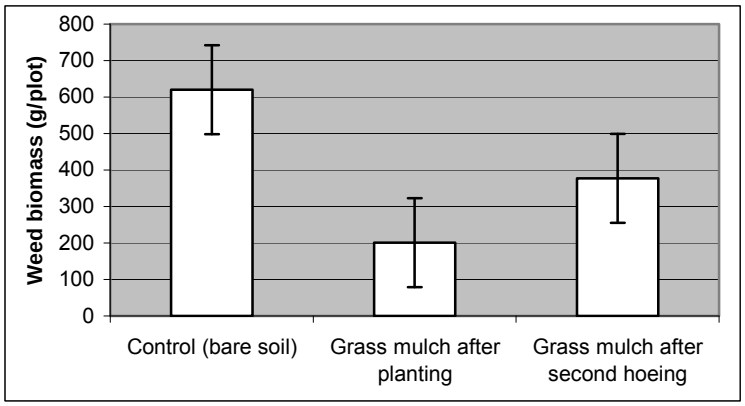

Figure 1 **The effect of grass mulching on the weight of weed biomass** (on average of varieties)
Note: vertical lines represent minimum significant difference ($HSD_{0.05}$)

Tubers yield

Results showed that the yield was influenced mostly by mulching (55.9 %), then by variety (39.2 %) and by growth structure (4.9 %). In comparison with control variant (bare soil), grass mulching increased significantly the total number of tubers per plot in both terms of mulch application (*Table 2*), however, markedly higher number of tubers per plot was found out in GM1.

Table 2

The effect of grass mulching on the total number of tubers and the yield of ware potatoes (on average of varieties)

Variant	Number of tubers (No. per plot)	$HSD_{0.05}$	Yield of ware potatoes (t/ha)	$HSD_{0.05}$
Bare soil	120.5*	26.51	25.4^{n}	7.662
GM1	191.6*		34.7*	
GM2	160.3*		30.2^{n}	
Notes: statistically significant difference α=0.05 (*); statistically insignificant (^{n})				

Results also proved the positive effect of grass mulch and a term of its application on the yield of ware potatoes (*Table 3*), where a significantly higher yield of ware potatoes (by 9.3 t/ha) were found out in GM1 than in control variant (bare soil). Although higher yield of ware potatoes in GM2 than in control variant was also noticed, increasing was not significant. Grass mulch and a term of its application also influenced the size proportionality of tubers under the hill. In both variants with grass mulch higher number and weight of tubers under hill in the size fraction 55 – 60 mm and in the fraction over 60 mm were measured than in control variant (*Table 4*). However, in GM1 the number and the weight of tubers under hill in mentioned fractions were the highest from all variants.

Table 3

The size proportionality of tubers under the hill (on average of varieties)

Variants	Under 40 mm		40-55 mm		55-60 mm		Over 60 mm	
	weight (g)	No.	weight (g)	No.	weight (g)	No.	weight (g)	No.
Bare soil	164.0	7.7	580.8	6.9	124.7	0.8	89.0	0.4
GM1	195.2	8.8	682.0	7.5	214.2	1.5	223.9	1.2
GM2	124.1	5.0	624.0	7.5	183.6	1.3	129.4	0.6

Tubers quality

Results of the experiment proved the effect of grass mulch and a term of its application on the parameters of inner quality of tubers (*Table 5*). In comparison with control variant (bare soil), GM1 had a positive effect on ascorbic acid content (higher by 8.7 %), chlorogenic acid (higher by 17.2 %) and glycoalkaloids content (lower by 6.2 %) on average of tested varieties.

Table 5

The effect of grass mulching on inner quality of tubers

Variant	Variety	Ascorbic acid	Chlorogenic acid	Glycoalkaloids
Bare soil	Finka	99.0	68.2	30.5
	Katka	107.4	167.5	156.2
	average	103.2	117.9	93.3
GM1	Finka	120.1	131.6	73.3
	Katka	103.9	144.7	101.7
	average	112.0	138.2	87.5
GM2	Finka	101.4	113.1	62.2
	Katka	108.3	196.2	170.3
	average	104.9	154.7	116.2

CONCLUSIONS

Grass mulch had a positive effect on the weight of weed biomass and it was even more effective way of the weed reduction than mechanical cultivation (in control variant). The measure of the reduction of weed biomass depended on a term of grass mulching. The mulch application after planting (GM1) reduced the weight of weed biomass by 67.6 %, whereas the mulch application after second hoeing (GM2) decreased weed biomass by 39.2 % in comparison with bare soil. Grass mulch applied after planting (and refill 16th DAP) increased significantly the total number of tubers by 59 % and the yield of ware potatoes by 9.3 t/ha (compared with bare soil) and had a positive effect on inner quality of potatoes. It occures a possibility of widespread using of surface grass mulching for potatoes growing in the system of organic farming.

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