

## SHORT COMMUNICATION

## The Effect of Some Herbicides on Seed Yield of Six Grass Species

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## Abstract

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The tolerance to or phytotoxicity of selected herbicides and their impact on seed yield was investigated in six grasses grown for seed: *Phleum pratense* cv. Sobol (a), *Festuca rubra* cv. Tábořská (b), *Festuca pratensis* cv. Otava (c), *Poa pratensis* cv. Slezanka (d), *Arrhenatherum elatius* cv. Medián (e) and *Dactylis glomerata* cv. Zora (f). All species were tolerant to Grodyl 75 WG (amidosulfuron 75%), (a) and (f) were tolerant to Grodyl plus (amidosulfuron 15 g/kg + isoproturon 600 g/kg) which was phytotoxic to the other grass species; all species were tolerant to Stomp 330 E (pendimethalin 330 g/l); Lintur 70 WG (triasulfuron 4.1% + dicamba 65.9%) was phytotoxic only to (c) while the other species were tolerant to it.

**Keywords:** grass; seed; herbicides

Grass seed is produced on only a small area, but is nevertheless an important agricultural activity and the control of weeds plays an essential role in the growing technology. The changing spectrum of weed species and new herbicides require knowledge of the tolerance to and phytotoxicity of the chemicals used in different grass species (MACHÁČ & CAGAŠ 1999).

## MATERIAL AND METHODS

The following grasses and cultivars were used: timothy (*Phleum pratense* L.) cv. Sobol (a), red fescue (*Festuca rubra* L.) cv. Tábořská (b), meadow fescue (*Festuca pratensis* Huds.) cv. Otava (c), Kentucky bluegrass (*Poa pratensis* L.) cv. Slezanka (d), tall oatgrass (*Arrhenatherum elatius* [L.] P. Beauv.) cv. Medián (e) and cocksfoot (*Dactylis glomerata* L.) cv. Zora (f). Two field plots of each grass (12.5 m<sup>2</sup>, 10 m<sup>2</sup> harvested) were treated by the basic rate of each herbicide, and two plots were treated by double this rate. The basic rates of the herbicides were: Grodyl 75 WG – 30 g/ha, Grodyl plus – 2 kg/ha, Stomp 330 E – 5 l/ha and Lintur 70 WG – 150 g/ha. Phytotoxicity was evaluated by EPPO methods, the number of fertile tillers, seed yield and TSW were determined

from samples (1 m<sup>2</sup>) taken before seed harvest. The plots were harvested by combine harvester Wintersteiger, the seed was dried, cleaned and seed yield and germination were determined. Differences between the effects of chemicals were evaluated by analysis of variance (UPAV plus method) and by Tukey test.

## DISCUSSION AND RESULTS

The results are summarised in Tables 1–2. Significance is expressed by the following symbols: --- or \*\*\* (99%), -- or \*\* (95%) and – or \* (90%), with – being a negative and \* a positive significance.

**Grodyl 75 WG.** All tested species were tolerant to this formulation, including meadow fescue, which in our previous field trials had been found to be very sensitive to many sulfonylurea compounds (MACHÁČ 1995). Both the basic and double rate did not damage the grass canopy. It is a herbicide with a very broad effect and with an acceptable price. The herbicide Hoestar (amidosulfuron 750 g/kg) is registered for use in grasses in Germany.

**Grodyl plus.** Timothy and cocksfoot were tolerant to both rates of this formulation. The basic rate was moderately phytotoxic, except in the first year, to meadow fes-

Table 1. The effect of selected herbicides on seed yield and its components in timothy (*Phleum pratense* L.) cv. Sobol, cocksfoot (*Dactylis glomerata* L.) cv. Zora and meadow fescue (*Festuca pratensis* Huds.) cv. Otava

Harvest year	Combination		Generative tillers		TSW		Seed yield			Germination of seed (%)
	herbicide	doses per 1 ha	number per m <sup>2</sup>	significance from the control	(g)	significance from the control	(kg/ha)	relative (%)	significance from the control	
Timothy cv. Sobol										
1 <sup>st</sup>	untreated		1080		0.3415		391.5	100.0		94
	Gro-dyl 75 WG	30 g	1141	0	0.3352	0	401.5	102.6	0	99
		60 g	1113	0	0.3412	0	396.0	101.1	0	98
	Gro-dyl plus	2 kg	1132	0	0.3460	0	388.5	99.2	0	100
		4 kg	1068	0	0.3398	0	400.7	102.3	0	98
	Stomp 330 E	5 l	1118	0	0.3215	---	394.5	100.8	0	98
		10 l	1115	0	0.3312	0	419.5	107.2	0	98
	Lintur 70 WG	150 g	1082	0	0.3418	0	388.5	99.2	0	92
300 g		1122	0	0.3416	0	404.8	103.4	0	95	
2 <sup>nd</sup>	untreated		867		0.3866		574.5	100.0		97
	Gro-dyl 75 WG	30 g	869	0	0.4095	0	642.0	111.7	**	99
		60 g	879	0	0.4122	0	625.5	108.9	0	98
	Gro-dyl plus	2 kg	891	0	0.4104	0	570.5	99.3	0	96
		4 kg	869	0	0.4040	0	556.0	96.8	0	96
	Stomp 330 E	5 l	878	0	0.4203	0	636.0	110.7	**	98
		10 l	874	0	0.4056	0	617.5	107.5	0	99
	Lintur 70 WG	150 g	909	0	0.4586	*	600.0	104.4	0	96
		300 g	906	0	0.4215	0	582.5	101.4	0	97
	3 <sup>rd</sup>	untreated		666		0.3686		511.0	100.0	
Gro-dyl 75 WG		30 g	668	0	0.3650	0	516.5	101.1	0	95
		60 g	656	0	0.3642	0	513.5	100.5	0	95
Gro-dyl plus		2 kg	662	0	0.3691	0	518.5	101.5	0	97
		4 kg	588	0	0.3574	0	509.0	99.6	0	99
Stomp 330 E		5 l	668	0	0.3833	**	523.5	102.4	0	96
		10 l	664	0	0.3822	**	524.0	102.5	0	98
Lintur 70 WG		150 g	674	0	0.4232	***	524.0	102.5	0	98
		300 g	662	0	0.3872	***	527.0	103.1	0	86
Cocksfoot cv. Zora										
1 <sup>st</sup>	untreated		793		1.0115		811.0	100.0		97
	Gro-dyl 75 WG	30g	843	0	0.9975	--	827.5	102.0	0	92
		60 g	836	0	0.9988	0	816.5	100.7	0	94
	Gro-dyl plus	2 kg	902	***	1.0035	0	839.5	103.5	0	92
		4 kg	895	**	1.0022	0	825.0	101.7	0	93
	Stomp 330 E	5 l	884	**	0.9660	---	817.0	100.7	0	92
		10 l	880	**	1.0040	0	824.0	101.6	0	93
	Lintur 70 WG	150 g	922	***	1.0458	***	849.0	104.7	0	95
		300 g	887	**	1.0456	***	818.5	100.9	0	94
	2 <sup>nd</sup>	untreated		562		1.1036		429.5	100.0	
Gro-dyl 75 WG		30 g	624	*	1.1199	**	438.0	102.0	0	98
		60 g	603	0	1.1134	0	422.3	98.3	0	96
Gro-dyl plus		2 kg	550	0	1.0855	---	426.8	99.4	0	97
		4 kg	522	0	1.0811	---	413.6	96.3	0	95
Stomp 330 E		5 l	673	***	1.1825	***	430.8	100.3	0	96
		10 l	662	***	1.1634	***	427.3	99.5	0	96
Lintur 70 WG		150 g	580	0	1.1466	***	452.5	105.4	0	95
		300 g	570	0	1.1398	***	443.5	103.3	0	95

Table 1 to be continued

Harvest year	Combination		Generative tillers		TSW		Seed yield			Germination of seed (%)
	herbicide	doses per 1 ha	number per m <sup>2</sup>	significance from the control	(g)	significance from the control	(kg/ha)	relative (%)	significance from the control	
3 <sup>rd</sup>	untreated		566		1.1962		344.3	100.0		93
	Gro-dyl 75 WG	30 g	564	0	1.2290	***	350.3	101.7	0	94
		60 g	558	0	1.2241	***	339.8	98.7	0	97
	Gro-dyl plus	2 kg	548	0	1.2147	***	353.3	102.6	0	96
		4 kg	524	0	1.2483	***	334.5	97.2	0	96
	Stomp 330 E	5 l	630	0	1.2751	***	420.0	122.0	**	98
		10 l	582	0	1.3116	***	426.0	123.7	***	93
	Lintur 70 WG	150 g	589	0	1.1821	—	388.5	112.9	0	95
		300 g	580	0	1.2502	***	375.0	108.9	0	96
Meadow fescue cv. Otava										
1 <sup>st</sup>	untreated		1180		1.8738		632.0	100.0		87
	Gro-dyl 75 WG	30g	1230	0	1.8892	**	649.5	102.8	0	88
		60 g	1198	0	1.8991	***	660.5	104.5	0	89
	Gro-dyl plus	2 kg	1224	0	1.9032	***	665.0	105.2	0	89
		4 kg	1078	--	1.8892	**	454.5	71.9	---	87
	Stomp 330 E	5 l	1215	0	1.7519	---	647.5	102.5	0	93
		10 l	1204	0	1.8254	---	640.0	101.3	0	92
	Lintur 70 WG	150 g	1209	0	1.9112	***	595.5	94.2	0	91
		300 g	659	---	1.8981	***	384.0	60.8	---	89
2 <sup>nd</sup>	untreated		718		2.0619		416.3	100.0		93
	Gro-dyl 75 WG	30 g	756	0	2.4126	***	434.5	104.4	0	96
		60 g	684	0	2.3849	***	433.1	104.1	0	95
	Gro-dyl plus	2 kg	440	---	2.5390	***	342.5	82.3	---	97
		4 kg	396	---	2.5154	***	304.3	73.1	---	96
	Stomp 330 E	5 l	774	0	2.2628	***	455.0	109.3	0	96
		10 l	736	0	2.3231	***	433.8	104.2	0	96
	Lintur 70 WG	150 g	272	---	2.0821	0	213.8	51.4	---	91
		300 g	128	---	2.0902	0	90.7	21.8	---	90
3 <sup>rd</sup>	untreated		1170		2.5674		347.1	100.0		98
	Gro-dyl 75 WG	30g	1167	0	2.4621	---	367.9	106.0	0	99
		60 g	1137	0	2.3428	---	351.0	101.1	0	92
	Gro-dyl plus	2 kg	1059	0	2.5753	0	310.1	89.3	0	98
		4 kg	966	--	2.3751	---	289.9	83.5	—	96
	Stomp 330 E	5 l	1197	0	2.6920	***	423.2	121.9	***	99
		10 l	1158	0	2.5683	0	409.5	118.0	**	99
	Lintur 70 WG	150 g	759	---	2.6226	***	170.3	49.1	---	97
		300 g	600	---	2.4890	---	96.2	27.7	---	94

TSW = Thousand seed weight

cue. The double rate was highly phytotoxic and caused a loss in seed yield of more than 20%. Treatment of red fescue brought different results: in the first harvest year both rates caused low phytotoxicity, in the second and third year the seed losses were very high. Kentucky bluegrass reacted similarly. In tall oat grass, phytotoxicity and

seed losses occurred in all tested years. These were expressed by different leaf colour, growth retardation and small deformations of the inflorescences, including a reduction of their number.

**Stomp 330 E.** All tested grass species were tolerant to it in the post-emergence application. In the case of pre-

Table 2. The effect of selected herbicides on seed yield and its components in red fescue (*Festuca rubra* L.) cv. Táborská, Kentucky bluegrass (*Poa pratensis* L.) cv. Slezanka and tall oat grass (*Arrhenatherum elatius* L.) cv. Medián

Harvest year	Combination		Generative tillers			TSW	Seed yield			Germination of seed (%)	
	herbicide	doses per 1 ha	number per m <sup>2</sup>	significance from the control	(g)	significance from the control	(kg/ha)	relative (%)	significance from the control		
Red fescue cv. Táborská											
1 <sup>st</sup>	untreated		2970		0.8539		800.0	100.0		86	
	Gro-dyl 75 WG	30g	3342	0	0.9977	***	915.0	114.4	***	89	
		60 g	3132	0	0.9877	***	887.0	110.9	**	90	
	Gro-dyl plus	2 kg	3336	0	0.9334	***	815.0	101.9	0	76	
		4 kg	3109	0	0.9227	***	773.7	96.7	0	78	
	Stomp 330 E	5 l	3224	0	0.8404	—	928.0	116.0	***	89	
		10 l	2995	0	0.8936	***	889.9	111.2	**	88	
	Lintur 70 WG	150 g	3298	0	0.8128	---	913.5	114.2	***	86	
300 g		3113	0	0.8328	---	849.5	106.2	0	88		
2 <sup>nd</sup>	untreated		2377		1.0370		878.0	100.0		100	
	Gro-dyl 75 WG	30 g	2460	0	1.0052	---	1059.0	120.6	***	99	
		60 g	2520	0	1.0016	---	1003.0	114.2	*	97	
	Gro-dyl plus	2 kg	2257	0	1.0904	***	790.6	90.0	0	93	
		4 kg	2124	—	0.9998	---	688.1	78.4	---	91	
	Stomp 330 E	5 l	2443	0	1.0868	***	1025.0	116.7	**	97	
		10 l	2582	0	1.0854	***	1017.5	115.9	**	98	
	Lintur 70 WG	150 g	2532	0	1.0635	***	983.0	112.0	0	99	
		300 g	2361	0	1.0564	**	947.0	107.9	0	99	
	3 <sup>rd</sup>	untreated		1032		1.1563		369.5	100.0		99
		Gro-dyl 75 WG	30g	1658	***	1.2657	***	612.5	165.8	***	100
			60 g	1160	0	1.2225	***	516.5	139.8	*	98
Gro-dyl plus		2 kg	1226	0	1.3076	***	321.0	86.9	0	100	
		4 kg	542	---	1.1794	***	146.5	39.6	---	96	
Stomp 330 E		5 l	1370	***	1.2811	***	506.0	136.9	0	97	
		10 l	1356	***	1.2615	***	459.5	124.4	0	100	
Lintur 70 WG		150 g	1704	***	1.2315	***	472.0	127.7	0	97	
		300 g	1454	***	1.3421	***	516.0	139.6	*	98	
Kentucky bluegrass cv. Slezanka											
1 <sup>st</sup>		untreated		2138		0.2320		412.0	100.0		79
		Gro-dyl 75 WG	30 g	2137	0	0.2458	*	431.5	104.7	0	78
	60 g		2141	0	0.2432	0	456.0	110.7	0	81	
	Gro-dyl plus	2 kg	2177	0	0.2374	0	410.5	99.6	0	84	
		4 kg	1694	---	0.2398	0	370.0	89.8	0	84	
	Stomp 330 E	5 l	2229	*	0.2295	0	431.5	104.7	0	90	
		10 l	2256	**	0.2356	0	420.0	101.9	0	90	
	Lintur 70 WG	150 g	2185	0	0.2543	***	419.5	101.8	0	82	
300 g		2116	0	0.2543	***	402.5	97.7	0	82		
2 <sup>nd</sup>	untreated		1518		0.2621		601.5	100.0		86	
	Gro-dyl 75 WG	30g	1534	0	0.2312	---	624.5	103.8	0	86	
		60 g	1536	0	0.2482	—	597.0	99.3	0	91	

Table 2 to be continued

Harvest year	Combination		Generative tillers			TSW		Seed yield		
	herbicide	doses per 1 ha	number per m <sup>2</sup>	significance from the control	(g)	significance from the control	(kg/ha)	relative (%)	significance from the control	Germination of seed (%)
3 <sup>rd</sup>	Grodyl plus	2 kg	1566	0	0.2330	---	647.5	107.6	0	85
		4 kg	1341	---	0.2667	0	363.0	60.3	---	93
	Stomp 330 E	5 l	1603	0	0.2272	---	645.5	107.3	0	84
		10 l	1608	0	0.2421	---	612.5	101.8	0	74
	Lintur 70 WG	150 g	1588	0	0.2435	---	616.0	102.4	0	79
		300 g	1560	0	0.2571	0	618.0	102.7	0	84
	untreated		1408		0.2342		470.0	100.0		81
	Grodyl 75 WG	30g	1496	**	0.2296	0	483.5	102.9	0	85
		60 g	1448	0	0.2264	0	480.0	102.1	0	81
	Grodyl plus	2 kg	1348	0	0.2331	0	436.0	92.8	0	68
1 <sup>st</sup>		4 kg	736	---	0.2356	0	258.5	55.0	---	70
	Stomp 330 E	5 l	1492	**	0.2378	0	490.5	104.4	0	56
		10 l	1468	0	0.2252	0	479.5	102.0	0	60
	Lintur 70 WG	150 g	1496	**	0.2236	0	489.0	104.0	0	69
		300 g	1456	0	0.2338	0	478.5	101.8	0	85
	<b>Tall oat grass cv. Medián</b>									
	untreated		710		3.4289		301.5	100.0		81
	Grodyl 75 WG	30 g	734	0	3.4276	0	379.5	125.9	***	88
		60 g	708	0	3.4426	*	353.5	117.2	***	88
	Grodyl plus	2 kg	620	---	3.3329	---	291.5	96.7	0	75
		4 kg	230	---	3.2111	---	83.5	27.7	---	55
	Stomp 330 E	5 l	732	0	3.6866	***	376.5	124.9	***	85
		10 l	704	0	3.6684	***	368.0	122.1	***	85
	Lintur 70 WG	150 g	746	0	3.6537	***	321.0	106.5	0	86
		300 g	726	0	3.6465	***	326.5	108.3	0	86
2 <sup>nd</sup>	untreated		518		3.7891		384.5	100.0		92
	Grodyl 75 WG	30 g	570	***	3.7433	---	398.0	103.5	0	81
		60 g	532	0	3.7291	---	388.0	100.9	0	84
	Grodyl plus	2 kg	500	0	3.6720	---	298.0	77.5	---	83
		4 kg	340	---	3.2142	---	103.0	26.8	---	57
	Stomp 330 E	5 l	602	***	3.8522	***	418.0	108.7	0	86
		10 l	560	***	3.9210	***	384.0	99.9	0	93
	Lintur 70 WG	150 g	550	**	3.7511	---	382.5	99.5	0	91
		300 g	530	0	3.9032	***	387.0	100.7	0	93
	untreated		512		3.7572		250.0	100.0		76
3 <sup>rd</sup>	Grodyl 75 WG	30g	541	0	3.6004	---	251.5	100.6	0	77
		60 g	524	0	3.7320	---	250.0	100.0	0	68
	Grodyl plus	2 kg	300	---	3.4110	---	131.5	52.6	---	59
		4 kg	158	---	3.4891	---	36.0	14.4	---	61
	Stomp 330 E	5 l	560	**	3.8171	***	262.0	104.8	0	82
		10 l	537	0	3.8776	***	252.0	100.8	0	77
	Lintur 70 WG	150 g	565	**	3.8056	***	261.5	104.6	0	65
		300 g	536	0	3.7410	--	247.0	98.8	0	79

TSW = Thousand seed weight

emergence use the grasses did not emerge. The best time of application in grasses is the second half of September. Application at that time is safe for the grown grasses while the emerged grass weeds (*Poa annua*, *Apera spica-venti*) are killed (although young seedlings of them are only slightly damaged). Our results do not agree with the manufacturers recommendation for this herbicide which calls for pre-emergence application in Kentucky bluegrass (MACHÁČ *et al.* 2000). Stomp SC (pendimethalin 400 g/l) is registered in grasses in the USA.

**Lintur 70 WG.** Timothy, cocksfoot, red fescue, Kentucky bluegrass and tall oat-grass were tolerant to this compound. Severe phytotoxicity was observed in meadow fescue; it was lower only with the basic rate in the first harvest year.

The results from the field trial brought information about the tolerance to or the degree of phytotoxicity caused by selected herbicides in some important grass species grown for seed. These results will serve as basis for registration of the herbicides in grasses in the Czech Republic: Grodyl 75 WG at a dose of 30 g/ha and Stomp 330 E at a dose up to 5 l/ha in all tested grass species, Grodyl plus at a dose of 2 kg/ha in timothy and cocksfoot

only, and Lintur 70 WG at a dose of 150 g/ha in timothy, red fescue, Kentucky bluegrass, tall oat grass and cocksfoot.

The number of herbicides registered for use in grasses grown for seed is relatively small. A larger selection would be a very useful help for grass seed multiplication.

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## Souhrn

MACHÁČ J., CAGAŠ B., MACHÁČ R. (2002): Vliv vybraných herbicidů na výnos semen šesti travních druhů. Plant Protect. Sci., **38**: 23–28.

U šesti travních druhů pěstovaných na semeno – bojínku lučního (*Phleum pratense* L.) odrůda Sobol (a), kostřavy červené (*Festuca rubra* L.) odrůda Tábořská (b), kostřavy luční (*Festuca pratensis* Huds.) odrůda Otava (c), lipnice luční (*Poa pratensis* L.) odrůda Slezanka (d), ovsíku vyvýšeného (*Arrhenatherum elatius* [L.] P. Beauv.) odrůda Medián (e) a srhy laločnaté (*Dactylis glomerata* L.) odrůda Zora (f) byla zjišťována tolerance vůči vybraným herbicidům. U přípravků byla zjišťována jejich fytotoxicita vůči zkoušeným travním druhům a vliv na výnos semen. Všechny travní druhy byly tolerantní vůči přípravku Grodyl 75 WG (amidosulfuron 75%), (a) a (f) byly tolerantní k přípravku Grodyl plus (amidosulfuron 15 g/kg + isoproturon 600 g/kg), který však byl fytotoxický vůči všem ostatním travním druhům. Všechny druhy byly tolerantní vůči přípravku Stomp 330 E (pendimethalin 330 g/l). Lintur 70 WG (triasulfuron 4,1% + dicamba 65,9%) vykázal fytotoxicitu pouze vůči (c), zatímco všechny ostatní travní druhy byly vůči tomuto přípravku tolerantní.

**Klíčová slova:** trávy; semeno; herbicidy

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