Possibilities for use of new herbicides in selected grass species grown for seed in Czech Republic

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Abstract

In small plot field trials conducted for three years the selectivity of some herbicides in selected grass species was studied. In the trials basic and double doses of herbicides were tested. Evaluations were made of potential phytotoxicity of herbicides in the grass species and their influence on number of fertile tillers, total seed yield, thousand seed weight, germination, germination energy and number of seed per fertile tiller. Based on trials Arrat (tritosulfuron 250 g kg^{-1} + dicamba 500 g ha^{-1}) applied at 0.2 kg ha^{-1} and Aurora super SG (carfentrazone-ethyl 1.5 % + MCPP-P 60 %) at 1 kg ha^{-1} have been allowed for minor use in seed crops of perennial ryegrass, red fescue, cocksfoot, timothy, Kentucky bluegrass (KBG) and loloid as well as festucoid type of the festulolium. Arrat has been allowed for minor use also in meadow fescue. Husar (iodosulfuron 50 g kg^{-1} + mefenpyr-diethyl 150 g kg^{-1}) applied at 200 g ha^{-1} shown good selectivity in KGB and cocksfoot but when it was applied in double dose the seed yield declined. In both types of the festulolium and timothy it is possible use the Callisto 480 SC (mesotrione 480 g ha^{-1}). However, Callisto caused small chlorosis after application, mainly in loloid type of festulolium. Arkem (metsulfuron 200 g ha^{-1}) at 30 g ha^{-1} applied in TM with CZ-600 (MCPP-P 600 g ha^{-1}, 1.5 l ha^{-1}) shown good selectivity in KBG, cocksfoot and timothy. Nevertheless, Arkem applied in double dose evoked the symptoms of phytotoxicity and decreased the seed yield of cocksfoot.

Key words: grasses, herbicide, selectivity, seed yield

Introduction

Grass seed crops are minor but important part of Czech agribusiness. High ratio of grass seed is exported and improves the balance of agro trade. However, grass seed yield falls behind the average yields of European Union. One of the causes is non-recognition of seed crops as a result of high weed infestation or non-recognition of harvested seeds due to contamination by uncleanable weed seed. The present assortment of herbicides registered in the Czech Republic for use in grass seed crops is poor and do not include the herbicides for control of changing weed spectrum. Czech grass seed producers need new and more effective herbicides.

Materials and Methods

Tests of herbicide selectivity were conducted in small plot trials at Grassland Research Station at Zubri (North-east Moravia, 360 m a.s.l., cambisol soil, average air temperature 7.5 ^{o}C, precipitation 864 mm). The trials were conducted with perennial ryegrass (*Lolium perenne* L.) cv. Olaf, meadow fescue (*Festuca pratensis* Huds.) cv. Roznovska, red fescue (*F. rubra* L.) cv.

Tagera, timothy (*Phleum pratense* L.) cv. Sobol, loloid type of *Festulolium* cv. Lofa, festucoid type of *Festulolium* cv. Hykor, cocksfoot (*Dactylis glomerata* L.) cv. Dana and Kentucky bluegrass (*Poa pratensis* L.) cv. Slezanka. The plot size was 10 m2. Test plots were situated to randomized complete block design. For each herbicide the base dose (2 times) and double dose (2 times) were tested. The herbicides and doses applied are given in Table 1.
All treatments were performed with wheelbarrow sprayer driven by compressed air (Lurmark 01F80 nozzles, a pressure 0.25 MPa, spraying volume 300 l ha^{-1}) in GS 25-29 (mid to end of tillering). The standard treatment (MCPA + clopyralid + fluroxypyr) was used for comparison (control). Fertilizers application: autumn 45 kg N, 20 kg P_2O_5 and 60 kg K_2O per ha, spring – only nitrogen at dose depending on grass species 70-100 kg ha^{-1}. The field trials were established in 2005 and for 3 years (2006-8) the selectivity of selected herbicides were evaluated (visual crop damage assessment). The trials were combined directly with plot combine Wintersteiger Elite. Harvested seed was dried and subsequently cleaned by laboratory cleaner Westrup for seed yield determination. Seed quality (TSW, germination) and number of seed per fertile tiller were analyzed in the lab of GRS Zubri. The results were analyzed by ANOVA and Tukey's post hoc test on significance level 95 % (Statistica 8.0).

Table 1 Herbicides, active substances, doses and tested grass species

Herbicide	active ingredient	basic dose g a.i. per ha	KBG	cocksfoot	Hykor	Lofa	timothy	meadow fescue	red fescue	perennial ryegrass
Arrat	tritosulfuron + dicamba	50 100	x	x	x	x	x	x	x	x
Aurora super	carfentrazone–ethyl +MCPP-P	15 600	x	x	x	x	x	x	x	x
Arkem + CZ 600	metsulfuron-methyl + mecoprop-P	6 900	x	x	x	x	x	x	-	-
Callisto 480 SC	mesotrione	144	-	-	x	x	x	x	-	-
Husar	iodosulfuron + mefenpyr-diethyl	3 30	x	x	-	-	-	-	-	-

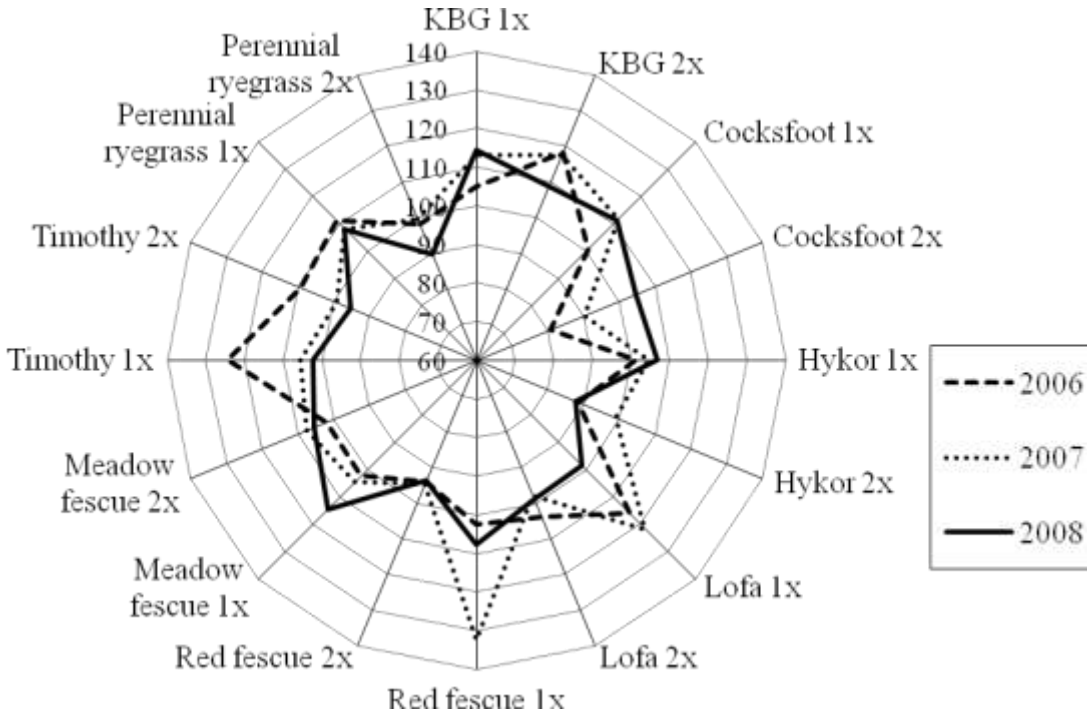
x herbicides was applied in the grass species

Results and discussion

Arrat
The field trials shown a good selectivity of Arrat (tritosulfuron + dicamba) in both doses (base and double) on all tested grass species. However, slight symptoms of damage crops were recorded on both types of Festulolium (growth retardation, chlorosis) and perennial ryegrass (chlorosis). If the base dose was tested the seed yields of all grasses were comparable or higher to standard treatment. Nevertheless, if the double doses was used the seed yields of some species (cocksfoot, Festulolium, red fescue) were significantly lower compared to control. Relative seed yield tested grass species treated by base dose (1x) and double dose (2x) of herbicide Arrat is shown in figure 1 (control = 100 %). Based on trials the Arrat in dose 0.2 kg ha^{-1} has been allowed for minor use in seed crops of each grass species under study.

Aurora super SG
The good selectivity of Aurora super SG (carfentrazone-ethyl + MCPP-P) in both doses was recorded on all tested grass species. However, slight growth retardations were observed on cocksfoot and KBG treated by double dose of herbicide. Small chlorosis, mainly in first harvest year, was recorded on Festulolium cv. Hykor. If the base dose was tested the seed yields of all grasses without meadow fescue were comparable or higher to standard treatment.

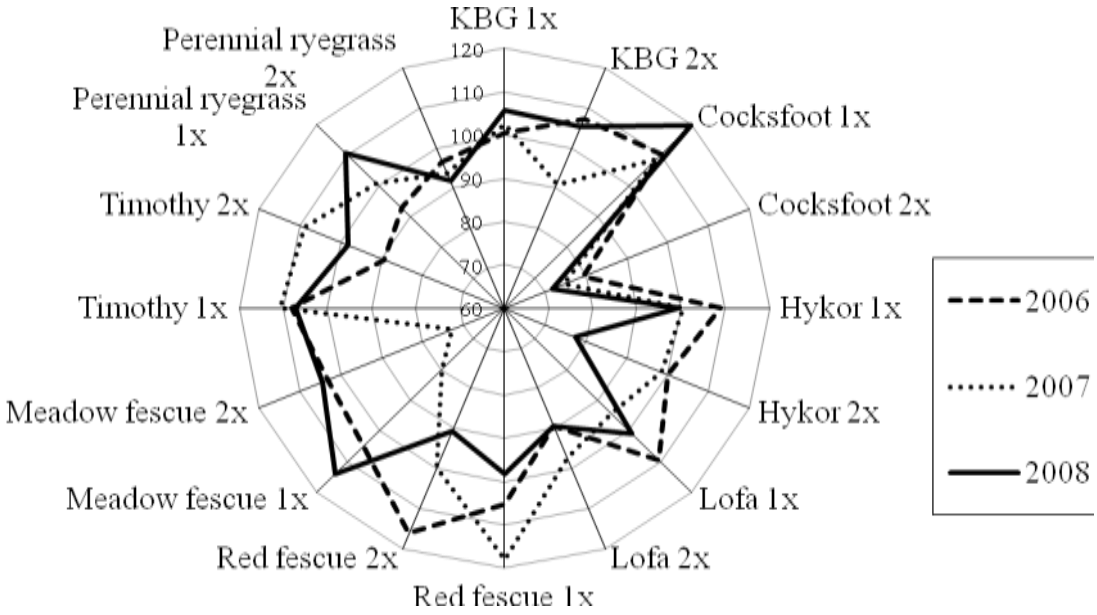
Figure 1 Relative seed yield (%) selected grass species treated by Arrat



Nevertheless, if the double doses was used the seed yields all the species were significantly lower compared to standard in one harvest year at the least. Based on trial results the Aurora super SG in dose 1.0 kg ha^{-1} has been allowed for minor use in seed crops of perennial ryegrass, red fescue, Festulolium, timothy, cocksfoot and KBG.

Arkem
Crops treated by Arkem (metsulfuron-methyl) showed relatively strong symptoms of injury, mainly growth retardation. Damage of meadow fescue and Festulolium in the first harvest year was very strong and so the Arkem was rejected from trials in the given species for subsequent years. This is corresponding with results obtained by Mathiassen *et al*. (2007). Inferior symptoms were observed only on KBG, cocksfoot and timothy. The seed yields were compared to the standard but if double dose was used the seed yield of cocksfoot became lower. Based on results of trials the Arkem in dose 30 g ha^{-1} has been allowed for minor use in seed crops of KGB, cocksfoot and timothy.

Figure 2 Relative seed yield (%) selected grass species treated by Aurora super SG



Callisto 480 SC

The herbicide Callisto 480 SC (mesotrione) caused strong chlorosis after application, mainly on Festulolium and timothy if a double dose was used. However, later the symptoms of chlorosis fade away. If the base dose was tested the seed yields of all grasses without meadow fescue were comparable to standard. Nevertheless, if the double dose was applied the seed yields of Festulolium and timothy in the third harvest year were lower compared to control. Based on trials the Callisto 480 SC in dose 0.3 l ha^{-1} has been allowed for minor use in seed crops of Festulolium and timothy.

Husar

The herbicide Husar (iodosulfuron + mefenpyr-diethyl) was applied only in KBG and cocksfoot. The slight symptoms of growth retardation were recorded on both species, mainly if double dose of Husar was applied. The seed yield was satisfied but when it was applied in double dose the seed yield of cocksfoot was significantly decreased. Nevertheless, due to good control of *Poa annua*, one from most problematic weeds in grass seed crop (Cagaš *et al*. 2006), this herbicide is allowed for minor use in seed crops of KGB and cocksfoot at 200 g ha^{-1}.

References

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