

FIELD HORSETAIL

Equisetum arvense L.

PERENNIAL: Reproduces by spores and most commonly by rhizomes



Horsetail in winter wheat during early May with the brownish spore producing shoots and the green, pine-tree like vegetative shoots.



A close-up of the brown spore producing shoot which emerges first in the spring.



Close-up of the vegetative shoot.

Although I get asked about field horsetail management most often, unfortunately, I don't have many effective solutions for the weed. While you can get reasonably good top growth control with the right herbicide, success is short lived due to the weed's tenacity. I often joke that the best way to get rid of field horsetail is with a backhoe, since that's what you'll need to exhaust its massive root system. While digging a water reservoir, one Ontario farmer actually observed field horsetail rhizomes at a depth of 6 metres (Cody and Wagner, 1980).

CROP YIELD LOSSES

Very little data exists on crop yield losses from field horsetail competition. Corn silage yields in Quebec were reduced by 95% when field horsetail, at a density of 1.6 million shoots/acre, was left uncontrolled all season (Cloutier and Watson, 1979). In contrast, an Ontario study states that field horsetail is not a serious competitor with corn. Corn grain yield, was only reduced once (by 13%) in four experiments when left uncontrolled all season (Wagner, 1980). However, the Wagner study provides no information as to the density of field horsetail in each of the experiments, and one assumes that this yield loss relationship is density-dependant. An Alberta study found that barley yields were unaffected by field horsetail densities of 200,000 shoots/ac (Hoyt and Carder, 1962).

TOXICITY TO LIVESTOCK

Field horsetail contains thiaminase, an enzyme that will cause thiamine deficiency in horses. The side effects include weakness, a rapid pulse and muscular exhaustion (Kingsbury, 1964). A 1952 case study demonstrated that two out of three horses that had contracted poisoning from horsetail responded favourably to injections of thiamine hydrochloride. However, the third horse that had eaten a ration consisting solely of hay

contaminated with horsetail for 35 days did not respond to treatment (Henderson, 1952). This weed is rarely lethal to cattle (Kingsbury, 1964), most likely because thiamine can be produced in the rumen.

TIMING OF HERBICIDE APPLICATIONS

Control of field horsetail can be variable even when an effective active ingredient, like MCPA, is used. More consistent control of field horsetail top growth is achieved when applications are delayed until the vegetative shoots of the plant are fully developed. A British study reported successful shoot kill when growth-regulating herbicides (e.g. MCPA, 2,4-D) had been applied to vegetative shoots once they had reached 25 cm in height (Holly, 1953). More recently, herbicide efficacy studies on field horsetail conducted at the University of Guelph's Ridgetown Campus point to better herbicide performance if applications are made when the majority of shoots are 20 cm or more in height.

EFFECTIVENESS OF GLYPHOSATE AND OTHER HERBICIDES

Farmers and agronomists have shared their personal experiences with me on the subject. When it comes to controlling field horsetail with herbicides, there is a lot of variability. What is successful for one person might not be for another. A Japanese study provides insight into one significant factor: some populations of field horsetail are more tolerant to herbicides than others. In a study comparing field horsetail at nine different locations, glyphosate was applied at various rates to establish a rate that would reduce growth by 50% (known as GR50). The GR50 rate of glyphosate for the most tolerant population was 4.93 kg ae/ha (roughly 5.5 times greater than the normal field rate) and this was 2.3 times higher than the most sensitive population (Uchida et al., 2000).

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Top growth control of field horsetail when glyphosate (360 g/L concentration) was applied at 6 L/ac compared to the unsprayed strip (right).

This is consistent with dose response studies conducted in Ontario in 2016 where a rate of 5.4 kg ae/ha was needed to get acceptable top growth control of field horsetail. This is beyond the maximum labelled rate of 4.32 kg ae/ha that is used for difficult to control perennial weed species.

Herbicides that have been shown to have the most activity on field horsetail top growth in Ontario field trials have been MCPA and Broadstrike RC.

Comparing the average and range in "top growth" control of Canada field horsetail evaluated at eight weeks after the application of glyphosate at three rates.

PRODUCT (active ingredient)	PRODUCT RATE/ACRE (a.i.rate/ha)	AVERAGE CONTROL (%) (8 weeks after application)	RANGE IN CONTROL (%)	NUMBER OF TRIALS
GLYPHOSATE 360 g/L (glyphosate)	6 L/ac* (5.4 kg/ha)	90	70-100	3
GLYPHOSATE 360 g/L (glyphosate)	4 L/ac (3.6 kg/ha)	65	50-80	3
GLYPHOSATE 360 g/L (glyphosate)	2 L/ac (1.8 kg/ha)	10	0-20	3

Source: (Cowbrough, 2016)

*This rate was used for experimental purposes only. It exceeds the maximum labeled rate of 4.8 L/ac (360 g/L concentration).

INFLUENCE OF TILLAGE

Since the root system of field horsetail exists at depths far below any tillage implement, tillage will only temporarily control this weed. However, when tillage is removed from a cropping system field horsetail will dominate in areas where it exists (Légère and Samson, 2004). Ploughing in late autumn or early spring has been more effective than early autumn ploughing (Mukula, 1966).



CORN

In Roundup Ready corn, field horsetail is tolerant to glyphosate rates that are labelled for use (900-1800 gae/ha). The addition of both MCPA and Broadstrike RC has provided good suppression of top growth. However, this treatment must be applied prior to the 4 leaf over stage of corn. When MCPA is applied after the 4 leaf over stage it can cause significant crop injury that leads to lodged corn and **yield losses as high as 27 bu/ac** (Sikkema, P.H. 2012). If growing Liberty Link corn, the 1 L/ac rate of Liberty 200SN with the addition of ammonium sulphate can provide very good top growth control.

BEST HERBICIDE OPTIONS

CORN

Applications made to emerged weeds and crop (**post-emergence**) in Roundup Ready (glyphosate-tolerant) corn only.

PRODUCT (active ingredient)	PRODUCT RATE/ACRE (a.i.rate/ha)	AVERAGE CONTROL (%) (8 weeks after application)	RANGE IN CONTROL (%)	NUMBER OF TRIALS
GLYPHOSATE 360 g/L (glyphosate)	2 L/ac (1.8 kg/ha)	0	0	6
Tank-mix partners with glyphosate				
+ BROADSTRIKE + MCPA AMINE* (flumetsulam + MCPA)	+ 25 g/ac + 0.5 L/ac (50 + 630 g/ha)	71	11-93	6
+ MCPA AMINE* (MCPA)	+ 0.5 L/ac (630 g/ha)	53	6-80	6
+ BROADSTRIKE (flumetsulam)	+ 0.25 g/ac (50 g/ha)	40	28-51	6

Source: Dr. P.H. Sikkema, University of Guelph (Ridgetown Campus)

*When MCPA is applied after the 4 leaf over stage of corn it can cause significant crop injury that leads to lodged corn and yield losses as high as 27 bu/ac.

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Top growth control of field horsetail eight weeks after an application of glyphosate + Broadstrike RC + MCPA Amine (left) compared to an unsprayed strip (right).

Top growth control of field horsetail four weeks after an application of Liberty 200 SN + ammonium sulphate (right) and an unsprayed strip.

CORN

Applications made to emerged weeds and crop (**post-emergence**) in Liberty Link (glufosinate ammonium tolerant) corn only.

PRODUCT <i>(active ingredient)</i>	PRODUCT RATE/ACRE <i>(a.i.rate/ha)</i>	AVERAGE CONTROL (%) <i>(8 weeks after application)</i>	RANGE IN CONTROL (%)	NUMBER OF TRIALS
LIBERTY 200 SN <i>(glufosinate ammonium)</i>	1 L/ac <i>(500 g/ha)</i>	85	75-95	2

Source: Cowbrough, 2016



SOYBEANS

Glyphosate + Broadstrike RC at 35 g/ac applied pre-plant to soybeans has provided the best control of field horsetail. However, susceptibility of field horsetail to this treatment varies significantly by population. If growing Liberty Link soybean the 1 L/ac rate of Liberty 200SN with the addition of ammonium sulphate can provide very good top growth control. Refer to the corn section for data on the effectiveness of Liberty 200 SN.

BEST HERBICIDE OPTIONS

SOYBEANS

Applications made prior to planting (**pre-plant**) but to emerged field horsetail.

PRODUCT <i>(active ingredient)</i>	PRODUCT RATE/ACRE <i>(a.i.rate/ha)</i>	AVERAGE CONTROL (%) <i>(8 weeks after application)</i>	RANGE IN CONTROL (%)	NUMBER OF TRIALS
GLYPHOSATE 360 g/L <i>(glyphosate)</i>	2 L/ac <i>(1.8 kg/ha)</i>	52	5-83	3
Tank-mix partner with glyphosate				
+ BROADSTRIKE <i>(flumetsulam)</i>	+ 35 g/ac <i>(70 g/ha)</i>	84	51-99	6

Source: Dr. P.H. Sikkema, University of Guelph (Ridgetown Campus)



Top growth control following an application of Broadstrike RC (right) compared to the unsprayed area at the edge of the field (left).

Photo credit: Jesse Kloepfer – Harley, ON

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An infestation of vegetative shoots prior to planting soybeans in early June.

SOYBEANS

Applications made to emerged weeds and crop (**post-emergence**) in Roundup Ready (glyphosate-tolerant) corn only.

PRODUCT <i>(active ingredient)</i>	PRODUCT RATE/ACRE <i>(a.i. rate/ha)</i>	AVERAGE CONTROL (%) <i>(8 weeks after application)</i>	RANGE IN CONTROL (%)	NUMBER OF TRIALS
GLYPHOSATE 360 g/L <i>(glyphosate)</i>	2 L/ac <i>(1.8 kg/ha)</i>	57	57	1
FLEXSTAR GT <i>(fomesafen/glyphosate)</i>	1.4 L/ac <i>(1,200 g/ha)</i>	49	49	1
GUARDIAN <i>(chlorimuron-ethyl + glyphosate)</i>	9 g/ac + 1 L/ac <i>(36 g/ha + 0.9 kg/ha)</i>	41	41	1
GLYPHOSATE 360 g/L <i>(glyphosate)</i>	1 L/ac <i>(0.9 kg/ha)</i>	30	30	1

Source: Dr. P.H. Sikkema, University of Guelph (Ridgetown Campus)



Top growth control four weeks after an application of Pixxaro herbicide in winter wheat. Pixxaro contains MCPA, which is effective at burning off top growth.



CEREALS

There is limited public trial data available that has evaluated field horsetail. Of the work that has been done, herbicides that contain either the active ingredient 2,4-D or MCPA have provided good top growth control. Infinity and Lontrel 360 have not been as effective at controlling top growth control.

POST-CEREAL HARVEST

Little work has been done in the area of post-harvest control of field horsetail. Farmer anecdotes of good results using the highest labeled rate of glyphosate (4.8 L/ac of the 360 g/L concentration products) have been shared but otherwise the experience of weed scientists has been that top growth control in the fall does not result in the absence of shoots the next spring.

BEST HERBICIDE OPTIONS

CEREALS

Applications made to emerged weeds and winter wheat (post-emergence).

PRODUCT (active ingredient)	PRODUCT RATE/ACRE (a.i.rate/ha)	AVERAGE CONTROL (%) (8 weeks after application)	RANGE IN CONTROL (%)	NUMBER OF TRIALS
MCPA ESTER (600 g/L) (MCPA)	0.56 L/ac (850 g/ac)	100	100	1
REFINE M [REFINE SG + MCPA] + non-ionic surfactant (thifensulfuron-methyl/tribenuronmethyl + MCPA)	12 g/ac + 0.45 L/ac + 0.2% v/v (15 g/ha + 0.55 kg/ha)	100	100	1
BUCTRIL M (560 g/L) (bromoxynil/MCPA)	0.4 L/ac (0.56 kg/ha)	100	100	1
PEAK + PARDNER + non-ionic surfactant (proflufenoxone + bromoxynil)	5.3 g/ac + 0.2 L/ac + 0.2% v/v (10 g/ha + 140 g/ha)	100	100	1
PEAK + PARDNER + non-ionic surfactant (proflufenoxone + bromoxynil)	5.3 g/ac + 0.2 L/ac + 0.2% v/v (10 g/ha + 140 g/ha)	100	100	1
2,4-D ESTER (660 g/L) (2,4-D)	0.52 L/ac (850 g/ha)	99	99	1
TROPHY [TROPHY A plus TROPHY B] (fluroxypyr plus MCPA)	0.24 L/ac + 0.45 L/ac (108 g/ha + 560 g/ha)	98	98	1
DICHLORPROP-D (582 g/L) (dichlorprop/2,4-D)	0.7 L/ac (1.017 kg/ac)	98	98	1
LONTREL 360 (clopyralid)	0.22 L/ac (0.2 kg/ha)	80	80	1
INFINITY (pyrasulfotole/bromoxynil)	0.33 L/ac (213 g/ha)	66	66	1

Source: Dr. P.H. Sikkema, University of Guelph (Ridgetown Campus)



Vegetative shoot in winter wheat during mid-May.

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