

## WHAT THE RESEARCH SUGGESTS

# CULTURAL CONTROL OF WILD OAT

**W**ild oat (*Avena fatua* L.) is a problematic weed for farmers in western Canada, and has been for a long time. In the proceedings of the first weed science related conference in Canada, wild oat was noted as problematic in central and northern Prairies, while the south was too dry for wild oat (1929). By the 1950s significant work was being conducted on wild oat. It was common enough to be considered a “companion crop” in spring cereals or flax, and cultural management strategies were being evaluated (Brown 1953). Cultural strategies being investigated included delayed seeding, fall and pre-seeding tillage (now considered a physical tactic), including summerfallow in rotation, seeding to grass and legumes, and utilizing fall seeded winter crops. Selective graminicides, released between about 1975 – 1985, went a long way to reducing concerns about wild oat on the Canadian Prairies. While wild oat remains one of the top 10 weeds on the Prairies, the densities and frequency of the weed have decreased since the 1970s (Leeson 2016; Leeson et al. 2005, 2017, 2019). However, herbicide resistance to Group 1 (ACCase inhibitors), Group 2 (ALS inhibitors), and group 15 (fatty acid biosynthesis inhibitors) has resulted in reduced control with these products today, and the increased need for alternative management strategies once again.

A number of integrated weed management strategies have been investigated for wild oat in western Canada (Harker et al. 2009; Harker et al. 2016; O'Donovan et al. 2013). Cultural management techniques



*Increased seeding rate not only increases the competitiveness of a crop with wild oat, but is typically synergistic with herbicidal controls as well.*  
Photo courtesy Neil Harker.

encompass any tactics that give a competitive advantage to the crops. These include seeding rate, seeding depth, crop rotation, variety selection, planting date, soil fertility, and management of other pests (Cahoon 2019).

### Seeding Rate

One of the simplest strategies for management of wild oat is the use of increased seeding rate. Increased seeding rate not only increases the competitiveness of a crop with wild oat, but is typically synergistic with herbicidal controls as well (higher seeding rates = better control with a

herbicide) (O'Donovan et al. 1999, 2000, 2004, 2006, 2013; Harker et al. 2009, 2016; Tidemann et al. 2023; May et al. 2011). The other way to increase crop density within a given land area is by utilizing narrower row spacings. While there is good theoretical basis for using this as a wild oat management technique (faster canopy closure, more competition from the crop), there is limited evidence of significantly increased competition in narrower rows in field studies (Reinertsen et al. 1984; Barton et al. 1992). However, wider row spacings does result in slower canopy closure which leads to an extended opportunity for wild oat emergence.



For more information on Wild Oat management, visit: [weedscience.ca/wild-oat-action-committee/](https://weedscience.ca/wild-oat-action-committee/) or scan the QR code with your smartphone.

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# CULTURAL CONTROL OF WILD OAT (cont.)

### Competitive Varieties and Competitive Crops

Varietal selection has also been shown to impact crop competitiveness with wild oats, with more competitive varieties reducing the biomass of wild oat or suffering from less yield loss due to competition (O'Donovan et al. 2000, 2005). However, while some traits are linked to better competitiveness (taller>shorter, early emerging>later emerging, early canopy cover > later/less canopy cover) these traits are not well defined by variety in a format that is available to producers. As a result this tactic is difficult to adopt on farm, although ongoing research is aiming to address this gap.

Crop selection is also a consideration for wild oat management. Typically, winter cereals are more competitive than spring cereals, which are approximately equally competitive as canola, and pulses are the least competitive (Beres et al. 2010; Harker et al. 2011). The caveat for winter cereals is that they must successfully establish (not die over winter) to maintain that competitiveness ranking (Beres et al. 2010; Tidemann et al. 2023). Including early cut barley silage (1 week after heading) in a rotation also results in lower wild oat densities, as panicles are cut during silage while seeds are being produced. Wild oat densities in the absence of herbicides were reduced utilizing early cut silage, even in comparison to barley produced for grain utilizing full herbicide rates, particularly at one location (Harker et al. 2003). Diversified cropping systems in general are a tool for helping to manage wild oat (Harker et al. 2009, 2016; Tidemann et al. 2023).

Careful use and placement of fertilizers is also a consideration for wild oat management. In a study led



*Wild oat seed that has fallen to the soil surface and entered the soil seedbank. Courtesy Eric Johnson.*

by O'Donovan et al. (2008) excess seed placed nitrogen resulted in seedling barley damage. That damage translated to less ground cover, and increased wild oat biomass and fecundity (O'Donovan et al. 2008). Additionally, seeding depth and seeding speed have been shown to affect canola emergence (Harker et al. 2012). Reduced emergence results in reduced ground cover early in the season which provides more opportunity for wild oat establishment and competition.

### Many Tiny Hammers

It's important to recognize that any one of these tactics alone is not a replacement for herbicides. However, it is possible to significantly increase the level of control observed by combining these tactics together. For

example, in Harker et al. (2009) three cultural controls were studied: normal versus doubled seeding rate, short versus tall cultivar (tall expected to be more competitive) and a continuous versus diverse crop rotation. By choosing the optimized cultural strategy (2x seeding rate, tall cultivar, diverse rotation) and using only one tactic alone, wild oat biomass was reduced **2-3 fold** (Harker et al. 2009). When using two optimized strategies in combination (2x + tall, tall + diverse, or 2x + diverse), wild oat biomass was reduced **6-7 fold** (Harker et al. 2009). When all three were used in combination (2x + tall + diverse) wild oat biomass was reduced by **19 fold** (Harker et al. 2009). These strategies can work synergistically with one another, and, as mentioned earlier, also increase efficacy of herbicides.



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# CULTURAL CONTROL OF WILD OAT (cont.)

The following technical resources are referenced in this fact sheet, and provide further detail on the topic of wild oat seed production and the soil seedbank:

**(1929)** *Proceedings of a Conference on the Destruction of Weeds by Means of Chemicals. Pages 168 in Proceedings of a Conference on the Destruction of Weeds by Means of Chemicals.* Edmonton: National Research Council

**Barton DL, Thill DC, Shafii B (1992)** *Integrated wild oat (Avena fatua) management affects spring barley (Hordeum vulgare) yield and economics.* Weed Technol 6:129-135.

**Beres BL, Harker KN, Clayton GW, Bremer E, Blackshaw RE, Graf RJ (2010)** *Weed-competitive ability of spring and winter cereals in the Northern Great Plains.* Weed Technol 24: 108-116.

**Brown DA (1953)** *Wild Oats — Progress in Cultural Control.* Weeds 2:295-299

**Cahoon C (2019)** *Chapter 10: Cultural Control in A Practical Integrated Weed Management Guide in Mid-Atlantic Grain Crops.* Ed. Mark VanGessel. Northeastern IPM Centre and USDA.

**Harker KN, Kirkland KJ, Baron VS, Clayton GW (2003)** *Early-harvest barley (Hordeum vulgare) silage reduced wild oat (Avena fatua) densities under zero tillage.* Weed Technol 17:102-110.

**Harker KN, O'Donovan JT, Irvine RB, Turkington TK, Clayton GW (2009)** *Integrating cropping systems with cultural techniques augments wild oat (Avena fatua) management in barley.* Weed Science 57:326-337

**Harker KN, O'Donovan JT, Blackshaw RE, Johnson EN, Holk FA, Clayton GW (2011)** *Environmental effects on the relative competitive ability of canola and small-grain cereals in a direct seeded system.* Weed Sci 59:404-415.

**Harker KN, O'Donovan JT, Blackshaw RE, Johnson EN, Lafond GP, May WE (2012)** *Seeding depth and seeding speed effects on no-till canola emergence, maturity, yield and seed quality.* Can J Plan Sci 92: 795-802.

**Harker KN, O'Donovan JT, Turkington TK, Blackshaw RE, Lupwayi NZ, Smith EG, Johnson EN, Pageau D, Shirtliffe SJ, Gulden RH (2016)** *Diverse rotations and optimal cultural practices control wild oat (Avena fatua).* Weed Science 64:170-180

**Leeson JY, Thomas AG, Hall LM, Brenzil CA, Andrews T, Brown KR, Van Acker RC (2005)** *Prairie weed surveys of cereal, oilseed and pulse crops from the 1970s to the 2000s.* Weed Survey Series Publ. 05-1. Saskatoon, Canada Agriculture and Agri-Food Canada. 395.

**Leeson JY (2016)** *Saskatchewan Weed Survey of cereal, oilseed and pulse crops in 2014 and 2015.* Weed Survey Series Publication 16-1. Agriculture and Agri-Food Canada, Saskatoon, SK. 371 pp.

**Leeson JY, Gaultier J, Grenkow L (2017).** *Manitoba Weed Survey of Annual Crops in 2016.* Weed Survey Series Publication 17-2. Agriculture and Agri-Food Canada, Saskatoon, SK. 213 pp.

**Leeson JY, Hall LM, Neeser C, Tidemann B, Harker KN (2019)** *Alberta Weed Survey of Annual Crops in 2017.* Weed Survey Series Publication 19-1. Agriculture and Agri-Food Canada, Saskatoon, SK. 285 pp.

**May WE, Shirtliffe SJ, McAndrew DW, Holzapfel CB, Lafond GP (2011)** *Management of wild oat (Avena fatua L.) in tame oat (Avena sativa L.) with early seeding dates and high seeding rates.* Can J Plant Sci 39:763-773.

**O'Donovan JT, Newman JC, Harker KN, Blackshaw RE, McAndrew DW (1999)** *Effect of barley plant density on wild oat interference, shoot biomass and seed yield under zero tillage.* Can J Soil Sci. 79: 655-662.

**O'Donovan JT, Harker KN, Clayton GW, Hall LM (2000)** *Wild oat (Avena fatua) interference in barley (Hordeum vulgare) is influenced by barley variety and seeding rate.* Weed Technol 14: 624-629.

**O'Donovan JT, Newman JC, Harker KN, Clayton GW (2004)** *Crop seeding rate influences the performance of variable herbicide rates in a canola-barley-canola rotation.* Weed Technol 18:733-741.

**O'Donovan JT, Blackshaw RE, Harker KN, Clayton GW, McKenzie R (2005)** *Variable crop plant establishment contributes to differences in competitiveness with wild oat among cereal varieties.* Can J. Plant Sci 85:771-776.

**O'Donovan JT, Blackshaw RE, Harker KN, Clayton GW (2006)** *Wheat seeding rate influences herbicide performance in wild oat (Avena fatua L.)* Agron J 98: 815-822.

**O'Donovan JT, Clayton GW, Grant CA, Harker KN, Turkington TK, Lupwayi NZ (2008)** *Effect of nitrogen rate and placement and seeding rate on barley productivity and wild oat fecundity in a zero tillage system.* Crop Sci 48: 1569-1574.

**O'Donovan JT, Harker KN, Turkington TK, Clayton GW (2013)** *Combining cultural practices with herbicides reduces wild oat (Avena fatua) seed in the soil seed bank and improves barley yield.* Weed Science 61:328-333

**Reindertsen MR, Cochran VL, Morrow LA (1984)** *Response of spring wheat to N fertilizer placement, row spacing and wild oat herbicides in a no-till system.* Agron J 76:753-756.

**Tidemann BD, Harker KN, Shirtliffe S, Willenborg C, Johnson E, Gulden R, Lupwayi NZ, Turkington TK, Stephens EC, Blackshaw RE, Geddes CM, Kubota H, Semach G, Mulenga A, Gampe C, Michielsen L, Reid P, Sroka E and Zuidhof J (2023)** *Using integrated weed management systems to manage herbicide-resistant weeds in the Canadian Prairies.* Front. Agron. 5:1304741



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