A DEEPER LOOK

WILD OAT SEED PRODUCTION and THE SOIL SEEDBANK

Seed Production

Wild oat seed production differs by the environment it's in (cropping or non-crop), the abiotic conditions it has been exposed to (precipitation, temperature), and the time of emergence compared to the crop. Wild oat produces the most seeds per plant in greenhouse tests that provided a 22°C day and a 16°C night regime. In a cropping system environment, a wild oat plant produces approximately 20 to 150 seeds (Rolston 1981). In less competitive crops, seed production can be higher than that. When analyzing that on a m^2 basis, that seed production can represent anywhere from 180 to nearly 10,000 seeds/m^2 (Wille et al. 1998). Part of the reproductive capacity of wild oat comes from its ability to grow secondary tillers. Wild oat in a bareground situation was measured to produce an average of 19 tillers (Morrow and Gealy 1983).

Seed Shatter

Wild oat is well known for its shattering characteristics. This means that the seed is spontaneously dropped to the soil at maturity. In Manitoba, a timespan of 375 growing degree days resulted in a shift from 100% retention on the plant to 80% of the seeds shattered to the ground (Shirtliffe et al. 2000). Wild oat seed shatter at the time of harvest is variable by crop species being harvested, and year/growing degree day accumulation. Seed shatter is highly variable with shatter estimates of 20 – 95% measured in Alberta and Saskatchewan, with an approximate average of 30 – 70% as typical (Burton et al. 2016, Burton et al. 2017, Tidemann et al. 2017). Seeds that are not shattered out and that enter the straw or chaff stream during harvest, can be spread over 200 m away by combine harvester (Shirtliffe et al. 2005).

Wild oat seed burying itself in a crack in the soil by twisting its awn with changes in moisture. Photo courtesy Dr. Breanne Tidemann.

Seed Adaptations for Survival and Germination

Wild oat seeds that fall to the soil have adaptations to help them bury in the soil. Wild oat seeds have an awn that is twisted at maturity. The awn is 'activated' to untwist when it

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

RESISTANT WILD OAT ACTION COMMITTEE

2024

A DEEPER LOOK

WILD OAT SEED PRODUCTION AND THE SOIL SEEDBANK (CONT.)

comes in contact with moisture. The untwisting motion aids in the burial of the seed into the soil (Sharma and Vanden Born 1978; Raju 1984; Somody et al. 1985). The awns aid in the burial of the seed, even in soil that is not cracking, although burial is more successful when soil cracks are present (Somody et al. 1985). Burial of the seed results in longer term persistence in the seed bank, compared to seeds that reside on the surface where mortality is higher.

Germination Depth

Seed bank densities reflect the size of the above ground population and the effectiveness of management practices, and can be used to predict the number of seedlings that may be an issue (Polziehn 2011). Typically, seed germination and recruitment is lower for seeds on the surface compared to buried seeds (Boyd and Van Acker 2003; Somody et al. 1984b). Wild oat typically emerges from shallow surface depth to a depth of 4.5 cm (1.75") (Van Acker et al. 2004), however emergence at depths greater than 20 cm (8") have also been recorded (Murdoch 1983). Wild oat can emerge from depth as it has the ability to elongate a number of the seedling or embryonic plant parts, that other plants cannot (Raju and Steeves 1998).

Seed Persistence

Wild oat seeds are typically viable in the seedbank for 4 to 5 years (Van Acker 2009). A small percentage of the seeds remain viable longer than that, with viable seed measured up to 9 years (Miller and Nalewaja 1990). Seeds persist longer in the seed bank the deeper they are buried (Kropac et al. 1986). In addition to depth, seed bank persistence is lower in zero-till systems (Gallandt et al. 2004). Wild oat seeds can germinate over a wide range of temperatures, including as low as 5°C (Sharma and Vanden Born 1978), and germinate particularly well between 15 and 25°C (Friesen and Shebeski 1961; Banting 1974; Sharma et al. 1976).

Wild oat seedling emerging from soil surface. Photos courtesy Dr. Breanne Tidemann.

Wild oat seed germinating on damp soil surface.

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

RESISTANT WILD OAT ACTION COMMITTEE

2024

A DEEPER LOOK

WILD OAT SEED PRODUCTION AND THE SOIL SEEDBANK (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:

Banting JD (1974) *Growth habit and control of wild oats.* Agric Can Publ 1531. 34pp.

Boyd NS and Van Acker RC (2003) *The effects of depth and fluctuating soil moisture on the emergence of eight annual and six perennial plant species.* Weed Sci 51: 725-730.

Burton, N.R., Beckie, H.J., Willenborg, C.J., Shirtliffe, S.J., Schoenau, J.J., Johnson, E.N. 2016. *Evaluating seed shatter of economically important weed species.* Weed Sci. 64: 673-682.

Burton, N.R., Beckie, H.J., Willenborg, C.J., Shirtliffe, S.J., Schoenau, J.J., Johnson, E.N. 2017. *Seed shatter of six economically important weed species in producer fields in Saskatchewan.* Can. J. Plant Sci. 97:266-276.

Friesen G, Shebeski LH (1961) *The influence of temperature on the germination of wild oat seeds.* Weeds 9: 634-638.

Gallandt ER, Fuerst EP, Kennedy AC (2004) *Effect of tillage, fungicide seed treatment, and soil fumigation on seed bank dynamics of wild oat (Avena fatua).* Weed Sci 52: 697-604

Kropac Z, Havranek T, Dobry J (1986) *Effect of duration and depth of burial on seed survival of Avena fatua in arable soil.* Folia Geobot Phytotax 21: 249-262

Miller SD, Nalewaja JD (1990) *Influence of burial depth on wild oats (Avena fatua) seed longevity.* Weed Technol 4:514-517.

Morrow LA, Gealy DR (1983) *Growth characteristics of wild oat (Avena fatua) in the Pacific Northwest.* Weed Sci 31: 226-229.

Murdoch AJ (1983) *Environmental control of germination and emergence in Avena fatua.* Asp Appl Biol 4: 63-69.

Polziehn KB (2011) *Wild oat (Avena fatua L.) population dynamics within integrated weed management systems.* M.Sc. Thesis, Dept. of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB. 174 pp.

Raju MVS (1984) *Studies on the inflorescence of wild oats (Avena fatua).* Can J Bot 61:74-78.

Raju MVS, Steeves TA (1998) *Growth, anatomy and morphology of the mesocotyl and the growth of appendages of the wild oat (Avena fatua L.) seedling.* J. Plant Res. 111:73-85.

Rolston MP (1981) *Wild oat in New Zealand: a review.* N. Z. J. Exp Agric 9:115-121

Sharma MP, McBeath DK, Vanden Born WH (1976) *Studies on the biology of wild oats.* I. Dormancy, germination and emergence. An J Plant Sci 56:611-618.

Sharma MP, Vanden Born WH (1978) *The Biology of Canadian Weeds.* 27. Avena fatua L. Can J Plant Sci 58:141-157.

Shirtliffe SJ, Entz MH, Van Acker RC (2000) *Avena fatua development and seed shatter as related to thermal time.* Weed Sci 48:555-560

Shirtliffe SJ, Entz MH (2005) *Chaff collection reduces seed dispersal of wild oat (Avena fatua) by a combine harvester.* Weed Sci 53: 465-470.

Somody CN, Nalewaja JD, Miller SD (1985) *Self-burial of wild oat florets.* Agron J 77:359-362.

Somody CN, Nalewaja JD, Miller SD (1984) *Wild oat (Avena fatua) seed environment and germination.* Weed Sci 32:502-507.

Tidemann BD, Hall LM, Harker KN, Beckie HJ, Johnson EN, Stevenson FC (2017) *Suitability of wild oat (Avena fatua), false cleavers (Galium spurium), and volunteer canola (Brassica napus) for harvest weed seed control in western Canada.* Weed Sci 65: 769-777.

Van Acker RC, Bullied WJ, du Croix Sissons MJ (2004) *Tillage index predicts weed seedling recruitment depth.* Can J Plant Sci 84:319-326.

Van Acker RC (2009) *Weed biology serves practical weed management.* Weed Res. 49:1-5.

Wille MJ, Thill DC, Price WJ (1998) *Wild oat (Avena fatua) seed production in spring barley (Hordeum vulgare) is affected by the interaction of wild oat density and herbicide rate*. Weed Sci 46: 336-343.

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

RESISTANT WILD OAT ACTION COMMITTEE

2024