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AGRONOMY UPDATE

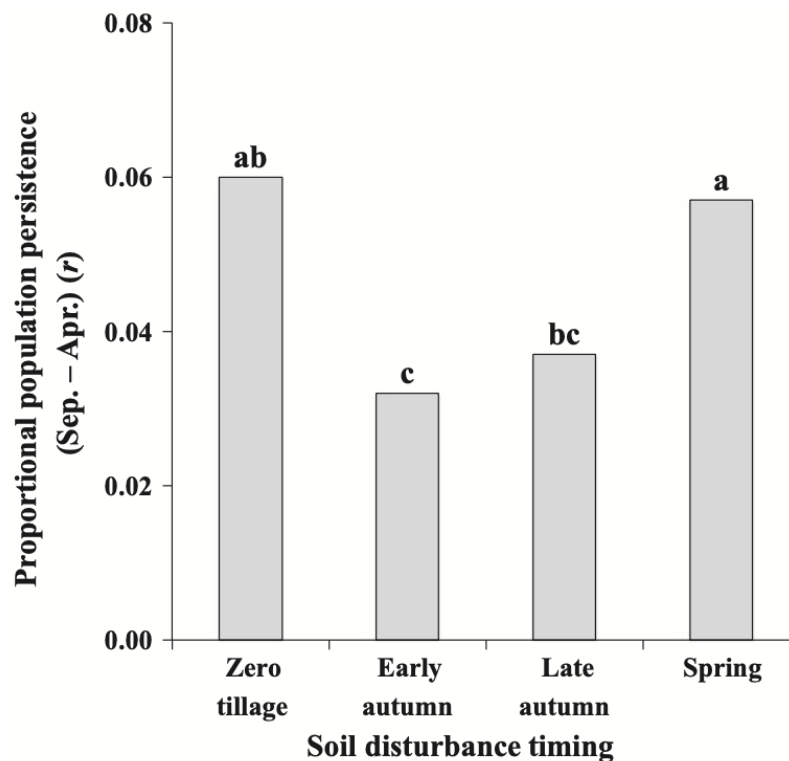
Fall and Spring Harrowing

Historically, tillage was the primary method for weed management in the prairies which lead to poor soil health and high erosion from over tilling. As a result, central Alberta has moved to no-tillage (zero-till) production systems which rely mostly on chemical controls for weed management. Although this has improved soil health and reduced erosion, it has opened the door for herbicide resistance which if left unmitigated will render most herbicides useless if not carefully managed. Relying too much on chemical control in farming will lead to the same result as relying too much on tillage, reduced benefits with increased disadvantages. Canada has taken steps to implement cultural controls such as limiting the use of glyphosate in crop to slow the emergence of herbicide resistant weeds; however, it is also necessary to integrate mechanical controls to properly address herbicide resistance.

Tillage in the form of harrowing is one of the most effective mechanical controls for large acre crop production as it disrupts weed growth while still being able to cover hundreds of acres within a relatively short period of time. Harrowing is highly effective with limited negative impacts if it is implemented with other controls such as crop rotation and herbicides to effectively control weeds while maintaining soil health and preventing or addressing herbicide resistance. A great example of this is fall harrowing a pea field with group 2 and 4 resistant wild oats after harvest and a couple of weeks before a hard frost. The harrowing causes the weed seeds to break dormancy and start germination by exposing them to light, however, the seedlings cannot establish before a heavy frost, killing all the seedlings that had just germinated and reducing the weed seedbank for the following spring.

There are several considerations when it comes to the type and timing of harrowing, as a field needs to be harvested several weeks before a killing frost to allow for harrowing and seed germination while at the same time it is also important to not harrow too early, as this allows the weeds to reach a reproductive phase before winter kill, which will increase the weed seedbank in a field. In addition, the depth of the harrow will also determine how many weed seeds will break dormancy and how much water

is lost. Water loss can be mitigated by reducing the depth of the harrow; however, the effectiveness of the harrow will also be reduced (i.e. fewer weeds will break dormancy).



Another factor to consider is the end goal of the harrowing. For reducing weed seeds like Lamb's Quarters, Wild Oats, and Kochia, it is important to harrow later in fall to prevent the plant establishing itself (8-10 true leaves) and reproducing. However, if volunteers are a concern, an earlier fall harrowing would be better, as the plant will not reproduce within a month. The above graph demonstrates the effectiveness of Fall tillage on volunteer canola. Hardier weeds such as Lamb's Quarters will follow the same trend as volunteer Canola, however, due to Lamb's Quarter's ability to reproduce within a month, there is less risk of weeds going to seed when tilled in the late Fall. An earlier fall harrowing might also be applicable if an herbicide is being applied, as the damage to established plants which are transferring resources to the roots or germination of new seedlings will make the herbicide more effective than in the Spring. For the Spring, if the end goal of harrowing is to prepare a seedbed and reduce active weed pressure, a late spring harrowing before planting would be the best option. Alternatively, if the goal is to integrate stubble and force germination of weed seeds before a pre-season herbicide spray, then an early Spring harrow is the better option. Finally, if the goal is to reduce weed competition for the seedling crop, a light harrowing a few days after planting, but before crop emergence might be a better option. Fall typically allows for a heavier harrow as the risk of water loss is not as significant and allows for integration of stubble before planting the following Spring. A lighter harrow is typically used in the Spring as water loss is a concern and there are fewer weeds germinated.



Figure 1: WF = Wheat-Fallow, WSF = Wheat-Sorghum Fallow, WW = Wheat- Wheat

Historically we have over-used tillage-based weed control which resulted in poor soil health, but mindful integration with other control measures is essential for the longevity and maximum effectiveness of herbicides within a no-till system. Harrowing is an effective control for herbicide resistant weeds and increases the effectiveness of an herbicide while leveraging natural cycles such as winter kill to provide effective weed control without the risk of a plant developing resistance. This is demonstrated by the above graph which compares no-tillage with strategic (targeted heavy tillage) and reduced tillage (light tillage) within a wheat to fallow, wheat-sorghum to fallow, and wheat to wheat crop cycle on long-term no-till crop land.

Referenced Articles:

A summary of the research on Fall Harrowing for Volunteer Canola can be found at <https://canadianagronomist.ca/fall-harrowing-for-volunteer-canola-control/#:~:text=Early%20fall%20tillage%20lowered%20canola%20population%20persistence,t o%20no%2Dtill%20or%20spring%20soil%20disturbance%20only.>

Strategic Tillage Effects on Crop Yields, Soil Properties, and Weeds in Dryland No-Tillage Systems research study

<https://www.mdpi.com/1054806>



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