

CULTURAL PRACTICES

To Give the Crop Advantage

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Photo credit: Brenda Frick
Header Photo: Roadside weeds at Grasslands National Park.

INTRODUCTION

Cultural weed management refers to the way in which the crop is grown. It includes all of those techniques that give the crop an advantage: creating diverse rotations that reduce insects and pests; selecting strong cultivars of vigorous crops; maintaining healthy soils; and seeding at the right time, depth and density. Cultural techniques provide the conditions for strong crop competitiveness and thus for optimal crop yield and quality. These techniques are surprisingly effective, especially in combination.

The best weed management tool is a strong crop. When crops flourish, there is little room for weeds. Crop agronomy and weed management are long-term processes that begin long before the crop is seeded. However, each crop year is an opportunity to start anew, choose appropriate crops and cultivars, and grow them in a way that achieves optimal quality.

USE A SOUND ROTATION

Rotations are crucial to growing competitive crops. They provide the potential to improve soil and soil biological activity, control insects, manage diseases, and if weed management techniques are rotated, as well as the crop, they can be highly successful in reducing weed outbreaks.

“Combining optimal agronomic practices can dramatically reduce weed infestations.”

***- Neil Harker,
Research Scientist,
Agriculture and Agri-Food Canada, 2008***

CHOOSE AN APPROPRIATE CROP

Crops that perform poorly under specific growing conditions are not likely to yield well or give best quality. And they are likely to provide opportunities for weeds. Many factors are involved in crop selection:

- Region, weather, and stored moisture. Of course it is difficult to predict the weather, but previous crop and soil reserves are an indication of water availability. Avoid lentils in a wet year, avoid faba beans in a drought. Keep an eye on the weather and be prepared to be flexible. Solid choices made in March may not be optimal choices in May.
- Match crops to soil fertility. Heavy feeding crops, such as hemp, or high protein wheat, grow much better when fertility is high, generally after a green manure, or with application of animal manure or compost. Pulses can have a competitive advantage when grown on low nitrogen soils, as they can access nitrogen not available to weeds.
- Anticipate weed populations. The best indication of this year's weeds is last year's weeds. If weed populations are high, competitive crops such as barley or fall rye can help reduce weed populations. Many strongly competitive crops such as fall rye, oats, barley, mustard, sweetclover, and hairy vetch are allelopathic – they produce chemicals that can suppress small seeded weeds in following crops. If weed populations are low, it may be time to seed weakly competitive crops such as lentil or flax.
- Consider intercropping. Intercrops can improve competitive ability and reduce disease and insect problems.

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CHOOSE A STRONG CULTIVAR

Cultivar selection is also important. Variety trials under organic management have pointed to different cultivars performing best in different regions. The best choices may vary from farm to farm. In general, strong cultivars are those that jump out of the ground; they have at least some of these characteristics: they germinate and emerge rapidly, cover the ground quickly, have large spreading leaves, produce a canopy quickly, have lots of tillers, are tall, have strong deep roots, and are allelopathic.

Heritage varieties may have advantageous traits. They were, after all, selected before chemical inputs were widespread. However, modern breeding has been beneficial in introducing a number of useful traits, such as disease resistance and early maturity that are very useful under organic management. Both old and new varieties are worth considering.

Sometimes the best performance is hard to predict. For instance, despite the importance of height to competitive ability in wheat, the semi-dwarf variety CDC Go performed very well in organic trials near Edmonton. Leafy varieties of pea would be expected to suppress weeds better than semi-leafless varieties. However, competition studies have gone both ways. True to prediction though, the leafy 4010 forage pea has been outstanding in organic variety trials. This lack of predictability underlines the importance of regional variety trials.

Organic breeds, those that have been selected, at least in part, on organic farms, can be a preferred choice. AAC Oravena oat is the first variety in Canada to come out of an organic breeding program. Farmers may choose to be involved in participatory breeding programs to facilitate the development of organic varieties. They may also develop their own strains. By saving and replanting only the best seeds produced on-farm, a producer improves the suitability of those seeds to that farm. Over time, this can result in a level of speciality that may be marketable, for instance, Blé Marquis de Loiselle wheat.

When choosing a cultivar, it may be best to consult buyers, and use a cultivar that the buyer will accept. The competitive ability of a crop will not guarantee milling quality. Unless the cultivar is being used for green manure or cover, or for your own feed or forage, buyer acceptability is important.

Cultivar selection can be especially important in intercropping. Matching crop maturities is often a matter of picking appropriate cultivars. If intercrops are sold separately, the cultivars should be easily separated, for instance small seeded lentils with cereals, large seeded lentils with mustard.

USE GOOD SEED

Competitive ability in crops often involves early vigour. This is largely a function of seed health. Seed should not be leftover grain; it should be of the highest quality – clean, heavy, and high vigour. Ideally, the field where the seed is produced should be identified early, and then monitored for disease, rogued for weeds and any crop plants with characteristics that seem problematic – low vigour, disease. Avoid planting all the seed at once. That way, if this year's seed crop shows signs of disease, you can return to a previous seed lot, rather than use the diseased crop as seed.

If seed is purchased, it often comes with quality statements, indicating its purity, germinability and vigour. Avoid bringing new (or more) weeds or diseases onto the farm by avoiding seed with these contaminants. High germinability seed is more likely to produce vigorous seedlings. A simple germination test can be conducted at home. Place a number of seeds (perhaps 20) on a damp paper towel. Fold to cover seed, and place in a clear plastic bag. After a week, count the germinated seeds and express as a percentage. If seedlings look abnormal, twisted, brown or deformed, be cautious. If germination is low, but the seed is desirable for other reasons, seeding rates can be boosted to compensate for the germination rate. For instance, if germination is 80%, planting 1.25x your desired rate will result in the same plant population ($1.25 \times 0.8 = 1$).

For some crops, such as oats, screening for heavier seeds can improve the vigour and competitive ability of the crop. Lighter seeds might be used for feed.

SEED HEAVILY

Seeding rate recommendations for organic crops are usually about 1.25x to 1.5x the conventional seeding rate. There are several reasons for this. Heavier seeding rates are more competitive with weeds. For instance, increasing seeding rates to 1.5x or 2x reduced weeds to a quarter in lentils and a third in peas, and increased yields by 35-40%. A higher seeding rate also compensates for losses from in-crop tillage, such as harrowing and inter-row tillage after seeding or after emergence.

On the downside, higher seeding rates mean higher seed costs, and may not be ideal in the presence of disease, which can spread more easily in a denser crop, or if nutrients are inadequate for the heavier crop. Many producers find that 2x the recommended rate works well for them.

SEED WELL

Different seeders offer different benefits. The ideal seeder is one that matches the soil – whether it is rocky or clayey, tilled or untilled, whether the soil is wet or dry at seeding. The choice of seeder can determine the precision of seeding, and the ability to seed into crop residues.

The usual recommendation for large seeds is to sow as deep as necessary to seed into moisture. Packers may be used to assure good seed to soil contact. However, they also press weed seeds into the soil and encourage them to germinate. Ideally the packers will cover only the seed row. Looser soil above the seed, or in the interrow space, may reduce weed emergence. If pre-emergence tillage is planned in the layer above the emerging seedling, seed may be placed deeper, although deeper seeding may slow crop emergence. Shallow seeding is used for smaller seeds and requires timely rain for germination, as shallow layers are often dry.

Crops are most competitive if they emerge ahead of the weeds. This is achieved by two methods. Pulses and cereals can often be seeded early. If weeds are mostly warm season species, such as green foxtail or pigweed, early seeding allows the crops to get ahead of the weeds. Alternately, if many of the weeds are cool season weeds such as stinkweed and wild oats, pre-seeding tillage can stimulate weed seed germination, and those weed seedlings can be killed before or as the crop is seeded. This delays seeding somewhat, and care should be taken when using this technique with late maturing crops.

Crops have a minimum temperature for successful germination. Seeding before the soil has warmed can delay germination and increase the chances of seed rot. Soil temperatures at seeding depth should be at least 5°C, but preferably 20°C for most crops. Tillage can warm the soil. Some producers begin tillage as soon as the soil is dry enough to drive on. Other producers use phenological cues, such as the emergence of wild oats, the opening of poplar buds, or blooming of berry trees to determine when to seed.

Seeding with narrow row spacing has been suggested as a way to give the crop the advantage. Theoretically, the closer the row spacing, the more evenly the crop plants are distributed, and the more quickly they can close the crop canopy to suppress weeds. It may be difficult for the producer to alter row spacing, but there are some options, including changes to openers/knives that distribute grain over a wider seed row, and cross seeding.

IN-CROP OPTIONS

A number of tillage options are available around seeding time, and in early crop growth. These include methods that skim above the seed or emerging seedling, using shallow harrows, cultivation or rod-weeders; of course caution must be used to keep the tillage above the crop. Methods that are used once the crop has emerged include various harrows or rotary hoes. Inter-row cultivation is a possibility if crops are seeded in wider rows. Clipping above the crop can reduce seed set of taller weeds in shorter crops.

During the cropping season there may be few options to directly support the crop. However, continued monitoring can provide a number of insights. A useful metric for farm success is “eyes per acre.” A deep understanding of the farm and its holistic nature is only possible by being there. A similar thought is expressed in the truism: “the greatest fertilizer is the footsteps of the farmer”.

During crop monitoring, weed levels and patches of perennials can be identified for future management. Disease and insect levels can be noted, to provide further input into rotation planning. Crop colour and vigour provide clues to soil fertility. Where there are concerns, tissue sampling can be useful.

SANITATION

Weeds are easily spread on the farm because their seeds, roots, or rhizomes move with equipment such as tillage equipment, harvest equipment or even pickup trucks. They can also be spread on boots and pant legs. Cleaning equipment and clothing between fields can reduce this spread.

WHOLE FARM INTEGRATION

The farm is more than a collection of fields. Buffer areas, shelterbelts, natural areas and even rock piles can provide diversity and habitat for a range of beneficial organisms - weed eaters, pollinators, and pest controllers - that bring more life to the farm. Trees reduce wind speed, trap snow, and provide nesting for grasshopper predators. They stop the spread of tumbleweeds. Perennial vegetation in water runs retains soil during flooding, and improves infiltration. Wetlands may be annoying to drive around, but they act as sponges, providing water capture and release. Although the benefits of natural habitats and wildlife may seem a bit esoteric, many people find they add to their quality of life.

Livestock can provide vital synergies. Weedy areas can be cut for green feed; cattle can reduce fall weeds and

volunteers, by stubble grazing. Grazing can turn a green manure from a cost to a cash crop. Animals such as swine and poultry can turn screenings into feed. Fertility can be brought onto the farm by importing bales or other feed/fodder. If feed/fodder is home grown, feeding it in low nutrient fields can still move where they are needed, and in either case, passing through an animal can make nutrients more plant-available.

Of course, care should be taken when importing feed, to make sure that new weeds are not imported with bales, and that screenings and weedy grain is put through a hammermill before feeding.

APPROACHING HARVEST

As harvest approaches, weeds mature. The old saying “one year’s seeding, seven year’s weeding” rules this period. Some adjustments at harvest can keep the weed seeds at bay, giving the next years’ crops an advantage. Many weeds shatter easily and early, and have already fallen by harvest. Swathing allows harvest to begin days earlier, so more of these weed seeds can be captured in the swath. If the combine is set to blow most of the weed material through, a chaff wagon can reduce weed seed inputs to the soil and can reduce the lateral spread of weed patches. If the combine is set to retain weeds, they can be removed with the crop, and cleaned from it before storage. Either way, weed seeds are removed from the seed bank. They can be put through a hammermill, and then through livestock to add value to the farm, or they can be sold as feed.

SUMMARY

Many of the individual techniques suggested here can provide significant advantages in weed management, by tilting the playing field in the crop’s favour. Put together, the effects can be powerful. Neil Harker, describing a study investigating the effects of cultivar selection, seeding rate and crop rotation on barley performance and weed management said “individually, these factors had considerable effects ... but when combined the effects are dramatic.” Taken together, these factors reduced the weed populations 70-fold. This is the effect weed scientists refer to as “many little hammers”, using a multiple factor approach to achieve solid weed management. Knowing these options increases your chances of growing a high yielding and top quality crop.

RESOURCES

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