Weed Management and Soil Fertility on a Sub-Arctic Farm

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Title: Weed Management and Soil Fertility on a Sub-Arctic Farm

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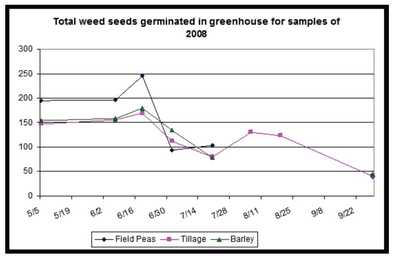
Weeds are the biggest current problem on Rose Creek Farm

USDA and University of Alaska weed team at work on Rosie Creek Farm

Situation:

Interior Alaska's short growing season and temperature extremes raise challenges for sustainable, profitable agriculture. Long summer daylight hours change growing characteristics of many crops and weeds, and little research has been done on organic weed management under these distinctive conditions.

On Rosie Creek Farm, certified organic and herbicide free since it began in 1998, the abundance of annual weeds is the biggest current problem. The major weed problems are Chickweed (*Stelleria media* [L] Vill.) and shepherd's purse (*Capsella bursa-pastoris* L.)



The farm uses traditional methods of weed management – hand weeding, flaming and tractor cultivation:

- Hand weeding is effective but time-consuming
- Flaming is effective early in the season, but the huge seed bank results in a second flush after crops emerge
- Tractor cultivation also works well, but disturbing the soil can bring on a new weed flush later on

Cover crops out-compete weeds, but they don't deplete the seedbank. A method is needed that reduces the likelihood of weeds germinating in the first place.

Objectives:

1. Determine the impact of tillage on soil nutrients in a bare-fallow treatment
2. Determine the efficacy of bare-fallow in reducing the weed seedbank
3. Assess the impacts of managing weeds with landscape fabric (plasticulture) in crop aisles

Actions:

Bare-Fallow Experiment

A 1/3-acre plot was divided into three treatments, 1) bare-fallow full season, 2) bare-fallow followed by field peas and 3) bare-fallow followed by barley, each managed as follows:

1. Till every 10-14 days throughout the growing season when a flush of weed seedlings emerges, pre-flowering
2. Till to peak of growing season; then plant field pea cover crop (mixture of three varieties: Trapper, CDC Sage and SW Midas)
3. Till to peak of growing season; then plant barley cover crop (variety: Albright)

For nutrient analysis, soils were sampled three times – pre-plant, mid season and end of season – to a depth of 30 cm, separated 0-15 cm and 15-30 cm.

Weed species were counted and percent cover was estimated within three subplots per plot.

To assess seedbank weeds in mechanical versus biological methods, soils were sampled at 0-6 inches before and after treatments, and then frozen until grow-out in the greenhouse. A second freeze-thaw simulated a second growing season.

Plasticulture Experiment

Black opaque landscape fabric was applied with ground staples in half of the aisles, and rows of annual ryegrass (*Lolium multiflorum* Lam.) were sowed following planting in the other half.

Photographic and anecdotal observations were made of the effects.

Field peas in September 2009.

Barley in September 2009.

Bare-fallow tilling at Rosie Creek Farm in May 2007.

Some chickweed mat remains after tillage.

Annual ryegrass in the aisles.

Landscape fabric in the aisles.

Results:

Bare-Fallow Experiment

Seedbank measures in 2008 and 2009 showed that tillage and cover cropping decreased total seedbank weeds. Chickweed and shepherd's purse were most dominant.

In 2008, a second flush of germinating weed seeds was observed, suggesting a weed strategy of germinating throughout the season, not just at one time.

Total C, N, P and S in soil samples did not change between early and late in the first season, showing that total nutrient concentration was unaffected by mechanical tillage for weed control.

For the cover crop treatments, barley was superior for both its rapid growth and its ability to inhibit further weed growth during the season.

Plasticulture Experiment

Landscape fabric was totally effective in suppressing weeds, but only if complete coverage was obtained in the aisles.

Annual ryegrass could be equally effective if seeded early enough. And it has the added benefit of adding organic matter back into the soil.

Impacts or Benefits on Agriculture:

While it's too early to draw conclusions on the impact of bare-fallow on soil fertility, the impact on the weed seedbank is important: Both the counts from weeds emerging in the field and the seed bank decreased over the course of the summer. Whether the reduction is significant relative to its effect on farming will require another study.

Bare-fallow appears to have some promise because:

1. It is a quick method to kill weeds over a large area
2. It can reduce the weed seed bank by more than 70% if employed season long
3. It could provide a long-term strategy for reducing weeds to accommodate seeded and slow-to-germinate crops like carrots and beets

Special Acknowledgement:

This study would not have been possible without the hard work of Erin Carr, a University of Alaska graduate student who did field and greenhouse work and collected data.