

Adaptive Management for Cover Crop Mixtures

Improving overwintering cover crop mixtures for weed suppression and nitrogen fixation

Something to (k)vetch about!

Posted on [October 24, 2014](#) by err76@cornell.edu

Well over a year ago now (in May 2013) I planted a few vetch cultivars in an effort to produce more seed that we could use in a field-scale experiment. Vetch is typically planted in the fall and it overwinters until the spring when it flowers and sets seed. However, the maturation time from germination to flowering is about 90 days in a greenhouse, so it made sense that they would have set seeds before the end of the growing season if I planted them right at the beginning of June. As I [showed](#) back a year ago, the flowering was very successful, we just didn't get many seeds. While I collected as many of the seed pods I could, I barely recovered what I planted.

(After talking to a few people, I think that the main factor that prevented the seed production was the timing. But it didn't have anything to do with the temperature or the light as the season went on. I took for granted the fact that the bees required to pollinate the flowers would be there, but of course they have their own schedule and life cycle. By the time the vetch flowered there were likely fewer bees still active. The most successful plot of vetch in terms of seeds, was directly next to a small wood lot. This area provides undisturbed soil for ground nesting bees, as well as lots of wood for small nests for other bees.)

The farm manager was generous enough to leave as many of the plots as he could in the hopes they might come back over the winter. Only one of the plots successfully regrew (the last one planted). As it flowered at the typical spring time, it was well pollinated and set quite a few seeds. The farm staff used a sickle-bar mower to cut the plants right at the bottom and just let them lay on the ground to dry a bit. It worked great and I went a few days later and bagged it all up. By the time I finally got a minute to start removing the seeds from the pods, I found that the bags were infested with a strange bug that seemed to be in every pod, and crawling out of a perfectly round hole in one or more seeds. I didn't know it at the time, but I had just met the [vetch weevil](#) face to face.



Long story shorter, the weevils had made a big dent (literally) in all of the seeds making them nonviable. Without a doubt I have learned a lot from this whole process, but I have nothing much to show for it. I do have a much greater appreciation for the farmers who produce the seed for all the rest of us. We think that the whole story starts when we order the bag of seeds from the seed house, but in fact it has started long before that.

A lot of seed production happens on the west coast of the US (eastern Washington and Oregon) due to the long growing season, and few diseases and pests due to the dry conditions. The vetch weevil has been a problem on the east coast of the US for at least 100 years. One solution to the problem is to stop growing vetch for seed, which seemed to happen likely coinciding with the general decline in the use of cover crops 75 years ago. A USDA publication from 1933 ([THE HAIRY-VETCH BRUCHID, BRUCHUS BRACHIALIS FAHRAEUS, IN THE UNITED STATES](#)) is the most comprehensive description of the insect to date, a sad reflection on our current knowledge. This lack of information makes it hard for any interested farmers on the east coast from trying to grow more locally adapted varieties especially without using insecticides. This is an area with a lot of potential though it

won't be without a lot of work as well. In a recent [survey](#) farmers rank cover crop seed costs and availability in the high-middle of a number of challenges. Though this doesn't seem to be a large barrier to the initial use of cover crops by farmers, advances in local sources of seeds would increase cover crop performance, and potentially reduce costs. Not a bad combination.

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Out at the farm(s)

Posted on [September 24, 2014](#) by [err76@cornell.edu](#)

One of the exciting part about the second field season is that we have a subset of the treatments from the main research farm replicated on four local farms. We are incredibly lucky to have such willing and capable farmer collaborators. They have all generously loaned us some land on their farms for these cover crop trials. They also provide us with insights about cover crop establishment and management on-farm that we wouldn't have without them. Thank you!



Looking down the length of the first farm plots



My lab for the day at the second farm...



and my lab mate



Seed incorporation at farm three



Part of the fourth farm plots.

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The next round...

Posted on [September 24, 2014](#) by [err76@cornell.edu](#)

The second field season of this experiment was planted at the main research farm site in mid-September. Here is a glimpse of the process and site.



My new ride

The new site has a dairy farm neighbor (the red barn in the back). Since the road to the field site is a bit bumpy I can borrow the Gator to get all the supplies closer. I weigh out the seeds for each plot and put them in separate envelopes (~800). I then have the move them from the lab out to the field.



Moving the seeds from the lab...



to the field.

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Deer fence

Posted on [December 13, 2013](#) by [err76@cornell.edu](#)

As many of the species of cover crops I planted are also used by hunters as deer forage, the guys at the research

farm suggested I do something more to protect the plants than just keep my fingers crossed. Fortunately, most people aren't doing research over the winter, so I was able to borrow an electric fence set from another lab that I can use until I harvest in the spring.

I'm a little embarrassed to show my handiwork setting up the electric fence and power connection, as I'm sure there is a better way, but Brook and I were quite proud of the fact that we at least got it working! And in below freezing temperatures it felt even more satisfying! The farm manager has told me that so far the fence seems to be working. I'm still keeping my fingers crossed, just in case.



Down the line



Power connection

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Vetch seed “production”

Posted on [October 30, 2013](#) by [err76@cornell.edu](#)

As I mentioned [before](#), in June we planted some unique research strains of hairy vetch to try to get more seeds in order to use in later experiments. We actually got pretty good germination even though the seeds were old, and for most varieties they grew very well. However, they don't seem to be setting much seed even though they are flowering prolifically. We planted them in 40 ft long strips at the end of fields scattered around the research farm to ensure they were not cross pollinated.



Full plot view

While each variety differed in how mature the plants and seeds were, there were clearly distinct stages for seed production.



Young, green seed pods



Filled, green seed pods

These brown, dried seed pods with large seeds inside are what we're looking for. They're surprisingly hard to actually see in the mess of vetch leaves, but if you shake the plants they make a distinctive rattling sound that's much easier to follow.



Dried pods

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More growth

Posted on [October 30, 2013](#) by [err76@cornell.edu](#)



Greening of the fields



Down a row of plots: you can see some of the treatment differences



Brown-tinted vetch



Greener vetch



Forest of winter peas



Close-up of winter peas

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Seedling emergence!

Posted on [October 9, 2013](#) by err76@cornell.edu



You can start to see the checker board of cover crops



Seedlings!



Towards the west



Vetch and some clover seedlings

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Experiment establishment

Posted on [October 8, 2013](#) by [err76@cornell.edu](#)



On September 16th and 17th I planted this year's experiment at the Musgrave Research Farm in Aurora, NY. The preparation took much longer than I planned, but I was glad to get all the seeds in in two days. Several days later we had a long soaking rain, giving the seeds a great start. The warm weather and sun the last few weeks have also been good for them, so I'm hopeful they will be well established before the winter. Here is a picture of the field preparations before planting. String was strung to create a grid, indicating the 8ft. by 8ft. square plots for each treatment.

The treatments are composed of 6 species of overwintering cover crop species (see right). Within those six species, there are multiple cultivars, or varieties. We have each cultivar growing alone, all cultivars of the same species growing alone, and then mixtures of the different species and cultivars. The idea is to have different levels of diversity in each treatment mixture. Diversity can be simply the number of species, but there is also diversity within-species in the form of varieties and cultivars. In this experiment we are growing equal legume and non-legume mixtures with increasing diversity, starting with one species and one cultivar of each all the way up to all the species together and all possible cultivars. While not every combination was planted, the design will allow us to look along the gradient of diversity for its effect on biomass productivity, nitrogen fixation, and weed suppression.



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USDA recommendations for hairy vetch seed production circa 1920

Posted on [August 7, 2013](#) by [err76@cornell.edu](#)

UNITED STATES DEPARTMENT OF AGRICULTURE

**BULLETIN No. 876**Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C.

PROFESSIONAL PAPER

September 1, 1920

HAIRY-VETCH SEED PRODUCTION IN THE UNITED STATES.By L. W. KEPHART, *Scientific Assistant*, and ROLAND MCKEE, *Assistant Agrostologist*,
Office of Forage-Crop Investigations.

In trying to increase our available seed for several unique breeding strains, I've been reading online about saving hairy vetch seed. This bulletin would have been even more helpful back in May, though it's clearly been around long enough. Though some of the machinery references are outdated and a bit of a mystery to me, the vast majority of it is spot on, and more detailed than I've been able to find anywhere else. Perhaps most interesting is the picture and explanation of the spiral vetch separator (pg 21), which is still demonstrated to Cornell undergrads in the introductory field crops course.

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