Final Project Report for 1994-1995
Increasing Options for Cover Cropping in the Northeast
Project # FNE-94-66
August 11, 1995

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Project Collaborator: Lee Stivers, Cornell Cooperative Extension

Objective:

Our objective was to evaluate the suitability of several cover crop species and practices for vegetable growers interested in integrating cover crops into their production systems.

Experiments:

1. Fall Cover Crops Trial

This trial was established in the fall of 1994, as a second-year follow up to last year's project. 5" x 12" plots of the following cover crops were planted in replicated plots on September 3 and Sept 16:

oilseed radish *(Raphànus sativus)*
yellow mustard *(Brassica hirta)*
white senf mustard *(Brassica hirta)*
forage kale *(Brassica oleracea)*
canola *(Brassica napus cv. Sparta)*
forage turnip
oats
control

This list includes all of the cover crops we evaluated last year, with the exception of phacelia (dropped due to extreme difficulty in obtaining seed), and also included some other brassica cover crops which are easily obtainable in the US. Biomass samples were collected from both planting dates twice during the growing season. Soil samples were taken in plots from the first planting date at the same time that biomass samples were collected. Plots were left to winter-kill. In late March, residue samples and soil samples were collected from all plots. Residue samples were divided into cover crops and weed samples for measuring the weed suppressive effects of each cover crop. Biomass samples

were dried, weighed and analyzed for percent N. Soil samples were analyzed for nitrate content.

2. Cabbage Overseeding Trial:

The second trial, also a follow-up to last year's project, consisted of the following cover crops overseeded into a standing cabbage crop in replicated 9" x 15" plots:

red clover
alsike clover
hairy vetch
rye
ryegrass
control

Because of our observations from the previous year's overseeding trial, the plantings were staggered in order to allow cover crops to get established, but not become too competitive with the cabbage crop. Clovers were overseeded on August 15, the vetch on August 24, and rye and ryegrass plots were planted on September 13.

In the summer of 1994, a large commercial storage cabbage grower expressed interest in experimenting with overseeding cover crops in cabbage. We planted a non-replicated demonstration trial in a field of red cabbage at his farm consisting of vetch, rye and ryegrass in plots measuring 7.5" x 100". The vetch was overseeded on August 24th, following final cultivation, and the rye and ryegrass were planted on September 13.

Results:

1. Fall cover crops trial:

Data on cover crop biomass and N accumulation and soil N concentrations for our trials conducted in 1993-1994 and 1994-1995 are presented in Figures 1-6 (first planting date only). After following these cover crops for two years, we are able to draw the following conclusions:

Fall brassica cover crops grew faster and accumulated more N than oats. In the first year, brassica cover crops and phacelia grew faster and had greater biomass by November than oats, accumulating approximately 3500 kg/ha (Figure 1). In the second year, oats were almost able to match the biomass of the brassicas by November, probably due to a very mild fall, but in both years, brassicas took up more potentially leachable soil N than oats (approximatley 100-120 kg N/ha; Figures 2-4).

A greater proportion of oat residues and biomass N remained on the soil surface in the spring compared to that of fall brassicas. All of the cover crops lost much of their aboveground biomass and biomass N between November and April, but brassicas lost a larger proportion than oats (Figures 1-4), probably because their finer leaves were more prone to being blown away by winds, or physically broken down and mixed with the soil surface. Several of the cover crops evaluated the second year, including kale, canola and turnip, did not completely winter-kill, and therefore showed relatively high values in April for N remaining in the residues (Figure 4).

Cover crops depleted leachable soil N during the fall, but the fate of that accumulated N by spring not clear. Nitrate concentrations decreased through the fall in both years, but the decrease was greater in cover crop plots compared to bare plots (Figures 5-6), indicating that cover crops were taking up potentially leachable soil nitrogen. Nitrate losses in bare plots could indicate leaching. Since the majority of nitrogen taken up by the cover crops would have been stored in the above ground biomass, and since much of that biomass was lost over the winter, the fate of the accumulated N remains in question. The trend for higher nitrate concentrations in the bare plots in the spring may indicate that at least part of that biomass N could have leached back into the soil (Figures 5-6).

Fall brassicas provided greater weed suppression than oats. Cool season weeds such as malva, henbit and chickweed grew thickly in non-cover cropped control plots. In both years, weed biomass in oat plots was three to four times greater than weed biomass in fall brassica plots (data not shown). In the second year, no measurable weed growth was found in plots planted to canola, kale, turnip, and oilseed radish in the early planting. Later plantings always resulted in less weed suppression.

August 25-September 5 is the optimum planting window for these cover crops in western NY. Comparisons of cover crop and weed growth from all three planting dates from the first year and the two planting dates of the second year indicate that these cover crops should be planted between August 25 and September 5 for greatest growth. Brassicas planted earlier than August 25 could also grow well, but an earlier planting date could allow for flowering and seed set, which could create a weed problem in the following year.

2. Cabbage overseeding trial:

Observations during the fall indicated that while the clovers and vetch became well established, the rye and ryegrass plots never established well, probably because the ground was not freshly worked when they were planted, as was the case with the earlier

planted cover crops (planted following cultivation). Also, compared to last year's trial, the frame leaves of the cabbage were much larger, filling in more of the field, and leaving narrower strips between rows where cover crops could find sunlight and grow. There were no differences in cabbage yields between treatments, measured in early December. Unfortunately, we were not able to follow this trial through spring regrowth of the cover crops because sheep got into the field during the winter and spring and severely grazed the cover crops.

Although we did not take biomass or soil samples at the non-replicated trial in the commercial grower's field, we did observe several interesting things:

--while residual herbicides were used on the cabbage field at cabbage planting and later in the season as a post-emergence application, the cover crops were planted late enough that the herbicides seemed to have no deleterious effect on them. In fact, they established quickly and grew quite well, especially the vetch. This was probably due in part to the very mild fall during 1994, and possibly the cover crops were also responding to higher fertility levels in the commercial field.

--conventional harvesting methods, which include the use of large trucks, tractors, and many harvesters, did not seem to cause a lot of damage to the cover crops. Regrowth, especially of the vetch, was strong, with little signs of wheel-traffic damage.

--while the grower was pleased with the results of this demonstration, he has had reservations about using the practice on a larger scale. His reasons are that he has no way of seeding the cover crops other than a spinner-broadcaster, and he does not want cover crop seeds to fall into the heads of cabbage as they formed. He is also hesitant about the cost of seeding hairy vetch.

Cover Crops Seeder:

Although we have not been able to build a mechanical seeder to seed cover crops into cabbage yet, we have made significant progress towards that goal. In February, we went to Ithaca to view a similar seeder that was designed and built in Dr. Jane Mt. Pleasant's lab for overseeding cover crops into corn. From viewing this seeder, we were able to come up with a simple plan for retrofitting an existing seeder at Porter Farms for this purpose. While we have been too busy during the growing season to get the seeder built, we hope to be able to build the seeder this winter for use in 1996.

Outreach Efforts:

We have been involved in a number of outreach efforts to publicize this project and to get the information in the hands of growers. While we did not host a field day this year due to problems of poor turn-out in the past, we have published several newsletter articles and given talks to primarily grower audiences:

1. *Lake Plains Vegetable News* Newsletter Articles. Two articles were published in this Cornell Cooperative Extension newsletter which has a circulation of approximately 500 growers and vegetable industry representatives. The articles presented results and conclusions from the first year's trials. Other vegetable agents across the state have reprinted the articles, or summaries of the articles, in their own newsletters, so that many of the vegetable growers in NY have seen the articles.

2. NOFA/The Natural Farmer Articles. The same articles were recently submitted to the editor of The Natural Farmer, the region-wide newsletter of the Northeast Organic Farmers Association. Publication is expected sometime during 1995.

3. Presentations at Extension and Grower Meetings. The information gained from these trials has been presented at several meetings during 1994-5, including an agricultural production in-service training for CCE vegetable agents, specialists and faculty (25 in audience); the Lake Plains Vegetable Program Fresh Market Vegetable Meeting (80 growers in audience); and the CCE Fresh Market Sweet Corn IPM Program (20 growers in audience).

4. Professional Presentations. Lee Stivers gave an oral presentation on the fall cover crops trials (1993-1995) at the American Society for Horticulture Science meetings in Montreal in August, 1995. Results from these trials will also be written up this winter and submitted to HortTech, a refereed journal from ASHS. Lee will also be giving a presentation at the CCE Cover Crops Symposium, to be held in Ithaca in November.

Linkages with Other SARE or Related Projects:

Although the scope of this project has been focused on two specific cover cropping systems for vegetable growers, we have been able to successfully link our work with a number of other SARE or related projects. Specifically, Lee Stivers has been able to use this project as a base to expand her work in cover crops in a number of different directions:

--Lee is a cooperator on the NE SARE project "Management Strategies for Improved Soil Quality with Emphasis on Soil Compaction", coordinated by Dr. Dave Wolfe, Cornell University. As part of this research project, we will be conducting cover crops trials at several locations across NY, including many of the species used in the trials at Porter Farms.

--Lee is also cooperating on a USDA/IPM grant with Dr. Rose Loria, Cornell University, studying the soil-pathogen suppressive effects of brassica cover crops, including some of those used in the Porter trials.

--A project funded by USDA/EPA has allowed Lee to work closely with five area vegetable growers in using a process of "whole farm planning" to integrate cover crops into their operations. Participating growers will have the opportunity to try out the cover crops used in these trials on their own farms.

--A SARE grant written by Dr. Steve Reiners, Cornell University, and Lee Stivers will fund a Cover Crops Symposium at Cornell for Extension faculty and staff, as well as interested growers and NRCS staff. This will be an opportunity for sharing information and ideas among many people across the state who are working with cover crops, not only in vegetables, but also in field crops and fruit crops.

Figure 1. Biomass, Planting 1, 1993-1994

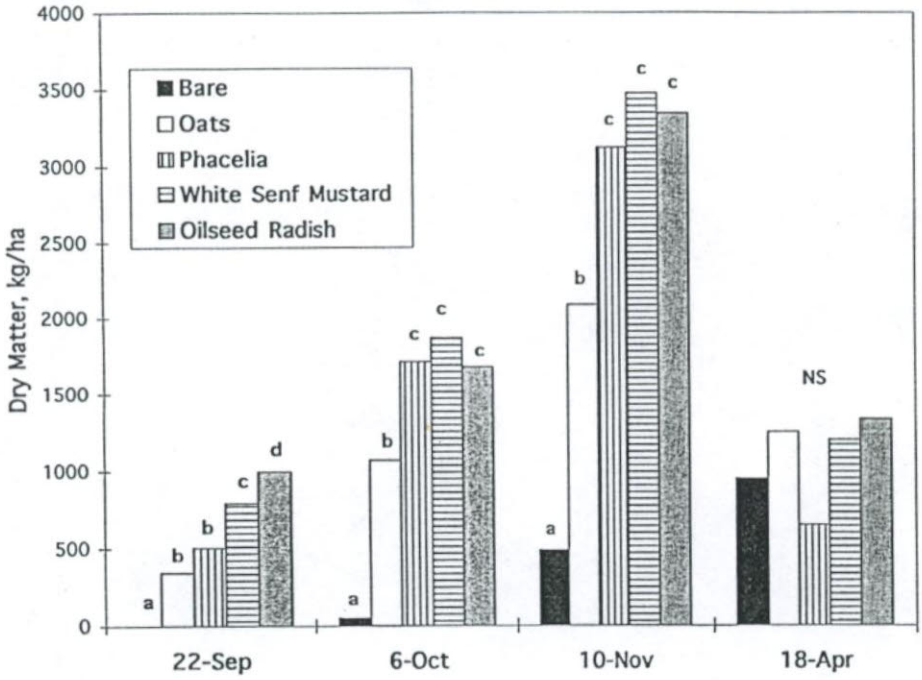

Figure 2. Biomass, Planting 1, 1994-1995

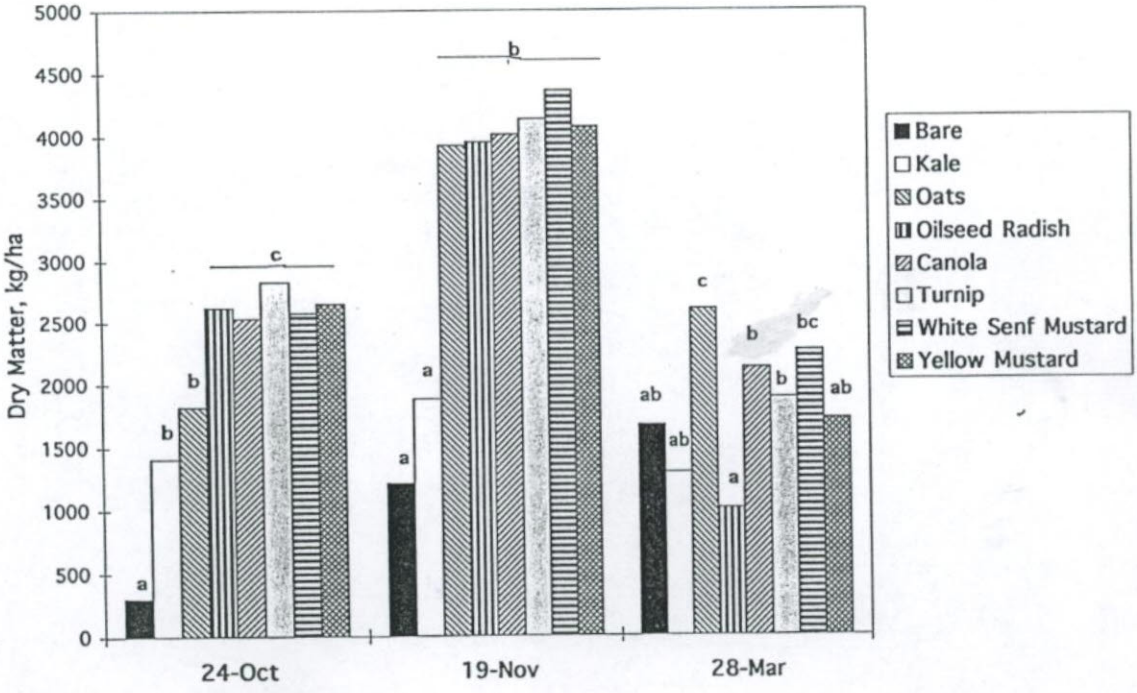

Figure 3.

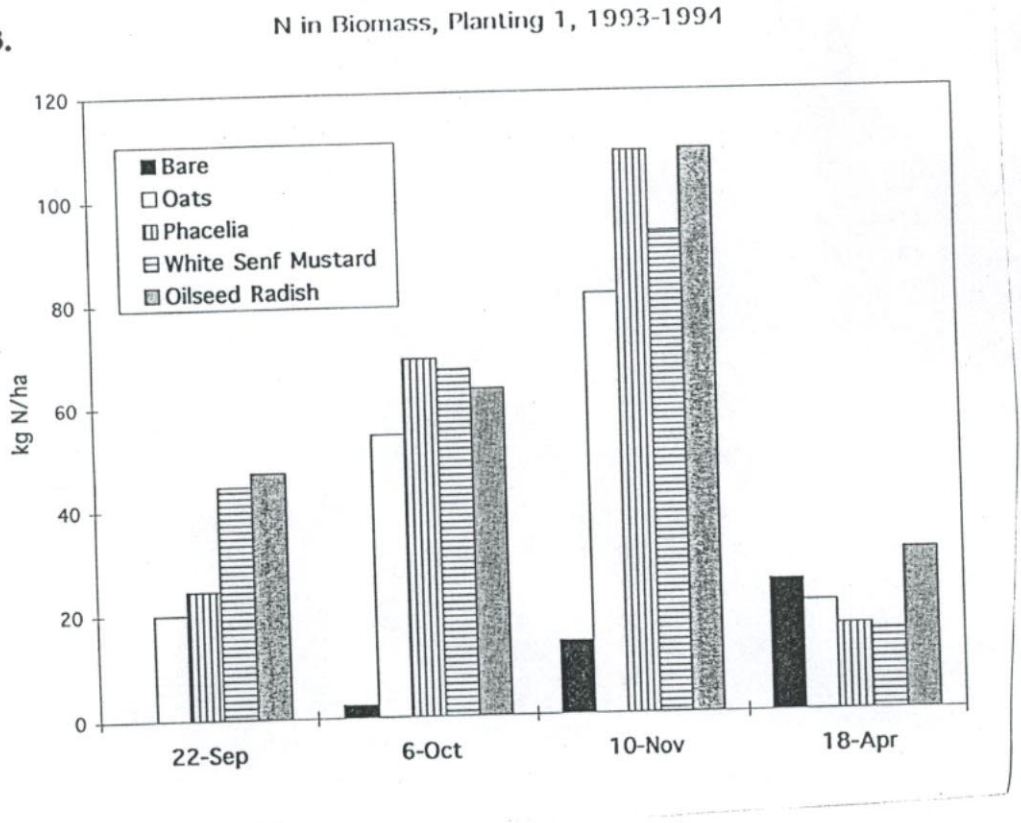

Figure 4.

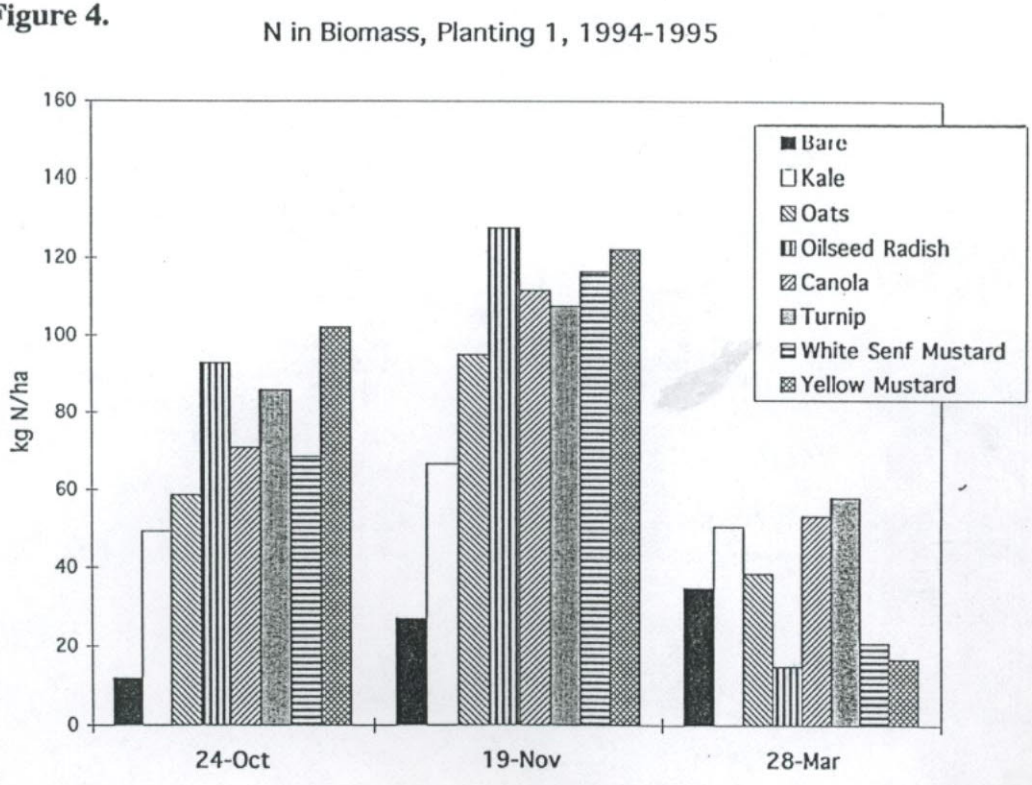

Figure 5.

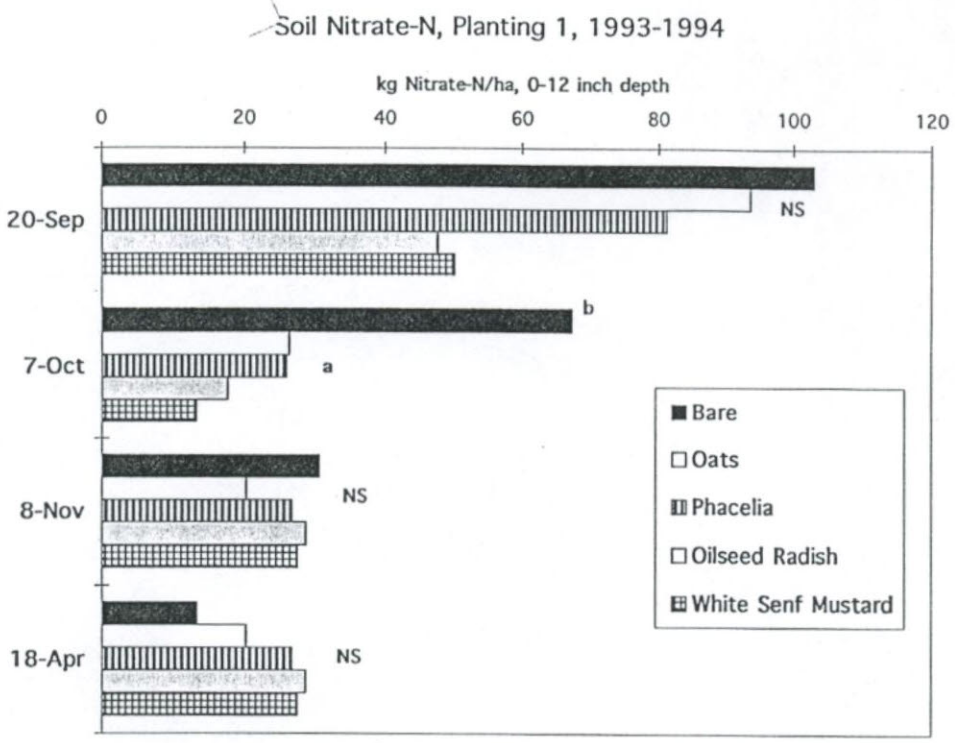

Figure 6.