1. Project Title: The Agronomic and Economic Effects of Harvesting Legume Cover Crops at Varying Maturities. FNE04-511

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2. Goals: The use of cover crops as an organic alternative to synthetic fertilizers is a common practice on Vermont and Northeast farms. However, their use comes at a high cost to the organic farmer. Seed costs, tillage time, lost income from fields not producing cash crops, and others, all can add up to lower profit margins on organic farms and raise the costs of locally grown organic produce. It is a widely held belief that cover crops should not be harvested, since allowing cover crops to go to fruit robs the soil of needed nitrogen and biomass replenishment. Many common cover crops, including soy beans, cow peas, rye, and oats, would have commercial cash crop value if harvested, but traditional wisdom prevents this, as stated above. This study endeavors to test this belief by testing the effects on nitrogen and biomass inputs of harvesting a legume cover crop with cash value (cow peas) at various maturities. If conclusive, the results of this study will determine if it is economically and agronomically viable to harvest a cover crop for its cash value while simultaneously putting needed nitrogen and biomass into organic production fields. Other variables included in this study will be plant maturity at harvest, planting dates, and crop variety. The effects on weed suppression, insect damage and beneficial insect population will also be measured.

3. How did your project fit in with your farm operation?
Cedar Circle Farm is an organic 50 acre diversified vegetable, berry and flower farm located in the Upper Connecticut Valley region of Vermont. The farm consists of a farm stand, thirteen plastic houses (six heated), vegetable fields, cut flowers, u-pick strawberries, pumpkins, blueberries, raspberries, and a limited number of animals. Produce includes strawberries, blueberries, annual and perennial flowers, pumpkins, corn, peppers, tomatoes, onions, garlic, squash, lettuce, herbs, eggs, honey, beans and others. CCF is run as a full-time, family style farm, employing between 5 full time and 25 seasonal people.

Cedar Circle Farm is operated by organic farmers Will Allen (formerly Program Director of the Sustainable Cotton Project and current board member of Organic Consumers Association) and Kate Duesterberg (formerly of the UVM Center for Sustainable Agriculture and managing director of the Sustainable Cotton Project). CCF is dedicated to sustainable farming practices and local food production. CCF offers educational opportunities for next generation farmers and the community through working farmer programs, tours, workshops, and harvest celebrations. In addition, CCF focuses on increasing the availability of quality, organic produce to low income people. The farm was conserved with the Vermont Land trust in 1990.

Because CCF is run as an organic farm, soil fertility, weeds, and pests are managed through the use of cover crops, organic manure compost, organic fertilizers, and various cultivating strategies. Our connection to inner-city markets has led to the recent introduction of cowpeas to the farm's production schedule.

4. Participants: Vern Grubinger, Agricultural Extension Vegetable Crop Specialist, University of Vermont. Will Allen & Kate Duesterberg, CCF farm managers, Norman Staughton, Education Program Coordinator, Cedar Circle Farm (2004 season only)

5. Actual Project Activities:

Methods, Planting Decisions. We sampled three different cowpeas over a three-year period. In the first year we planted Mississippi Pink Eyes and California Black Eyes #5. In the second and third years we planted California Black Eyes #5, Mississippi Pink Eyes. In the third, fourth, and fifth year we planted Purple Podded Pink Eyes. Each plot was sampled by cutting a four-foot square sample of vegetative matter (hereafter referred to as a biomass sample) at the vegetative, green bean, and dry bean stages. Each plot was tested for: biomass, nitrogen level, weed population, insect damage, nitrogen nodule development and beneficial insect population. The agro and economic effects were then evaluated.

Evaluating the Results. At the end of each growing phase each plot was analyzed for weed suppression (by visual count) and beneficial population (via sweep netting) tests completed prior to harvesting and cutting. Plots designated for harvest were harvested, and all acres were mowed and tilled into the soil. Three four-foot squares randomly selected from each plot were gathered and sent to the UVM labs for nitrogen and biomass analysis in 2004. This process was repeated for the 2006 planting of Purple Podded Pinkeyes. However, since the samples for 2006 were essentially identical (varying from 20 to 21.5 pounds per sample), we only sent in one sample for analysis. All plots were tested for soil fertility before and after the 2004 season.

How will the results of this project help farmers in the Northeast? Farmers in the NE who use cover crops to increase organic matter and nitrogen levels will benefit from the knowledge generated by this study. Since the use of cover crops is widespread, any potential economic benefit from harvesting marketable crops from a cover crop, without agronomic losses, will be a benefit to farmers and consumers by lowering production costs for organic and sustainable farms. Additionally, the agronomic benefits of cowpeas, which are not a well-known crop to farmers in this area, will also be helpful to sustainable farmers in the Northeast.

California Blackeye #5

On June 11, 2004 we planted California Blackeye #5 on three acres on the Home Farm and an acre each of Mississippi Pinkeyes on two parcels of rented land, hereinafter referred to as Jack's and Alice's . We only thoroughly sampled the sixteen, two hundred foot rows that were planted in the Home Farm Field # 5 location in 2004. However, we did analyze the dry bean stage of each planting for comparative purposes for our own use in evaluating crop performance. Only the Home farm data will be analyzed in this report.

The California Blackeye #5 was a very productive fertilizer crop at both the vegetative stage and the green bean stage. At full growth of the vegetative stage, most of the Blackeye plants provided 100% coverage and completely blanketed the inter row space (45 inches). Those few spots where that did not occur still provided 90% cover, which almost completely covered the inter row space. After one cultivation with a finger weeder, the Blackeyes were virtually weed-free at both the vegetative and green pea stages.

We determined that the peak vegetative stage started with full growth of the plant just before flowers emerged. We determined that the vegetative stage stopped with the blossoming of the first flowers. So we took our vegetative sample when the first flower buds appeared. We took our second sample during the middle of the peak of green pea production. At both the ends of the vegetative stage and the peak of the green pea stage (which were only fifteen days apart) the Blackeyes produced an average of about 16 pounds of green biomass on each four foot by four foot sample (16.06 for vegetative and 15.7 for the peak green pea stage). This meant that the plants were producing about one pound of wet vegetative matter per square foot. We submitted our samples to the UVM Agriculture and Environmental Testing Service and received a Forage Analysis Report for each sample (see appendix on Forage Analyses). All of the data on dry matter, percentage of nitrogen and nutrient matter in the following paragraphs are derived from those forage reports.

We cut and measured the biomass of the Blackeye crop at the vegetative stage. That measurement yielded 16.06 pounds for 16 square feet. This equaled 1.00375 pounds per square foot. Multiplying that times 43,560 square feet—the number of square feet in an acre--equaled 43,723 pounds. This is the green biomass yield of the vegetative stage. Multiplying the green biomass yield of the vegetative stage by the dry weight yield of biomass per acre (.139) yielded 6077.49 pounds of dry biomass per acre. Multiplying the dry biomass times the percentage of nitrogen (.0304) equaled 184.76 pounds of nitrogen per acre when the sample was taken. At this stage these peas were a very good producer of both nitrogen and biomass.

We swept with a bug net for beneficial insects at the vegetative stage. We found that the beneficial insect populations of the Blackeyes at the vegetative state were only equal to other surrounding crops that were not flowering.

At the peak of the green pea stage from 70% to 80% of the inter row space was still covered. That reduction in coverage was largely due to picking traffic through the beans which broke up the full coverage observed at the vegetative state. On 9/20/04 the biomass of the green pea stage was 42,688 pounds or .98 pounds per square foot. Multiplying the fresh weight of the biomass by the percentage of dry biomass weight (.263) equaled 11,227 pounds of biomass. Multiplying the dry biomass weight by the percentage of nitrogen (.0219) yielded 245 pounds of nitrogen per acre when the sample was taken.

All pea pods were stripped from the plants when the sample was taken and were not submitted for laboratory analysis. At the green pea stage Blackeyes are an even better producer of biomass and nitrogen than in the vegetative stage. And, you can sell the beans and have the fertilizer too.

In the early green pea stage when there is an abundance of flowers there was a dramatic increase in beneficials, including syrphid flies, lady bugs, lacewings, soldier beetles, spiny soldier bugs and wasps. At this stage the production of nodules as large as a pea or larger varied from 12 to 18 nodules in the first eight inches of soil.

The Blackeyes were tardy in reaching the dry pea stage and it became difficult to determine when the peak dry stage would have been reached because a frost in early October defoliated the plants when there were still immature peas on the plants. We took our sample on 10/06/04, the night before the killing frost, so the results are a bit skewed because about 10% of the plants had not fully matured. We took our sample in the most mature sections of the crop, so the results should serve as a sufficient benchmark for analyzing the dry pea stage as a fertilizer crop.

By this time only 50% of the inter row area was covered with vegetation and the larger weeds had begun to reach the seed stage, especially Red Root Pigweed, Witchgrass, Hairy Calisoga, and Lambsquarter.

On 10/6/04 the fresh weight of the sample only yielded .63 pounds per square foot which produced a biomass at the dry pea stage of 27,443 pounds per acre. Multiplying the weight of the fresh cut sample by the percentage of dry matter (.187) equaled 5132 pounds of biomass. Multiplying the percentage of nitrogen (.0259) by the dry biomass weight yielded 132 pounds of nitrogen. All pea pods were stripped from the sample when it was taken and were not submitted for laboratory analysis.

Economic Analysis of California Blackeye #5

The California Blackeye # 5 is a slow maturing plant in the Northeast as a pea producer. In 2004 it took a full 90 days in Vermont to reach peak green pea production. It reaches its maximum vegetative cover, however, in 75 to 80 days. It takes more than 100 days to reach the dry pea stage. If planted earlier, in mid May, instead of early June, its maturation times are shorter—as we found out in 2005 and 2006. If planted in early May (which we could not do in 2004 because of rainy weather) it reaches its vegetative cover peak in 60 days and its peak green pea stage in 70 days and its peak dry bean stage in 85 to 90 days, which happened for us in 2005.

California Blackeye #5, however, is a very prolific producer of peas and is a very prolific producer of biomass and nitrogen throughout the time that it is producing green peas. At the green pea stage it produced an average of .51 pounds of pea pods from each 16 square foot sample for 7 picking days on that same 16 square foot spot (or 87 pounds per acre per day and 1044 pounds for the 12 days) The peas stayed at peak green pea stage for about 23 days and each sample spot could be picked every other day. As a green pea it is very marketable as a diversion from snap beans in our local farmers' markets. But, in order to interest customers in green cowpeas (most people know about dried blackeyes) we conducted cooking demonstrations at our markets. These green peas were much more easily marketed to ethnic communities in Massachusetts that we work with because they knew that green cowpeas were a delicious treat.

Cowpeas are also much easier to pick in both the green and dry pea stages than either snap peas or snap beans, since they put all of their peapods on the top of the plant where it is easy to see the maturity of the pea and enable a more rapid harvesting pace. As a dry pea/cover crop, it is less

valuable than at the green pea stage since it produces less nitrogen, less biomass, more weeds, and the dry peas must be removed from the pods.

After two years of planting California Blackeyes #5 we decided that we should look for other cowpeas that might be as prolific as a fertilizer and cash crop cultivar, but progress to harvest somewhat faster for New England's short seasons.

Mississippi Pinkeyes

We planted several plots with Mississippi Pinkeyes but we only thoroughly analyzed those plantings on the Home Farm from Field #5. We did so because this plot provided the best side-by-side comparison in a field that had been organically managed for three years.

On the same plot where the California Blackeyes #5 were planted, we planted sixteen two hundred foot rows of Mississippi Pinkeyes on 6/11/04. On 8/31/04 the plants had slightly passed their maximum vegetative state. On some plants flowers had already begun to emerge and on others incipient peapods (two inches in length) had begun to form. At that time the plant only covered about 55% of the inter row area. When the plant reached its maximum vegetative state (at first flower bud) the biomass sample averaged 10.7 pounds per 16 square feet of sample, or .66875 pounds per square foot. Multiplying that yield per square foot times the number of square feet per acre totaled 29,130 pounds of green biomass per acre. Multiplying the fresh cut biomass by the percentage of dry weight yield of biomass (.177) yielded 5156 pounds of dry biomass. Multiplying the percent of nitrogen (.0218) by the dry weight biomass yield totaled 112 pounds of nitrogen per acre.

At maximum green pea stage the Pinkeyes only covered 50% of the 45 inch inter space between the rows. At this point the green biomass yield was only .60 pounds of freshly cut biomass foliage per square foot which yielded 26,136 pounds of biomass per acre. Multiplying the amount of fresh cut biomass (minus the peapods) times the dry weight yield of biomass (.186) equaled 4861 pounds of dry biomass. Multiplying the percentage of nitrogen (.0229) by the dry weight yield of biomass equaled 111 pounds of nitrogen per acre. By this time weeds were already beginning to reach the seed stage in between the rows of peas. At this stage nodule formation varied from 10 to 12 nodules as large as a pea or larger in the first eight inches of soil.

At maximum dry pea stage the Pinkeyes only covered 45% of the 45 inch inter space between the rows. At this point the biomass yield was .68 pounds per square foot of freshly cut foliage, which yielded 29,620 pounds of Biomass. Multiplying the amount of fresh cut matter (minus the pea pods) times the percentage of dry matter (.216) yielded 6398 pounds of dry biomass. Multiplying the percentage of nitrogen (.020) by the dry weight yield of biomass yielded 127 pounds of nitrogen. As with the Blackeyes, we stripped all plants in the biomass sample of the peas. Only the vegetation was included in the sample.

Economic Analysis of Mississippi Pinkeye

Mississippi Pinkeye is a very prolific producer of edible pods at least three weeks earlier than California Blackeyes #5. By the time that the Pinkeyes were in peak green pea production (which lasted about three weeks) the plants were averaging .56 pounds (8.96 oz.) of peas on every pick day on each 16 square foot sample. These peas could only be picked every other day

(on the same 16 square foot sample spot) for a total of 11 days. On an acreage basis, that would have yielded 1048 pounds of green pea pods per acre.
Like the California Blackeyes #5, this is a very productive pea.

Mississippi Pinkeye, however, is not nearly as good a fertilizer crop as the Blackeyes. And, it is not nearly as good a weed suppressor as the Blackeyes. Interestingly it produced more nitrogen and more biomass in the dry pea stage than in either the vegetative or green pea stage. In the second year of planting, we narrowed the row spacing to 36 inches. At that distance, the Pinkeyes were much more effective at closing the rows with a complete canopy and suppressing weeds. With a much higher plant population in the narrower row spacing we imagine that the Pinkeyes would be better fertilizer plants. The narrower rows, however, required almost 20 pounds of seed per acre, versus the 15 pounds that were required to plant Blackeyes on the 45 inch rows and the 10 pounds that we now use.

Pinkeyes, however, are a much earlier beneficial attractant plant than Blackeyes, since they flower earlier. We planted Mississippi Pinkeyes again in 2005 because we had the seed and we wanted to see if a closer row spacing would produce a better cover crop.

Purple Podded Pinkeyes
We decided to trial another cowpea to find a pea which flowered early (to attract and hold beneficial insects), matured early, and provided a complete canopy for weed control. We think Purple Podded Pinkeyes satisfies all of these needs. In 2006 we planted Purple Podded Pinkeyes on three acres on Home Farm fields #4 and #5. Two and one half acres were planted on Field #4 as a fertilizer and weed suppression crop for strawberries which will be planted in 2007. Twenty two hundred foot rows were planted in Field # 5.

Like the Mississippi Pinkeye, the Purple Podded Pinkeyes are listed as 55 day peas. In the Northeast that maturation time is more like 65 days (at least it was in the rainy Vermont of 2006), but better than either the Blackeyes (at 90 days) or the Mississippi Pinkeyes (at 80 days).

In 2006, the Purple Podded Pinkeyes were planted on June 1. Again we were tardy at planting these peas because of the heavy rains in late spring and early summer. By August 1, the peas had reached their maximum vegetative growth. By that time their canopy had covered all 100 percent of the inter row spacing. By August 5, we began harvesting the first green peas. By the 10th of August the plant was in peak green pea production. They continued producing about half of the average amount of tender green peapods on the 10th of September, 2006.

On August 31, 2006 we sampled the Purple Podded Pinkeyes at peak green pea stage. They produced 1.28 pounds of fresh cut green matter per foot or 55,927 pounds per acre.
The highest Biomass yield we got from the California Blackeyes was 43,723 pounds. The Purple Podded Pinkeyes produced 12,204 pounds more per acre than the Blackeyes and 26,797 pounds more than the Mississippi Pinkeyes at peak green pea stage on the same piece of ground (Home Field #5). Multiplying the amount of fresh cut biomass times the dry weight yield of biomass (.187) equaled 10,458 pounds of dry biomass. Multiplying the percentage of nitrogen (.0224) by the dry weight yield of biomass equaled 234 pounds of nitrogen per acre.

By this time weeds liberated by the picking traffic were already beginning to reach the seed stage in between the rows of peas. Nodule formation (15-25 pea sized and larger nodules in the first eight inches) was significantly better than Mississippi Pinkeyes but only produced slightly more than the Blackeyes.

Economic Analysis of Purple Podded Pinkeyes

These peas are very marketable because they are an attractive purple and green pod, possess a large pea, and are very tasty and creamier than the Blackeye. Their biomass at the green peapod stage is much better than either the California Blackeyes #5 or the Mississippi Pinkeye. Their green peapod production averaged .53 pounds per 16 square foot sample for 12 days. Again this pea can be picked off of the same spot every other day for a total of twelve days. So, this pea produces about 90 pounds of peas per acre every other day for 12 days which totals 1090 pounds of green pea pods. And it keeps producing even after it is mowed. We picked for the entire month of August, 2008 from four 400 foot rows that had been mowed to control weeds in a new patch. Clearly, this is the pea that we will be using in the immediate future, although we are hoping to conduct small trials on other cowpeas (including Chinese Reds, Whippoorwills, and Mississippi Silver Crowders).

Results

The use of cowpeas as a cover crop, a weed suppressor and a cash crop has had interesting ramifications for Cedar Circle Farm. We are using it as a preplant fertilizer and a weed suppressing crop. But, to more effectively suppress weeds on larger plots we have plowed the plants down before they reach the dry pea stage. We tried plowing down all plants towards the end of the green pea stage. Cowpeas allow us to purchase less nitrogen, increase organic matter, and help suppress weeds. Planting cowpeas in the season prior to strawberries and vegetables such as spinach, lettuce, broccoli, garlic, onions, cucumbers, tomatoes, eggplant, peppers, corn and squash can provide these important benefits—plus you can sell and eat their delicious peas.

Conditions

During the several years of this study and of growing cowpeas in Vermont, we have experienced very cool and rainy weather, especially in the spring. These conditions prevented the planting of two successive crops in 2004 and 2005. In 2007, we planted our first crop in late May (the 27th). In 2008 we could not plant until early June. Our solution to this cold, wet weather has been to find a faster maturing pea. We will continue to use the Purple Podded Pinkeyes in the future and will be looking for other short-season cowpeas.

Agronomics and Economics

Blackeyes (at $1.25 per pound for a 50 pound bag) and Purple Podded Pinkeyes (at $1.35/lb for a 50 pound bag) are relatively cheap peas to grow compared to snap beans (Provider at more than $5.00/lb for a 50 pound bag) or snap peas (Super Sugar Snap at more than $3.00/lb for a 50 pound bag). All of these peas and beans give nitrogen and organic matter, but not as much as cowpeas. When we began growing cowpeas we used about 15 pounds per acre on rows 45inches apart. In 2006 we reduced our plant populations from 15 pounds per acre to about 10 pounds per acre with Purple Podded Pinkeyes with more precision planting and more efficient cultivation. By cultivating twice we felt that more plants were spared being damaged or covered by the first cultivation. In 2006, our first cultivation was with coulter discs, which throw soil away from the

plants. Our second cultivation was with a belly mounted finger weeder which cultivates between the plants and throws soil back on the plants at a later stage when the plants can take having soil thrown on them. These two cultivations replaced the single cultivation with the finger weeder, which we used the first two years and which occasionally covered the smaller plants—thus necessitating a higher plant population. In 2008, with so much rain, three cultivations were necessary to get relatively clean rows.

Of course, the economics of getting both copious amounts of fertilizer and marketable green peas is an economic boon. We recorded yields of 1048 pounds from the Mississippi Pinkeyes, 1044 pounds from the California Blackeyes #5 and 1080 pounds from the Purple Podded Pinkeyes. We charged $2.50 per pound, so this adds up to a potential of about $2700 per acre for the Purple Podded Pinkeyes. Add to this the weed control that both Blackeyes and Purple Podded Pinkeyes can provide at the green pea stage and these crops could have bright futures in the North east.

Assessment

The Blackeyes and Purple Podded Pinkeyes studied in this project provided more fertility in the green pea stage than in the vegetative stage for both dry biomass and nitrogen. We feel that the demonstration that cowpeas seem to provide as much biomass and more fertility in the green pea stage than in the vegetative stage is justification for reconsidering some of our other strongly held beliefs about cover crops. One area that needs to be analyzed better is the amount of impact that the cover crop has on soil fertility through the root system. In other words, what is happening underground may be more interesting than we have thought. Of course, almost all of our analysis of the cowpeas was taken above ground by cutting four foot square blocks of vegetative material and having a forage analysis conducted. Copies of the forage analyses are included in the appendix.

Besides the soil samples, taken before and after the study, no analysis was done on how much nutrient material was provided by plant material below ground except for the slightly incremental improvement that the soil samples provide. Copies of soil samples are included in the appendix. We did look to see how many nitrogen nodules were formed within six or eight inches of the surface, but we did not analyze the soil profile or the complete root system in any systematic way. Fifteen to twenty-five nodules (larger than a pea and as a wide as a nickel) were commonly found in the first six to eight inches of soil. But, many large nodules (twice the size of a pea) were found as deep as a foot and a half below the surface.

Most entomologists acknowledge that many insect pests and predators are more nocturnal than they are daytime inhabitants, yet most of entomology is done in daylight hours. The same applies to cover crop analyses. We all know that about half of what is going on is below ground—but almost all our analyses are of above ground vegetation.

Soil Analyses:

Soil sample before we planted the Blackeyes and the Mississippi Pinkeyes.

SOIL TEST RESULTS

			LOW	MEDIUM	OPTIMUM	EXCESSIVE
Avail.phosphate	(ppm P)	9.5	**********			
Potash	(ppm K)	173	**********	**********	**********	**********
Magnesium	(ppm Mg)	98	**********	**********	**********	
pH		6.3	LOW			
Calcium	(ppm Ca)	888	LOW			
Effective CEC	(meq/100g)	5.7				
Ca:Mg:K ratio		11: 1.8:1				
Aluminum	(ppm Al)	38				

PACKAGE 1 MICRONUTRIENTS * (ppm in soil)

		Your results	Avg. levels in Vermont soils
Sodium	(Na)	13.0	20.0
Iron	(Fe)	4.8	7.0
Boron	(B)	0.3	0.3
Manganese	(Mn)	11.4	14.0
Copper	(Cu)	<.2	0.4
Zinc	(Zn)	0.9	1.0
Sulfur	(S)	17.6	

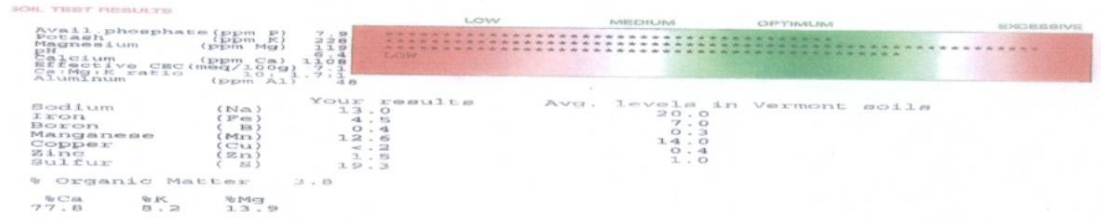
% Organic Matter 2.6

%Ca	%K	%Mg
77.9	7.8	14.3

As can be seen cation exchange capacity was low and calcium were low as was organic matter. This sample was taken with a pea crop on it prior to planting the Blackeyes and Mississippi Pinkeyes.

After the Blackeyes and Pinkeyes were worked into the ground in the fall of 2004, we took another soil sample for the Blackeye plot and one for the Pinkeye crop after we applied limestone at the rate of 200#s per acre.

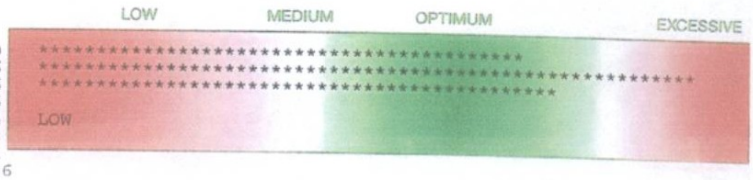
Soil test after California Blackeyes #5:



The organic matter rose considerably after the covercrop of Blackeyes and the application of limestone. Calcium increased but still remained lower than we want to see in healthy soils and the cation exchange capacity increased but still remained low.

Soil Test after Mississippi Pinkeyes

SOIL TEST RESULTS



Avail.phosphate	(ppm P)	8.0
Potash	(ppm K)	186
Magnesium	(ppm Mg)	116
pH		6.5
Calcium	(ppm Ca)	974
Effective CEC	(meq/100g)	6.3
Ca:Mg:K ratio		11: 2.0:1
Aluminum	(ppm Al)	46

		Your results	Avg. levels in Vermont soils
Sodium	(Na)	14.0	20.0
Iron	(Fe)	5.1	7.0
Boron	(B)	0.4	0.3
Manganese	(Mn)	11.5	14.0
Copper	(Cu)	<.2	0.4
Zinc	(Zn)	1.2	1.0
Sulfur	(S)	18.8	

% Organic Matter 3.4

%Ca	%K	%Mg
77.1	7.6	15.3

As with the Blackeyes, the soil organic matter rose, though not as much after the cover crop and the application of limestone. Calcium increased but still remained low and the cation exchange capacity increased but still remained low.

Adoption

Of the three cowpeas that we thought would be appropriate, we concluded that only two, California Blackeyes #5 and Purple Podded Pinkeyes, would be effective as both cover crops and cash crops. Mississippi Pinkeyes would be very effective as a cash crop, but does not have the bushy vegetation that we would want for biomass and nitrogen supply. At this point, the Purple Podded Pinkeyes are our most productive and most effective fertilizing choice and they are highly marketable.

Outreach

Our primary outreach effort was to host a "Cover Crop Field Day" to which farmers from around the NE were invited. The cover crop field day was held in the late fall of 2004 and was integrated into the full program schedule the farm offers. Uunfortunately, the field day was hampered by a driving rainstorm that lasted throughout the day. Consequently, while many farmers signed up for the workshop only 4 people attended. Since that time, however, we have continued to grow cowpeas as a cover crop and recently we conducted a weed control and greenhouse management field day for more than 40 beginning farmers with UVM. Cowpeas and their weed control, fertility potential and cash crop potential were featured items.

CCF will seek to publish the results of this study through a number of means. This current report will be posted on both the Cedar Circle Farm and thewaronbugsbook websites as will any additional cowpea research. Results will also be published through connections with the Center for Sustainable Agriculture and NOFA/VT

Report Summary

We had grown blackeyed peas and pinkeyes for an ethnic market in central Massachusetts after customers requested that we try growing them. We only grew small amounts but we realized that we could grow them in New England. We had read about their characteristics as a cover crop, so we decided that we would try to grow them as both a cover crop and a cash crop. But, we did not want to sacrifice the fertility benefits for the sake of a cash crop. We decided to try several peas to see if they would still produce sufficient fertility and produce a cash crop as well.

We conducted a forage analysis at three stages of plant development. Our first analyses were done at the peak vegetative stage. Our second analyses were done at peak green pea production. Our third analyses were done at peak dry pea stage.

Results from the forage analyses and from weights taken of each cutting at each stage indicated that plowing the peas down at either the vegetative stage or the green pea stage for both California Blackeyes #5 and Purple Podded Pinkeyes would provide the grower with excellent biomass and considerable nitrogen. In fact, for both of these peas, the green pea stage produced approximately the same amount of biomass as the vegetative stage and produced more nitrogen. So, at this stage, growers could take off a green pea crop and still get excellent fertility results and excellent weed control. If growers waited until the dry bean stage the fertility dropped significantly and the weed control effect was lost. We eliminated Mississippi Pinkeyes because although they produced excellent crops of peas they did not produce nearly as much biomass, produced less nitrogen and did not suppress weeds.

We think this was a valuable project because it illustrates that farmers and agronomists may not know the effects of pulling a cash crop off of a fertilizer crop of cowpeas. The commonly held belief is that extracting a cash crop from a fertility crop reduces the fertility value. That was certainly not the case with these peas. In fact, when the crop was at the peak green pea production stage it produced as much biomass (or more in the case of purple podded pinkeyes) and more nitrogen. We think this illustrates that we need to keep rethinking our basic premises. We have a saying on the farm that goes like this: "If we are still farming organically the same way we are farming now in five years we have failed." We all have a lot to learn. If we all share our little breakthroughs then we can leapfrog over problems together, instead of all of us trying to reinvent the same wheel. Hopefully this little study will help the leapfrog process.

Kate Duesterberg and Will Allen September 4, 2008

UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
175	BLACK-EYES FIELD #5 8/30/04 WET CHEMISTRY RESULTS	09-01-04	09-08-04

Report For:

CEDAR CIRCLE FARM

FAX:802-785-2830

33.00

Feed Service Representative:

KATE DUESTERBERG
225 PAVILLION RD
E THETFORD VT 05043

pH 6.14

Analysis Results		
Description	**As fed Basis**	**DM Basis**
% MOISTURE	86.1	
% DM	13.9	
% CP	2.6	19.0
% ADIN	0.0	0.3
% AV CP	2.6	19.0
% SOL PRO		
% Nitrogen	0.42	3.04
% ADF	4.1	29.6
% NDF	5.7	41.3
% Fat		
% Ash		
% Lignin		
DE Mcal/lb		
NEl Mcal/lb	0.09	0.68
% TDN	9.2	65.9
% NFC		
% RFV		
% Ca	0.25	1.79
% P	0.05	0.34
% K	0.40	2.91
% Mg	0.05	0.36
% S	0.03	0.23
% Na	<.01	<.01
ppm Fe	173	1248
ppm Mn	12	85
ppm B	2	17
ppm Cu	2	11
ppm Zn	6	43
% Nitrate	0.07	0.53

Agricultural & Environmental Testing Laboratory
219 Hills Bldg-University of Vermont-Burlington, VT 05405-0082
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UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
176	MISSISSIPPI PINK EYES FIELD #5 8/30/04 WET CHEMISTRY RESULTS	09-01-04	09-08-04

Report For:

CEDAR CIRCLE FARM

FAX:802-785-2830

33.00

Feed Service Representative:

KATE DUESTERBERG
225 PAVILLION RD
E THETFORD VT 05043

pH 6.27

Analysis Results		
Description	**As fed Basis**	**DM Basis**
% MOISTURE	82.3	
% DM	17.7	
% CP	2.4	13.6
% ADIN	0.1	0.3
% AV CP	2.4	13.6
% SOL PRO		
% Nitrogen	.39	2.18
% ADF	5.3	29.9
% NDF	6.1	34.3
% Fat		
% Ash		
% Lignin		
DE Mcal/lb		
NEl Mcal/lb	0.12	0.68
% TDN	11.6	65.7
% NFC		
% RFV		
% Ca	0.20	1.12
% P	0.04	0.25
% K	0.37	2.10
% Mg	0.05	0.26
% S	0.03	0.15
% Na	<.01	<.01
ppm Fe	332	1878
ppm Mn	16	88
ppm B	< 1	< 1
ppm Cu	2	11
ppm Zn	4	25
% Nitrate	0.03	0.17

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UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
300	JACK'S # 1 BLACK EYES WET CHEMISTRY RESULTS	10-08-04	10-13-04

Report For:

CEDAR CIRCLE FARM
FAX:802-785-2830

33.00

Feed Service Representative:

KATE DEUSTERBURG
225 PAVILLION RD
EAST THETFORD VT 05043

pH 5.71

Analysis Results		
Description	**As fed Basis**	**DM Basis**
% MOISTURE	72.8	
% DM	27.2	
% CP	2.8	10.2
% ADICP	0.1	0.3
% AV CP	2.8	10.2
% SOL PRO		
% N	0.44	1.63
% ADF	7.1	26.1
% NDF	8.9	32.8
% Fat		
% Ash		
% Lignin		
NEl Mcal/lb	0.20	0.72
% TDN	18.6	68.2
% NFC		
% RFV		
% Ca	0.17	0.64
% P	0.07	0.27
% K	0.38	1.41
% Mg	0.05	0.20
% S	0.06	0.23
% Na	<.01	<.01
ppm Fe	30	110
ppm Mn	11	39
ppm B	5	20
ppm Cu	2	8
ppm Zn	12	45
% Nitrate	<.01	<.01
% NDICP		
Lignin % NDF		
ADICP % CP		
NDICP % CP		

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UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
301	JACK'S PINK EYES WET CHEMISTRY RESULTS	10-08-04	10-13-04

Report For:

CEDAR CIRCLE FARM
FAX:802-785-2830

33.00

Feed Service Representative:

KATE DEUSTERBURG
225 PAVILLION RD
EAST THETFORD VT 05043

pH 5.85

Analysis Results		
Description	**As fed Basis**	**DM Basis**
% MOISTURE	74.8	
% DM	25.2	
% CP	3.3	13.1
% ADICP	0.1	0.4
% AV CP	3.3	13.1
% SOL PRO		
% N	0.53	2.10
% ADF	6.3	25.0
% NDF	7.6	30.0
% Fat		
% Ash		
% Lignin		
NEl Mcal/lb	0.19	0.74
% TDN	17.4	68.9
% NFC		
% RFV		
% Ca	0.25	1.01
% P	0.07	0.28
% K	0.44	1.75
% Mg	0.05	0.21
% S	0.06	0.25
% Na	<.01	<.01
ppm Fe	48	192
ppm Mn	12	46
ppm B	7	27
ppm Cu	2	8
ppm Zn	10	39
% Nitrate	<.01	<.01
% NDICP		
Lignin % NDF		
ADICP % CP		
NDICP % CP		

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UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
302	ALICE'S #1 BLACK EYES WET CHEMISTRY RESULTS	10-08-04	10-13-04

Report For:

CEDAR CIRCLE FARM
FAX:802-785-2830

33.00

Feed Service Representative:

KATE DEUSTERBURG
225 PAVILLION RD
EAST THETFORD VT 05043

pH 6.23

Analysis Results		
Description	**As fed Basis**	**DM Basis**
% MOISTURE	77.1	
% DM	22.9	
% CP	3.9	17.1
% ADICP	0.1	0.4
% AV CP	3.9	17.1
% SOL PRO		
% N	0.63	2.74
% ADF	6.1	26.8
% NDF	6.6	28.9
% Fat		
% Ash		
% Lignin		
NEl Mcal/lb	0.16	0.71
% TDN	15.5	67.8
% NFC		
% RFV		
% Ca	0.39	1.69
% P	0.07	0.31
% K	0.50	2.18
% Mg	0.06	0.28
% S	0.06	0.25
% Na	<.01	<.01
ppm Fe	162	709
ppm Mn	12	54
ppm B	6	27
ppm Cu	3	13
ppm Zn	6	26
% Nitrate	0.00	0.02
% NDICP		
Lignin % NDF		
ADICP % CP		
NDICP % CP		

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UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
303	ALICE'S PINK EYES WET CHEMISTRY RESULTS	10-08-04	10-13-04

Report For:

CEDAR CIRCLE FARM
FAX:802-785-2830

33.00

Feed Service Representative:

KATE DEUSTERBURG
225 PAVILLION RD
EAST THETFORD VT 05043

pH 5.38

Analysis Results		
Description	As fed Basis	DM Basis
% MOISTURE	75.0	
% DM	25.0	
% CP	2.6	10.2
% ADICP	0.1	0.3
% AV CP	2.6	10.2
% SOL PRO		
% ∿	0.41	1.63
% ADF	8.1	32.2
% NDF	9.2	36.8
% Fat		
% Ash		
% Lignin		
NEl Mcal/lb	0.16	0.65
% TDN	16.1	64.2
% NFC		
% RFV		
% Ca	0.12	0.48
% P	0.08	0.32
% K	0.44	1.75
% Mg	0.08	0.31
% S	0.07	0.28
% Na	<.01	<.01
ppm Fe	118	472
ppm Mn	6	23
ppm B	5	21
ppm Cu	2	9
ppm Zn	11	43
% Nitrate	<.01	<.01
% NDICP		
Lignin % NDF		
ADICP % CP		
NDICP % CP		

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UVM Forage Analysis Report

Lab #	Sample Identification	Received	Completed
67	BEANS PURPLE PODDED PINKEYES WET CHEMISTRY RESULTS	09-05-06	09-08-06

Report For:

CEDAR CIRCLE FARM
FAX:802-785-2830

NITRATE PENDING

33.00

Feed Service Representative:

WILL ALLEN
225 PAVILLION RD
E THETFORD VT 05043

pH 4.64

Analysis Results		
Description	As fed Basis	DM Basis
% MOISTURE	81.3	
% DM	18.7	
% CP	2.6	14.0
% ADICP	0.0	0.2
% AV CP	2.6	14.0
% SOL PRO		
% ADF	7.2	38.6
% NDF	8.5	45.3
% Fat		
% Ash		
% Lignin		
NEl Mcal/lb	0.11	0.57
% TDN	11.2	60.0
% NFC		
% RFV		
% Ca	0.15	0.82
% P	0.08	0.41
% K	0.67	3.60
% Mg	0.08	0.44
% S	0.07	0.35
% Na	0.00	0.02
ppm Fe	73	391
ppm Mn	5	28
ppm B	4	20
ppm Cu	4	22
ppm Zn	5	25
% NDICP		
Lignin % NDF		
ADICP % CP		
NDICP % CP		

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