



Northern NY Agricultural Development Program 2013-14 Project Report

Additional Innovations in Parasite Management in Northern New York Sheep and Goat Farms

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Cooperating Producers:

Essex County - BFT study
Asgard Farm & Goat Dairy
Rhonda Butler and David Brummer

Jefferson County – COWP study
Thousand Island Boer Goat Farm
Karen and Bill Stumpf

St. Lawrence County – BFT and COWP studies

Cornell Cooperative Extension of St. Lawrence County Learning Farm

Dorset Sheep

Betsy Hodge: managed COWP study, Kitty O’Neil: supervised BFT planting and care

Background:

Northern New York is blessed with an abundance of grazing land. However, a major limitation for raising kids and lambs with their dams on pasture is control of internal parasites in young, growing animals, and in lactating dams. *Haemonchus contortus* (barber pole worm, stomach worm) is a major cause of death in pastured sheep and goats in the Northeast US and must be managed carefully to prevent it from developing resistance to the limited classes of available dewormers. Other strongyle worms such as brown stomach worm (*Ostertagia circumcincta*) also contribute to significant production losses in the region. Many Northern New York (NNY) sheep and goat farmers report strongyle resistance to multiple dewormers and regional surveys have indicated that future control of internal parasites is of major concern to Northeast sheep and goat farmers.

In response to this concern, the Cornell Sheep & Goat Program and Cornell Cooperative Extension (CCE) of St. Lawrence County are studying promising new methods of worm control to see if they have application on Northern NY sheep and goat farms. The two new approaches being studied are:

- 1) dosing sheep and goats with copper oxide wire particles (COWP) to observe the effect on barber pole worm populations, and
- 2) grazing sheep and goats on birdsfoot trefoil (BFT) pastures to observe the effect of BFT condensed tannins on strongyle worm populations in these host populations.

In an effort to slow the development of widespread dewormer resistance, this collaborative project also trains sheep and goat farmers in integrated parasite management skills such as 1) FAMACHA certification, and 2) “evasive grazing techniques.”

Copper oxide wire particles (COWP) are an alternative to chemical anthelmintics. COWP have effectively reduced infection of barber pole worm (*H. contortus*) in the Southeast US, but it is not clear how safe or effective COWP are in the Northeast under different soil and forage conditions. The objective of the COWP studies are to determine:

- 1) the effectiveness and risks of incorporating different dosages of COWP into parasite management systems for Northeast sheep and goat farms, and
- 2) whether the timing of dosage with regard to weaning and/or other management factors influences the effectiveness of COWP.

Our second research project is evaluating the effect of grazing nurse pastures of specific varieties of birdsfoot trefoil with elevated levels of condensed tannins on worm populations in weaned lambs and kids. Sheep and goats fed forages with high-tannin concentration have improved resistance to nematodes, accompanied by decreased fecal egg counts, egg hatch, and larval development.

Condensed tannins (CT), also called proanthocyanidins (PAC), are naturally occurring plant polyphenols that significantly affect the nutritive value of forage by forming complexes with proteins, carbohydrates, and minerals. The majority of research on the anthelmintic effect of CT-containing forages in sheep and goats has been on *Sericea lespedeza*, a forage legume with poor winter hardiness in many Northeastern states. However, birdsfoot trefoil (*Lotus corniculatus*), a forage legume commonly grown in the Northeast, has also demonstrated some anthelmintic efficacy in small ruminants.

Methods:

BFT studies

2014 was the first year of the Birdsfoot Trefoil study. In early April, previously recruited study farmers received 1) a cover letter describing the study and outlining farmer and extension duties, 2) materials and instructions for taking and mailing soil samples, 3) a 6-page fact sheet on planting BFT, and 4) a hard copy of an excel spreadsheet to keep track of cultural practices and dates, and 5) electronic copies of all materials.

A phone conference among farmers, extension staff and researchers followed discussing growth habit and disease resistance for Pardee and Bruce (the 2 commercially available BFT varieties with highest concentration of condensed tannins chosen for the on-farm studies) and challenges in attempting to plant and establish relatively pure stands of BFT.

The list serv, BIRDSFOOTTREFOILFARMERSTUDY-L@cornell.edu, was established to facilitate communication among participating farmers, extension staff and researchers.

Two NNY farms planted 3-acre nurse pastures of Pardee BFT in either the spring (St. Lawrence County Extension Learning Farm) or fall (Asgaard Goat Dairy) of 2014. Planting practices, soil fertility, and field management were recorded. Pasture measurements were taken at the Extension Farm in late August 2014 (Tables 1 & 2). The pastures will be ready for grazing trials in July/August 2015.

At the Extension Farm, standard N-P-K fertilizers were applied to half the field in response to soil fertility test recommendations while organic fertilizers were applied to the other half. Chemical herbicides may be applied to the “inorganic” portion this spring and compared to using mowing or grazing as the primary weed control method in the “organic” portion. These comparisons will help determine challenges that organic farmers may have when attempting to establish heavy stands of BFT. The BFT pasture is

being managed organically at the other farm but has extremely high soil fertility, probably due to a long history of poultry manure fertilization.

COWP studies

Two NNY farms participated in the COWP studies during the 2014 grazing season. Studies focused on determining whether the timing of COWP administration in relationship to weaning is an important determinant of the effectiveness of COWP in weaning age lambs and kids.

At one farm, the effect of dosing lambs with two different levels of COWP (0.5 g versus 1 g) two weeks prior to weaning was compared to dosing lambs two weeks post-weaning (Table 3). Lambs were rotationally grazed and supplemented with $\sim\frac{1}{4}$ lb of concentrate/head/day after weaning. Fecal samples and FAMACHA scores were monitored every 2 weeks over the 8-week study. Weights were taken 2 weeks pre-weaning, at weaning, 2 weeks post-weaning and at the end of the study at 6 weeks post-weaning.

The second study compared the effect of COWP dosing at 0.5 g versus 1 g on barber pole worm infections in self-weaning Boer goat kids (Table 5). Fecal samples and FAMACHA scores were monitored every two weeks over the 4-week study. Pastures were continuously grazed rather than rotated and kids and their dams were supplemented with $\sim\frac{5}{8}$ lb of concentrate/hd/day. Fecal samples were evaluated for overall strongyle egg counts and for *H. contortus* worm egg counts specifically.

Pasture management practices and mineral composition of forages and supplemental feed were recorded at both farms to help evaluate if they influenced the efficacy of COWP.

Results:

COWP study

There was an interaction ($P < 0.10$) for fecal egg counts between the level of COWP treatment and date of fecal sampling in the COWP study at the Extension Learning Farm (Table 4). Fecal egg counts in Control lambs (not given COWP) increased dramatically from day 0 to day 42. Egg counts from lambs given either 0.5 g COWP or 1 g COWP pre-weaning remained relatively flat throughout the study. Fecal worm egg counts increased from day 0 to day 28 in lambs given either 0.5 g COWP or 1 g COWP post-weaning then decreased sharply after the COWP dosing (Figures 1 and 2). Egg counts increased slightly in the lambs given COWP during the last 2 weeks of the study when compared to counts for Control lambs which steeply decreased. However, counts for treated lambs were still far below those of Controls.

There was no long term effect of COWP dosage on either strongyle worm counts overall or barber pole worm egg counts in the self-weaning goat kids at Thousand Island Goat Farm. However, the change in worm egg counts 14 days after administering COWP was

significantly lower for kids given COWP than control kids (Table 6). Although barber pole worm egg counts increased in all three groups over the 14 days, the increase in eggs/g was only 864 and 1472 for kids receiving 1 g or 0.5 g COWP, respectively, compared with 3098 for control kids. The effect of sex was significant. Female kids had significantly increased strongyle ($P < 0.085$) and barber pole worm egg counts ($P < 0.081$) than male kids. The effect of sex X COWP interaction was insignificant.

Conclusions/Outcomes/Impacts:

Results at the St. Lawrence County Extension Learning Farm indicate that dosages of 0.5 g and 1 g COWP per head are effective at controlling barber pole worm (*H. contortus*) in predominantly grass-fed growing lambs.

When given 2 weeks prior to weaning, the COWP effect was long-term and extended through the ‘weaning shock’ period, thus providing more benefit than waiting until 2 weeks post-weaning to dose lambs. In contrast, COWP was not particularly effective to combat a heavy strongyle challenge in goat wethers at the farm studied although COWP did have a short-term effect. Even though the goat kids were with their dams, they were ~6 weeks older when treated than the Extension lambs treated pre-weaning and may not have been drinking much milk by this time. Thus, abomasum pH may have differed enough to affect COWP efficacy. In addition, pasture and nutritional management was very different and may have had adverse effects at the goat farm.

Outreach:

The project is ongoing in 2015 with new Northern New York Agricultural Development Program funding. Preliminary project results were the primary topic of the NNY Sheep & Goat Week in fall 2013. Therefore, other topics were chosen for the 2014 Sheep & Goat spring and fall programs.

Results from the COWP and BFT studies will be the topic of the fall 2015 NNY Sheep and Goat Week. An entire track of the Cornell Sheep & Goat Symposium on 4 October 2014 was dedicated to Integrated Parasite Management. Forty-eight people received FAMACHA certification and >50 people attended the presentation on results of the 2014 COWP studies. Several presentations focused on establishing birdsfoot trefoil and on management of pastures on organic sheep and goat farms. Preliminary results of the 2014 COWP and BFT studies were also presented to 15 extension educators at the Cornell Cooperative Extension In-Service Training at Cornell University on 19 November 2014.

Presentation of results and parasite workshops in NNY since last year’s annual report included:

1. Innovations in parasite management project description. NNYADP Eastern Annual Meeting; 28 February 2014; Chazy, NY. Michael Thonney, presenter; 12 farmers.
2. Integrated Parasite Management workshop with FAMACHA certification; 7 February 2015; Canton, NY. Betsy Hodge, workshop leader; 11 people certified in FAMACHA.

The percentage of questions answered correctly changed from 55.5% to 77.8% for pre- and post-quizzes taken by participants in the February 2015 FAMACHA workshop. Workshop participants appeared to improve their understanding of FAMACHA and evasive grazing techniques and the possible role of COWP and high-tannin forages in an integrated parasite management program. Several SUNY Canton Vet Tech students and Extension Learning Farm interns participated in the COWP and/or BFT studies and gained valuable skills in animal handling and research management.

Articles discussing the results of the research are listed later in this report. Dr. Tatiana Stanton co-wrote several resources for the collaborative project, *Forage-based Parasite Control in the Northeast for Sheep & Goats*. One example is Burdett, Holly and Tatiana L. Stanton. "Establishing Birdsfoot Trefoil for Pasture and Hay: A Guide for USDA OREI Project Demonstration Farms", April 2014. 6 pages. Print, online.

http://web.uri.edu/sheepngoat/files/BFTestablishment_OREI-demo-farms_April20141.pdf

Next steps:

More work is needed to determine why the effectiveness of COWP dosing to control barber pole worm infection varies among farms. For example, the type and amount of concentrate or mineral supplementation may have some influence.

In addition, grazing trials on the newly established Birdsfoot Trefoil pastures are necessary to evaluate the potential use tannin forage legumes on worm loads in sheep and goats. These pastures will be grazed in July and August 2015. Weaned market lambs at 1 farm (St. Lawrence County) and Alpine/Nubian wether goats at the other farm (Asgaard Goat Dairy) will be rotated through the BFT pastures for 4 weeks and compared to control groups grazed on standard pastures. In addition half the animals in each treatment group will be dosed with COWP 2 weeks pre-weaning to observe whether there is an additive effect of combining these two innovative methods of parasite control.

Field crop advisors at the Extension Learning Farm also plan to establish a 1/8 acre test plot of *Sericea lespedeza* (SL) to study the palatability and persistence of this high-tannin pasture species in a NNY climate to evaluate whether it has any potential in the North Country to help control worms in sheep and goats.

Acknowledgments:

- Cornell University Experiment Station Hatch funding and Cornell Cooperative Extension Smith-Lever Federal Formula Funds helped pay the labor for lab analyses.
- CCE of St. Lawrence County paid Betsy Hodge's and Kitty O'Neil's salaries.

- An USDA OREI grant provided additional materials for FAMACHA workshops and helped with expenses (seed, fertilizer, labor) to plant and establishment the birdsfoot trefoil pastures at the Extension Learning Farm and Asgaard Goat Dairy.
- A NESARE grant helped pay for fecal sampling materials and labor for lab analyses.

Reports and/or articles in which project results have been published:

1. Stanton, tatiana L. "Using copper oxide wire particles to help control barber pole worms on Northeast sheep and goat farms." *Country Folks Magazine, Sheep & Goat Issue*, 12 May, 2014. Print, online. <http://countryfolks.com/using-copper-oxide-wire-particles-to-help-control-barber-pole-worms-on-northeast-sheep-and-goat-farms/>
2. Stanton, tatiana L. and Holly Burdett. "Case studies of 4 farms planting birdsfoot trefoil pastures." Sept 2014. 46 Slides. Online. http://web.uri.edu/sheepngoat/files/DemoFarms_OREI_2014.pdf
3. Dunn, Kara. Morning Ag Clips: <https://www.morningagclips.com/nyadp-renews-parasite-control-project/> June 1st, 2014 NNYADP renews parasite control project.
4. Other media hits for this project in 2015:
 - 04-05-15 Plattsburgh Press Republican
 - 04-01-15 Valley News Adk
 - 03-26-15 Ogdensburg Journal
 - 03-26-15 Massena-Potsdam Courier
 - 03-26-15 Lowville Journal
 - 03-26-15 Carthage Republican
 - 03-26-15 Watertown Daily Times
 - 02-05-15 North Country Now
 - 02-01-15 Plattsburgh Press Republican
 - Feb 2015 NY Grazette
 - 01-31-15 Lowville Journal
 - 01-31-15 Carthage Republican-Tribune
 - 01-31-15 Massena-Potsdam Courier
 - 01-31-15 Ogdensburg Journal
 - 01-31-15 Malone Telegram
 - 01-31-15 Plattsburgh Press Republican
 - 01-31-15 Lancaster Farming
 - 01-30-15 Empire State Farming Blog
 - 01-29-15 New York Ag Connection
 - 01-29-15 Morning Ag Clips
 - 01-29-15 Empire State Farming Blog
 - 01-28-15 South Jeff Journal
 - 01-27-15 North Country Now Calendar
 - 01-27-15 Peru Gazette
 - 01-21-15 American Agriculturist Magazine

For more information (including farmers who have participated):

Asgard Farm & Goat Dairy – BFT study Rhonda Butler and David Brummer 74 Asgaard Way, Au Sable Forks, NY 12912	Thousand Island Goat Farm – COWP study Karen and William Stumpf 3204 New York State Route 12E Cape Vincent, NY 13618
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Appendix I. Figures and Tables

Table 1. Birdsfoot Trefoil population in a newly established stand at the St. Lawrence County Extension Learning Farm.

Plot	Number and types of plants per square foot ¹				
	Birdsfoot trefoil plants	Forage legumes	Forage grasses	Broadleaf Weeds	Sedges/Rushes
1	5	2	3	2	0
1	8	3	4	1	0
1	2	10	3	1	0
1	2	11	2	1	0
2	9	7	2	0	13
2	3	4	3	0	0
2	5	5	10	1	9
2	4	5	4	3	8
3	7	1	7	3	4
3	0	7	2	3	4
3	3	2	9	2	8
3	6	3	7	2	3
4	5	0	6	0	3
4	5	2	6	2	0
4	6	0	2	4	0
4	6	3	7	3	0

¹Measurements taken with one foot square from 22 August through 26 August 2014.

Table 2. Alignment of Birdsfoot Trefoil plots covering a 3-acre field at the St. Lawrence County Extension Learning Farm.

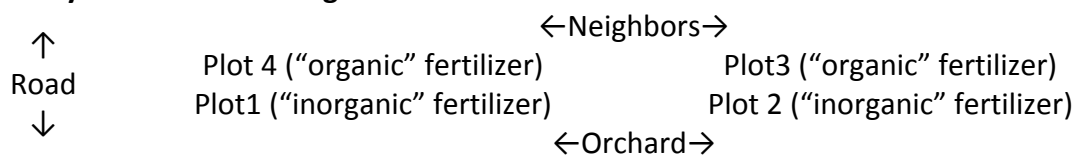


Table 3. Study design: St Lawrence County Extension Learning Farm.

Lamb sex	COWP administration				
	Control	2 weeks pre-weaning		2 weeks post-weaning	
		0.5 g	1 g	0.5 g	1 g
Ewe	4	4	4	4	4
Ram	4	4	4	4	4

Table 4. Effect of copper oxide wire particles (COWP) and date on fecal egg counts for the St. Lawrence County Extension Learning Farm.

	COWP	Strongyles		<i>H. contortus</i>	
		Ln (+1)	Geometric mean	Ln (+1)	Geometric mean
Administration	Control	8.05	3121	7.85	2573
Pre-weaning	0.5 g	6.28	534	5.33	206
	1 g	6.42	613	5.44	230
Post-weaning	0.5 g	6.72	830	5.86	350
	1 g	6.73	835	5.95	385
	SEM	0.29		0.37	
	P-value	0.001		<0.001	
COWP x Date interaction	P-value	<0.001		<0.001	

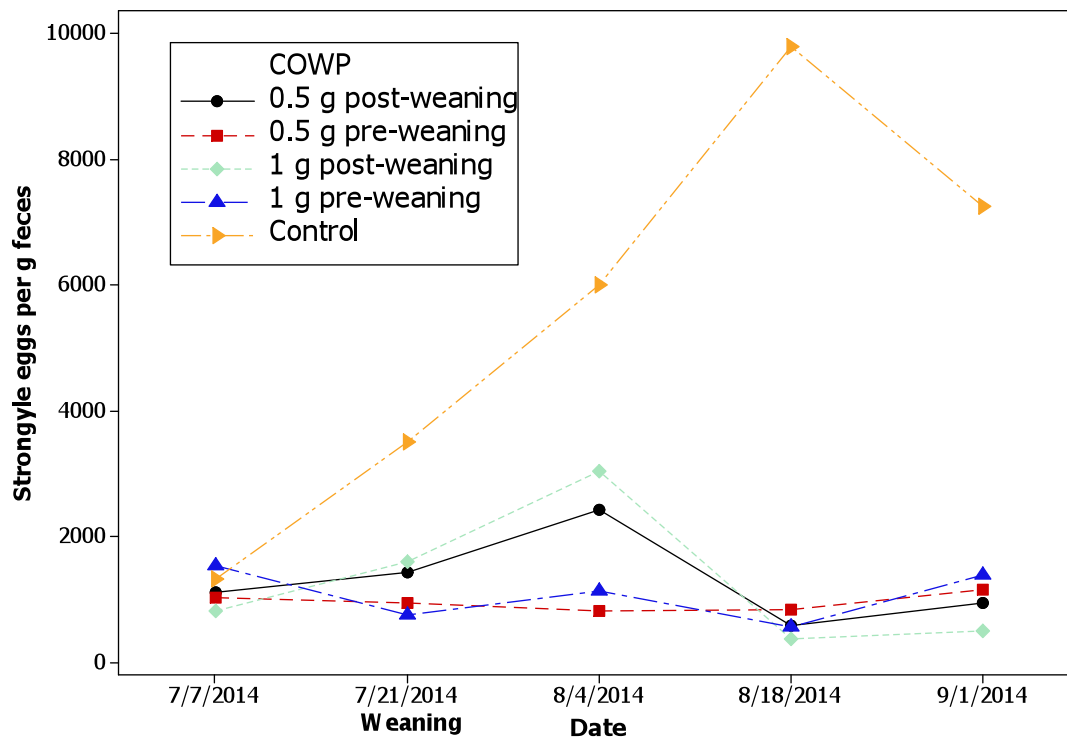


Figure 1. Effect of COWP treatment on strongyle egg counts over 56 days at the Extension Learning Farm.

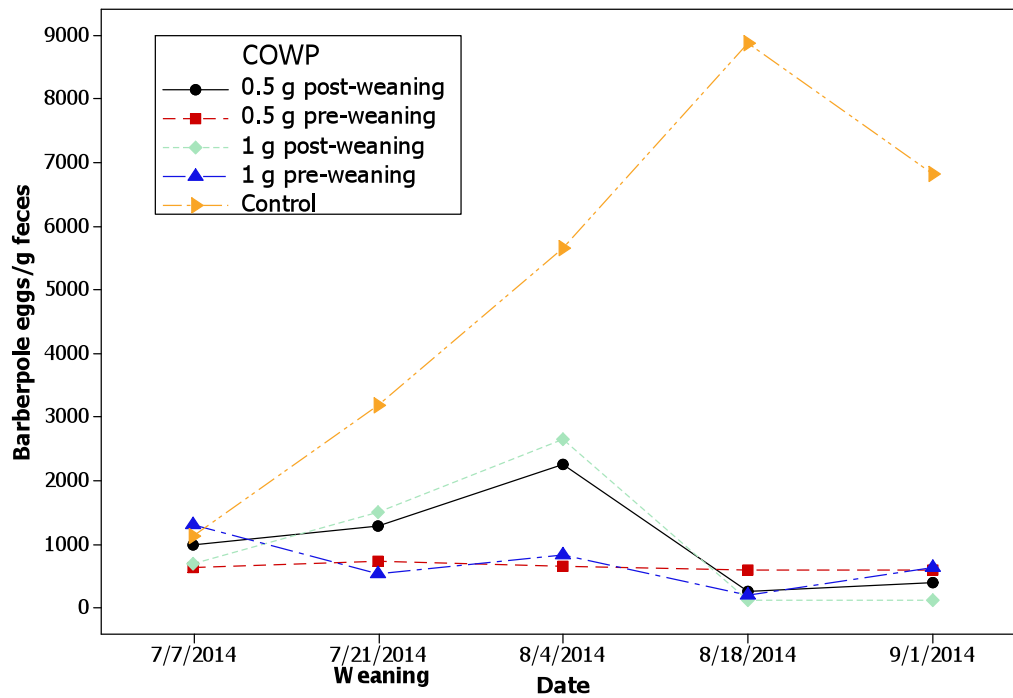


Figure 2. Effect of COWP level on barberpole worm egg counts over 56 days at the Extension Learning Farm.

Table 5. Study design: Thousand Island Goat Farm.

Kid sex	COWP administration		
	Control	0.5 g	1 g
Doeling	4	4	4
Wether	4	4	4

Table 6. Effect of copper oxide wire particles (COWP) on the change in fecal egg counts after 14 days in self-weaning Boer goat kids.

	Strongyle	<i>H. contortus</i>
COWP dosage	Change in fecal egg counts, g/g feces	
Control	3156	3098
0.5 g	1494	1472
1 g	900	864
SEM	500	486
P-value	0.014	0.013
Sex		
Doeling	2375	2330
Wether	1325	1292
SEM	408	397
P-value	0.085	0.081

Appendix II. Photos

The photos listed below and others from the study can be accessed via:

https://www.dropbox.com/sh/kw9ksqiawdh7e2h/AADp9HT0_fualOorXmLxq5cma?dl=0.

Examples:

1. Lamb Weighing at St. Lawrence County Extension Learning Farm, Canton, NY; pictured are Melissa Marlowe and Betsy Hodge with Molly Parent and Jenny Spencer in background; photo: tatiana Stanton.
2. Volunteer Style at Thousand Island Goat Farm, Betsy Hodge (CCE), tatiana Stanton (CU), Jenny Spencer (vet tech student volunteer from SUNY Canton) and Molly Parent (CCE summer intern and SUNY Canton Vet Tech student); photo: Karen Stumpf, Thousand Island Goat Farm, Cape Vincent, NY.
3. Cornell University Professor tatiana (spelled with lower case t) Stanton and farm owner Karen Stumpf at Thousand Island Goat Farm, Cape Vincent, NY; the farm's Boer goats with Karen Stumpf, co-owner of farm and regional director of the Empire State Meat Goat Producers Association) and tatiana Stanton of Cornell University; photo: Betsy Hodge.

Larger pictures

1. BFT ELF 8-5-14 A: New birdsfoot trefoil field at the St. Lawrence County Cornell Cooperative Extension Learning Farm about 4 weeks after emerging and prior to mowing; photo: Betsy Hodge
2. BFT ELF 8-18-14 D: New birdsfoot trefoil field at the St. Lawrence County Cornell Cooperative Extension Learning Farm 12 days after mowing; photo: Betsy Hodge
3. COWP bolusgun1, 4, and 5 – all taken at St. Lawrence County Cornell Cooperative Extension Learning Farm by tatiana Stanton, Betsy Hodge pictured.
4. Pillgun 1, 2, 5, and 6: all taken at the St. Lawrence County Cornell Cooperative Extension Learning Farm by tatiana Stanton, Betsy Hodge pictured.
5. Photos of St. Lawrence County Cornell Cooperative Extension Learning Farm lambs while on the COWP study, all taken by Betsy Hodge:
 - A. ELF lambs nap
 - B. ELF lambs close
 - C. ELF lambs in the mist
 - D. ELF lambs in the lane.