Sustainable Agriculture Research and Education Program
Producer Grant Final Report

FNE97-175
Conservation of Wild Blueberry and Cranberry Pollinators

1. Restate the goals of your project.

Project Goals were to make pollination of wild blueberry and cranberry more sustainable and less costly through building-up populations of native bumble bees and leafcutting bees. This project continued and expanded the initial research funded on SARE 96-138. These goals were to be accomplished by providing additional nesting sites (wooden nesting boxes, wooden nesting blocks, and bales of straw) and early spring flowering plants nearby the nest sites for the bees.

2. Update the information on your farm since you received a producer grant. Include acres farmed, crops, livestock.

The blueberry farm operation is full time and is approximately 50 acres of wild blueberries split into 6 small lots. The cranberry operation is part-time with approximately 3 acres in production (harvested).

3. Who were your cooperators and what were their roles in the project?

Dr. Connie Stubbs, pollination ecologist at the University of Maine, provided technical support and advice in all phases of the project, including providing bee house designs, recommendations for conservation bee house placement, demonstrating bee sampling, identifying bees, supervising student assistants, summarizing and interpreting the data collected, and helping to circulate information.

Mr. Del Emerson, Farm Manager at the University of Maine Blueberry Hill Experiment Station Research Farm, assisted in the construction of leafcutting bee houses and in circulating information on the project.

4. Tell us what you actually did in your project and how it was done.

Four farm study sites were used: two blueberry and two cranberry. Overall for the period 1996—1998, one hundred fifty-one conservation bee nests blocks were set out, either nailed to 3.3 ft. stakes or to tree trunks at 5 ft. above the ground for native leafcutting bees (40 blocks in blueberry and 60 in

cranberry). In 1997 and 1998, replacements for damaged or missing conservation leafcutting bee houses were set out in the early spring. Also, 32 bumble bee houses, 15 per crop were set out at ground level. One of the bumble bee houses was moved to a homestead (Dr. Stubbs') when she noted a bumble bee queen searching for a nest site. Another bumble bee house was moved to another blueberry grower's field in Stockton Springs when again Dr. Stubbs noted several queens searching for nests. At one blueberry site and one cranberry site, 18 bales of straw (per site) that had been previously set out in three mounds, were available for bumble bees to either nest in or to use for hibernation. In 1998 individual bumble bee houses were tucked into the straw mounds with only the nest hole visible in an attempt to trick queens into thinking the nest box was under ground.

To obtain measures of native bumble bee and leafcutting bee abundance during bloom, their presence was measured in the fields by taking one minute counts of bees in one meter^2 (1.2 sq. yds) plots in the blueberry fields and cranberry bogs.

Throughout the summer and into the fall, the nesting blocks for leafcutting bees and houses for bumble bees were examined to assess nesting success. In the fall, the bumble bee houses were opened and examined for evidence of bumble bee nesting. Also, the bales of hay were periodically checked for evidence of bumble bee activity.

Leafcutting bee blocks were left in the fields over winter; bumble bee houses were brought in for storage and then set out again, along with flowering hyacinths and crocus in the spring of 1997 and 1998. We hope to continue monitoring bee abundance and nesting success in the future.

5. What are your findings and accomplishments? Did you have any unexpected results? If so, what were they?

Initial base-line bee abundance measures per one meter^2 (1.2 sq. yd.) ranged from 0 leafcutting bees to 0.79 bumble bees per square meter in 1996. By the end of 1998 the average number of leafcutting bees and bumble bees per m^2 had increased. The average number of leafcutting bees in 1996 was 0.01 ± 0.017 and in 1998 it was 0.06 leafcutting bees per m^2. This increase in the average number of leafcutting bees was significant ($p = 0.0495$, ANOVA), which indicates the blocks significantly improved pollinating bee numbers over time. (Hammond cranberry/blueberry site not included in the analysis. See Table 1 B note below.) The average number of bumble bees per m^2 in 1996 was 0.423 ± 0.375 and in 1998 it was 0.523 ± 0.419. This increase in bumble bees per m^2 was not significant ($p = 0.7736$).

Table 1A. Average number of bees observed per square meter (1.2 sq. yds) in 1996.

Site	Leafcutting Bees	Bumble Bees
S. Kelley Bog (blueberry)	0	0.44
S. Kelley Cromwell (blueberry)	0	0.04

Hammond (cranberry)	0.03	0.79
Hammond (cranberry/blueberry)	0.02	0.02

Table 1B. Average number of bees observed per square meter (1.2 sq. yds) in 1998.

Site	Leafcutting Bees	Bumble Bees
S. Kelley Bog (blueberry)	0.06	0.74
S. Kelley Cromwell (blueberry)	0.06	0.08
Hammond (cranberry)	0.06	0.79

*Note that Hammond (cranberry/blueberry) was converted in large part to a new cranberry bog which obviously did not flower in 1997 or 1998 so no measurements of pollinating bumble and leafcutting bees per m^2 could be made.

Four species of bumble bees (*Bombus ternarius, Bombus impatiens, Bombus affinis* and B*ombus vagans*) and two genera of leafcutting bees were found pollinating the crops (*Megachile* and *Osmia.*)

Leafcutting bee abundance increased over time as the benefits of the nest blocks took effect. Tables 2A and 2B show the percentages for leafcutting bee nesting success. It should also be noted that blocks on stakes had more leafcutting nests and less occupation by other organisms than blocks on trees.

Table 2A. Percentage of nesting blocks occupied and nests completed by leafcutting bees in 1996.

Site	% Blocks occupied	% Nests completed
S. Kelley Bog (blueberry)	20.0	3.3
S. Kelley Cromwell (blueberry)	8.9	1.4
Hammond (cranberry)	37.8	5.2
Hammond (cranberry/blueberry)	36.0	5.4

Table 2B. Percentage of nesting blocks occupied and nests completed by leafcutting bees in 1998.

Site	% Blocks occupied	% Nests completed
S. Kelley Bog (blueberry)	22.0	4.3
S. Kelley Cromwell (blueberry)	10.0	4.4
Hammond (cranberry)	33.0	7.7

1998 was the first year that some of the bumble bee houses were used by bumble bee queens. Bumble bees occupied two bumble houses, and 10 houses contained nests made by ants. Mice established nests in 7 houses.

Table 3. Number of bumble bee houses occupied and bumble bee nests established by bumble bee queens by 1998.

Site	# Houses occupied
S. Kelley Bog (blueberry)	0
S. Kelley Cromwell (blueberry)	0
Hammond (cranberry)	0
Hammond (cranberry/blueberry)	0
Winterport (Dr. Stubbs' homestead)	1
Stockton Springs	1

No bumble bees established nests in the bales of straw. Also it appears no bales of straw were used as hibernacula (overwintering sites for the Queens).

6. Is there any specific site information relevant to your project or the results.

One of the blueberry fields (S. Kelley Bog) has a fair amount of leather leaf, that may provide forage (nectar and pollen) for the bumble bees before blueberry bloom.

7. What were your economic findings (if relevant to your project).

S. Kelley for blueberry reported the following yield data.

Table 4. Crop yields from 1996—1998.

Site	Date	Lbs./acre
S. Kelley Bog (blueberry)	1996	1,000
	1997	1,166
	1998	700
S. Kelley Cromwell (blueberry)	1996	6,300
	1998	3,600

Hammond (cranberry)	not available as of the submission of this report

The lower yields for blueberry in 1998 than 1996 can be attributed to the following: flea beetles wiped out 3 acres of plants at the Cromwell site. Then in July drought hit both sites. S. Kelley still achieved in 1998 a higher average yield on his Cromwell field, than the 2,000 lbs. per acre statewide average.

It appears that the use of the wooden nesting blocks for the wild leafcutting bees is an inexpensive way to significantly build-up leafcutting bee populations and thereby reduce the cost of pollination. Continuing to use wooden nest blocks for leafcutting bees, especially if affixed to stakes is a worthwhile endeavor.

The bumble bee houses are still of questionable economic value. At this point Dr. Stubbs does not feel growers should start putting out houses for bumble bees. The fact that in 1998 two houses were finally used is somewhat hopeful and thus she has submitted a grant to the Lindbergh Foundation to test what cues might attract bumble bees to potential nest sites. She will know next June (1999) whether that grant received funding.

8. Have the results from your project generated new ideas about what is needed to solve the problem you are working on? What would the next step be?

Yes. See #7 above about testing for cues that bumble bees queens might use to locate and choose nest sites.

9. Will you continue to use the practice you investigated? Why or why not?

Yes, at the very least, given the good nesting success and the increase in leafcutting bee numbers, the use of wooden blocks for conservation of leafcutting bees will be continued. Although the number of boxes occupied by bumble queens was not as high as hoped, we will again check them next year to test the hypothesis that "seasoning" of the wood (all resins dried out and mouse scent thoroughly imbued) is an important factor.

10. What do you tell other producers about your project and the results?

Basically we have told others about being awarded a SARE Farmer grant, explained what SARE farmer grants are, and shared with them the same information that we have provided in this report.

11. Explain what you did in your outreach program. Please send a copy of any articles written about your project.

Outreach included telling approximately 150 growers/farmers about the project at the annual Farm Field Day, Jonesboro, ME, July 15, 1998. Also a presentation on native bee conservation was made at the annual Maine Organic Growers Fair, Unity Maine, September 20, 1998. Included again with this report is a copy of an article that appeared on the initial project, focusing especially on the participation by the Mt. Desert Island High School students who made the bumble bee houses, in *The Bar Harbor Times*, May 2, 1996.

12. Enclosed are two slides. Slide 1 shows a leafcutting bee nest block at the Hammond cranberry site in 1997. Slide #2 shows University of Maine student, Sadie Stevens collecting a bumble bee conservation house in 1997 for examination and later relocation to "the mouse site" outside the Clapp Greenhouse, University of Maine, Orono for the fall – winter.