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Blueberry Advisory Committee Research Report

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BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1985 to March 1986

Investigator: H. Y. Forsythe, Jr.

Title: Control of secondary blueberry pest insects.

Methods: Secondary pest insects were located from field infestations recorded in 1984 and from surveys carried out in 1985.

Laboratory Tests:

Collections were made of those insects present in sufficient numbers and with few or no potential recommended controls. Square-foot patches of blueberry plants were sprayed with different treatments, using a small hand sprayer at a rate of 23 gals. of water/acre. Treated stems were cut and taken into the laboratory where they were placed in small screened cages. A single cage constituted a replication; there were 2 to 3 replications per treatment. At indicated hours after the insects were introduced into the cages, a knockdown count of dead or inactive insects was made.

Field Tests:

A field test was conducted for those insects for which more control information is known and which were more homogeneously distributed over a larger field area. Randomized complete block designs with 3 replications were utilized, with each plot measuring 7 x 7 m or less. All field plots were treated with a hand-held, CO_2 - propelled sprayer at 25 gal. of water-mixture/acre. On a pre-treatment and various post-treatment dates, insects found in each plot were counted. Generally the center of each plot was sampled with 10 to 15 sweeps of a standard 12-inch sweep net. After the live insects were recorded, they were spread back over the same plot. In 2 grasshopper trials, efficacy was evaluated by observing the number of insects jumping when disturbed by a wand or foot steps.

Results:

The attached table indicates that the pyrethroids, although not yet registered for use on blueberries, seem to be effective for a number of secondary pest insects. The labelled insecticides, Imidan and Marlate, do not appear to control the larger sizes of grasshoppers or some of the other insects. Except for Sevin, which did not perform well for grasshoppers this year, these results are generally supportive of data obtained in the past couple years.

One test was conducted for control of grasshoppers by Nosema, a microsporidium. Although this test is a long-term one, there were possible indications in August that some control was becoming apparent.

Conclusion:

Tests from recent years have begun to indicate some effective and usable insecticide control recommendations for various prevalent secondary pest insects.

Blueberry Insect Control Tests[a]

1985

Insect[b]	Laboratory Tests: Imidan	Marlate	Pydrin	Ambush	Spur	Others
Sawfly L.	VG	F	G	-	G	Guthion-E
Looper L.	P	F	E	-	-	
Rootworm A.	E	VG	VG	-	G	
Flea Beetle L.	-	P	-	G	-	Lorsban-E
Spanworm L.	-	-	E	E	VG	
W. Cutworm L.	F	F	E	E	-	
Leaf Beetle A.	E	-	VG	-	E	Rotenone-G

Insect[b]	Field Tests: Imidan	Marlate	Diazinon	Sevin	Pydrin	Others
Sawfly L.	E	VG	VG	-	-	-
Rootworm A.	VG	E	-	-	-	-
Flea Beetle L.	E	G	VG	-	E	-
Grasshopper N.	G	VG	-	F	VG	-
Grasshopper A.	F	F	-	F	VG	Ambush-F

[a]E = excellent, VG = very good, G = good, F = fair, P = poor

[b]L = larvae, A = adults, N = nymphs

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1985 to March 1986

Investigator: H. Y. Forsythe, Jr.

Title: Effect of pruning practices on blueberry insect abundance.

Methods: A single abandoned field was divided into 8 parts, each of which was subdivided into 3, 50 x 140 ft. plots. The 3 plots constituted the spring "treatments" of untreated (bearing), flail mowed and burned. Velpar was applied in the spring to all plots to reduce sampling effort and biased results due to differential weed distribution. Plots were sampled weekly beginning late June 1985. Five sets of 10-sweep samples were taken along a single long transect within each plot. Subsequent samples were taken from a transect located to one side or the other of the previous transect to avoid bias caused by sampling the same plants too often. The number of each type of insect captured in each set of 10 sweeps was recorded.

Results:

Populations of most insects were very low in this field; only grasshoppers occasionally averaged more than 1 per 10 sweeps. Data for the most abundant insects are tabulated here. The most striking trend is the larger numbers of insects found in the burn area early in the season. These apparent differences may be due simply to a different sweeping technique used on very barren land, which results in collection of single insects in a low population area.

Conclusions:

Because of the very low insect populations in this field, it would be hazardous to conclude much from this study.

Number of insects per 100 sweeps

Date	Treat-ment	Grass-hoppers	Root-worm Adults	Leaf Beetle Adults	Span-worm Larvae
6/25 + 7/2	burn	11.4	4.5	4.4	2.9
	mow	8.4	2.2	2.6	1.8
	none	7.2	1.5	1.1	2.8
7/9 + 7/30	burn	1.8	0.1	0.2	0.1
	mow	4.9	0.6	0.5	0.2
	none	15.5	0.1	0.5	0.0
8/6 + 8/20	burn	3.2	0.0	0.0	0.0
	mow	5.4	0.0	0.0	0.0
	none	4.2	0.0	0.0	0.0

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Effect of Hexazinone on Species Distribution in Lowbush Blueberry Fields

METHODS: EXPERIMENT I. A comparison of weed and blueberry populations on hexazinone-treated (2 lbs/A) vs non-treated fields was initiated in the spring of 1984 in Aurora and on T-18 MD. Species composition was recorded and cover was rated in September 1984, from 30 - 10.8 square foot quadrats per site, using a Daubenmire Cover Abundance Scale. Blueberry stems were cut from 20 - 1 square foot quadrats per site to determine stand density and productivity. Composite soil samples were collected in September 1984. Yields were obtained by mechanically harvesting 10 - 2 by 100 ft strips per treatment, in August 1985. The sites will be pruned this spring and hexazinone at 2 lbs/A will be applied to the entire area.
EXPERIMENT II. A survey was initiated in June 1985 to determine the species distribution in fields treated 1 cycle or 2 cycles with hexazinone. In July, species abundance at 14 locations, rated with the Daubenmire Scale, was determined from 10 quadrats on two or four transects, depending on the size of the field. Soil samples and blueberry stems were collected in October and November 1985. Fields were selected from those that were included in the 1980 IPM survey. Data obtained on species density will provide baseline information on weed populations for comparison with the 1985 data. Growers' response to questions on the previous management of their fields will be used to help interpret the results of the treatments.

RESULTS: EXPERIMENT I. Blueberry-stem density increased in response to hexazinone on one site (Table 1). The number of branches, flower buds and yield were greater on the hexazinone-treated fields on both sites in 1984 (Table 1). The grass cover and frequency of _Danthonia spicata_ (L.) Beauv., _Poa compressa_ L., _Muhlenbergia tenuiflora_ (Willd.) BSP., and _Panicum boreale_ Nash., decreased with hexazinone treatment. Other species that showed a significant decline include black chokeberry, sweetfern, bracken fern, meadowsweet, cherry, strawberry, goldenrod and aster (Table 2). Only lowbush blueberry and violet increased in cover and frequency. Hexazinone reduced the number, frequency and cover of competing species, which resulted in increases in blueberry growth and yield. No differences in plant species or cover was found on the hexazinone-treated plots in 1985.
EXPERIMENT II. Results from the 14 fields surveyed in 1985 are being compiled and will be presented in next year's report.

DISCUSSION: The data indicate that there is a decrease in susceptible species and a corresponding increase in blueberry yield. However, no increase in resistant species was obtained in the first two years of treatments. The sites will be re-treated and sampling continued to determine if any changes occur through the next production cycle.

The 14 fields treated once (1) or twice (2) will be compared to the baseline data provided by the 1980 IPM survey. Yield data will be obtained from some of the fields in 1986. These fields cover a wider geographic range and have a greater species diversity. Once they are compiled, results from this survey will provide more information on the effect of hexazinone on weed species in lowbush blueberry fields.

Table 1. Effect of hexazinone on lowbush blueberry

Location	Rate (kg/ha)	Blueberry Cover (%)	Stems (ft^2)	Laterals (ft^2)	Buds (ft^2)	Yield (kg/ha)
T-18	0	43	33	18	62	516
	2	57	37	47	115	1015
F test		*[a]	NS[a]	**	**	**
Aurora	0	23	16	17	36	560
	2	52	44	59	108	1198
F test		**[a]	**	**	**	**

[a] **=1%, *=5%, NS=Non-significant

Table 2. Effect of hexazinone on weed cover and frequency.

Species	Location	Rate (kg/ha)	Cover (%)	Frequency (%)	Significance
Grasses	T-18	0	77	100	
		2	15	64	**
	Aurora	0	73	100	
		2	23	67	**
Ground	T-18	0	18	77	
		2	37	97	**
	Aurora	0	23	97	
		2	45	100	**
Black Chokeberry	T-18	0	11	50	
		2	1	13	**
	Aurora	0	0	0	
		2	1	7	NS
Sweetfern	T-18	0	3	10	
		2	<1	3	NS
	Aurora	0	6	26	
		2	<1	3	*
Bracken fern	T-18	0	3	10	
		2	<1	3	NS
	Aurora	0	5	27	
		2	<1	3	*
Meadowsweet	T-18	0	4	13	
		2	0	0	*
	Aurora	0	8	47	
		2	1	13	*
Cherry	T-18	0	15	57	
		2	2	7	**
	Aurora	0	<1	3	
		2	0	0	NS
Strawberry	T-18	0	0	0	
		2	0	0	--
	Aurora	0	17	67	
		2	0	0	**
Goldenrods	T-18	0	11	47	
		2	0	0	**
	Aurora	0	27	93	
		2	0	0	**
Asters	T-18	0	0	0	
		2	0	0	--
	Aurora	0	16	70	
		2	0	0	**
Violet	T-18	0	0	0	
		2	0	0	--
	Aurora	0	<1	13	
		2	6	37	**

* = 5%, ** = 1%, NS = non-significant, -- = not present.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Dichlobenil for Control of Bunchberry

METHODS: Experiments were established on crop and newburn fields, at Blueberry Hill Farm, comparing the effects of 0, 4 and 8 lbs ai/A dichlobenil, applied in November 1984 and March 1985, on bunchberry and blueberry growth and yield. The number of bunchberry stems in 2 - 1 square foot quadrats per plot were counted in July 1985. All berries were harvested from the crop site in August 1985 and weighed to the nearest 0.7 oz. A 1 qt sample was retained and the weight and number of bunchberries and blueberries were determined. Blueberry stems were cut from 4 - 0.5 square foot quadrats in each plot, from the newburn site, in October 1985.

RESULTS: For the crop site, the average of all the treatments resulted in a 31% decrease in bunchberry stems compared with the untreated control (Table 1). Furthermore, there was a 31% decrease in bunchberry stems as the rate was increased from 4 to 8 lbs ai/A. The mixed blueberry/bunchberry yield was unaffected by all treatments (Table 1). The number of bunchberry stems at the newburn site were unaffected by dichlobenil treatments (Table 1). There was no difference whether treatments were applied in the fall or in the spring for either the crop or newburn studies.

DISCUSSION: Results from the 1984 experiment, presented last year, and results from this experiment indicate that dichlobenil does give some suppression of bunchberry without a reduction in blueberry yield. Stem data have not been tabulated or analyzed, but this will give an indication of whether dichlobenil will injure blueberries when applied to the newburn fields.

Dichlobenil is a non-selective herbicide, which inhibits seed germination and shoot and root growth of germinating or sprouting plants. Selectivity is obtained by placement, particularly through depth protection. It has low water solubility and limited movement through the soil. It is volatile and soil incorporation is recommended. Because of the lack of activity of dichlobenil on bunchberries in lowbush blueberry fields, no further work is planned with this herbicide.

Table 1. Effect of Dichlobenil on Bunchberry - Jonesboro, 1985

Dichlobenil Rate (lbs ai/A)	Timing	Number of Bunchberry Stems/1 ft² Crop[a]	Newburn[b]	Blueberry Yield (lbs/A)
Control	--	58	21	1275
4	Fall	55	16	1213
8	Fall	34	12	2486
4	Spring	40	14	2306
8	Spring	32	14	2089
Treatment mean		40	14	2027
4 lb rate mean		48	15	1759
8 lb rate mean		33	13	2288
CONTRASTS				
Control vs Treated		*[c]	NS[c]	NS
4 vs 8		*	NS	NS

a Log transformation used to normalize data
b Square root transformation used to normalize data
c *=5%, NS=Non-significant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Evaluation of Postemergence Herbicides for Grass Control

METHODS: I. Residue Study (Jonesboro and Deblois) - A blueberry field in the crop cycle (Jonesboro) was selected so that berries could be obtained for residue analysis. A field in the newburn cycle (Deblois) provided information on the efficacy of fluazifop-P-butyl and sethoxydim for controlling grasses that were resistant to hexazinone or germinating after hexazinone was no longer present in the rooting zone. Fluazifop-P-butyl was applied as a triple application of 0.375 lbs ai/A on June 20, July 5 and 19, 1985. Sethoxydim was applied as a double application on July 1 and 19, 1985 at 0.5 + 0.3 lbs ai/A. Temperature and rainfall data were recorded for the entire period. In August, 10 randomly selected clumps of grass in each plot were selected and the height was measured. A subjective rating was also made on the degree of grass control attained. Soil samples were collected in August 1985.

II. Efficacy Study (Brunswick) - Blueberry fields with heavy infestations of broom grass were selected, in both prune and crop cycles, for postemergence treatment when the grass was 4" tall. Fluazifop-P-butyl at 0.19 + 0.19 or 0.25 + 0.25 lbs ai/A was applied as a double application on June 7 and 21, 1985. Sethoxydim was applied, on the same days, at 0.28 + 0.19 or 0.47 + 0.28 lbs ai/A. On August 12, 1985, the effect of the treatments was rated using a 0-10 scale, where 0=no effect and 10=complete control. Ten clumps of grass were also randomly selected from the center of each plot and the grass height was measured. The plots treated in the crop cycle were harvested on August 13, 1985 and the berries were weighed to the nearest 0.7 oz. Samples of blueberry stems in 2 - 1 square foot quadrats per plot were collected from the newburn site, in October 1985.

RESULTS: Residue Study - Subjective ratings indicated that sethoxydim suppressed the growth of grasses in the plot by 50% and that fluazifop-P-butyl suppressed growth by 70% (Table 1). Sethoxydim and fluazifop-P-butyl effectively suppressed the height of grasses when compared with the untreated control. Observations made on November 7, 1985 revealed that even though growth was suppressed in plots treated with sethoxydim, the grasses were still able to produce seed. There was no effect on yield because of the treatments. Fluazifop-P-butyl and sethoxydim were not phytotoxic to blueberries at the rates and under the conditions of this experiment.

Efficacy Study - Grass control increased and grass height decreased when either fluazifop-P-butyl or sethoxydim were applied (Table 2). A response occurred between the low rate and the high rate of fluazifop-P-butyl, but even at the higher rate of both herbicides, only suppression was attained. Subjective observations made in October 1985 indicated that grasses may have recovered. There was no difference in yield between the untreated plots and those receiving the herbicides when treatment was made in the crop year (Table 2). Data from blueberry stem samples obtained from the newburn site indicated that none of the treatments affected blueberry growth.

DISCUSSION: Currently, it is legal to use these herbicides in the pruning or non-bearing year. Use of these herbicides in the crop year suppressed grasses, but did not kill them. The treatments did not result in an increase in blueberry yield. These plots will be maintained for carryover effect on the crop-year site and evaluated on the carryover and blueberry yield on the newburn-treated site.

Table 1. Effect of Sethoxydim and Fluazifop-P-butyl on Grasses and on Lowbush Blueberry Yield - Deblois, 1985

Herbicide	Rate (lbs ai/A)	Grasses Height (in)	Grasses Control Rating (0-10)[b]	Blueberry Yield (lbs/A)
Control	----------	22.7	0	4367
Sethoxydim	0.5 + 0.3	10.7	5	4619
Fluazifop-P-butyl	0.375 * 3	5.2	7	4558
Contrasts				
Control vs Treated		**[a]	**	NS
Sethoxydim vs Fluazifop-P-butyl		**	NS[a]	NS

a **=1%, NS=Non-significant
b 0-10 scale, 0=no effect and 10=complete control

Table 2. Effect of Postemergence Herbicides for Broom Grass Control in a Lowbush Blueberry Field - Brunswick, Maine 1985

Herbicide	Rate (lbs ai/A)	Grass Height (in) Newburn[b]	Grass Height (in) Crop[c]	Grass Control (0-10 scale)[a] Newburn[d]	Grass Control (0-10 scale)[a] Crop[d]	Blueberry Yield (lbs/A)
Control	-----------	13.9	18.5	1	0	1363
Sethoxydim	0.28 + 0.19	5.8	6.4	6	6	1330
	0.47 + 0.28	6.1	6.2	7	6	1348
Fluazifop-P-butyl	0.19 + 0.19	5.6	6.9	7	4	1505
	0.25 + 0.25	5.4	6.5	7	6	1234
Contrasts						
Control vs Treated		**[e]	**	**	**	NS[e]
Sethoxydim vs Fluazifop-P-butyl		NS	NS	NS	NS	NS
Low Sethoxydim vs High Sethoxydim		NS	NS	NS	NS	NS
Low Fluazifop-P-butyl vs High Fluazifop-P-butyl		NS	NS	NS	*[e]	NS

[a]0-10 scale, where 0 = no effect and 10 = complete control
[b]Log transformation used to normalize data distribution
[c]Non-normal data analyzed by non-parametric statistics
[d]Square root transformation used to normalize data distribution
[e]** = 1% level, * = 5% level, NS = non-significant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Hand-wiper Applications of Herbicides on Woody Weeds

METHODS: A commercial blueberry field on T-18 MD, treated preemergence with 2 lbs ai/A hexazinone, was selected because of a large number of surviving woody weeds. Maple, willow and cherry stems were treated with 0, 1, 2 or 4% v/v solutions of glyphosate or dicamba in water. Five replications were made. Stems were marked with a metal tag and colored flag and herbicides were applied with a Sideswipe Weed Wiper in July 1985. Efficacy ratings will be made in July 1986 and blueberries will be collected in August for analysis of dicamba residues if the data are supportive of registration.

RESULTS: Results will be obtained in 1986.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Evaluation of Steam as a Pruning Practice for Lowbush Blueberry Fields

METHODS: An experiment that was initiated by Mike Zuck, in Fall 1984, was used. Treatments were: 1) mowing alone, 2) burning alone, 3) mowing plus steam at a tractor speed of .5 mph, 4) mowing plus steam at a tractor speed of .6 mph and 5) mowing plus steam at a tractor speed of 1 mph. Blueberry stems were sampled in October 1985, from 2 - 1 square foot quadrats in each plot. If the stem data indicate significant differences among treatments, plots will be mechanically harvested in August 1986 to assess effects on blueberry yield.

RESULTS: Stems are being measured and data will be analyzed this spring.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Evaluation of Glyphosate and 2,4-D Applied with a Commercial Weed Roller to Control Woody Weeds

METHODS: A lowbush blueberry field on the Columbia barrens, with many woody weeds, was selected in September 1984. A total of fifty stems were marked with metal tags and colored flags. The species treated were birch, maple, willow, poplar, oak, cherry and alder. Thirty stems were in an area treated with 10% v/v glyphosate in water and ten stems were treated with 2,4-D in oil. Herbicides were applied with a commercial-size, segmented weed roller. Ten other stems were selected as untreated controls. Untreated plants were hand cut and the emergence of these species was compared with the growth of the treated plants. Preliminary ratings of efficacy were made just before the field was flail mowed in November 1984. Stems were relocated in May 1985 and efficacy was rated in June. Injury to blueberries was also noted.

RESULTS: Both glyphosate and 2,4-D were effective in controlling woody weeds (Table 1). Control was consistent from the year of treatment to the year following treatment. Strips of injured blueberries could be seen in the field, which were caused by glyphosate dripping from the edges of the rollers. Blueberries were also injured by 2,4-D.

DISCUSSION: Careful application of glyphosate or 2,4-D, using a commercial-size, segmented weed roller, will provide postemergence control of woody weeds. Proper saturation of the rollers, to prevent dripping, must be stressed otherwise this will lead to considerable injury to the blueberries. This will be a recommended practice in fields heavily infested with woody weeds, when the registration procedures for glyphosate and 2,4-D in oil are completed.

Table 1. Effect of Glyphosate and 2,4-D Applied with a Commercial Weed Roller on Woody Weeds - Columbia, 1985

Herbicide	Control Rating (0-10)[a] 1984	1985
Control	0	1
Glyphosate	9	9
2,4-D/Oil	8	7
Control vs Treated	**[b]	**
Glyphosate vs 2,4-D	NS[b]	NS

a 0-10 scale, 0=no effect and 10=complete control

b **=1%, NS=Non-significant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Hand-wiping and Cutting Treatments for Dogbane

METHODS: A site with a severe infestation of dogbane, on Cherryfield Ridge, was selected in July 1984. Twenty - 10.8 square foot areas in each plot were marked with a wooden stake and all dogbane and bracken fern stems within the areas were counted. The design was completely randomized with 3 treatment blocks measuring 60 by 160 feet. The treatments consisted of 1) cutting weed stems with a brush saw, 2) wiping with a 10% solution of glyphosate in water and 3) an untreated control. Blueberry stems were cut from 20 - 1 square foot subsamples in each block. Stems were counted, measured and number of flower buds were determined. Post-treatment counts of weeds were made in July 1985. The change in number of dogbane and bracken fern stems was calculated.

RESULTS: The greatest decrease in weed density occurred in the area that was treated with glyphosate, but herbicide damage to lowbush blueberry plants also resulted (Table 1). Information provided by the stem samples indicated that there were more blueberry stems in the untreated area than in the cut or glyphosate areas (Table 1). This difference cannot be explained, but may be because there were more stems in the control plots before treatments were applied.

DISCUSSION: Because of the great amount of injury to the blueberry plants, a wiper application of 10% glyphosate is not recommended for areas where it is difficult to apply the herbicide carefully. Cutting with a brush saw also resulted in as much injury to blueberry plants. No selective method of control for dogbane is available. An experiment was initiated in July 1985 at Blueberry Hill Farm to test the effectiveness of a 2% glyphosate in water solution for controlling dogbane.

Table 1. Effect of Glyphosate and Cutting on Dogbane and Bracken Fern in a Lowbush Blueberry Field

Treatment	Change in Number of Stems ($10.8\ ft^2$)		Blueberry Stems/ft^2
	Dogbane	Bracken Fern	
Control	-0.7	- 0.4	43
Cutting	-3.3	- 2.7	27
Glyphosate	-6.4	-10.0	27
Contrasts			
Control vs Treated	**[a]	**	**
Cutting vs Glyphosate	**	**	NS[a]

[a] **=1%, NS=Non-significant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Evaluation of Airblast-Sprayer Application of Asulam for Bracken Fern Control

METHODS: Asulam was applied to a commercial lowbush blueberry field in July 1984 at rates of 0, 0.5 or 1 gal/A using an airblast sprayer. Eight blocks of ferns were marked and photographed. Visual evaluations were made in July 1985 on the effectiveness of the treatments. Blocks were photographed again at the time they were evaluated. Berries were obtained for residue analysis.

RESULTS: Visual observations made in July indicated that both rates of asulam completely controlled all growth of bracken fern. In August, when the residue berries were raked, some regrowth of bracken fern stems was noted. IR-4 will be requesting that the berries be sent to their analytical lab to determine residues because there are questions about the use of the berries that have been frozen from a 1982 study on asulam.

DISCUSSION: A new method for determining the residue of asulam in blueberries has been formulated. Samples were obtained from the treated areas and will be sent at the request of IR-4 for residue analysis. If the analyses indicate that there are acceptable levels of residue and the efficacy data are supportive, registration proceedings for asulam use in lowbush blueberry fields will begin. The airblast sprayer provided an effective means of applying asulam as a postemergence spray.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: John M. Smagula, Project Leader
David E. Yarborough, Assistant Scientist
Antonia L. Hoelper, Research Associate

TITLE: Spot Treatment of Woody Weeds with 2,4-D in Oil

METHODS: A 2.5% solution of 2,4-D in fuel oil was applied either as a stump treatment on a cropped field after mowing or as a basal treatment on a newburn field, on T-19 MD in October 1984. An assortment of birch, maple, willow, cherry and poplar stems were treated. Thirty stems from each site were treated at the rate of approximately 1 tbsp for each .5 "-diameter of stem and marked with a PVC pipe, a numbered tag and a colored flag.

On T-18 MD, sixty birch stems were commercially treated with a basal spray of 4% 2,4-D in fuel oil in September 1984, marked with a PVC pipe, a numbered metal tag and a colored flag. Efficacy ratings were made in July 1985 and berry samples were harvested from the stump-applied site on T-19 MD. Residue analysis will be conducted by Dr. Rod Bushway of the Food Science Department.

RESULTS: The 4% basal and the 2.5% stump treatments provided complete control of woody weeds (Table 1). The 2.5% basal only controlled to a rating of 6.

DISCUSSION: The efficacy data support the use of an oil carrier for 2,4-D. Residue analyses are being conducted by Dr. Rod Bushway. Results from these analyses will determine if the residue is below the established limit of 1 ppm. Vertac, the company that carries the label for Esteron 99, indicated that they would support a label change if we provided them with the appropriate data.

Table 1. Effect of 2,4-D in Oil on Woody Weeds.

Treatment	T-18 Basal (0-10)[a]	T-19 Basal (0-10)	T-19 Stump (0-10)
Control	1	1	3
2,4-D/Oil (2.5%)	--	6	10
2,4-D/Oil (4%)	10	--	--
Significance	**[b]	**	**

[a] 0-10 scale, 0=no effect and 10=complete control
[b] **=1% level

Blueberry Advisory Committee
Research Report

Date: March 1986

Investigator: C.W. Murdoch (continuation of research began in 1984 by F. L. Caruso)

Title: Chemical control of *Botrytis* blossom blight

Methods and Results:

Ronilan is a newly developed fungicide that has been shown to be effective in controlling *Botrytis*-caused disease in several small fruit crops. Vinclozolin (Ronilan) was tested as a chemical control of *Botrytis* blossom blight on lowbush blueberry. Vinclozolin was applied at rates of 1.0, 1.5 and 2.0 lb/A at early, mid and late bloom, or at various combinations of bloom stages as a replicated field experiment conducted at the Blueberry Hill Experimental Farm (Table 1). Benomyl was also evaluated at recommended rates and application schedules. An absence of *Botrytis*-caused disease in any of the research plots precluded reporting of any results on disease control efficacy. However, the necessary data were supplied to BASF Wyandotte Corporation (Dr. Martin Mascianica) to pursue a temporary use permit for Ronilan on blueberries in Maine.
In addition, berry samples were collected at harvest for chemical residue and yield analysis (Table 1).

Conclusions:

Possible resistance of *Botrytis* to the fungicide Benlate has made the testing of additional materials, such as Ronilan, necessary in order to ensure the availability of adequate disease control agents for the lowbush blueberry growers of Maine. Future work should include obtaining any further data necessary for labeling purposes, timing and rate studies for optimizing Ronilan use in the field, and the study and evaluation of possible resistance of *Botrytis* to Benlate.

Table 1.

Chemical Control of Botrytis
Blossom Blight - Yield Data 1985

Treatment/Rate	Growth Stage[a]	Total Yield[b] (KG)	Average/Plot (KG)
Benlate 1 lb/A	E,M,L	51990	12998
Ronilan 2 lb/A	E,M,L	44670	11168
Ronilan 1.5 lb/A	E,M,L	42720	10680
Ronilan 1 lb/A	E,M,L	47730	11933
Ronilan 2 lb/A	E,M	55560	13890
Ronilan 1 lb/A	E,M	49780	12445
Ronilan 2 lb/A	M	40760	10190
Ronilan 1 lb/A	M	41870	10468
Benlate 1 lb/A	E,M	47300	11825
Benlate 1 lb/A	M	57670	14418
No treatment	----	42610	10653

[a]Growth stages when treatments were applied:
E = early bloom (5-23-85)
M = mid bloom (5-31-85)
L = late bloom (6-10-85)

[b]Total yield from 4 plots, 15.2 m x 0.9 m, arranged in a randomized, complete block design.

Blueberry Advisory Committee
Research Report

Date: March 1986

Investigator: C. W. Murdoch (continuation of research began in 1984 by F. L. Caruso)

Title: Evaluation of preliminary steam treatments (1984) at Blueberry Hill Farm.

Methods:

Mummies were seeded in late September 1984 at a rate of 100 per plot. Control plots were either burned or mowed. Steam treatments were applied 35 days after seeding at three rates. Mummies were left in place over the winter and assessed to determine fungus survival rates in June 1985. Twenty mummies per plot (100/treatment) were brought into the laboratory to determine their viability based on the presence of fungal tissue and the ability of the mummies to produce mycelium on agar. Any mummies that appeared healthy were incubated under conditions favorable to fruiting body development to determine the overall fitness of treated mummies. Field observations of fruiting body development were also made.

Results:

There were no significant differences (P=0.05) between steam treated (160^{o}F, three different speeds: 600 rpm - .475 mph, 900 rpm - .612 mph, 1200 rpm - .95 mph)) burned and untreated plots for viability of overwintered mummies containing the causal agent of the mummyberry disease, Monilinia vaccinii-corymbosi (Table 1).

Conclusion:

Steam treatments were not effective in preventing the growth of M. vaccinii-corymbosi following overwintering. This could have been due to the method of steam application or a steam temperature too low to be effective. Future research should focus on: comparative studies on disease incidence and severity on burned versus mowed fields over time; methods of applying steam to fields; laboratory and field studies on steam temperatures necessary to ensure adequate mortality of M. vaccinii-corymbosi in the litter area; and additional studies to investigate the effect of steam treatments on other microflora, i.e. antagonists, other pathogens, insects, etc., and their effect on the development of the mummyberry disease.

Table 1. Isolation of *Monilinia vaccinii-corymbosi* from overwintered blueberry mummies following steam treatments.

Treatments	Isolation of *Monilinia vaccinii-corymbosi*[a,b] (+)	(-)
Steam - 600 rpm[c]	48	52
Steam - 900 rpm	56	44
Steam -1200 rpm	40	60
Burned	50	50
Mowed	52	58

[a]Isolation of *M. vaccinii-corymbosi* on water, potato dextrose or rabbit pellet agar shown as either positive(+) or negative(-). Total of 100 attempted isolations/treatment.

[b]No significant difference (P=0.05) according to Chi-square test for goodness of fit to compare treatments to controls. A Yates correction for continuity was applied to the data.

[c]Steam treatments applied at 160°F under the following conditions:

600 rpm - 0.475 mph
900 rpm - 0.612 mph
1200 rpm - 0.950 mph

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: PROJECT LEADER: John M. Smagula
ASSISTANT SCIENTIST: Edward J. McLaughlin

TITLE: LONG TERM EFFECTS OF N AND NPK FERTILIZER ON PLANT GROWTH AND YIELD

METHODS: Long term fertility research plots (1955-71) established by Professor Moody Trevett on land owned by Cherryfield Foods, Inc. are being maintained. The original fertilizer treatments (control, N or NPK) were resumed in spring 1981 and 1983. Plant stand, stem length and branching, concentration of nutrients within the leaves, flower bud formation, winter injury and yield have been measured during successive production cycles between 1974 and 1984.

In 1983, extra control plots (200 ft. long) were divided into four 50 ft. subplots and 2 of the subplots were randomly selected to receive NH_4-NO_3.

In 1985, treatment plots were split to accomodate new treatments. In addition to maintaining the original Control, N, and NPK treatments, treatments of N(urea) and NPK were superimposed on randomly selected portions (50 ft.) of the 200 ft. long control plots. Portions of the original N and NPK treatment plots were randomly selected for discontinuation of their treatments.

RESULTS: Data collected between 1975 and 1980 indicated that N and NPK fertilization (1955-1971) resulted in higher plant stand (stems/sq ft) and yield (lbs/A) compared to no fertilization. There was no difference between N and NPK treatments. Second year crop yields taken in 1976 and 1980 averaged 27, 31 and 23% of the first year yields for the N, NPK and control treatments plots, respectively (Table 1).

Leaf analysis in 1978 did not detect any differences among any treatments for N, P, K, Mg, Ca, Al, B, Cu, Fe, Mn, Mo or Zn.

Fertilizer applications (0, 50 lb. N/acre from urea or 50 lb N/A from a 1- 1-1 complete fertilizer) in 1981 and 1983 also resulted in no difference in yields between N and NPK treatments. The yields from either N or NPK treatment plots were more than double that of the control.

Stem length, branching and flower bud formation measurements taken in 1981 indicate urea N had a greater influence on these parameters than NPK. Treatment plots receiving either N or NPK had longer stems (Table 2) and more flower buds per stem than the controls.

All collected data has not been analyzed . Yield data is reported in Table 1 and indicates no significant difference between urea and NH_4NO_3 forms of nitrogen.

Plant stand (stems/sq ft) was determined in 1976 and again in 1981 (Table 3). NPK treatment plots did not have a greater stem density than treatment plots receiving only N fertilizer in 1976 or in 1981.

Table 1

YIELDS (lbs/A)

	1975	1976	1979	1980	1982	1984
Urea	1544b	525b	2322b	434b	3863b	1243b
NH_4NO_3	-	-	-	-	-	1257b
NPK	1355b	580b	2249b	419b	3750b	1595b
Control	592a	182a	1188a	170a	1576a	682a

Table 2

STEMS

	Stem length		Branches/stem		No.flower buds	
	81	83	81	83	81	83
Urea	11.0a	*	1.0a	*	3.7a	*
NH_4NO_3	-	*	-	*	-	*
NPK	9.0b	*	0.4b	*	2.9b	*
Control	6.6c	*	0.3b	*	2.3c	*

----

* Data collected but not yet analyzed.

Table 3

PLANT STAND (stems/sq ft)

	1976	1981
Urea	67a	87a
NPK	72a	75ab
Control	31b	62b

CONCLUSIONS: The data suggest that the area on which this experiment is located has benefited from application of urea or a complete NPK fertilizer. Yields from N or NPK treatment plots have been consistently higher than control plots due to increased stem density and perhaps increased stem length and more flower buds/stem. The effect on yield was seen in 1975 and 1979 several years after professor Trevett's treatments were stopped (1971). This suggests that fertilization every burn cycle may not be necessary at this site. Results of experiments established in 1985, testing the recovery of control plots and the need for fertilization every cycle, should provide this information.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: PROJECT LEADER: John M. Smagula
ASSISTANT SCIENTIST: Edward J. McLaughlin
RESEARCH COOPERATOR: Jeff Risser
EXTENSION COOPERATOR: Tom DeGomez

TITLE: NUTRITIONAL SURVEY OF SELECTED LOWBUSH BLUEBERRY FIELDS

METHODS: Commercial lowbush blueberry fields were selected spring 1984 (11 sites) and spring 1985 (13 sites) based on the field manager's assessment of productivity. Approximately half the fields were rated "poor", the others "good". Five 50x100 ft plots were established at each location. The nutritional status of the leaves and the nutrient content in the organic pads of the soils in these plots were determined.

RESULTS: Data collected in 1984 were presented orally and graphically to advisory committee members on Oct. 17, 1984. The blueberry leaf analysis standards established by Lockhart and Langille were presented along with published leaf analysis data from previous fertility experiments. The only element in the fertility studies that seems to be lower than satisfactory is zinc. In our nutritional survey, zinc was also lower than the reported standard satisfactory levels. Molybdenium was also much lower than the satisfactory range established by Trevett, but does fall into the satisfactory range of Lockhart and Langille. We do not think this means there is a zinc or molybdenum deficiency.

An apparent trend seemed to exist for two locations (2&6) identified as consistently "poor" fields: high concentrations of nitrogen (N), phosphorous (P), copper (Cu), and zinc (Zn), and low concentrations of boron (B) and calcium (Ca). A reverse trend of low concentrations of N, P, Cu and Zn and high concentrations of B and Ca were evident in some of those fields identified as consistently "good" (9&11). Stem samples were taken in the fall 1984 at sites 2,6,9,and 11; and stem length, flower buds/stem and plant stand (stems/sq ft) was measured. Stem density was significantly lower at the "poor" fields compared to the "good" fields, but there was no relationship for stem length or number of flower buds per stem (table 1).

Location 1 and 5 are Blueberry Hill Farm mow and burn demonstration areas, respectively. They are managed the same (fertilizer and weed control) except for pruning practice. These two sites had similar levels of N, Zn, potassium (K), B and Ca in the leaf tissue sampled. Leaves sampled from location 2 (burn) had slightly higher P concentration and slightly lower Cu concentration than those sampled from location 1 (mowed). Other than these minor differences mowing several cycles has not produced any striking changes in nutritional levels. The nutritional differences among all fields samples can not be attributed simply to soil pH. The pH of the organic pad did seem to be higher for most of the fields identified as "good" but location 6 was also high.

Samples taken at 13 sites in 1985 showed no trend in leaf nutrient content or in nutrient content of the soil organic pad between "good" and "poor" fields.

<u>CONCLUSION</u>: We feel a survey in 1986 is not warranted, but we are encouraging growers who feel that they may have a nutritional problem in their field to 1) contact their county extension agent or the extension blueberry specialist 2) take leaf and soil samples for analysis through the Department of Plant and Soil Sciences and 3) set up fertilizer test strips if the results of the analysis suggest that a nutrient element may be deficient, approaching deficiency, or unavailable. We would be willing to help establish test strips if the results of an analysis were indicative of a nutritional problem.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: PROJECT LEADER: John M. Smagula
ASSISTANT SCIENTIST: Edward J. McLaughlin
RESEARCH COOPERATOR: Jeff Risser

TITLE: INTERACTION OF FERTILITY AND PRUNING PRACTICES ON SOIL CHARACTERISTICS AND LOWBUSH BLUEBERRY GROWTH AND YIELD

METHODS: This study was designed to determine the interaction of fertility and pruning practices (mow vs burn) on soil and leaf nutrients and lowbush blueberry growth and yield. Treatment plots were established on land owned by Cherryfield Foods, Inc. Treatments consisting of five rates of urea (0, 40, 80, 120 or 160 lb N/A) were applied in the spring 1983,and 1985, after fall pruning by oil-fire or flail mowing. Stem length and branching, concentration of nutrients within the leaves, flower bud formation and yield data are being collected. Soil samples consisting of the organic "pad" and 1 inch of mineral soil immediately beneath it were taken in April and July 1983 and analyzed for NH_4-N. Soil samples were also taken in spring 1984 to determine residual NH_4-N. Organic pad samples were sampled again in July 1985. A composite of soil samples from mow and burn plots from 1984 and 1985 were analyzed for P, K, Mg and Ca.

The soil nutrient levels will be correlated with leaf tissue analysis data to help establish a more appropriate blueberry soil testing procedure.

RESULTS: Interactions - There was no interaction of fertility and pruning method on soil characteristics or plant growth and yield.

Leaf analysis - There was no effect of pruning method on leaf nutrient content. Analysis of leaf nutrient data indicated a linear increase in nitrogen content of leaves with increasing rate of urea fertilization. Blueberry leaves from control plots contained 1.66% N, which is within the "satisfactory" range (1.6-2.0%). While leaf N increased from 1.66% (control) to 1.85% (160 lbs N/A), calcium decreased linearly from 0.28% to 0.24%. The lower end of the "satisfactory" range for Ca content of blueberry leaves is suggested to be 0.27%. Magnesium also decreased linearly from 0.13 to 0.11% with increasing rates of urea. Only at fertilizer rates above 40 lbs N/A did the magnesium levels in leaf tissue drop below the satisfactory range (0.13- 0.25%). There was no effect of urea fertilization on leaf phosphorus levels, which might be expected if soil phosphorus were limiting.

Soil analysis - Ammonium nitrogen soil testing methods were used to monitor 1983 nitrogen levels in the organic "pad" and the mineral soil immediately beneath it. The organic pad was consistently higher in ammonia nitrogen level and showed a linear increase (8.6-72.8ppm) in response to increasing rates of urea fertilization.

Soil samples collected in 1984 indicated a dramatic drop in ammonium nitrogen in all treatment plots. A similar trend of increasing ammonium level with increasing rate of urea fertilization was found but levels were extremely low, ranging from 0.25 to 2.5ppm. The level and linear trend of ammonium nitrogen in the organic pad in 1985 was similar to that found in 1983.

Composite soil samples from mowed and burned treatment plots had similar levels of phosphorus, potassium, calcium and magnesium in their organic pads in 1984 and 1985.

Growth and Yield - There was no effect of pruning method (Tables 1 & 2) or fertilizer treatments (Tables 3 & 4) on stem length or branching , flower bud formation, winter injury, or yield.

Table 1.

Prune Method	Stem Length	Branches/ Stem	Flower Buds/ Shoot Tip	Flower Buds/Stem
Burn	7.5	0.5	1.8	2.7
Mow	7.2	0.5	1.5	2.4
F Value^z	NS	NS	NS	NS

^{z}treatment effects are not significant (NS) or significant at the 5% (*) or 1% (**) level.

Table 2.

Prune Method	Flower primordia/bud	Winter injury Dead flower primordia %	Pre-Treatment Yield Data 1982 lbs/A	Yield Data 1984 lbs/A
Burn	8.7	9.2	1750	1000
Mow	8.9	12.0	1620	780
F Value^z	NS	NS	NS	NS

^{z}treatment effects are not significant (NS) or significant at the 5% (*) or 1% (**) level.

Table 3.

N rate (kg/ha)	Stem Length	Branches/ Stem	Flower Buds/ Shoot Tip	Flower Buds/ Stem
0	6.9	0.5	1.6	2.4
45	7.0	0.6	1.7	2.7
90	7.5	0.5	1.6	2.4
135	7.7	0.5	1.7	2.6
180	7.5	0.6	1.7	2.7
F Value^{z}	NS	NS	NS	NS

^{z}treatment effects are not significant (NS) or significant at the 5% (*) or 1% (**) level.

Table 4.

N rate (kg/ha)	Flower primordia/Bud	Winter injury Dead flower primordia %	Pre-treatment Yield Data 1982 lbs/A	Yield Data 1984 lbs/A
0	8.7	10.9	1700	1080
45	8.6	16.0	1720	980
90	9.0	6.5	1510	850
135	8.7	6.7	1640	810
180	8.9	13.0	1840	760
F Value^{z}	NS	NS	NS	NS

^{z}treatment effects are not significant (NS) or significant at the 5% (*) or 1% (**) level.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: PROJECT LEADER: John M. Smagula
ASSISTANT SCIENTIST: Edward J. McLaughlin

TITLE: FREQUENCY OF FERTILITY APPLICATION FOR ESTABLISHMENT OF LOWBUSH BLUEBERRY SEEDLINGS

METHODS: Twelve seedlings of two crosses (4161 x Augusta and 2827 x Augusta) were planted into 4'x 10.5' treatment plots May 1983 on Blueberry Hill Farm. Treatment plots received a total of 100 lbs N/acre through 1, 2, 5 or 10 applications of Peters Special liquid fertilizer, a control plot received no fertilizer. Lateral spread, nutritional status of the leaves, nutritional status of the soil and yields are being recorded as appropiate to assess the effect of fertilizer application frequency on growth and early establishment.

RESULTS: The area covered by seedlings in treatment plots was determined in 1983, 1984 and 1985 using a non-destructive photographic method. Data from all years indicated that seedlings grew more (covered more area in the treatment plot) with more frequent applications of fertilizer (Table 1). Fruit produced in 1984 and 1985 were harvested by hand. Analysis of yield data (gms/treatment plot) also showed a significant increase with increasing frequency of fertilizer application (Table 2).

Analysis of soil samples taken in 1984 prior to treatment application indicated no significant difference among treatment plots.

Table 1. Area (%)

	1983	1984	1985
Control	1.41	2.3	11.7
1 application	2.1	2.5	17.4
2	2.3	3.4	20.0
5	2.7	5.7	21.2
10	3.2	7.4	26.4
F test	L**	L**	L**

Table 2. Yields (g/trt plot)

	1984	1985
Control	1.9	11.3
1 application	1.0	18.3
2	3.4	29.8
5	12.7	66.4
10	14.9	95.0
F test	L**	L**

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: PROJECT LEADER: John M. Smagula
ASSISTANT SCIENTIST: Edward J. McLaughlin

TITLE: SLOW RELEASE vs. LIQUID FERTILIZER FOR ESTABLISHMENT OF LOWBUSH BLUEBERRY SEEDLINGS.

METHODS: Eight lowbush blueberry seedlings were planted into 7.5' x 8' treatment plots on Blueberry Hill Farm, May 1984. Treatments began in May 1984 and included: Mag Amp (7-40-6 Mg 12%), Osmocote (18-6-12), Peters slow release (14-7-7), Peters Special-neutral (21-7-7) liquid or Urea (46%) liquid fertilizer. One treatment plot received no fertilizer and served as a control. The solid fertilizers were applied at 100 lbs. N/A and the liquids at 10 lbs. N/A weekly for 10 applications (May-July). Lateral spread, leaf nutrient status, soil nutrient status and yields will be recorded when appropriate.

RESULTS: Plant area measurements and yield data were collected in 1985 (table 1.). The yield data has been analyzed and may indicate that a slow-release fertilizer will substantially increase early productivity of interplanted lowbush blueberries. Slow-release fertilizers may offer a simple way of effectively fertilizing young plants during the important early years of establishment.

Treatment	Yield - 1985 (g/plot)
Slow Release	
Osmocote (18-6-12)	10.3
Peters (14-7-7)	7.9
MagAmp (7-40-6 Mg 12%)	5.7
Liquid	
Urea (46% N)	3.4
Peters Special (21-7-7)	3.2
Control	2.9
F test	**

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: March 1986

INVESTIGATORS: PROJECT LEADER: John M. Smagula
ASSISTANT SCIENTIST: Edward J. McLaughlin
RESEARCH COOPERATOR: Mike Goltz

TITLE: THE EFFECT OF SEVERAL MULCHES ON FROST HEAVING, SOIL MOISTURE, SOIL TEMPERATURE AND RHIZOME DEVELOPMENT

METHODS: Seedlings of three crosses (Augusta x 4161, 4161 x Augusta and 4161 x 2827) were planted in the spring 1982 on Blueberry Hill Farm. In October 1982, mulch treatments of bark, sawdust, cedar shavings, and wood chips were applied around the plants in a 4 x 10' treatment plot to a depth of 4 inches. Soil temperature and moisture have been monitored since spring 1983. The effect of type of mulch on plant growth, spread and frost-heaving are being studied. These data will be correlated to soil moisture and temperature.

An identical experiment was established in the spring of 1983 on a heavier soil at Highmoor Farm (apple research farm).

RESULTS: Blueberry Hill Farm - Frost heaving and survival data taken in 1983 indicated significant control of frost heaving by all sources of mulch. Mulches reduced frost heaving from 85% in non-mulched plots (control) to 0% in all mulched plots. There was also a significant increase in survival due to mulching. Survival increased from 80% (control) to 90-95% for mulched plots, with no significant difference among the mulches.

After three years, seedlings from crosses 4161 x Augusta and 2827 x 4161 had grown more (covered more area) than cross Augusta x 4161. Seedlings had grown more in the cedar, sawdust and bark treatment plots than in the chip or control plots (table 1).

Highmoor Farm - Frost heaving and survival data taken in 1984 indicated a similar plant response to that observed at Blueberry Hill Farm. Mulches reduced frost heaving from 92% in non-mulched plots to 0% in all mulched plots. Seedling survival increased from 65% for the non-mulched plots to 94-98% for mulched plots. Seedlings from cross 4161 x Augusta grew more than seedlings of the other crosses as determined by photographic area measurements. Seedlings had grown significantly more (covered more area) in all mulch treatment plots compared to the control (table 2).

CONCLUSIONS: Mulching seems to be extremely important to reduce frost heaving and increase survival of any plant material introduced into commercial blueberry fields to increase plant cover. Differences among mulch sources are appearing after three years of growth. Growth and yield of seedlings at the Blueberry Hill Farm location were significantly better in the bark, sawdust, and cedar treatment plots. Soil temperature and moisture measurements may help to explain these differences.

Table 1. Blueberry Hill Farm

Treatment	AREA (%) 1983	1984	1985	Yield (gm/plant) 1985
Control	5.5abc	12.5cd	9.9c	16.0c
Bark	5.3bc	13.6bc	17.4a	32.0b
Chips	5.1c	11.2d	14.2b	17.7c
Sawdust	6.0ab	14.8ab	18.7a	38.5ab
Cedar	6.1a	16.0a	18.7a	46.2a
F test	**	**	**	**

Table 2. Highmoor Farm

Treatment	AREA (%) 1984	1985
Control	1.8c	
bark	3.7ab	
Chips	3.1b	
Sawdust	3.9a	
Cedar	3.2ab	
F test	**	

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: February 10, 1986

Investigators:

Project leader: Tom C.S. Yang

Research Technician: Angela Yang/Carolyn Wills

Title: **Blueberry Product Development: (1) Raisin-type Blueberries**

Methods: economic assessment for this type of product, explore cheaper dehydration/evaporation methods which would produce similar quality products; utilize the high quality syrup obtained from raisin preparation.

Results:

1. Publicity of blueberry raisin- this unique product had attracted wide attention and favorite reaction from general public, and the project leader had received intensive interviews from national news, local news, television channels, and radio stations. Recipe experimentations are being conducted at the UMO cafeteria and School of Human Development Wednesday Lunch Program.

2. Alternative drying methods- a preliminary experiment was conducted by using a vacuum drying operating at 29.3" Hg and 70°C; it took approximately 100-120 min to produce a product with 16-20% (w/w) moisture. The product, however, was found to suffer a severe shrinkage and a lose of flavor. A modification was hence made to lower the operating temperature to 50-55°C and it required 8 hrs to reach an ideal moisture level (Figure 1).

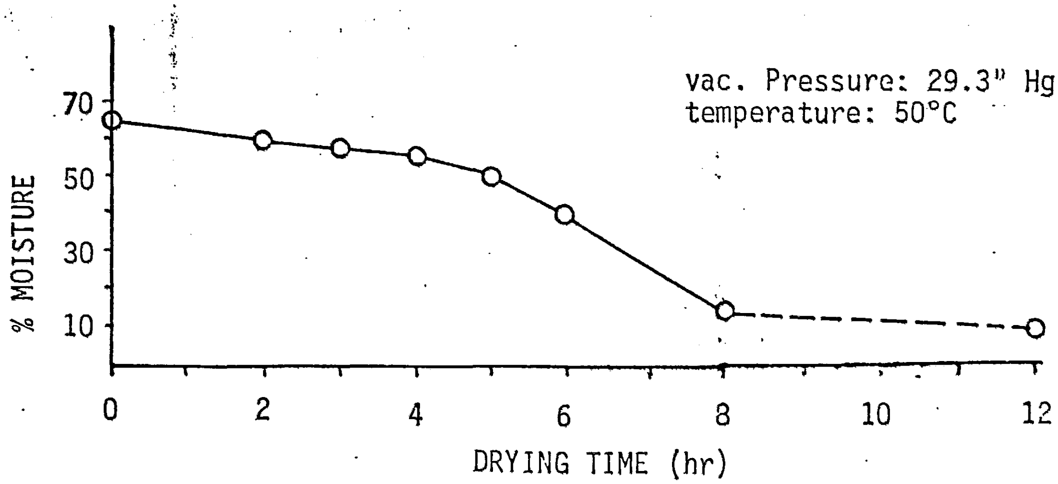

Figure 1. Effect of vacuum drying time on the sweetened blueberry moisture.

The product was found to have very similar intensity of flavor, color, and chewing texture as compared to the previously freeze dried ones.

3. Freezing of blueberry raisins was found not only maintaining the ultimate quality of product, but also reduce the occasional stickiness problem. A frozen batch of raisins prepared in early 1984 was recently defrosted and served side-by-side with a freshly prepared raisin to a group of panelists and no significant difference was found.

4. A long-term storage study (August 6, 1984-February 5, 1986) of blueberry raisins stored at 35°C was found to have slight reduction of berry flavor, but the color and texture were well retained.

5. Utilization of syrup obtained as a by-product from raisin preparation- besides blueberry roll-ups, bars, and low-calorie jellies, the syrup showed a potential to be a "stock" for blueberry wine manufacturing. A pleasant, sweet, and fermented aroma was detected after storing a 40° Brix syrup at 5°C for 2 wks.

Conclusions:

Blueberry raisin, an ultimately prepared product, was gaining its popularity. A subsequent study to replace the costly freeze drying process with cheaper methods was found feasible and a vacuum drying at low temperature looked promising. Future experiments involving rotational type vacuum dryer should shorten the drying time thus further reduce the operation cost, also can handle large load of berries, and reduce the stickiness and bleeding problem which would otherwise occur in a stationary vacuum dryer. Storage of raisins at either extra-low or elevated temperature showed no significant quality deterioration after at least 18 month of storage.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

Date: February 10, 1986

Investigators:

Project leader: Tom C.S. Yang

Research Technician: Angela Yang/Carolyn Wills

Title: **Blueberry Product Development: (2) Blueberry Puree**

Methods:

1. Flow behavior of the puree at different processing temperature- defrosted puree previously obtained from one of the processors was used in this experiment. Viscosity measurement was conducted at 20, 30, 40, 50, and 60°C with a Brookfield viscometer equipped with a RV-1 spindle and rotating at 20, 50, and 100 rpm. A power law model was adapted to describe the consistency and flow behavior of puree:

$$\tau = K \dot{\gamma}^{n}$$

where τ = shear stress (dyne/cm^2); $\dot{\gamma}$ = shear rate (sec^{-1}); K = consistency index; n = flow behavior index.

2. Color stability test- main effects of pH, several chemicals, and holding time at 50°C and -20°C on the color of berry puree were evaluated. (detailed methodology will be provided upon request).

Results:

1. Flow behavior of puree:

	Temperature (°C)				
	20	30	40	50	60
K	1.64	3.34	0.98	1.81	1.80
n	0.74	0.57	0.78	0.65	0.67

Throughout the tenmperature range of 20-60°C, two transition stages were observed and 30°C seemed to be a critical point where puree became thickening up; as temperature departured from 30°C, a thinner puree was found. A processing temperature at 50°C seemed to be an ideal condition which would give puree a low consistency (K) as well as a low flow behavior (n) which indicated a pseudoplastic or shear-thinning flow behavior.

2. Color stability test:

As pH shifted from low to high, the puree became darker and more bluish-purple. Chemicals such as EDTA and $AlCl_3$ tended to produce a redder and yellower puree whereas $SnCl_2$ and $SnCl_4$ (chemicals used in strawberry puree) would make the color bluish-purple. The combining effect of pH and chemicals showed a stabilizing effect on puree color which was independant of holding time of 24 hrs at 50°C or 4 wks at -20°C. Hue values were recommended to be used rather than absorbance ratios A_{510}/A_{410} to judge color of blueberry puree.

Conclusions:

Results presented above were obtained from one single batch of puree. Since more interest had been expressed from the blueberry industry, more studies should be continued to assess this product.

Questions for
REPORT TO THE MAINE BLUEBERRY COMMISSION: 1985 DATA

M,F. TREVETT

1 Feb. 1986

INTRODUCTION

Why spend money on rotary mowing research when flail mowing seems firmly entrenched as the standard techniques for the mechanical pruning of reasonably smooth fields? For these reasons:

* The cutting action of the rotary mower differs radically from that of the flail mower.

** In the past the bulk of plant research has focused merely on proving that fire or hay burning could safely and profitably be replaced by mechanical flail pruning, not on also increasive yields.

*** The research proposed will fill in a few gaps not covered by past flail mowing studies.

Current research places emphasis on these goals:

* Increase yield of individual stems.

** Make machine, or hand, raking more efficient.

*** Determine how to shift from a two year cycle to a three year. (Two harvests between pruning years instead of one.)

**** Determine whether in the long run machine pruning may not prove feasible.

***** Explore some of the factors involved in the shift from vegetative to reproductive growth.

****** Prove or disprove the notion that rotary mowing is more practicable and profitable than flail mowing.

SOME OF THE BASIC QUESTIONS OR PROBLEMS OR NEEDS MUST BE ANSWERED TO RESEARCH THE HAVEN OF THE ANNOUNCED GOALS.

1. Will light burning be required occasionally?
2. What changes in stem growth can be induced by mechanical pruning, or should be induced?
3. Can rotary mowing effect the changes in (at?) "2" more effectively than flail mowing?
4. What role will fertilzer play in reaching these goals?

   Involved in fertilizer usage are:

   I. Rate and ratio of N,P,K, applied

II. The need for secondary elements (Ca,Mg,S)

III. The need for trace element fertilization (Fe,B, Zn,Cu, ??? or others).

IV. Time of fertilizer application:

a. Within a season:

Preemergence, at emergence, at dieback, late or early fall.

b. Between seasons:
The pruning year, the first crop year, the second crop year.

V. Fertilizer carriers:

Urea nitrogen or nitrate N or ammonium N.
Muriate of potash, sulphate of potash.

VI. The role of foliage sprays in managing the shift from vegetative to reproductive growth.

VII. Other

VIII. Other

NOTE: Much of the information obtained from rotary mowing research will apply to flail mowing, and the other way round.

5. Density of stand as affecting raking in mowed fields.

6. Mowing procedures:

I. Height of mowing

II. Time of mowing

a. Fall
b. Spring

7. Machinery weight and health of clones.

8. Diagnostic techniques developement.

a. Soil tests
b. Foliar tests

9. The place of granular herbicides in weed management.

10. What are the characteristics sought for in mowed field stems?

11. Will the number of epicormic buds per stem determine the interval between burns in mowed fields?

12. Other

13. Other

1985 DATA OBTAINED BY TREVETT THAT MAY HELP ANSWER A FEW OF THE BASIC QUESTIONS THAT NEED ANSWERING. (MOWING WAS DONE AT A 3 INCH HEIGHT.)

Tables containing the data are in appendix table I through XV. Time was not available to run statistical analyses on the data. But a reasonably safe estimate of the likelyhood of significantness can be made:

If the percentage of the time one treatment is better than another is 60 percent or higher, it can be assumed that upon statistical analysis it will be shown that the 60 percent or higher treatment will be significantly different at the 10 percent level of significance than the other treatment.

For example in Table I rotary mowing was better than flail mowing 43.6% of the time. This, therefore means that rotary mowing was not statistically better (or worse) than flail mowing, but the same.

CONCLUSIONS DRAWN FROM THE 1985 DATA.

ROTARY vs. FLAIL MOWING - TABLE I.

In 1985 rotary mowing was not significantly better than flail mowing. In 1984 the rotary was 25% better. This shows tha st experiments have to be repeated in different fields at leas e a year for four or five successive years before a Researche: tell growers that if you do so and so you will increase, or crease, yields, say, 75% of the time you do so and so.

This is the UNCERTAINTY PRINCIPLE in ACTION. You will remember that the PRINCIPLE goes like this:

You can't say rotary mowing is always better - and be right. Nor can you say rotary mowing is never better - and be right. But you can say rotary mowing will sometimes be better - and never be wrong.

Of course, over the years, it may turn out, in fact, should turn out, that rotary mowing will always be better if we follow proper field management practices. You of course, recognize that most of these practices have yet to be established.

At bottom, the reason for the difference between 1984 and 1985 results is that in 1984 the stems in the field where the test was made averaged 4 inches tall or taller.

In 1985 the stems averaged, generally, 4 inches tall or less.

FALL vs. SPRING MOWING - TABLE II.

Spring rotary mowing produced significantly more fruit buds per stem than fall rotary mowing.

PERCENT OF UNPRUNED STEMS vs. FERTILIZER PRACTICE TABLE III.

There were significantly fewer unpruned stems in fertilized plots.

NUMBER OF BRANCHES PER BRANCHES STEM - TABLE IV.

Spring rotary mowed stems had significantly more branches than fall mowed.

EFFECT OF DATE OF FERTILIZER APPLICATION THE YEAR OF ROTARY MOWING.

Both early and late applications of fertilizer produced significantly more fruit buds than unfertilized stems. The 20 May date was significantly better than 23 April.

EFFECT OF FERTILIZER ON FRUIT BUD FORMATION IN ROTARY MOWED ELDS.

Number of fruit buds per stem were significantly increa[illegible] by fertilizer as shown in Tables V, VI, VII, VIII, XII, others.

EFFECT OF SPLIT APPLICATION OF PHOSPHORUS ON FRUIT BUD FORMATION THE PRUNING YEAR.

Part of the phosphorus applied was withheld until July 22. The reason: to see if by so doing the date of the shift from vegetative growth to reproductive growth could be changed. It was not.

THE CARRYOVER OF FERTILIZER EFFECT FROM A PINK CLUSTER BUD APPLICATION THE FIRST CROP YEAR INTO THE PRUNING YEAR. TABLE VIII.

There was a significant carry over. The pink cluster bud stage: In a bearing year the outer scales on a fruit bud have expanded, opened at the top exposing the domes of the unopened flower buds. These unopened buds stick up out of the fruit bud like so many eggs out of an egg box. The domes of the buds may be pinkish, whitish, greenish, nevertheless we call it the pink cluster bud stage.

The reason for fertilizing at the pink stage are several:

________ An attempt to keep leaves green and flourishing so as to supply ample growth substances for the fruit.

________ An attempt to provide conditions suitable for fruit bud formation for a second crop that will be equal to the usual size of a first crop.

A COMPARISON BETWEEN ROTARY AND FLAIL MOWED STEMS FERTILIZED AT THE PINK CLUSTER BUD STAGE - TABLE IX.

No significant difference between rotary and flail mowing. This gives some sort of an indication that results from fertility studies done in rotary mowed plots will apply to flail mowi also.

Note that levels of nitrogen did not affect this relat ip, and that both rates gave more fruit buds than unfertilized.

AN EMPIRICAL STUDY OF THE EFFECT OF SPLITTING THE NITROGEN APPLICATION.

Two small applications were better than one large.

MAGNESIUM SPRAYS AND FRUIT BUD FORMATION - TABLES XI AND XII.

In Table XI: a magnesium spray significantly increased fruit bud production, but when combined with zinc chelate, Table XII, did not.

THE EFFECT OF CONSECUTIVE APPLICATIONS OF FERTILIZER ON FRUIT BUD FORMATION THE FIRST CROP YEAR. - TABLE XIII.

Two successive applications - one the pruning year, one the first crop year - produced more fruit buds for a second crop than a pruning year application alone. Note the same result for number of branches per stem, which may account for the greater number of fruit buds.

DAP (DIAMMONIUM PHOSPHATE) COMPARED TO AMMONIUM NITRATE PLUS 4 PERCENT SUPERPHOSPHATE, BOTH APPLIED THE YEAR OF PRUNING, ON FRUIT BUD FORMATION - TABLE XIV.

No significant between the two fertilizers.

A FIRST APPROXIMATION OF SOIL STANDARDS, 1984 SAMPLES - TABLE XV.

Standards are at hand for other nutrients, but were not included here. Another set of samples for 1985 will be analysed in March of 1985 if sufficient funds are available.

Note that these values (Table XV) were obtained from comparisons between good stems and poor stems in the same clones - paired plots so to speak. Thus they are direct comparisons of the effect of soil conditions on stem performance. Nothing else intervenes to impair the comparisons.

Comparisons made between good farms and poor farms are flawed if what you are after is a correlation between soil nutrients and plant growth.

NOTE: Data for four other studies made in 1985 has not yet been processed. When it has been processed it will be sent to the committee probably in April 1986.

APPENDIX TABLES (ALL TREATMENTS WERE PAIRED)

(ALL DATA IS FROM ROTARY MOWED PLOTS)

I. NUMBER OF FRUIT BUDS PER STEM: ROTARY MOWED vs. FLAIL MOWED. (THREE INCH MOWING HEIGHT).

Rotary mowed	Flail mowed	
4.61	4.48	Rotary better in 43.6% of the pairs.

II. NUMBER OF FRUIT BUDS PER STEM: SPRING ROTARY vs. FALL ROTARY MOWED.

Spring mowed	Fall Mowed	
4.91	3.58	Spring mowed higher in 88.2% of the pairs.

III. PERCENT OF UNPRUNED STEMS: ROTARY MOWED, FERTILIZED vs. UNFERTILIZED.

Unfertilized	Fertilized	
40.4	15.4	Fertilized lower in 71.4% of pairs.

IV. NUMBER OF BRANCHES PER STEM: ROTARY MOWED.

Spring mowed	Fall Mowed	
4.75	3.90	Spring mowed higher in 76.4% of pairs.

V. NUMBER OF FRUIT BUDS PER STEM FOLLOWING EARLY vs. LATE FERTILIZER APPLICATION THE PRUNING YEAR - ROTARY MOWED.

Not fertilized	53 lbs Nitrogen pink stage, 1984 - from DAP		
1983, 84, 85 (")	23 April 1985 (10)	20 May 1985 (12)	
3.17	5.80	8.00	23 April higher than check 100% of the time. 20 May higher than 23 April 90% of time.

VI. EFFECT RATE OF NITROGEN APPLIED PREEMERGENCE THE PRUNING YEAR ON NUMBER OF FRUIT BUDS PER STEM - ROTARY MOWED.

Not fertilized 1983,84,85	35 lbs N from DAP Pink stage 1984 25 lbs N, DAP Pre 1985	50 lbs N, DAP, Pre 1985	
3.76	4.81	6.40	25 lbs higher than not fertilized in 78.6% of the pairs 50 lbs N higher than 25 lbs in78.5% of the pairs

VII. NUMBER OF FRUIT BUDS PER STEM FOLLOWING APPLICATION OF TWENTY SEVEN POUNDS NITROGEN PREEMERGENCE INTERACTED WITH SPLIT PHOSPHORUS APPLICATIONS - ROTARY MOWED.

Not fertilized 1983,84,85	27 lbs Nitrogen applied per acre the 1 May 1985 100 lbs P_2O_5 applied 1 May	25 lbs P_2O_5 applied 1 May and 75 lbs applied the 22 July 1985.	
2.61	3.91	3.36	1 May higher than not fertilized in 90% of pairs 1 May higher than 22 July in 50% of pairs.

VIII. CARRYOVER FROM PINK STAGE FERTILIZATION INTO PRUNING YEAR ON NUMBER OF FRUIT BUDS PER STEM, - ROTARY MOWED.

Unfertilized 1983,84,85	Unfertilized 1983, 85, 1984: applied 53 lbs nitrogen per acre at the pink cluster bud stage.	
3.97	5.30	Pink fertilization higher in 89.4% of the pairs.

IX. ROTARY vs. FLAIL - NUMBER OF FRUIT BUDS PER STEM: FOLLOWING 35 AND 53 LBS OF NITROGEN APPLIED AT THE PINK CLUSTER BUD STAGE

Not fertilized		Number of [illegible] per stem the fall of the year fert[illegible] [illegible]as applied. 35 lbs [illegible]ogen from DAP at pink cluster		53 lbs Nitrogen from DAP at pink cluster	
Rotary	Flail	Rotary	Flail	Rotary	Flail
2.23	2.99	5.93	5.64	4.74	4.29

35 lbs rotary higher than 35 Flail 50% of time, and 53 lbs Rotary higher than 53 Flail 60.0% of time

X. ROTARY MOWED SPLIT APPLICATIONS OF NITROGEN: NUMBER OF FRUIT BUDS PER STEM.

Not fertilized	70 lbs Nitrogen, DAP, 84 nothing in 85.	35 lbs N in 84, nothing in 85.	35 lbs Nitrogen in 84 35 lbs Nitrogen, DAP in 85
1.62	3.82	3.58	6.24

No statistical analysis, empirical values only. (Pruned in 1985).

XI. LOCATION # 1: ROTARY MOWED, EPSOM SALT SPRAY AT WEEKLY INTERVALS FOR SIX CONSECUTIVE WEEKS.

50 lbs per acre nitrogen from DAP applied at pink cluster stage in 1984 and again at preemergence in 1985, the pruning year: Rotary mowed.

Not sprayed FB. Stem	Sprayed weekly for six consecutive weeks, Epsom salts plus wetting agent. Number of fruit buds per stem:
3.51	4.31 Spray higher than unsprayed in 77.3% of pairs.

XII. LOCATION # 2: ROTARY MOWED, EPSOM SALT PLUS ZINC CHELATE SPRAYED FOR SIX CONSECUTIVE WEEKS. NUMBER OF FRUIT BUDS PER STEM.

35 lbs Nitrogen from DAP at cluster bud stage in 1984 plus 50 lbs Nitrogen from DAP the pruning year: Preemergence in 1985.

Unfertilized	DAP in 84 and in 85. sprayed: Magnesium plus zinc in 85	DAP in 84 and in 85. No spray	
3.23	5.15	5.27	Sprayed higher than unfertilized in 80% of pairs, and higher than unsprayed in 46.7% of pairs.

XIII. NITROGEN APPLIED THE PINK CLUSTER BUD STAGE THE FIRST CROP YEAR, FRUIT BUD COUNTS MADE ON STEMS THAT HAD BORNE FRUIT. NUMBER OF FRUIT BUDS PER STEM AND NUMBER OF BRANCHES PER STEM.

	Not fertilized in either 84 or 85.	Not fertilized in 84, the pruning year. Fertilized at the pink stage in 85.	Fertilized in 84 and at pink cluster bud in 85
Fruit buds per stem	2.46	3.50	4.48
Number of branches per stem	6.82	8.44	9.77

Empirical study only. Not statistically analized.

XIV. DAP COMPARED WITH AMMONIUM NITRATE PLUS 46% SUPERPHOSPHATE. NUMBER OF BLOSSOMS PER STEM.

DAP APPLIED Preemergence	Ammonium nitrate plus superphosphate applied preemergence	
10.17	8.70	DAP higher in 10 out of 18 pairs = 55.5%

Epsom salt with or without calcium chloride was broadcast on Grower fertilized fields. No response in 1985. Will hold block for two years.

XV. A FIRST APPROXIMATION OF SOIL NUTRIENT STANDARDS. THESE ARE POUNDS PER ACRE OF AVAILABLE NUTRIENT PER TOP FOUR INCH DEEP ACRE FURROW SLICE.

Phosphorus - 4.0

Potassium - 50.0

Calcium - 300.0

Magnesium - 45.0

Zinc - 3.5

percent calcium saturation - 40.0

PH - 4.5