Winter 1988

Blueberry Advisory Committee Research Report

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BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1987 to March 1988

Investigators: H. Y. Forsythe, Jr., Project Leader
Judith A. Collins, Research Associate

Title: Effect of pruning practices on blueberry insect abundance

Methods:

In 1985, a series of 50 x 140 ft plots was established in an abandoned blueberry field in Jonesboro; there were 8 replications of 3 "treatments" (flail mowing, burning, and untreated or bearing). Five sets of 10-sweep samples were taken along a long transect within each plot at various dates throughout the season. The number of each type of insect captured in each set of 10 sweeps was recorded. The study was continued in 1986 to determine insect population trends on bearing plants the second season after different pruning practices. In 1987, mow and burn treatments were repeated to simulate normal pruning cycles. The control plots were high mowed to stimulate new blueberry growth. In addition, Velpar was applied in the spring to all plots to reduce sampling effort and biased results due to differential weed distribution.

In 1987, 4 fields were located which had large mowed areas adjacent to large burned areas. Three of the fields were mowed or burned in 1987; one was pruned in 1986. A sampling procedure similar to that described above was followed. Five sets of 10-sweep samples were taken along 3 or 4 long transects within each field, and the number and type of insect captured was recorded. The same fields were monitored in late June and July for spanworm adults. On each of several dates, the number of adults at each location was determined by taking 5 sets of 10 paces along the transects, and recording the number of moths flushed into flight.

Results:

Populations of insects were again very low in the abandoned field in Jonesboro. The three major insects collected, grasshopper nymphs, sawfly larvae, and spanworm larvae, were all most abundant during the June sampling periods when they averaged up to 1.1 to 1.7 per 10 sweeps. Grasshopper nymphs showed no apparent preference in field type. Spanworm and sawfly larvae were most abundant on the control plots which were high mowed in 1987; blueberry production on the control plots ranged from 20-50%. Sawfly and spanworm larvae also showed some preference for mowed areas over burned areas (Table 1).

In the survey of large fields, sawfly larvae, spanworm larvae, grasshopper nymphs, and lygaeids (adults and nymphs) were the most prevalent insects, averaging up to 1.0 to 5.9 per 10 sweeps. All four insects were at least twice as abundant in mowed vegetative fields as compared to burned vegetative fields. Sawfly and spanworm larvae were also more prevalent in crop year fields which had been mowed in 1986 (Table 2). Spanworm moths were more abundant in mowed as compared to adjacent burned areas in all fields sampled, on all dates.

Conclusions:

More definitive data are beginning to accumulate which indicate that certain pest insects, when present, are more likely to be found in higher numbers in mowed fields than in burned fields. The insects most involved include sawfly larvae and spanworm larvae. Flea beetle larvae, from 1986 research, also showed this trend. However, since mowing is a relatively new practice, further observations are necessary to determine if, or what, pest insects will eventually become annual pests of concern.

Recommendations:

It is important for growers to examine their blueberry fields carefully, especially early in the season, so as to be aware of pest insect outbreaks and damage. Mowed or lightly burned fields may show the worst pest insect problems.

(Table 1)

Abundance of significant insects. 1987.

Sample dates	1987 Treatment	Number of insects per 100 sweeps		
		Grass-hopper Nymphs	Sawfly Larvae	Spanworm Larvae
5/12 + 5/20	burn	5.4	0.0	0.1
	mow	6.9	0.0	1.6
	none[a]	5.2	0.0	8.8
6/1 + 6/10 + 6/18	burn	10.3	0.3	1.7
	mow	9.5	2.2	9.2
	none	11.2	15.5	17.1
7/7 + 8/13	burn	4.2	0.0	0.0
	mow	3.6	0.0	0.0
	none	2.6	0.0	0.1

[a] plants high-mowed; 20-50% bearing.

(Table 2)

Summary of insects captured, mow vs. burn surveys. 1987.

Insect[a]	Sample dates	Insects collected per 50 sweeps			
		3 Fields (vegetative)		1 Field (cropping)[b]	
		Mow	Burn	Mow	Burn
Sawfly L.	5/29 - 6/4	4.8	0.1	8.1	3.5
Spanworm L.	5/20 - 6/4	29.4	1.0	6.4	0.4
Spanworm A.[c]	6/26 - 7/24	28.9	6.8	12.2	2.4
Grasshopper A.	6/18 - 7/16	1.3	0.5	-	-
Grasshopper N.	5/20 - 6/15	6.7	3.4	-	-
Lygaeids N. & A.	6/18 - 7/16	27.2	10.5	1.8	1.9

[a] L = larvae, A = adults, N = nymphs; other insects were captured in much smaller numbers.

[b] the cropping field was pruned in 1986.

[c] moths per 50 paces.

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1987 to March 1988

Investigators: H. Y. Forsythe, Jr., Project Leader
Judith A. Collins, Research Associate

Title: Economic thresholds and control of secondary blueberry pests

Methods:

Secondary pest insects were located from field observations, prior surveys, and grower reports.

Laboratory Tests

Collections were made of those insects present in sufficient numbers and with few or no recommended controls. Square-foot patches of blueberry plants were treated with different insecticides using a small hand-pump sprayer at a rate of 23 gallons of water-mixture per 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 or 3 replications per treatment. At indicated hours after insects were introduced into the cages, a knockdown count of dead or inactive insects was made.

Field Tests

Field tests were conducted when insect species were present in sufficient numbers and homogeneously distributed over a large field area. Randomized complete block designs with 2 or 3 replications were utilized, with each plot measuring 15 x 15 or 23 x 23 ft with 10 ft buffer strips. Field plots were treated with a hand-held, CO_2-propelled sprayer at 25 gallons of water-mixture per acre. On a pre-treatment and various post-treatment dates, insects in each plot were counted. The center area of each plot was sampled with 5 or 10 sweeps of a standard 12-inch sweep net. After the live insects were counted, they were spread back over the same plot.

In the spanworm adult control test, plots measured 200 x 200 ft with 200 ft buffer zones. Treatments were applied at 400 psi in 15 gallons of water-mixture per acre with a Bean FMC^R airblast sprayer mounted on a tractor driven at 2 mph. Efficacy was evaluated by observing the number of moths disturbed by walking through the plots. Nine sets of 10 paces were taken in each plot and 15-26 sets were taken outside each plot.

Results:

In laboratory tests, the unregistered pyrethroids Asana, Ambush, and Spur, as well as Lorsban and higher rates of Marlate, seemed to be effective for a number of secondary pest insects and stages, and compared favorably with Imidan and Guthion. Sevin was very good for adult spanworm and flea beetle control.

In the field, similar effective results were obtained for sawfly larvae, flea beetle larvae, and spanworm larvae. However, Marlate and Dipel did not perform well in one field test for spanworm larvae. Sevin gave the best control in a field test of three insecticides against spanworm adults.

Because of the time committed to research on the outbreaks of flea beetle and spanworm in 1987, no research time was available to develop economic injury and action threshold levels.

Conclusions:

Tests from recent years have begun to indicate some effective insecticidal controls for various prevalent secondary pest insects. The results presented here are generally supportive of data obtained in the past few years and indicate that some new insecticides, specifically Asana, Ambush, and Spur, all show promise for blueberry pests.

Control data on strawberry rootworm, leaf tier, blueberry looper, leaf beetle, spanworm adults, and grasshoppers are presently incomplete and further work is necessary before recommendations can made for these insects.

Recommendations:

Control tests conducted in the field in the last two or three years have confirmed some effective treatments. Imidan, Guthion, and Marlate seem to be effective for control of sawfly larvae. Marlate is the only one not highly toxic to bees and will probably be the material of choice for most growers. Marlate and Imidan have also proven highly effective in controlling outbreaks of blueberry flea beetle (larvae and adults). Present recommendations for control of blueberry spanworm larvae during bloom are for high rates of Marlate and Dipel, although control at times has been erratic.

Blueberry Insect Control Tests[a]

Laboratory Tests

Insect[b]	Guthion (16 oz)	Asana (2 oz)	Ambush (13 oz)	Spur (6 oz)	Imidan (16 oz)	Imidan (32 oz)	Marlate (48 oz)	Marlate (64 oz)	others
Sawfly L.	E	E	E	E	E	-	-	-	Marlate (80)-VG
Grasshopper N.	-	G	G	G	-	-	-	-	-
Spanworm L.	-	E	E	E	-	-	-	-	Marlate (80)-E
Spanworm A.	P	-	E	-	P-F	P	P-F	VG	Sevin (64)-E Malathion (16)-E
Flea Beetle L.	-	E	E	E	E	E	P-F	E	Lorsban (32)-E
Flea Beetle A.	E	E	E	-	E	E	-	E	Sevin (32)-E Sevin (48)-E

Field Tests

Insect	Guthion (16 oz)	Asana (2 oz)	Ambush (13 oz)	Spur (6 oz)	Imidan (16 oz)	Imidan (32 oz)	Marlate (48 oz)	Marlate (64 oz)	others
Flea Beetle L.	VG	F-G	G-VG	F-VG	E	E	E	VG	Lorsban (32)-E
Sawfly L.	G	VG	VG	G	G	-	-	-	Marlate (80)-G
Spanworm L.	-	E	E	G	-	VG	-	-	Guthion (32)-VG-E Lorsban (32)-E Marlate (80)-P-F Dipel (8)-P
Spanworm A.	-	-	-	-	-	P-F	-	-	Guthion (32)-F-G Sevin (64)-VG

[a] E = excellent, VG = very good, G = good, F = fair, P = poor; ounces of formulation per acre given in parenthesis.

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

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1987 to March 1988

Investigators: H. Y. Forsythe, Jr., Project Leader
Judith A. Collins, Research Associate

Title: Control of blueberry maggot

Methods:

All materials were applied at 400 psi in 15 gallons of water-mixture per acre with a Bean FMC[R] airblast sprayer mounted on a 674 International[R] tractor driven at 2 mph.

Evaluation was based on post-spray counts of blueberry maggots found in 1 qt of berries raked on 2 dates from each of several preselected areas within each treatment plot, and compared to samples from adjacent untreated areas. Berries were refrigerated and processed for maggots within 7-10 days after collection.

General Insecticides

A field test for control of blueberry maggot with ground applications of insecticides was an important priority again in 1987. Six materials were evaluated for effectiveness in reducing maggot populations. A randomized block design with 2 replications of each treatment was utilized; each plot measured 100 x 100 ft.

Insecticides plus Nu-lure Insect Bait

Tests were performed to determine attractiveness and control of blueberry maggot with insecticides and Nu-lure insect bait. Imidan and Guthion, with Nu-lure, were tested to determine if maggots can be controlled by lower rates of insecticides with the addition of a bait. A randomized design with 2 large replications of each treatment was used; plots measured 200 x 200 ft. A test on the attractiveness of Nu-lure was monitored after applying combinations of insecticides and/or Nu-lure, and by sampling the maggot population at 50 ft intervals from the center of each plot. A total of about 20 berry samples was taken to evaluate the results of each treatment.

Results:

Maggot populations were generally low in the general insecticide test, averaging 0.8 to 7.0 maggots per quart in the untreated areas. The most effective insecticides, comparable to Guthion and Imidan (both rates), seemed to be Lorsban 4E and Zolone, both unregistered materials. Populations were too low in both treated and untreated areas of the Ambush (12 oz), Asana, and Lorsban XRM 4656 plots to allow conclusions to be drawn.

Low populations were even more of a problem during the Nu-lure tests and no definitive results were obtained. Untreated areas averaged less than 0.9 maggots per quart.

No aerially applied treatments were made because the available test fields were too small.

Conclusions:

Results from the last two years indicate that the unregistered insecticides Zolone, Lorsban, and possibly Ambush, may be as effective as Imidan and Guthion in controlling blueberry maggot. These materials warrant at least one more field test on a more vigorous maggot population. Since Asana is effective for apple maggot, a revealing test for blueberry maggot is still in order.

Although no efficacy data on Nu-lure were collected in 1987 due to low maggot populations, previous data seem to warrant continuing this area of research.

Recommendations:

Guthion and Imidan are still the best registered insecticides for blueberry maggot. Three applications of Malathion and the unregistered materials Lorsban, Ambush, and Zolone all show promise as possible alternative controls. Until a vigorous maggot population is located to evaluate Nu-lure plus insecticide treatments, no recommendation can be made for this combination.

Material (amt. form./acre)	Percent control of blueberry maggot [a]	
	1986	1987
Asana (2 oz)	20	-
Asana (3 oz)	-	?
Asana (4 oz)	-	?
Lorsban XRM 4656 (32 oz)	-	?
Lorsban XRM 4656 (64 oz)	61	-
Lorsban 4E (32 oz)	-	88
Lorsban 4E (64 oz)	54	-
Ambush (12 oz)	49	?
Ambush (16 oz)	-	68
Rotacide (80 oz)	32	-
Sevin XLR Plus (64 oz)	24	-
Imidan (16 oz)	-	94
Imidan (32 oz)	59	80
Zolone (16 oz)	79	82
Guthion (16 oz)	-	96
Malathion (2 applications)(16 oz)	10	-
Malathion (3 applications)(16 oz)	81	-

[a] Average % control based on 2 sample dates; 1986 = 8/13 + 8/21; 1987 = 8/4 + 8/13.

? indicates questionable % control data because of extremely low maggot populations (<1.5 maggots/qt in untreated areas adjacent to treated plots).

DATE: January 19, 1988

INVESTIGATOR: D.H. Lambert

TITLE: EVALUATION OF FUNGICIDES FOR CONTROL OF BOTRYTIS BLIGHT ON LOWBUSH BLUEBERRY, 1987

METHODS: This study was conducted in an established field at the Blueberry Hill Research Farm, Jonesboro, ME. Treated areas were misted with a greenhouse-type system for 20 seconds every 6 minutes after artificial inoculation. On 29 April (late bloom - petal fall), pre-infection fungicides were applied with a hand-held sprayer at 50 gal/A. Plots 2 by 3 ft were replicated ten times in a randomized complete block design (nine replicates were within a single blueberry clone). On 30 April, Botrytis spores of a local blueberry isolate were applied at a density of 8 x 10^6 per ft^2 in a solution of 0.11 M glucose, 67 mM NaH_2PO_4. Fifty-one hr after inoculation, post-infection fungicide treatments were applied, and misting was continued for three days. After nine days, all stems (ca. 100) within a 2.7 ft^2 area of each plot were rated for the incidence of any amount of blossom blight on a stem. On 3 August, berries within single 2.7 ft^2 subplots were harvested and weighed. Twenty berries per plot were placed in an enclosed container exposed to light and monitored for the incidence of postharvest Botrytis fruit infection over a two week period.

RESULTS: Ronilan at 2 lb/A provided adequate control under severe disease pressure whether applied before or after infection. This material is not considered to have post-infection activity. Benlate was not effective, and subsequent testing confirmed benlate-tolerance, previously undetected for Botrytis in Maine blueberries. Fruit infection was insignificant in the nontreated plots, possibly because successful infections immediately killed blossoms and ovaries rather than becoming latent in the developing fruit. Single applications of Ronilan at late bloom did not prevent subsequent berry infection. Although infected, these berries were sound at harvest in most cases.

CONCLUSIONS: Ronilan @ 2 lb/A will provide very good control of Botrytis blight, and may have some useful post-infection activity. Botrytis strains resistant to Benlate are present in Eastern Maine, and apparently do not require much selection to develop.

Table 1.

Treatment-rate/A	Application time[1]	Incidence %[2]	Yield lb/A	% berry infection
Ronilan 50WP 1 lb	pre-infection	28 b[3]	6785 b	22.5 b
Ronilan 50WP 2 lb	pre-infection	8 a	7290 b	25.0 b
Ronilan 50WP 2 lb	post-infection	8 a	7331 b	16.0 b
Benlate 50WP 1 lb	pre-infection	70 c	4322 a	---
Benlate 50WP 1 lb	post-infection	71 c	3837 a	---
Control		71 c	4799 a	0.5 a

[1] Fungicide applications one day prior to or 51 hr after inoculation.

[2] Percentage of stems having any affected blossoms.

[3] Means followed by the same letter do not differ significantly at the 5% level (DMLSD).

DATE: January 19, 1988

INVESTIGATORS: D.H. Lambert, W.A. Wright

TITLE: EVALUATION OF FUNGICIDES FOR CONTROL OF MUMMY BERRY ON LOWBUSH BLUEBERRY, 1987

METHODS: This study was conducted in Twp. 19, Washington Co., Me. The field was held over for a third year's fruit production, and was naturally infested with Monilinia sclerotia from previous crops. Plots measuring 5 by 10 ft separated by 2 or 5 ft spacer strips were replicated six times in a randomized complete block design. Treatments were applied with an air-powered boom sprayer that delivered 50 gal of spray/A at 30 psi 20 in from the ground. Spray dates were 27 April (swollen buds), 4 May (budbreak), 11 May, 26 May (early - mid bloom), 9 June, and 22 June 1987. Later sprays were for residue analysis rather than disease control. Temperatures and rainfall were near average for the area with 3.3 in, 4.2 in, and 4.9 in of rain for April, May and June respectively. During the first week of June, primary infection was rated for all stems in each of four 2.7 ft^2 subsamples per plot and expressed as the number of stems per yd^2 with any foliar or blossom blight.

RESULTS/CONCLUSIONS: Primary (ascospore) infection was light but results indicated that Bravo at all the tested rates/application times was as effective as the standard fungicide, Funginex, for the control of Monilinia blight.

Table 1.

Treatment-rate/A	Application date	Blight incidence[1]	Yield lb/A
Bravo 720F 8.3 pt	27/4	2.2 a[2]	1515 a
Bravo 720F 4.2 pt	27/4, 11/5	1.0 a	1428 a
Bravo 720F 2.75 pt	27/4, 11,26/5	2.2 a	1291 a
Bravo 720F 3.0 pt	27/4, 11,26/5, 9,22/6	1.4 a	1505 a
Funginex 1.6EC 18 oz	27/4, 4/5	2.6 a	1977 a
Control		22.8 b	1476 a

[1] Numbers of stems per yd^2 with any foliar or blossom blight.

[2] Means followed by the same letter do not differ significantly at the 5% level (DMLSD).

DATE: January 19, 1988

INVESTIGATOR: D.H. Lambert

MISCELANEOUS ACTIVITY:

1) **Fungicide Residue Analysis.** Berries from the mummy berry fungicide trial were frozen and shipped to an analytical lab for determinations of Bravo residues. This information will be used by the manufacturer to support product registration. Another set of spray plots was set out at the Research Farm to produce berries for Captan residue analysis. The Michigan Blueberry Growers Association solicited this work last year to support continued registration of Captan, which is needed in Michigan for control of Alternaria fruit rot.

2) **Blueberry Fact Sheet.** - Done

3) **Berry Contamination.** A preliminary survey of one frozen berry sample showed approximately half the fruit superficially contaminated with the fungus Penicillium. This fungus was recovered from about 10% of the berries which had been washed in a Chlorox solution for 1 minute, indicating that a certain percentage of berries were actually infected. A survey of fresh berries from the Captan plots showed small percentages of Botrytis, Penicillium, Aspergillus, and a few other unidentified fungi.

DATE: January 19, 1988

INVESTIGATORS: D.H. Lambert, D. Emerson, F. Olday, W. Wright

TITLE: EFFECTS OF PRUNING METHODS ON MUMMY BERRY DISEASE INCIDENCE, 1987

METHODS: Sampling grids were established in two Washington Co., ME lowbush blueberry fields to quantify differences in disease associated with mowing or burning. At the first site, a 0.4 ha area which had been mowed for the previous five crop cycles was compared to an adjacent 0.4 ha area which had been pruned only by burning since the establishment of the farm. At the second site, a seven-hectare portion of a larger field was burned following two cycles in which the entire field had been mowed. At site 1, six transects (130 m long, 10 m apart) were laid out to cross from one treatment area to the other. These were each divided into twelve subplots of 10 m (six per side) with a 10 m space between treatments. At site 2, nine transects (210 m long, 15 m apart) were likewise divided into two sets of ten subplots with a 10 m spacer. After petal fall, disease was quantified in each 10 m subplot by counting the number of stems within two 0.25 m^2 areas which showed blossom or foliar blight symptoms. In addition to split-plot analyses, within-treatment linear regressions were run to determine if disease gradients existed in the fields which could confound the interpretation of treatment effects in the split plot.

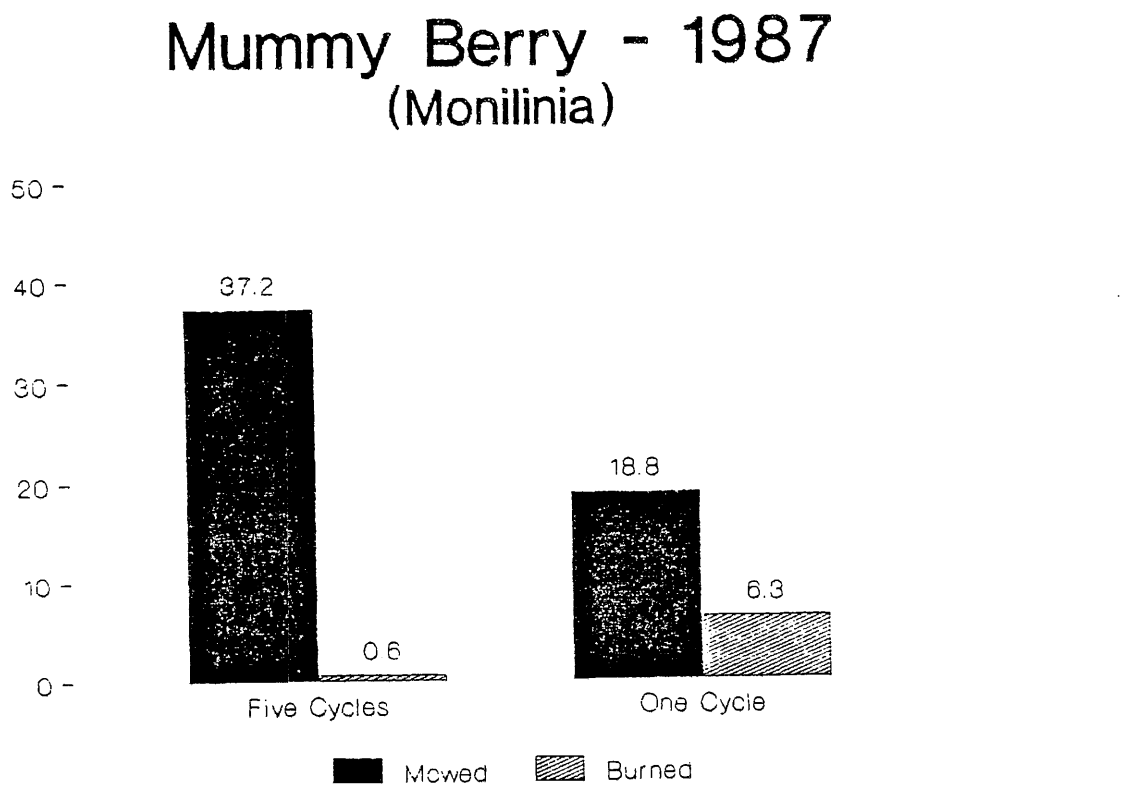
RESULTS: At the first site, where continuous burning was compared to five cycles of mowing, disease in the mowed treatment was 60-fold higher than that in the burned treatment. Although disease incidence was highly variable among the mowed subplots, no consistant pattern of increase or decrease along the transects was detected. At the second site, a single-cycle return to burning was associated with no more than a 3-fold difference in disease incidence. However, statistically significant disease gradients were found within both treatments. These gradients decreased along the transects from the outer end of the mowed treatment, where disease was greatest, to the outer end of the burned treatment, where disease was least. Thus, differences in disease incidence between pruning treatments at this site could not be differentiated from gradient effects due to variation within the field. For those subplots within 40 m of the common boundry between the two treatments, disease incidence was equivalent on the mowed and burned sides.

CONCLUSIONS: Results at site 1 indicate that, in the past, burning has kept disease levels low by the destruction of overwintering sclerotia (mummies). Results from site 2 suggest that once inoculum has built up in mowed fields, a single burning will not control the disease nor will it immediately reduce disease incidence to a pre-existing level.

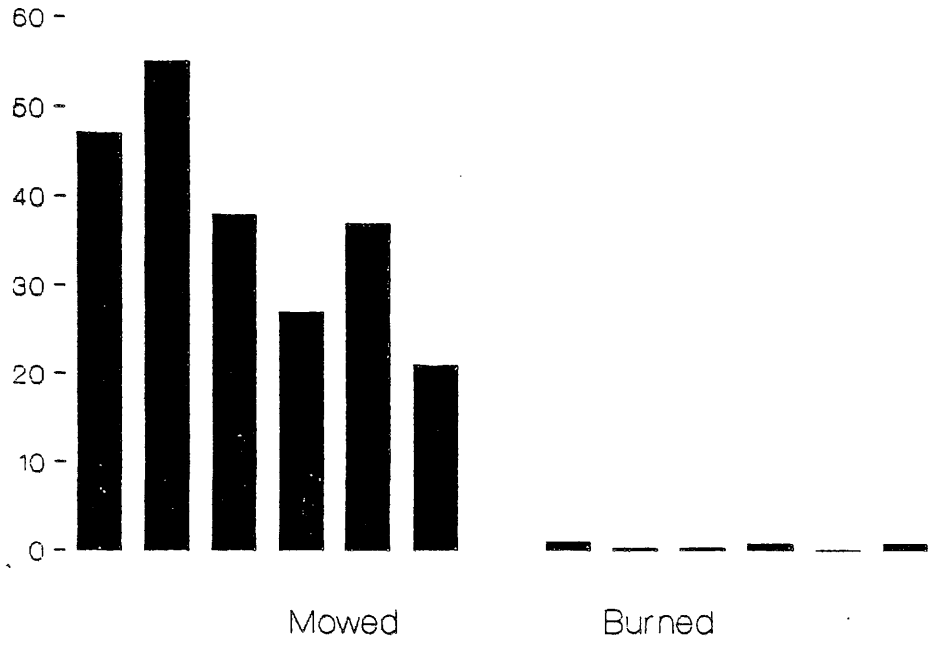
Location	Diseased stems/m²[1]		Orientation of increasing gradient[2]	
	Burned	Mowed	Burned	Mowed
Site 1	0.6	37.2	none	none
Site 2	6.3	18.8	B ---> M	B ---> M

[1] Diseased stems are those showing any amount of foliar or blossom blight. Treatment differences within locations were very highly significant ($P < .001$) at both sites.

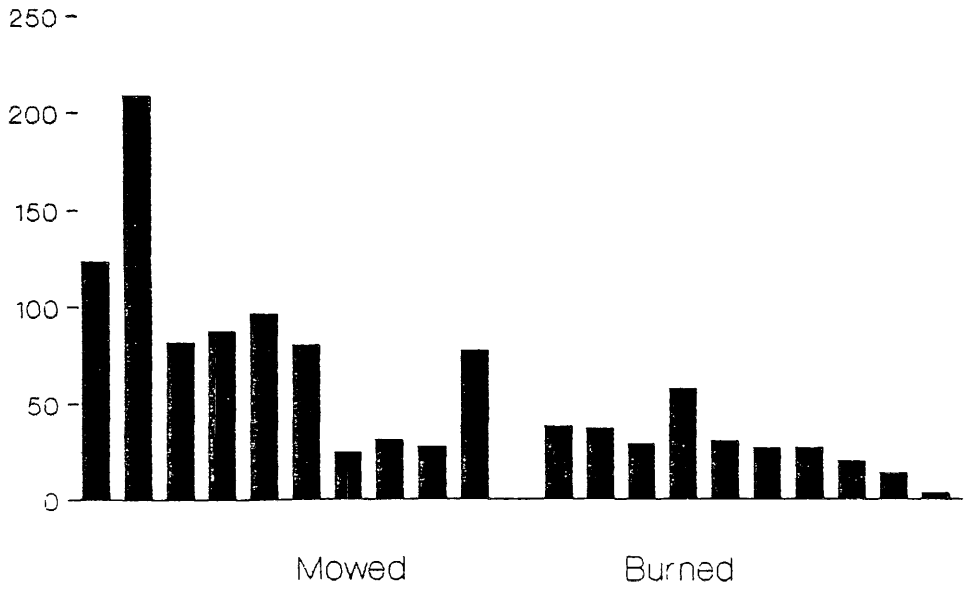
[2] Direction along transects in which a statistically significant increase in disease incidence occurs. Regression analyses of position along gradient on disease intensity were done within treatments and evaluated at the $P < .05$ level. B ---> M indicates that disease increases along the transects in the burned to mowed direction.



Monilinia Disease Gradient
Site 1



Monilinia Disease Gradient
Site 2



DATE: January 19, 1988

INVESTIGATORS: D.H. Lambert, D. Emerson, F. Olday, W. Wright

TITLE: EFFECTS OF PRUNING METHODS ON POWDERY MILDEW AND RED LEAF DISEASE INCIDENCE, 1987

METHODS: Sampling grids were established in two Washington Co., ME lowbush blueberry fields to quantify differences in disease associated with mowing or burning. At the first site, a 0.4 ha area which had been mowed for the previous five crop cycles was compared to an adjacent 0.4 ha area which had been pruned only by burning since the establishment of the farm. At the second site, a seven-hectare portion of a larger field was burned following two cycles in which the entire field had been mowed. At site 1, six transects (130 m long, 10 m apart) were laid out to cross from one treatment area to the other. These were each divided into twelve subplots of 10 m (six per side) with a 10 m space between treatments. At site 2, nine transects (210 m long, 15 m apart) were likewise divided into two sets of ten subplots with a 10 m spacer. At harvest, powdery mildew was quantified by rating the percentage of discolored or mildewed leaf area. Ten leaves were rated from each 10-m subplot. Red leaf disease was quantified by counting all diseased stems in a 3-m-wide strip through the subplots (30 m^2 total / subplot). Clusters of affected stems coming from the same same rhizome location were counted as a single infected plant, and where there was heavy localized spread, the number of infections per plot was limited to 50. In addition to split-plot analyses, within-treatment linear regressions were run to determine if disease gradients existed in the fields which could confound the interpretation of treatment effects in the split plot. Red leaf was rated at both sites in 1987 only, mildew was rated in 1986 and 1987 at site 2 only.

RESULTS: Amounts of red leaf disease were equivalent between treatments at both sites in 1987. Distribution of the disease within treatments was random. At Tracy Field in 1986 (burn year), mildew was 2.5-fold higher in the burned treatment, for reasons which have not been determined. Leaf phosphorus contents at harvest did not differ between treatments, and distribution of disease within treatments was random. In the following crop year, differences between treatments were not significant.

CONCLUSIONS: Mowing has not increased the severity of either red leaf or powdery mildew diseases. The increase in mildew due to burning may or may not be a widespread phenomenon.

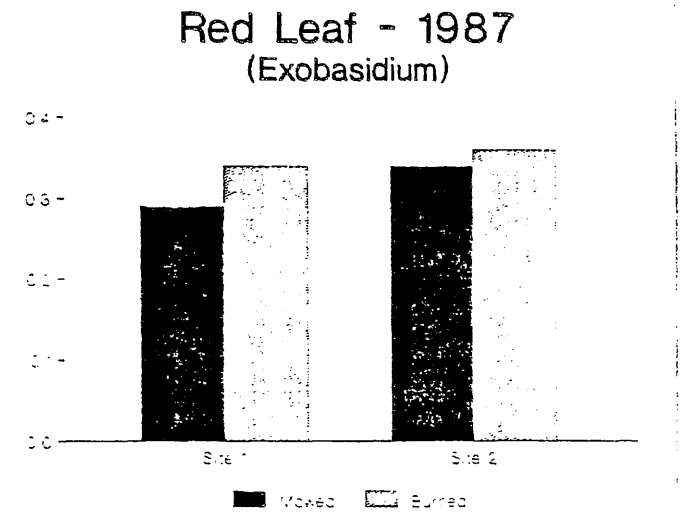
Table 1.

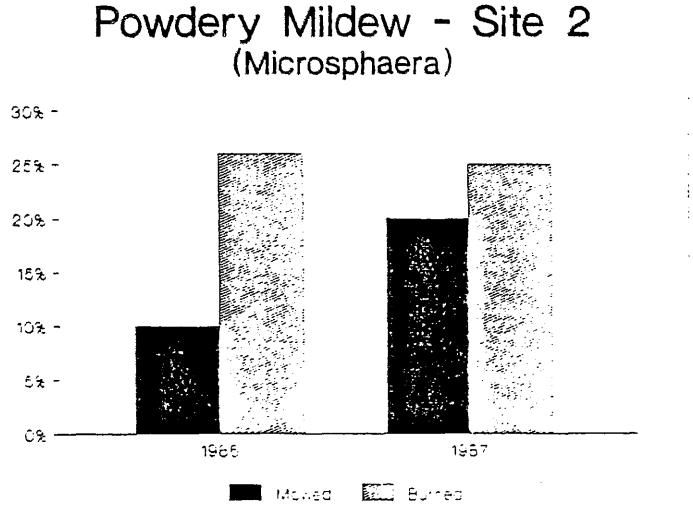
Treatment	Red Leaf[1] Site 1	Red Leaf[1] Site 2	Powdery Mildew[2] 1986	Powdery Mildew[2] 1987
Mowed	0.29	0.34	10 a[3]	20
Burned	0.34	0.36	26 b	25

1 Infections per m^2.

2 Percentage of leaf area affected.

3 Difference between treatments in 1986 significant at $P < 0.5$.





BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: JOHN M. SMAGULA

COOPERATORS: TOM DEGOMEZ
SUSAN ERICH

TITLE: NUTRITION SURVEY 1987

METHODS: Please refer to 1987 project proposal outline PROJECT -1

RESULTS:

Growers who participated in the survey got personal instruction for leaf sampling and soil sampling procedures. Growers who attended one of the 8 Extension field days received copies of two nutrition fact sheets (first drafts) describing the importance of nitrogen, phosphorus and potassium in plant nutrition and the procedures recommended for sampling leaf tissue and soil organic pads. Samples taken during these field days were included in the survey.

Twenty seven (27) fields or sections of fields were sampled in 1987 and included as part of the survey. Two additional fields were sampled but were not prepared for analysis with this group. Fifteen (15) of these fields were sampled using 5 strips to establish levels of variability. Plants in only three (3) of the twenty eight (28) fields sampled had levels of nitrogen in their leaf tissue below the 1.6% satisfactory level (Table 1). Plants in eighteen (18) fields, however, had levels of phosphorus at or below the satisfactory level (.125%) (Table 1). Plants in all fields had potassium levels above the satisfactory level (.400%)(Table 2). The levels of magnesium and calcium in tissue samples from all fields sampled were within the satisfactory range, with a few samples near the bottom of the range. Boron levels were below the satisfactory level (24ppm) in fifteen (15) of the samples.

Soil samples were also taken at the time of leaf sampling. These data are not available at this time but will be included in future reports.

CONCLUSIONS:

Nitrogen does not appear to be limiting in a majority of fields sampled as indicated by leaf tissue analysis. Phosphorus levels do appear to be low in a significant number of fields and application of P and NP fertilizer may be beneficial. Low Boron levels may be limiting growth and yield in lowbush blueberry fields.

RECOMMENDATIONS:

Leaf tissue analysis should be used to assess the nutritional status of lowbush blueberry fields. Dose-response curves should be developed for nitrogen and phosphorus by applying different rates of fertilizer to fields having different levels of nitrogen and phosphorus in their leaf tissue and measuring their response with regard to yield. Additional fields should be sampled in 1988 to locate sufficient number of sites low in nitrogen. Experiments should be conducted to determine if Boron applications will improve yields.

Table 1. Leaf Tissue Analysis - Nitrogen and Phosphorus

NITROGEN (%)			PHOSPHORUS (%)		
N CONCN RANGE	NO FIELDS		P CONCN RANGE	NO FIELDS	
>2.15	1		.161 - .165	1	
2.11 - 2.15	1		.156 - .160		
2.06 - 2.10			.151 - .155		
2.01 - 2.05			.146 - .150	1	
1.96 - 2.00			.141 - .145	3	
1.91 - 1.95	2		.136 - .140		
1.86 - 1.90	2		.131 - .135	1	
1.81 - 1.85	3		.126 - .130	3	satisfactory!
1.76 - 1.80	5		.121 - .125	4	
1.71 - 1.75	5		.116 - .120	5	
1.66 - 1.70	4		.111 - .115	4	
1.61 - 1.65	2	satisfactory!	.106 - .110	2	
1.56 - 1.60	2		.101 - .105	2	
1.51 - 1.55			.096 - .100	1	
1.46 - 1.50	1				

Table 2. Leaf Tissue Analysis - Potassium and Magnesium

POTASSIUM (%)		
K CONCN RANGE	NO FIELDS	
.611 - .620	1	
.600 - .610		
.591 - .600		
.581 - .590		
.571 - .580		
.561 - .570		
.551 - .560	1	
.541 - .550		
.531 - .540	4	
.521 - .530	3	
.511 - .520	4	
.501 - .510	1	
.491 - .500	1	
.481 - .490	2	
.471 - .480	2	
.461 - .470	3	
.451 - .460		
.441 - .450	1	
.431 - .440		
.421 - .430	4	
.411 - .420		
.401 - .410		satisfactory!
.391 - .400		
.381 - .390		

Table 3. Leaf Tissue Analysis - Magnesium and Calcium

MAGNESIUM (%)		CALCIUM (%)	
Mg CONCN RANGE	NO FIELDS	Ca CONCN RANGE	NO FIELDS
.226 - .230	1	.551 - .570	2
.221 - .225	3	.531 - .550	2
.211 - .220		.511 - .530	2
.211 - .215	1	.491 - .510	3
.206 - .210	1	.471 - .490	3
.201 - .205	3	.451 - .470	2
.196 - .200	1	.431 - .450	4
.191 - .195	3	.411 - .430	2
.186 - .190	2	.391 - .410	1
.181 - .185	3	.371 - .390	1
.176 - .180	1	.351 - .370	1
.171 - .175	1	.331 - .350	
.166 - .170	1	.311 - .330	
.161 - .165	2	.291 - .310	1
.156 - .160	2	.271 - .290	3 satisfactory!
.151 - .155		.251 - .270	
.146 - .150		.231 - .250	
.141 - .145	1		
.136 - .140			
.130 - .135	1 satisfactory!		
.126 - .130			
.121 - .125			
.116 - .120			
.111 - .115			

Table 4. Leaf Tissue Analysis - Boron

BORON (ppm)	
B CONCN RANGE	NO FIELDS
36 - 38	
33 - 35	
30 - 32	1
27 - 29	3
24 - 26	8 satisfactory!
21 - 23	10
18 - 20	3
15 - 17	2
12 - 14	
9 - 11	

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

Date: January 1988

INVESTIGATOR: JOHN M. SMAGULA

TITLE: NUTRITIONAL RESPONSES OF SEEDLINGS

METHODS: Please refer to 1987 project proposal outline PROJECT -4.

RESULTS:

Fertilizer can hasten the establishment of lowbush blueberry seedlings. Increasing the frequency of fertilizer application when blueberry seedlings are growing in a sandy soil with little ability to hold nutrients resulted in enhanced growth and spread (Table 1.). This trend was significant in all years that area measurements were made. Yield also increased in a similar fashion with the most frequent application (10 lbN/acre from 21-7-7 Peters azalea fertilizer applied 10 times during the growing season) resulting in the highest yields (Table 2). This suggests that a slow-release fertilizer would work even better. The most dramatic effects were in the first few years.

Tissue analysis of leaves sampled in July, 1987 indicated that fertilizer treatments influenced N, P, K, Ca, Mg, and B levels (Tables 3 and 4). Further analysis using contrast statements indicated that most of the differences were do to the fertilizer effect compared to the control. Nitrogen levels were above the satisfactory level of 1.6% in the control plots but P and K were below their suggested satisfactory levels (P = ,125%, K = .400%).

CONCLUSIONS:

Fertilizer can stimulate early seedling growth and hasten establishment of lowbush blueberries. In this study conducted on a sandy soil, frequent applications of a complete fertilizer influenced both growth and yield. The enhanced growth may have resulted from the phosphorus and potassium which appear to be limiting growth in the control plots.

RECOMMENDATIONS:

Frequent applications of fertilizer should be used in the first three years of seedling establishment to stimulate rapid cover and filling-in of bare spots. This is especially applicable when sandy soils with little organic matter are encountered. A slow-release fertilizer such as Osmocote 18-6-12 or Peter's slow release could serve this purpose and be used sparingly in the planting hole or banded along the row of plants. After three years, leaf analysis should serve as a guide to future fertilizer needs. After three years, leaf analysis should serve as a guide to future fertilizer needs.

Table 1. Effect of Fertilizer Frequency on Plant Spread

	AREA (%)			
Treatment	1983	1984	1985	1986
Control	1.4	2.3	11.7	18.9
1 application	2.1	2.5	17.4	37.7
2	2.3	3.4	20.0	41.1
5	2.7	5.7	21.2	45.5
10	3.2	7.4	26.4	49.8
F test	L**[z]	L**	L**	L**

[z]Means are significant at the 1% (**) level.
L =linear trend.

Table 2. Effect of Fertilizer Frequency on Yield

	YIELDS (g/trt plot)[z]			
Treatment	1984	1985	1986[y]	1987
Control	2	11	300	579
1 application	1	18	976	1047
2	3	30	631	1419
5	13	66	704	1074
10	15	95	1037	1460
F test	L**	L**	NS	L**

[z]Multiply yields by 4.8 to convert to lb/acre (1000 g/trt plot = 4,800 l/acre).
[y]Yields affected by mummyberry infection.

Table 3. Effect of Fertilizer Frequency on N, P, K.

LEAF TISSUE ANALYSIS

Treatments	N	P	K
Control	2.03	.118	.338
1 application	2.16	0.125	.419
2	2.27	0.125	.431
5	2.29	0.133	.457
10	2.22	0.132	.456
F test	**	**	**

Contrasts	N	P	K
0 vs Fert	**	**	**
10 vs Other Fert		*	
1 + 2 vs 5		**	*
1 vs 2			

Table 4. Effect of Fertilizer Frequency on CA, MG, B.

LEAF TISSUE ANALYSIS

Treatments	CA	MG	B
Control	0.50	0.18	26.8
1 application	0.44	0.13	19.7
2	0.45	0.12	20.8
5	0.42	0.11	18.7
10	0.46	0.13	19.1
F test	**	**	**

Contrasts	CA	MG	B
0 vs Fert	**	**	**
10 vs Other Fert			
1 + 2 vs 5			
1 vs 2			

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

Date: January 1988

INVESTIGATORS: JOHN M. SMAGULA
MIKE GOLTZ

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

METHODS: Please refer to March 1986 Progress Report.

RESULTS:

MULCH STUDY BLUEBERRY HILL FARM - 1987

Seedlings grown under bark and sawdust mulch produced more top growth as indicated by dry weight measurements. These data (Table 1.) suggest that seedling growth under wood chips is less compared to other mulch sources and is agreement with non-destructive area measurements made in 1984 and 1985 (see 1987 research report). The greatest rhizome production (dry wt basis) occurred when seedlings grew under bark mulch. While rhizome production on a dry wt basis is similar for chips, sawdust and cedar mulches, the characteristics of the rhizomes are not (Table 2.). The number of rhizomes produced by seedlings under chips was greater, but the number of secondary and tertiary branches was less than that produced under sawdust. This may explain why area measurements were higher for sawdust plots than for chips (see 1987 research report).

Significant differences were also found among seedling crosses (Tables 3&4). Two seedling crosses (Augx4161 and 4161xAug) were superior with regard to the number of rhizomes and primary, secondary and tertiary rhizome branches as well as length of rhizomes and their primary, secondary and tertiary branches. These two seedling crosses exhibited greater top growth and greater total rhizome production as indicated by dry wt. measurements.

CONCLUSIONS:

All sources of mulch encourage seedling survival by reducing temperature fluctuations and therefore frost-heaving. Blueberry spread is also enhanced by all sources of mulch, presumably by affecting moisture and soil temperature. Differences in rhizome development (number and length of branches) suggest that bark and sawdust are the best, cedar intermediate and chips the least desirable mulch. The organic "pad" in unplowed blueberry fields is probably affecting rhizome development in a similar fashion. Studies are being conducted to determine the effect of various mulches on lateral spread of established blueberry clones (see 1985 research report). Differences among seedling crosses suggest that parentage may be one reason why a particular blueberry field has filled-in quicker and more densly than another.

RECOMMENDATIONS:

A mulch is critical to assure survival of planted lowbush blueberries. Bark and sawdust mulches were superior to cedar and wood chips. Wood chips should be used only as a last resort. The best available plant material should be used for interplanting since differences among seedling crosses were found.

Studies of the effect of mulches on lateral spread of existing clones in commercial fields deserve continued support.

Table 1. Effect of mulches on aerial growth and rhizome production

Treatment	Tops (gm dw)	Rhizome (gm dw)
Control	20	8
Bark	36a[z]	35a
Chips	19 c	18 b
Sawdust	37a	22 b
Cedar	27 b	22 b

[z]Mean separation of mulch treatments only due to small number of surviving control plants. Means not followed by same letter differ at the 5% level according to Waller-Duncan test

Table 2. Effect of mulches on rhizome number and length

Treatment	Rh N	Rh L	Brl N	Brl L	Br2 N	Br2 L	Br3 N	Br3 L	Br4 N
Control[z]	3	34	7	31	2	4	0	0	0
Bark	20a[y]	636a	41a	681a	23a	266a	5a	48a	0.14a
Chips	21a	605a	30 b	445 b	13 b	140 b	2 b	15 b	0.00a
Sawdust	14 b	383 b	35ab	480 b	25a	213ab	8a	50a	0.44a
Cedar	14 b	469 b	29 b	509 b	20ab	233ab	5ab	42ab	0.14a

Rh N = Mean rhizome number/plant, Rh L = Mean total rhizome length (cm)/plant, Brl = Branch 1,Br2 = Branch off Brl, Br3 = Branch off Br2.
[z]Control was significantly different from all mulches.
[y]Means not followed by the same letter differ at the 5% level according to Waller's Test.

Table 3. Rhizome number and length of seedling crosses[z]

Cross	Rh N	Rh L	Brl N	Brl L	Br2 N	Br2 L	Br3 N	Br3 L	Br4 N	Br4 L
Augx4161	20a	660a	41a	647a	23a	223 b	5a	33 b	.22a	1.2a
4161xAug	17a	554a	36a	610a	26a	305a	8a	68a	.16a	1.2a
2827x4161	14 b	350 b	22 b	305 b	10 b	95 c	2 b	11 b	.11a	0.3a

[z]Means for mulch treatments only since few control plant survived. Means separation by Duncans multiple range test. Means not followed by the same letter differ at the 5% level.

Table 4. Growth differences among seedling crosses

Cross	Tops (gm dw)	Rhizome (gm dw)
Augx4161	35a[z]	76a
4161xAug	33a	75a
2827x4161	9 b	66 b

[z]Means for mulch treatments only, separation by Duncans multiple range test at 5% level.

MAINE BLUEBERRY COMMITTEE
RESEARCH REPORT

DATE: August 1987 to December 1987

INVESTIGATORS: Alfred A. Bushway, Associate Professor,
Department of Food Science
Rodney J. Bushway, Associate Professor,
Department of Food Science
Linda C. Benner, Graduate Student

TITLE: Time-Temperature Effects on Sugar Migration and Physical Characterization in Lowbush Blueberries

METHODS:

IQF blueberries from the 1987 crop were obtained from Jasper Wyman & Son packed in 30 lb boxes. To observe the effects of time and freezer temperatures on the berries, treatments of -21C, -11C, fluctuating (between -21 and -11C weekly), and company stored were observed over a period of four months. Twenty pounds of hand picked berries were also tested and stored at -21C. Three 30 lb boxes were placed at each treatment and the testing time for each treatment was staggered by one week so that all of the tests could be handled. The focus of this experiment was to observe the chemical and physical changes that took place relative to the initial testing time but differences between treatments were also observed.

To test the speculation that the sugars migrate from the core of the berries to the peripheries, high performance chromatography (HPLC) was used to monitor the changes in the simple sugars. Quantitative sugar changes were analyzed on HPLC for surface sugars of the berry, the cores, the peripheries, and the whole berry. Core/periphery tests were followed up by refractometer tests.

Other tests that were followed through the testing time included drip loss; texture (Instron - shear cell); moisture (forced air oven - 105C); pH, soluble solids (refractometer), and color (Hunter Lab Scan II) of both the drip and puree.

RESULTS:

The surface sugars in each treatment all showed a marked increase during the first month. The adverse treatments, -11C and fluctuating both showed the most dramatic increases. During the second and third months, however, the surface sugars declined rapidly in the fluctuating and -11C treatments while the other treatments remained relatively constant.

The core/periphery tests showed overall increases in peripheral sugars during the first three months but dropped off in the fourth month. In general, the cores showed a decrease in sugars. After the third month, company stored,

-21C, and hand picked berries all showed an increase in core sugars.

Instron tests showed dramatic increases that are linear up until the third month for the fluctuating and -11C treatments. The other treatments also showed increases but are much more gradual.

The other test results are currently being analyzed, but preliminary observations have not shown them to be as significant as those that have been mentioned here.

CONCLUSIONS:

The results obtained on the surface sugars indicate that during the first month, glucose and fructose migrate more readily and quickly than the ice crystals. After the first month, however, the fluctuating and -11C treatments indicated that water molecules were rapidly migrating to the surface also. These results also indicate that the cause of the dramatic sugar migration was the treatment temperature and the cause of the water migration was due to osmosis.

The increase in peripheral sugars during the first three months indicates that the sugars are continuing to migrate throughout this time and are concentrating in the blueberry skins. After the third month, the sugar concentration dropped in the peripheries and rose in the cores of the company stored, -21C, and the hand picked berries. This indicates that water molecules from the core were migrating out causing the core sugar concentration to rise and the peripheral sugar concentration to drop. The adverse treatments, -11C and fluctuating are not as easily explained; these changes are probably chemical whereby the sugars are broken down to organic acids.

The Instron tests demonstrate that the toughening of the berries is mostly due to adverse temperatures and fluctuations. Time also contributes to the toughening effect as demonstrated by both the adversely treated berries and the optimally treated berries.

These results and others will be thoroughly analyzed statistically and reported in a graduate thesis by late spring and will be available upon request.

RECOMMENDATIONS:

IQF blueberries have the best overall quality when the storage temperature is kept at or below -21C and is kept constant. These tests show, however, that even at optimum temperature, there are some adverse changes that occur with time. The hand picked berries showed the least changes from time zero tests. This observation suggests that the wash water and/or the handling and warm post-harvest storage may be the initial problems that lead to sugar and water molecule migration and consequently, toughening of the berries as the moisture migrates to the exterior of the berry. To obtain the highest quality blueberries, post-harvest handling and

storage temperatures must be closely controlled.

FUTURE WORK:

The results of this present research would indicate a need for a better understanding of the physiological changes that occur in the blueberry fruit from early formation through maturity which may affect the quality of the fresh or frozen product. This study would include an indepth investigation of the formation of and changes in the concentration of the organic acids and sugars found in blueberries. The pectins found in blueberries should also be characterized and possible commercial uses determined.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

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

METHODS: As indicated in 1987 project proposal outline 1.

RESULTS: Results of hexazinone on species distribution and blueberry growth and development were reported in 1986 and 1987. Data will be summarized over the four year duration of the project to determine if any trends of increasing species are occurring with hexazinone use on these two sites. Data from a second experiment involving fields treated once or twice will be compared to baseline data.

CONCLUSION: Will be made when data analysis is complete.

RECOMMENDATIONS: Treated areas should be sampled through another cycle to test for increases in resistant species.

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BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of Postemergence Herbicides for Grass Control

METHODS: As indicated in 1987 project proposal outline 2.

RESULTS: Ammonium sulfate did not enhance the activity of sethoxydim on the grass in this experiment but blueberry buds increased from 44 to 66 per ft^2 with its addition. Good grass suppression was observed during the first year but the level of suppression of the carryover ratings were low, indicating the grass recovered from the postemergence applications (Table 1). Suppressing the grass the first year resulted in an increase in blueberry flower bud production but yields were not increased the following year (Table 2).

CONCLUSION: Since no increase in yield was obtained no economic benefit was obtained with these treatments. Differences in timing of herbicide application, rate, or additional applications made in the crop year may be needed to maintain the initial suppression and increase yields.

RECOMMENDATIONS: An experiment to test the effect of later treatments of sethoxydim and an improved surfactant were initiated in 1986. Results from this experiment will determine if the efficacy is increased with these changes. Additional experiments should be conducted using a higher preemergence rate of hexazinone combined with spot treatments of both sethoxydim and glyphosate to evaluate the efficacy of grass control and injury to blueberries using the postemergence applications as a secondary or follow-up application as opposed to the primary treatment.

Table 1. Effect of sethoxydim on little bluestem vigor
Surry, ME.

Rate Kg/ha	Little Bluestem[a] 1986 Rating	1986 Height	1987 Rating	1987 Height
0	0	55	0	37
0.5	5	21	1	3
0.5+0.5	9	10	2	37
Test	**[b]	**	**	NS

a 0 = no effect, 10 = complete control, grass height in cm.
b ** = significant at the 1 % level, NS = nonsignificant

Table 2. Effect of sethoxydim on lowbush blueberry growth and yield, Surry, ME.

Rate Kg/ha	Blueberry[a] Stand ($0.1m^2$)	Buds	Height (cm)	Yield kg/ha
0	51	45	6.7	1558
0.5	64	57	5.7	1573
0.5+0.5	56	54	5.6	1618
F Test	NS	**[b]	NS	NS

a 0 = no effect, 10 = complete control, grass height in cm.
b ** = significant at the 1 % level, NS = nonsignificant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of Sulfonyl urea and Imidazoline compounds for Bunchberry Control.

METHODS: As indicated in 1987 project proposal outline 3.

RESULTS: Carryover ratings on the blueberry or bunchberry and measurements on the blueberry for the preemergent applications of the sulfonyl urea herbicides DPX-F6025 and DPX-M6316 indicated no effect but blueberry yield was reduced by the latter herbicide (Table 1). Postemergent applications of the imadazoline herbicides resulted in sustained injury of both blueberry and bunchberry and resulted in reduced stem length and buds as well as a decrease in yield in all cases except for imazapyr. Injury observed for the untreated imazapyr was due to drift on to the control plots which resulted in no yield on half of the plots, which is the reason for the lack of significance.
Postemergent applications of DPX-M6316 had no significant effect but the DPX-F6025 treatments resulted in an increase in blueberry stem length and buds but did not increase yield (Table 1). Postemergent applications of the imadazoline herbicides resulted in less injury and control than the preemergent applications but produced no effect or resulted a reduction of blueberry growth and yield.

CONCLUSION: All treatments except the postemergent application of DPX-F6065 were either too toxic or were ineffective. Results reported in 1987 for preemergence applications of DPX-F6025 indicated a decrease in the number of bunchberry and an increase in the number of blueberry stems, this combined with an increase in stem length and buds should have produced an increase in yield but did not. There may be subliminal effects from the DPX-F6025 that are depressing the yield.

RECOMMENDATIONS: The imidazoline herbicides are too toxic to the lowbush blueberries and so will be discontinued from study. A trial with postemergence applications of DPX-F6025 is currently under way. Canadian researchers have had some success with other compounds in this family so they merit further study.

Table 1. Effect of herbicides on blueberry and bunchberry, Jonesboro 1986.

Herbicide	Rate kg/ha ai	Blueberry	Bunchberry	Blueberry		
		Carryover rating 1987 (0-10)		Length (cm)	Buds ($0.1m^2$)	Yield kg/ha
PREEMERGENT						
DPX-F6025	0	0	0	204	59	2939
	35	1.0	0.8	150	70	1975
	70	1.5	0	278	66	2630
Significance		NS	NS	NS	NS	NS
DPX-M6316	0	0	0	313	90	5651
	22	0.8	0.2	259	95	2675
	44	0.2	0	209	71	1629
Significance		NS	NS	NS	NS	L**
Imazapyr	0	5.5	2.2	103	11	628
	23	10	9.2	0	0	0
	46	10	9.3	0	0	0
Significance		L**	L**	L*	NS	NS
Imazaquin	0	0	0	329	70	2275
	23	3.4	2.0	50	10	459
	46	4.2	0.3	62	2	146
Significance		L**	NS	L**	L**	L**
AC263,499	0	1.2	0	279	131	1320
	23	9.2	7.8	6	0	0
	46	10	8.8	0	0	0
Significance		L**	L**	L**	L*	L**
POSTEMERGENT						
DPX-F6025	0	0	0	196	54	5151
	18	0	0	269	91	3413
	35	0.7	0.2	380	107	3540
Significance		NS	NS	L*	L*	NS
DPX-M6316	0	0	0	282	77	3567
	11	0	0	270	80	3121
	22	0.3	0	397	141	2030
Significance		NS	NS	NS	NS	NS
Imazapyr	0	2.0	0	345	101	4359
	12	9.8	4.5	474	9	0
	23	8.4	4.0	255	5	1048
Significance		L**	L**	Q*	L*	L*
Imazaquin	0	1.5	0.3	310	58	3103
	12	0.6	0	465	108	2285
	23	0.5	0.2	387	66	2566
Significance		NS	NS	NS	NS	Q**
AC263,499	0	0	0	397	114	4995
	12	3.0	0.5	343	51	428
	23	5.0	0.3	437	38	209
Significance		L**	L**	NS	NS	Q**

*=5%, **=1%, L = linear trend, Q = quadratic trend, NS = nonsignificant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Use of Mechanical wiper with glyphosate (ROUNDUP) or dicamba for control of dogbane.

METHODS: As indicated in 1987 project proposal outline 4.

RESULTS: No injury to the blueberries was evident from the wiper applications. Dogbane plants were reduced in the crop year following mechanical wiper applications of dicamba or glyphosate. No differences between the chemicals or rates of application were detected.

CONCLUSION: Either glyphosate or dicamba will reduce dogbane stand without injuring blueberries if applied with a selective wiper applicator. The 5% rate was sufficient to reduce the dogbane stand and no increase in efficacy was obtained with the 10% rate.

RECOMMENDATIONS: Glyphosate at 5% applied by a selective mechanical wiper set above the blueberries and regulated not to drip may be used to suppress dogbane. Dicamba is not registered for this use. Data are have been submitted to support registration.

Table 1. Effect of mechanical applications of dicamba or glyphosate on dogbane. Blueberry Hill Farm, 1986.

Herbicide	Rate (%)	Dogbane 0.1m^2 Before	Dogbane 0.1m^2 After	Percent change
Dicamba	0	5.2	5.4	4
	5	6.5	2.1	-68
	10	6.1	1.4	-77
Glyphosate	0	6.8	4.8	-30
	5	5.4	2.8	-49
	10	7.3	2.0	-72
Contrasts		Significance		
Dicamba vs glyphosate		NS	NS	
5 vs 10% - glyphosate		NS	NS	
5 vs 10% - dicamba		NS	NS	
0 vs treatment		NS	**	

NS = nonsignificant, ** = 1% level of significance

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BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Integrated Weed Management

METHODS: As indicated in 1987 project proposal outline 5.

RESULTS: The percent cover of twenty two weed species, blueberries, grasses and open ground were determined in 1986 and 1987. The treatments had no significant affect on blueberry cover either year. Several species did show significant reductions and open ground increased with chemical treatments 1986 but mulch alone did not affect any species (Table 1). In 1987 dogbane, goldenrod, violets and grass was reduced with chemical treatments. Cinquefoil was higher and bunchberry was less when the mowed treatment is compared to the chemical treatment. Only violets and grass was less in the mulched plots. There was no affect of treatment on yield.

CONCLUSION: Many species in this study were not at high enough densities to get a detectable response. The lack of yield response may have been due to the low cover of blueberries and the injury to blueberries observed from the wiper treatments of glyphosate (yield averaged between 250 to 660 lb/a). In the mowed plot cinquefoil increased indicating that species spreading with a stolon would escape the mowing treatment. Of particular significance is the increase in bunchberry for the chemical vs cultural treatments indicating the resistance of bunchberry and its ability to increase when other weed species are suppressed.

RECOMMENDATIONS: An experiment with a greater density of sampling with either more replications or sites is needed for an accurate assessment of these treatments.

Table 1. Effect of treatment on blueberry and weed density - Jonesboro.

Treatment	Species (Percent cover)				
	1986				
	Blueberry	Blackberry	Violet	Sh Sorrel	Ind Pipe
Untreated(1)	32	0	8	0	1
Mow+Mulch(2)	46	1	8	7	4
Chemical(3)	40	0	0	0	0
Chemical+Mulch(4)	27	0	0	0	0
Significance	NS	B	B,C	B	B
	Grass	Ground			
Untreated(1)	40	17			
Mow+Mulch(2)	41	13			
Chemical(3)	0	35			
Chemical+Mulch(4)	0	40			
Significance	B,C	B			
	1987				
	Blueberry	Dogbane	Gld Rod	Bunchberry	Cinquefoil
Untreated(1)	42	6	0	23	13
Mow+Mulch(2)	45	4	1	10	23
Chemical(3)	37	0	0	28	<1
Chemical+Mulch(4)	35	2	0	30	2
Significance	NS	B,C	B	B	B
	Violet	Grass	Hawkweed		
Untreated(1)	8	29	3		
Mow+Mulch(2)	2	15	0		
Chemical(3)	2	8	0		
Chemical+Mulch(4)	0	<1	0		
Significance	A,C	A,C	C		

NS = nonsignificant
Significance of F test at 5% level or greater for:
A = Mulch vs none, treatment 1+3 vs 2+4
B = Chemical vs cultural, treatment 2 vs 3+4
C = Treated vs untreated, treatment 1 vs 2+3+4
Planned contrasts used to determine significance among treatments.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of Five Preemergence Herbicides for Control of Oat grass and Bunchgrass.

METHODS: As indicated in project proposal outline 6.

RESULTS: All herbicides except pronomade produced a significant reduction in grass vigor and height of the oat grass (Table 1). Hexazinone produced the greatest suppression at the lowest rate but also injured blueberries at the 4 lb/a rate. Hexazinone and terbacil suppressed bunchgrass growth and height and simazine reduced the height but atrazine application produced a slight increase in height (Table 1). Hexazinone caused visible injury at the highest rate.

CONCLUSION: Hexazinone provided the best suppression of either grass but terbacil, simazine and atrazine also provided control of oat grass. Bunchgrass was suppressed best by the 4 lb/a rate of hexazinone but control was far from complete.

RECOMMENDATIONS: Yield data needs to be collected before a final assessment can be made. Terbacil and simazine may be used to suppress oat grass but not bunchgrass. Atrazine provided good suppression of oat grass, but is not registered for use in lowbush blueberries. A postemergence herbicide combined with a preemergence application of a high rate of hexazinone may be needed to adequately control bunchgrass. A experiment to evaluate this treatment is needed.

Table 1. Effect of preemergence herbicide applications on blueberry and grass vigor, 1987.

Location	Herbicide	Rate lb/a	Rating (0-10) Grass	Rating (0-10) Blueberry	Grass height (cm)
Deblois (Oat grass)					
	Pronamide	0	0	0	61
		1	0.6	0	55
		2	1.6	0	54
		4	2.6	0	51
Significance			NS	NS	NS
	Hexazinone	0	0	0	55
		1	8.3	0	39
		2	8.5	0	17
		4	9.8	1.5	2
Significance			L**	L**	L**
	Terbacil	0	0	0	53
		1	8.2	0	23
		2	9.0	0	15
		4	9.6	0	4
Significance			L**	NS	L**
	Simazine	0	0.8	0	52
		4	2.9	0	53
		8	3.6	0	47
		16	6.6	0	36
Significance			L**	NS	L**
	Atrazine	0	2.0	0	50
		4	7.0	0	36
		8	8.5	0	25
		16	9.3	0	11
Significance			L**	NS	L**
Bucksport (Bunchgrass)					
	Pronamide	0	0	0	56
		1	0	0	52
		2	0	0	59
		4	0	0	59
Significance			NS	NS	NS
	Hexazinone	0	0	0	59
		1	0.3	0	54
		2	2.7	0	51
		4	6.8	0.7	38
Significance			L**	L**	L**

Continued next page...

Table 1. Continued.

	Terbacil	0	0	0	54
		1	0.5	0	51
		2	0.8	0	50
		4	3.5	0	41
Significance			L**	NS	L*
	Simazine	0	0.5	0	53
		4	0.0	0	55
		8	0.1	0	56
		16	1.5	0	48
Significance			NS	NS	L*
	Atrazine	0	0	0	52
		4	0.2	0	59
		8	0.4	0	58
		16	1.4	0	62
Significance			NS	NS	L*

Rating 0 = no effect, 10 = complete kill,
NS = nonsignificant, * = 5%, ** = 1% level

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Wiper Application of Dicamba for Woody Weed Control

METHODS: As indicated in 1987 project proposal outline 7.

RESULTS: No injury to blueberries was noted. Birch and cherry clumps were suppressed with a 20% solution of dicamba applied in mid-september with a hand-held sideswipe wiper (Table 1). Blueberry fruit samples were sent to a residue lab for analysis.

CONCLUSION: Dicamba will provide an alternative herbicide for spot-treatment of woody weeds. Registration is currently being pursued through the Sandoz Crop Protection, who hold the current label.

RECOMMENDATIONS: Dicamba should not be used until registered.

Table 1. Effect of hand-wiper applications of dicamba on birch and cherry on T-18, 1986.

Herbicide	Rate (%) v/v	Rating (0-10) Birch	Cherry
Dicamba	0	0	0
	20	8.8	9.2
		Significance	
Birch vs cherry		NS	
0 vs 20% dicamba		**	

Rating 0 = no effect, 10 = complete kill,
NS = nonsignificant, * = 5%, ** = 1% level

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BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Hexazinone (VELPAR) and terbacil (SINBAR) combinations for weed control.

METHODS: As indicated in 1987 project proposal outline 8.

RESULTS: Increasing rates of hexazinone reduced dogbane, bunchberry, St. Johnswort and bracken fern, with no significant affect on blueberry (Table 1). Higher rates of hexazinone were required for control of dogbane and bunchberry. The addition of terbacil only succeeded in reducing the grass density and did not improve the control of any other weeds.

CONCLUSION: Although this study was set up on a site with a previously high population of St. Johnswort, only a small population was found. Because of the low population, it is difficult to make any conclusion on the control of St. Johnswort in this study. However, high rates of hexazinone, i.e. 3 lb/a which is within the labeled rate, did suppress dogbane, bunchberry and bracken fern. The addition of terbacil did not provide any additional suppression.

RECOMMENDATIONS: Carry over and yield data need to be taken from this study before a final assessment may be made. Further experiments with hexazinone on bunchberry should be made with careful observations on blueberry injury to determine if a higher rate of hexazinone is justified.

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Table 1. Main effect of hexazinone and terbacil on blueberry and weed cover - Cooper, 1987.

Herbicide	Rate lb/a	Species Percent cover			
Hexazinone		Blueberry	Dogbane	Bunchberry	St. Johnswort
	0	59	26	17	4
	1	62	17	14	<1
	2	52	16	11	0
	3	55	3	3	0
Significance		NS	L**	L**	L*
Hexazinone		Bracken	Grass	Ground	
	0	6	3	9	
	1	4	<1	19	
	2	5	0	24	
	3	<1	0	33	
Significance		L*	L**	L*	
Terbacil		Blueberry	Dogbane	Bunchberry	St. Johnswort
	0	49	21	15	1
	1	62	17	8	1
	2	62	13	7	<1
	3	55	11	14	2
Significance		NS	NS	NS	NS
Terbacil		Bracken	Grass	Ground	
	0	4	3	22	
	1	3	<1	16	
	2	6	0	23	
	3	4	<1	23	
Significance		NS	L*	NS	

NS = Nonsignificant. ** = 1% level, * = 5% level, L = linear trend
Other species present but nonsignificant include rose, willow, aspen and blackeyed susan.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of Clopyralid and Lactofen for Bunchberry Control

METHODS: As indicated in 1987 project proposal outline 10.

RESULTS: These treatments had no effect on blueberry or bunchberry stand (Table 1). Some abnormal leaf growth on blueberries was observed from the high rate of clopyralid.

CONCLUSION: These materials did not control bunchberry.

RECOMMENDATIONS: This experiment should be terminated. No further carryover or yield results should be taken.

Table 1. Effect of clyopralid and lactofen on blueberry and bunchberry stand Jonesboro 1987.

Chemical	Rate lb/a	Blueberry Stems / quadrat	Bunchberry Stems / quadrat
Clyopralid			
	0	45	9
Preemergent	0.25	75	4
	0.5	52	10
Postemergent	0.25	59	6
	0.5	44	11
Significance		NS	NS
Lactofen			
	0	47	5
Preemergent	0.25	47	4
	0.5	41	3
Postemergent	0.25	47	1
	0.5	66	4
Significance		NS	NS

NS = nonsignificant

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BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of Postemergence Applications of chlorimuron for Bunchberry Control

METHODS: As indicated in 1987 project proposal outline 11.

RESULTS: The rating data indicate that both blueberries and bunchberries were injured as by increasing rates of chlorimuron applied either at emergence in May or at tip dieback in July. Higher rates of injury were obtained from the earlier applications. Injury consisted of a red coloration on the leaves and shorter plants but no tissue death was seen.

CONCLUSION: Comparing the pretreatment counts taken in 1987 to counts taken in 1988 will determine if this herbicide reduced the buncheberry stand. Stem counts and measurements of the blueberries are being made at Blueberry Hill Farm over the winter. These data combined with the yield data obtained in the summer of 1988 will indicate the effectiveness of this treatment.

RECOMMENDATIONS: The stem counts and yield data will be taken in the summer of 1988. More work with this herbicide will be contingent on the results. Researchers in Canada have had success, i.e. reduced bunchberry and increases in yield, with a closely related herbicide, sulfometuron methyl. Experiments with this herbicide should be initiated in Maine.

Table 1. Effect of timing of chlorimuron on blueberry and bunchberry, Jonesboro 1987.

Timing	Rate gm/ha	Blueberry	Bunchberry
		Rating (0-10)[a]	
Emergence - May			
	0	0	0
	18	2.6	1.4
	35	2.4	0.8
	70	5.2	4.0
	140	5.8	4.2
Significance		L**	L**
Tip dieback - July			
	0	0	0
	18	1.4	1.0
	35	1.2	0.8
	70	2.2	2.0
	140	1.4	1.4
Significance		L**	L**

a Rating 0 = no effect, 10 = complete kill, ** = 1% level, L =linear trend

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist
John M. Smagula, Professor of Horticulture

TITLE: Hexazinone seedling study.

OBJECTIVES: To determine the tolerance of blueberry seedlings to hexazinone.

METHODS: Blueberry seedling crosses 4161 x Augusta and Augusta x 4151 were planted and mulched with bark in May 1985 and dead plants were replaced in August 1986. Experimental design was a randomized complete block with 4 treatments, 8 replications and 10 seedlings of each cross in each block. Hexazinone was applied at 0, 1, 2 or 3 lb/a on April 4, 1986 and May 12, 1987. Seedling injury and weed control was rated in mid-August of both years by a scale of 0 = no effect and 10 = dead.

RESULTS: Blueberry seedlings were injured by all hexazinone treatments with injury increasing with rate but natural mortality was greater in the untreated than the 1 lb/a rate of hexazinone in 1986 (Table 1). Blueberry injury was greater in 1987 because of the late treatment date. No differences in injury was obtained between the two seedling crosses.

CONCLUSION: Some weed control was obtained using the mulch and the rates of hexazinone greater than 1 lb/a did not improve weed control appreciably.

RECOMMENDATIONS: Low rates of hexazinone should be used and treatments must be made before blueberry leaf break to avoid injury to newly planted seedlings.

Table 1. Effect of hexazinone on blueberry seedlings, Jonesboro

Hexazinone Rate lb/a	1986		1987	
	Blueberry Injury %	Weed Control %	Blueberry Injury %	Weed Control %
0	16	31	4	34
1	5	94	27	92
2	28	93	54	97
3	41	98	62	99
Significance	Q*	Q**	L*	Q**

Q = quadratic trend, * = 5% level, ** = 1% level.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist
John M. Smagula, Professor of Horticulture

TITLE: Seedling Pruning Study

OBJECTIVES: To determine the number of years seedlings need to be establishmed before the initial pruning to provide optimal survival and spread.

METHODS: Seedlings of 4161 x Augusta and Augusta x 4161 were planted into a cultivated field at Blueberry Hill Farm in May 1985. Plants were mulched with bark in June. Plants will be flail-mowed 2, 3 or 4 years after planting and then every 2 years after that. Treatments will be evaluated by subjectively rating plant spread using a modified Daubenmeyer scale.

RESULTS: Results will be presented once all treatments are made.

CONCLUSION: Data from this study may be used to determine the optimal time to mow after plants have been interplanted into native fields.

RECOMMENDATIONS: Will be made when study is completed.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Effect of bracken fern on blueberry yield.

OBJECTIVES: To determine the effect of bracken fern density and cover on blueberry yield.

METHODS: Blueberries were mechanically harvested from 20 strips at Blueberry Hill Farm, and 2 fields on T-18 under different densities of bracken fern. Yields were weighed from each strip and number of fronds counted on two 1 meter subplots and the cover estimated using a Daubenmeyer cover scale. A regression equation was developed for each field by plotting density or cover against yield.

RESULTS: Highly significant reductions in yield were obtained with increases in fern frond density per square meter or percent cover (Figure 1 and 2). Differences in slope among locations were greater using the density measure than the cover method. Blueberry yield loss was greater on the higher yielding field.

CONCLUSION: These data give an indication of how much bracken fern will reduce blueberry yield.

RECOMMENDATIONS: Further research on the control of bracken fern is justified.

Figure 1

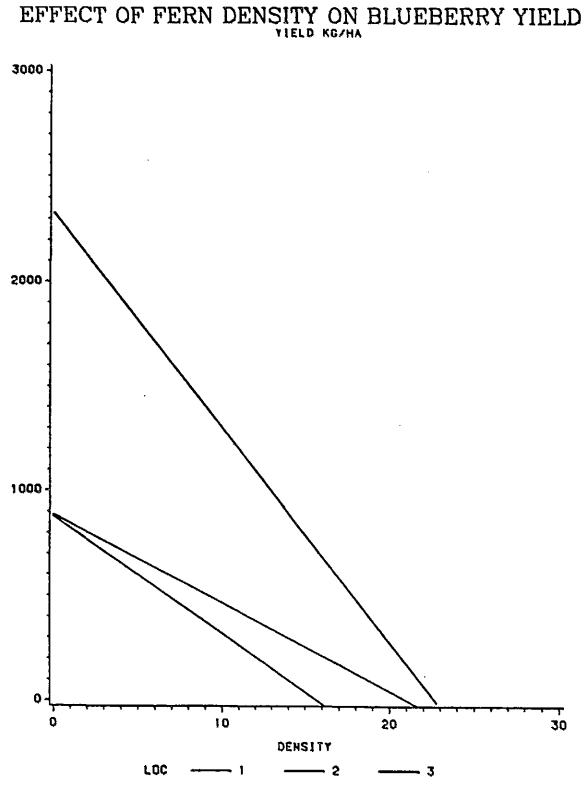
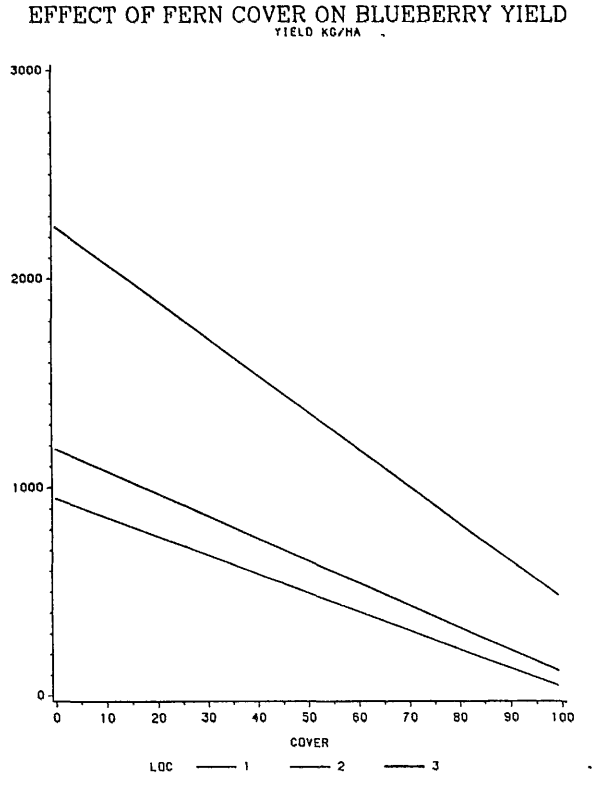


Figure 2



BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1988

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of two mechanical harvesters vs hand raking of lowbush blueberries.

OBJECTIVES: To compare hand raking, the Darlington harvester and the Nimco prototype for speed, recovery and quality of blueberries.

METHODS: The experiment was conducted at Blueberry Hill Farm, Jonesboro on August 13, 1987. The experimental design was a split-plot (3 machines /plot), replicated 4 times with each operator using all machines in each plot to give a total of 36 plots. Plot size was 0.6 by 15 m. Each of three operators harvested a plot with all of the three machines. Time to harvest was recorded when the operator finished. Blueberries were weighed at the end of the day. Samples for each operator were combined and blueberries were cleaned the following day using a fresh pack cleaning machine, only the number of Grade A Fresh Pack were counted.

RESULTS: The use of a hand rake resulted in a greater recovery of blueberries but required five to ten times longer than machine harvest (Figure 1 and 2). Yield range 2112 to 10153 kg/ha with a mean yield of 5162 kg/ha. The Darlington harvester produced a greater percentage of acceptable fresh pack berries, but all of the methods produced less than 50% recovery (Figure 3).

CONCLUSION: Mechanical harvesters recover less berries on high yielding fields than hand harvest but take less time. Methods of hand and mechanical harvest would have to be changed to get a more accurate assessment of the potential for use in fresh pack.

RECOMMENDATIONS: More extensive data and an economic analysis is needed to fully evaluate these machines.

Figure 1

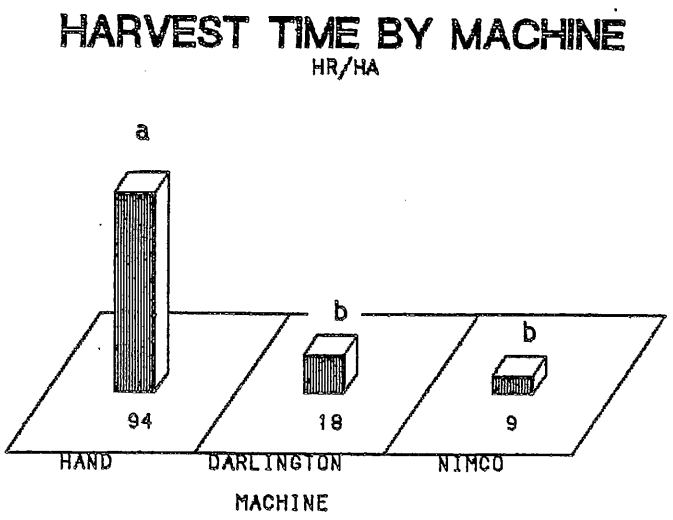


Figure 2

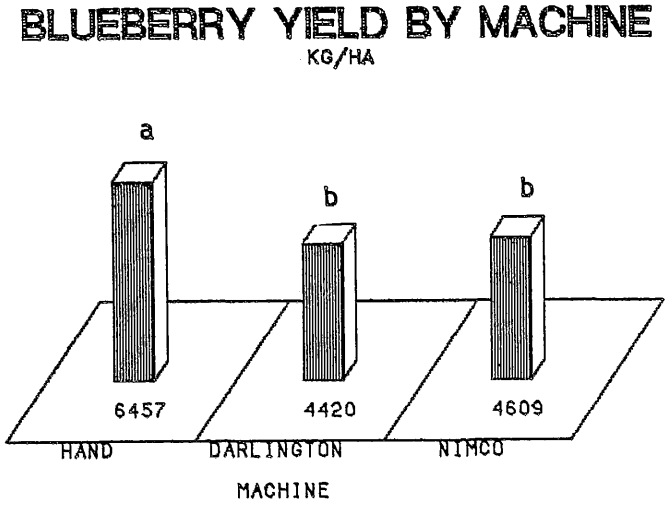
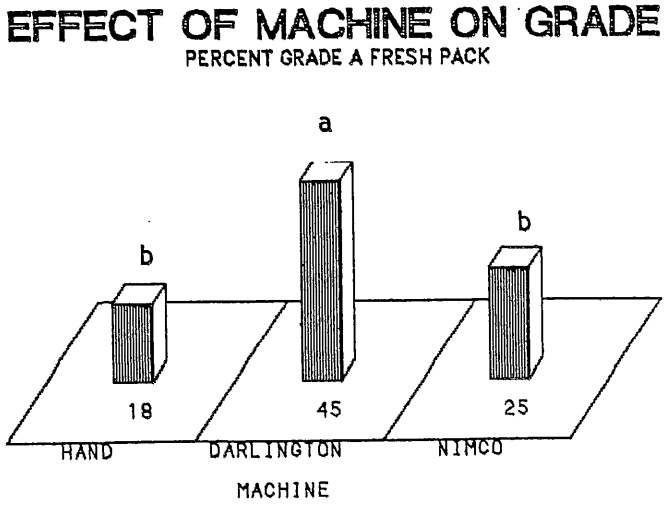


Figure 3



BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

DATE: 21 December 1987

INVESTIGATOR: M.F. Trevett

TITLE: A Comparison between Flail and Rotary Pruning.

METHODS: Paired plots were used, with, where possible, 20 replicates.

RESULTS: When you remember last year's results and combine them with this years, you may come to the conclusion that this research is in a state of chaos. Note quite--though progress is in a sort of hit or miss. The reasons for this is first, some relationships have to wait for a year or two to become visible, and second, that some of the techniques react on one another in ways not foreseen. This means that you have to start all over again, and take into account these unforeseen relationships in your experimental design.

One thing seems apparent: there is not the great difference between flail and rotary pruning that I had expected, so far anyway.

If you are going to change your height of pruning you might first change the height (length) of stem.

Comparing low pruning with high pruning: the high pruned stems have about double the number of branches that the low pruned have the pruning year.

High flailing (three inch or more stubs) and low flailing (one inch or lower stubs) produce the same number of fruit buds per stem, on the average the pruning year.

High flailed and high rotary pruned stems produce about the same number of fruit buds per stem for second crop yields.

In 1988 a comparison will be possible of the effect of high flailed with low flailed on production of fruit buds for second crops.

Post harvest sprays of nitrogen in 1987 did not prolong growth into late September as in 1986. The reason? Not known. The addition of phosphorus, potassium and several trace elements to the nutrient spray in 1987 did not change the response.

As has long been suspected, in 1987 some evidence was obtained showing that the success of producing a large second crop in a three year cycle depends on the total amount of fertilizer applied during the cycle, and the timing of the fertilizer application: whether the timing refers to a) year in the cycle or b) season of the year.

Mechanical stimulation did not induce as much lateral formation as had been anticipated.

Under results for 1987 I point to the Revision of 1979 Recommendations that has been sent to you under separate cover.

Below is a statement that to me has important consequences, or potentially important consequences, on the future of fertilizer research in lowbush blueberries.

A STATEMENT ON DEVELOPING A SOIL TESTING PROGRAM

FOR LOWBUSH BLUEBERRIES

M.F. Trevett
17 December 1987

1. Lowbush blueberry growers need an effective, efficient, and uncomplicated soil test program.

2. At present there are two potential procedures:

   A. Trevett's four-inch sample. This uses the conventional technique of taking four-inch deep by one-inch wide solid cores. All the material in the core that will pass a two millimeter sieve is retained and an aliquot of it sent to the Soils Laboratory, Deering Hall, University of Maine, Orono.

   B. The Smagula-DeGomez organic matter sample method by their own admission is about 6 years away from grower use--provided of course that the method proves better than the four-inch.

3. I suggest, therefore, that the four-inch method be put in place for grower use beginning in 1988.

4. In the development of the organic matter sample method I suggest that in addition to the supervision given by the lowbush Blueberry Advisory Committee another body be added:

   A soils committee comprised of members of the Plant and Soils Science Department. Included in this committee would be:

   The current chairman of the department, and
   Professor Robert Rourke
   Doctors: Glenn
   Fernandez
   Langille