Winter 1989

Blueberry Advisory Committee Research Report

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BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1988 to March 1989

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

Title: Monitoring methods, economic injury levels, and action thresholds for blueberry spanworm larvae in vegetative year fields (part of research proposal titled "Economic thresholds and control of secondary blueberry pests")

Methods:

This study involved 2 related objectives, (1) to compare the effectiveness of different methods in determining the presence of spanworm larvae in vegetative year fields, and (2) to define economic injury levels and action thresholds by comparing blueberry plant injury with numbers of spanworm larvae.

Monitoring Methods

Two procedures were studied to determine their potential usefulness to growers as aids in determining the presence of damaging spanworm larval populations in mowed fields. Fields were located which were infested with large populations of spanworm adults in 1987; fields were flail-mowed in 1988.

Litter samples - One pint of litter was collected by hand from each of several locations and placed in individual screened containers. Fresh blueberry foliated stems from the greenhouse were placed in each container and samples were observed periodically for the presence of insects or feeding damage.

Burning small areas in flail-mowed fields - In April, 1988, one hard burn (1 mph tractor speed) and one scorch burn (3 mph) plot were set up in each of 5 fields. Each plot measured 25 X 75 feet, with a 25 X 75 ft mowed area between and surrounding the 2 burned areas. Burned, mowed, and scorched plots were observed periodically, and plant growth and development (number of new stem buds and average stem height) were compared among the plots.

Economic Injury Levels and Action Thresholds

The number of spanworm larvae present in sweep-net samples and from a visual survey of ground litter was compared to blueberry plant growth and development.

Three 1-sq-ft wooden frames divided into quarters were placed along the midline of each burned, mowed, and scorched plot. In 1 quarter of each frame, records were kept of number of emergent stems, average stem height, and number of spanworm larvae visible on the litter and soil surface. Within each 25 X 75 ft plot, 3 sets of 10 sweeps with a standard 12-inch sweep net were also taken. When larvae were no longer found in sweeps or by visual observations, all stems in 1 quarter of each frame were cut for more exact counts of stem and branch length, remaining leaves, and % leaf damage; this procedure was repeated towards the end of the season to measure stem and branch lengths, number of leaves, and number of leaf and flower buds. Plant measurements and insect counts were recorded at ca. 3 to 5 day intervals.

Results:

Spanworm larvae were recovered from 2 litter samples taken from fields ultimately severly damaged by spanworm feeding in 1988. Although 2 other fields also had subsequent large spanworm populations, no larvae were found in litter samples.

There was an apparent delay in plant growth in mowed areas as compared to burned and scorched plots in 2 of 5 fields. Delay in growth in 1 mowed field was particularly striking; little or no above ground growth occurred until spanworm larval populations declined. Examination of the rhizomes showed that the new stems were being eaten as they sprouted.

Feeding damage as indicated by plant growth and development was minimal in the 5 burned plots. Counts of spanworm larvae in these plots were <3 larvae per 10 sweeps and <1 per 0.25 sq ft ground litter. Four of 5 scorched plots were similarly undamaged, again with <3 larvae per 10 sweeps and <1 per 0.25 sq ft. One scorched plot sustained moderate damage; spanworm counts averaged 5.3 larvae per 10 sweeps and <1 per 0.25 sq ft. Plant development (emergent stems) was delayed in 3 mowed plots; numbers of spanworm larvae averaged 3.1 to 3.7 per 10 sweeps (<2 per 0.25 sq ft). There were <3 larvae per 10 sweeps (<1 per 0.25 sq ft) in the 2 undamaged mowed fields.

Preliminary findings indicate a substantial reduction in numbers of flower buds in those fields where spanworm feeding delayed blueberry plant development.

Conclusions:

Detecting spanworm populations in vegetative year fields by observing litter samples is unreliable. Eggs may not be present in the litter, or larvae may not make their presence known.

Burning small areas of mowed fields can be useful as a method of detecting the presence of large spanworm populations. A hard burn will kill many overwintering eggs and reduce subsequent larval populations and feeding activity. Mowing as a pruning practice does not kill the eggs. If spanworm populations reach high enough levels in mowed fields, plant development may be delayed and flower bud set affected. Using sweep-net samples is the most practical method of determining actual larval population levels even on pruned areas; counts of 3 to 4 spanworm larvae per 10 sweeps may result in a significant delay in plant growth. Visual examination of ground litter does not give a consistent and easy indication of actual population numbers.

Recommendations:

Early season detection of insect pest populations in vegetative year fields is critical. Sweep-net sampling and burning small areas for stem growth comparison are useful methods of detecting spanworm larvae. Sweep-net sampling is also the most practical method of determining if and when chemical control measures should be applied. An economic injury level for vegetative year mowed fields may be between 3 and 4 larvae per 10 sweeps (this is a very tentative threshold!).

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1988 to March 1989

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

Title: Control of secondary blueberry pests (part of research proposal titled "Economic thresholds and control of secondary blueberry pests")

Methods:

Surveys, grower reports, and field observations were used to locate secondary pest insect populations.

Laboratory Tests

Insecticides were screened in the laboratory to determine their relative effectiveness against different blueberry pests for which few or no recommended controls are known. Square-foot patches of blueberry plants were treated with insecticides using a small hand-pump sprayer at a rate of 23 gallons of water-mixture per acre. Treated stems were cut, brought into the laboratory, and placed in small vials of water stoppered with cotton around each stem. Insects were placed in small screened cages with a vial of treated stems. A single cage constituted a replication; there were 3 replications per treatment. At indicated hours after insects were introduced into the cages, a knockdown count was made of dead or inactive insects. Reduction of feeding activity was also noted.

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 per treatment were used. Each plot measured 23 X 23 ft with 5 or 10 ft untreated buffer strips between plots. Each plot was treated with a hand-held, CO_2-propelled sprayer operating at 35 psi, and delivering 25 gallons of water-mixture per acre. Pounce granules were shaken from a clear plastic container covered at the top with 16-mesh screening to act as a sieve. The material was mixed with 1.0 lbs wheat bran per plot to facilitate even distribution over the plot area. On a pre-treatment and various post treatment dates, insects in each plot were counted by taking 5 or 10 sweeps with a standard 12-inch sweep net around the center area of each plot. After the live insects were counted, they were spread back over the same plot.

In the control test on spanworm larvae in pruned fields, insects were monitored by (1) sweep-net samples, (2) counting the number of larvae per sq ft of ground/litter surface, and (3) measuring blueberry plant emergence and development.

Results:

Under heavy insect population pressure, Dipel and Dylox, both short residual insecticides, performed fairly well against the various insects; a reduction in feeding was also noted. Marlate gave better control of sawfly and flea beetle than of spanworm; control of grasshopper nymphs was also poor with this material. Imidan and Guthion good to excellent control of most insects tested.

In addition to the registered materials listed in Table 1, an unregistered insect growth regulator performed fair to poorly on larvae of the spanworm, sawfly, and flea beetle, in both laboratory and field tests. It did seem to reduce spanworm feeding, however.

A variety of Bacillus thuringiensis (san diego) did fair to poorly on flea beetle and sawfly larvae.

Pyrethroids, not registered for blueberries, again showed good promise: Asana for grasshoppers (lab. tests), Spur for spanworm, flea beetle, and sawfly larvae (lab. and field tests), and even grasshopper nymphs (lab. test). Two other unregistered insecticides, Rotacide and Zolone, seemed to give good control of flea beetle and spanworm larvae.

Conclusions:

It was apparent in 1988, that short residual insecticides which are relatively non-toxic to honey bees, do not give long-term protection against huge insect populations; frequent and costly repeat applications are necessary. The most effective insecticides for use against prevalent foliage feeding pest insects such as spanworm and flea beetle continue to be the organophosphates Imidan and Guthion, which are also toxic to honey bees. Tests do confirm, however, that some unregistered insecticides show promise for control of certain blueberry pests.

Control data on other secondary pests, for example, thrips, leaf tier, and leaf beetle, were not collected due to the generally low population levels of these insects in 1988. Further research is necessary before recommendations can be made.

Recommendations:

Recommendations for control of blueberry spanworm larvae during the long bloom period will continue to be for Dylox, Marlate, and Dipel. It is apparent that repeat applications will be necessary for vigorous insect populations. Imidan or Guthion can be used if the larvae reach the action threshold, and after bees are removed from the field.

Sawfly and flea beetle larvae, and flea beetle adults, can be controlled very well by Marlate during bloom, and Imidan at post bloom.

Although Dylox and Marlate can be used during bloom, some bee kill will occur, especially if these insecticides are used when honey bees are actively foraging.

Table 1

BLUEBERRY INSECT CONTROL [a]

Laboratory Tests

Insect [b]	Dipel (2 rates)	Dylox (2 rates)	Imidan (16 oz)	Imidan (32 oz)	Marlate (48 oz)	Guthion (2 form.)	others
Spanworm L.	F *	G *					
Spanworm A.		G				G	Malathion (16 oz)-VG Sevin 4XLR (2 rates)-G-VG
Sawfly L.		VG					
Flea Beetle L.			E			E	
Flea Beetle A.		E	E		E	E	Sevin 4XLR (32 oz)-E
Grasshopper N.		VG		E	P		Marlate (64 oz)-VG
Grasshopper A.		G		G			

* Dylox and Dipel seemed to reduce feeding by spanworm L.

Field Tests

Spanworm L. (crop-year)	P-F	G-VG	G-VG		P		Marlate (80 oz)-P-F
Spanworm L. (vegetative year)		F	G			VG	
Flea Beetle L.		F	E		E		
Sawfly L.		E	E		E		

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

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

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1988 to March 1989

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

Title: Control of blueberry maggot

Methods:
All materials were applied at 40 psi in 15 gallons of water-mixture per acre with a CIMA® P55D Atomizer L. V. sprayer mounted on a 674 International® tractor driven at 2 mph. Control evaluation was based on sampling ripening berries in various areas within and around each plot and processing for maggots.

General Insecticides

The development of an alternative control for the blueberry maggot to lessen the hazard and drift problems associated with Guthion was an important priority again in 1988. Four materials which had shown promise in previous years were further evaluated for effectiveness in reducing maggot populations. Each material was applied to 1, 100 X 100 ft plot, which was surrounded by an untreated buffer zone.

Insecticides Plus Nu-lure Insect Bait

Guthion, with and without Nu-lure insect bait, was tested in an attempt to verify the attractiveness and control of blueberry maggot with insecticides and Nu-lure on lowbush blueberries. A randomized design with 1 replication of each treatment was used; plots measured 100 X 100 ft.

Results:
The most effective material, comparable to Imidan, was 3 applications of malathion. Although Zolone (2 applications) was also effective initially, residual activity was less. Long-term residual activity did not appear to be lacking in 1986 or 1987. The pyrethroids, Asana and Ambush, seemed to offer some promise. Zolone, Asana, and Ambush are not currently registered for use on blueberries.

Due to very low maggot populations again in 1988, no definitive results were obtained for combinations of Nu-lure and insecticides. Counts in 14 of 24 and 22 of 24 samples taken in adjacent untreated areas ranged from 0 to 1 maggot per quart on 8/9 and 8/17, respectively.

Conclusions:
Blueberry maggot populations were generally low and conclusions must be tentative. Results from the last 3 years indicate that 3 applications of malathion, or 2 applications of the unregistered insecticide Zolone, may be as effective as Imidan and Guthion in controlling blueberry maggot. While Asana and Ambush continue to show promise, neither appears as effective as the other materials tested.

Recommendations:
As in 1987, Guthion and Imidan remain the best registered insecticides for controlling blueberry maggot; 3 applications of malathion appears to be almost as

effective. In addition, Zolone continues to show promise as a possible alternative control and should be pursued through IR-4 for minor crop registration. It might be appropriate to test a combination of 2 applications of malathion and Nu-lure on a vigorous maggot population. The attractive power or Nu-lure, and its effect in combination with insecticides is still a question mark in our research on lowbush blueberries. No recommendations are possible, though data on Nu-lure from prior years seem to indicate promise in this area of research.

Table 1.

Material (amt. form./acre) [a]	Percent control of blueberry maggot [b]		
	1986	1987	1988
Asana (3 oz)	-	?	-
Asana (3.5 oz)	-	-	55
Asana (4 oz)	-	?	-
Ambush (12 oz)	49	?	58
Ambush (16 oz)	-	68	-
Zolone (16 oz)	79	82	62
Imidan (16 oz)	-	94	94
Imidan (32 oz)	59	80	-
Guthion (16 oz)	-	96	-
Malathion (2 applications)(16 oz)	10	-	-
Malathion (3 applications)(16 oz)	81	-	73

[a] Insecticides not registered for use on blueberries include Asana, Ambush, and Zolone.

[b] Average % control based on 2 sample dates; 1986 = 8/13 + 8/21; 1987 = 8/4 + 8/13; 1988 = 8/9 + 8/17.

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

BLUEBERRY ADVISORY COMMITTEE

RESEARCH REPORT

Date: April 1988 to March 1989

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

Title: Effect of pruning practices on blueberry insect abundance

Methods:

Due to a change in ownership, plots established in a field at Jonesboro in 1985 were not available for insect survey in 1988.

In 1988, 5 other fields were located which had large mowed areas adjacent to large burned areas. Three of the fields were pruned (vegetative year) and 2 were bearing (crop-year). In each field, 5 sets of 10-sweep samples were taken along each of 3 or 4 transects measuring ca. 100 ft long. The number of each type of insect captured in each set of 10 sweeps was recorded. The same fields were also monitored for spanworm adults beginning in June. On each of several dates, the number of adults at each location was determined by taking 5 sets of 10 paces along each transect and recording the number of moths flushed into flight.

Results:

A major outbreak of blueberry spanworm caused extensive damage in 1988. Most severe damage appeared to be to flail-mowed vegetative fields. Due to this outbreak, the insect survey areas, which were located in commercial blueberry fields, were treated by the growers with various insecticides which generally reduced all insect populations. Some trends were still apparent, however. Sawfly larvae and spanworm larvae were more prevalent in mowed than in burned fields. Grasshopper nymphs seemed to be a little more prevalent in burned areas, and spiders were possibly more apparent in mowed fields (Table 1).

Conclusions:

It is now becoming increasingly evident that flail mowing, when used as a management practice, can have a significant effect on insect populations. Certain pest insects, when present, are more likely to be found in higher numbers in mowed than in burned fields; most notably those insects which over-winter in the litter. Spanworm, sawfly, and flea beetle have shown this tendency.

Recommendations:

The importance of early detection of insect pest populations can not be over-emphasized. It is critical for growers to monitor their fields carefully, especially early in the season and during the entire bloom period. Sweep-net sampling has proven to be the most practical method of monitoring crop-year fields. Potential methods of monitoring vegetative year fields include sweeping burned or unburned stems, visual observation of new stem emergence and growth, and burning small areas for observation. It is possible to control pest insect outbreaks and minimize damage if potential problems are discovered early and control measures are undertaken promptly.

Table 1

Abundance of significant insects. 1988.

Insect [a]	Sample dates	Insects collected per 50 sweeps			
		3 Fields (vegetative)		2 Fields (cropping)[b]	
		Mow	Burn	Mow	Burn
Sawfly L.	6/3 - 6/10	0.6	0.2	4.1	0.0
Spanworm L.	5/5 - 5/27	3.9	0.5	5.1	3.2
Spanworm A.[c]	6/6 - 7/26	7.7	2.5	3.4	4.6
Grasshopper N.	5/24 - 6/11	2.8	3.5	2.6	4.2
Spiders	5/5 - 6/10	2.1	1.6	0.8	0.7

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

[b] the cropping fields were pruned in 1987.

[c] moths per 50 paces.

MAINE BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT FOR 1988

DATE: January 16, 1989

INVESTIGATOR: David Lambert

TITLE: Survey of Fungi Contaminating Lowbush Blueberries

METHODS: Three sets of samples (a total of 50) were collected on August 12, 18 or 26 from the receiving rooms of Merrill, Wyman, and Cherryfield Foods, or from several supermarket or roadside sources. Half of each sample was rinsed in 10% Chlorox for two minutes, with stirring. Surface sterilized and nonsterilized samples (216 berries each) were placed on hardware cloth grids in moist enclosed chambers (disposible aluminum cake pans with plastic tops). The berries were left at room temperature for a minimum of three weeks. Over this period, infected berries were removed and their type of fungus was recorded. Extra berries were frozen, and samples of these will be heat-treated at 185 ^{o}F for 20 minutes to screen for heat-tolerant fungi.

RESULTS/CONCLUSIONS: The relative frequency of isolated fungi is given in the pie graph (Fig. 1). The incidence of each of these fungi in the 50 samples is broken down in Fig. 2, with the samples consolidated into classes having 0%, < 1%, 1-5%, 5-10%, or > 10% of berries affected (of the total 432 berries per sample). Botrytis cinerea, which causes blossom blight, was found in 96% of the samples, with an average incidence of 3% of all berries affected. None of the thirty Botrytis isolates tested was tolerant of benlate. Glomerella cingulata, which causes "anthracnose" was nearly as common (78% / 3%). This fungus also causes a blossom and twig blight, and its relatively high frequency in fruit suggests that it may also be causing damage misidentified as Botrytis blight or mummy berry. A third unidentified fungus, refered to here as "acervulus" was also common. Like Glomerella, it produces a number of of acervuli fruiting structures which rupture through the berry skin. This fungus may be a recognized blueberry pathogen such as Gloesporium, previously thought to infect only twigs or leaves, or it might be a known pathogen of related species, such as cranberry. We are pursuing its identification. Alternaria species were present in most samples. At least five Penicillium species were isolated from berries. One of these produced (heat-tolerant) sclerotia. The fungi Trichoderma, Mucor, Rhizopus, and Aspergillus were also found.

In a dozen samples, soft berries were separated from initially sound berries to determine if fungi were causing rots or berry softening evident at at harvest. In these samples, berry infection was at least as frequent in sound berries, indicating that softening was probably physiological in most cases.

With the exception of Penicillium, these fungi appear to have little effect on the quality of processed fruit. In general, a minimum of several days at room temperature were required for molds to develop. This lag time retards visible problems in fresh-marketed berries. Alternaria is considered the worst problem for the fresh market as it spreads from berry to berry. It is controlled in highbush plantings by repeated fungicide treatments while fruit is developing.

RECOMMENDATIONS: Excepting the two unidentified species, the incidence of fungi in lowbush fruit is similar to that for highbush fruit grown in Northern areas. Without a perceived market problem, additional chemical control methods should not be taken. A better understanding of how and when Penicillium sclerotia develop and contaminate fruit would be useful.

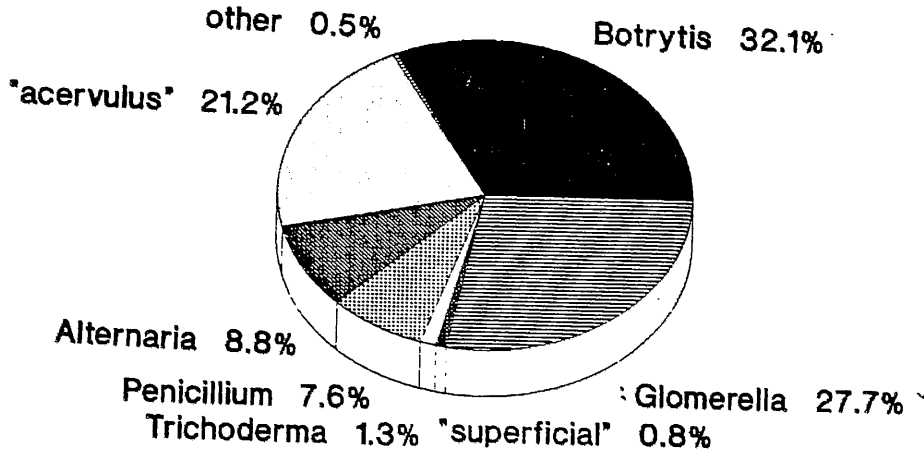
PROJECTED RESEARCH

1) This year I will be rating mummy berry disease at two mow/burn sites. Results from 1989 will be analysed with those from 1987 to give a more accurate estimate of the effects of burning, and to see if the pattern of severity in 1989 matches that for 1987.

2) Small test plots will be inoculated with the two unidentified fungi isolated from berries to determine if they also cause twig, blossom or leaf symptoms.

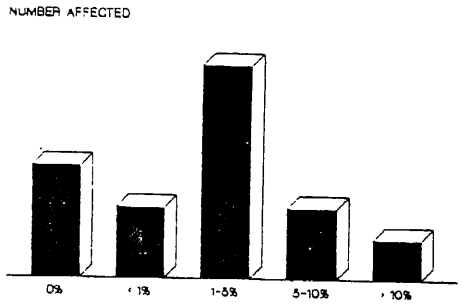
3) Rearch with Penicillium is continuing.

FUNGI CAUSING FRUIT ROT

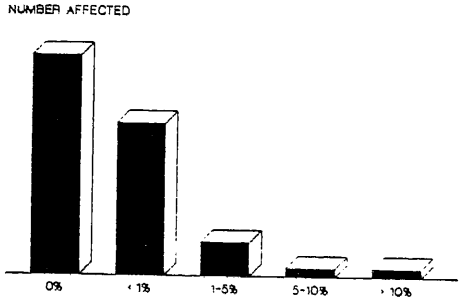


INCIDENCE OF FRUIT-ROTTING FUNGI
(% of Berries Affected, 50 Samples)

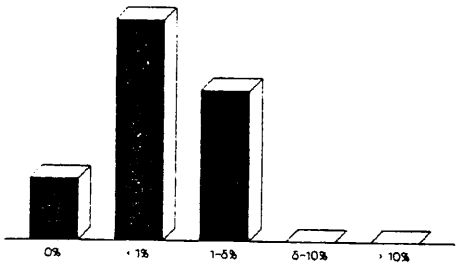
GLOMERELLA



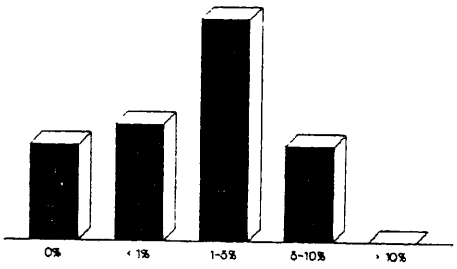
PENICILLIUM



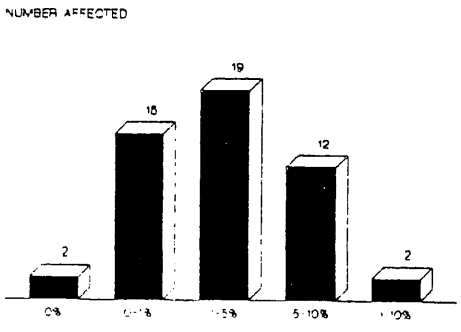
ALTERNARIA



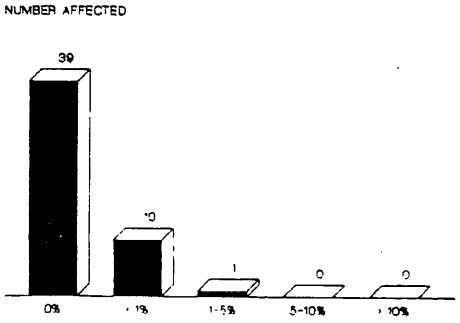
"ACERVULUS"



BOTRYTIS



TRICHODERMA



BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATORS: JOHN M. SMAGULA

Cooperators: TOM DEGOMEZ
SUSAN ERICH

TITLE: NUTRITION SURVEY 1988

METHODS: Please refer to 1988 project proposal outline PROJECT -1.

Changes in procedures include:

- No samples were taken at Extension field demonstrations.
- A total of 48 fields were sampled compared to 27 in 1987.
- Only 3 strips were sampled at each field.
- Two types of soil samples were taken; the organic pad and a 3 inch sample was taken. Ten samples were taken per strip and the depth of the organic pad was recorded.

RESULTS:

Leaf analysis

Forty eight growers' fields were sampled in 1988. Only 2 fields had nitrogen leaf tissue concentrations lower than 1.6%, the currently accepted standard (figure 1).

One field was low (less than .400%) in potassium (figure 2). In contrast, only 4 fields had phosphorus leaf tissue concentrations above the satisfactory level (above .125%) (figure 3).

Magnesium levels appear in figure 4 and indicate only 1 field was below the satisfactory level.

Calcium levels (figure 5) were above the satisfactory level in all fields sampled.

Iron levels were below the standard (50 ppm) in about half of the fields (figure 6).

Boron levels were below the current standard of 20 ppm in 8 fields (figure 7).

All fields were below the standard for zinc concentration (figure 8).

Soil analysis

The nutrient elements in the organic pad and a 3 inch sample were analyzed. When the organic pad was sampled, the depth of the organic pad was recorded for each sample.

The average depth of the organic pad in each field is presented in figure 9. The depth varied considerably but the 30 samples (10/strip) should be representative of the organic pad in the area sampled. Figure 10 shows that most of the fields had an average depth of 1/2, 3/4, or 1 inch.

The soil data has not been tabulated and put in graphic form.

Conclusions:

Phosphorus is the only major nutrient element which seems to be lacking in the majority of fields sampled. Nitrogen and potassium are present at satisfactory levels in leaf tissue samples from most blueberry fields.

Recommendations:

Promote the use of leaf tissue analysis by growers to determine fertilizer needs.

Test the accuracy of the phosphorus standard through proposed phosphorus dose/response study.

Determine yield response to added phosphorus in a range of field conditions through the phosphorus dose/response study.

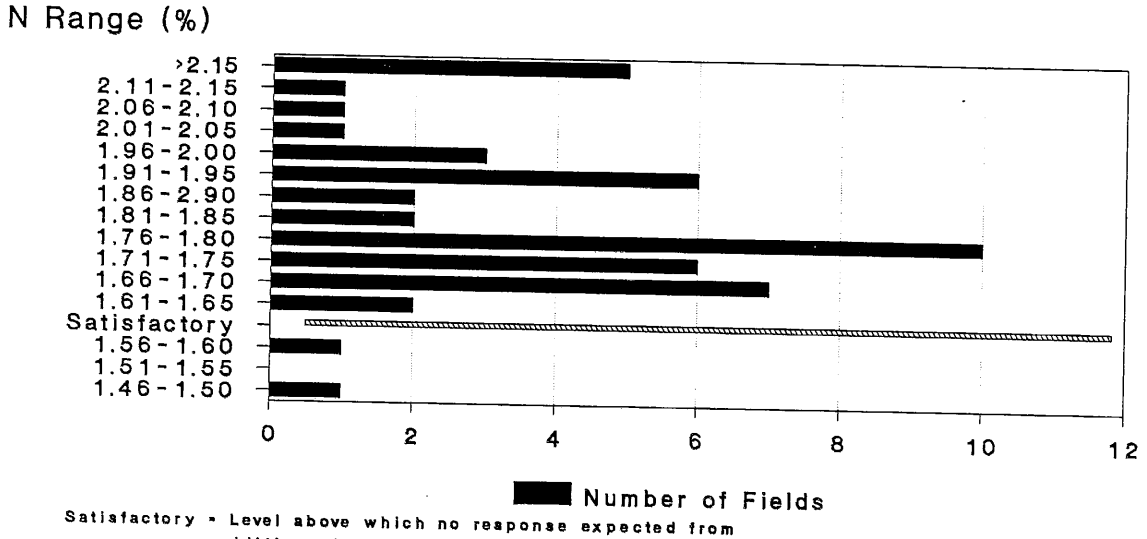
If technical assistance becomes available:

a. Continue nutrition survey to locate fields low in nitrogen for a future nitrogen dose/response study.

b. Establish a series of studies to determine responses to minor elements such as boron, calcium, iron.

Figure 1

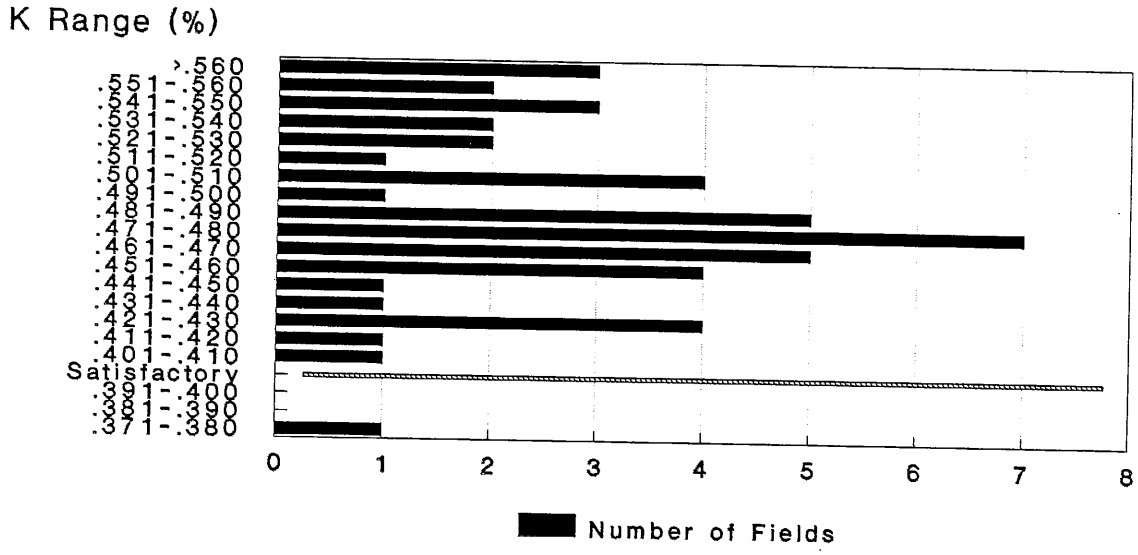
Nutrition Survey -1988
Nitrogen



Satisfactory = Level above which no response expected from addition of nitrogen

Figure 2

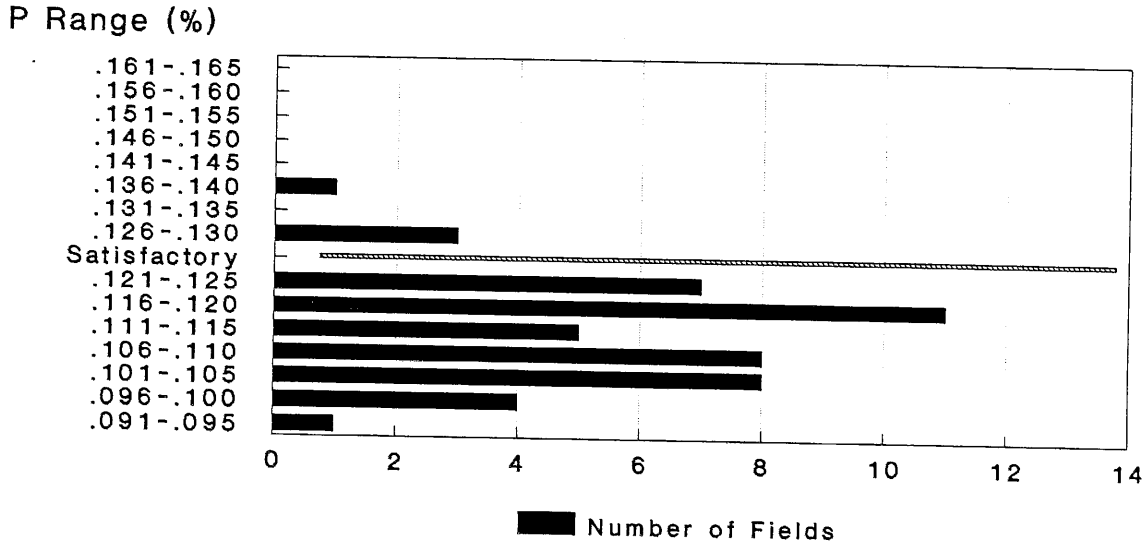
Nutrition Survey 1988
Potassium (K)



Satisfactory = Level above which no response expected from adding potassium

Figure 3

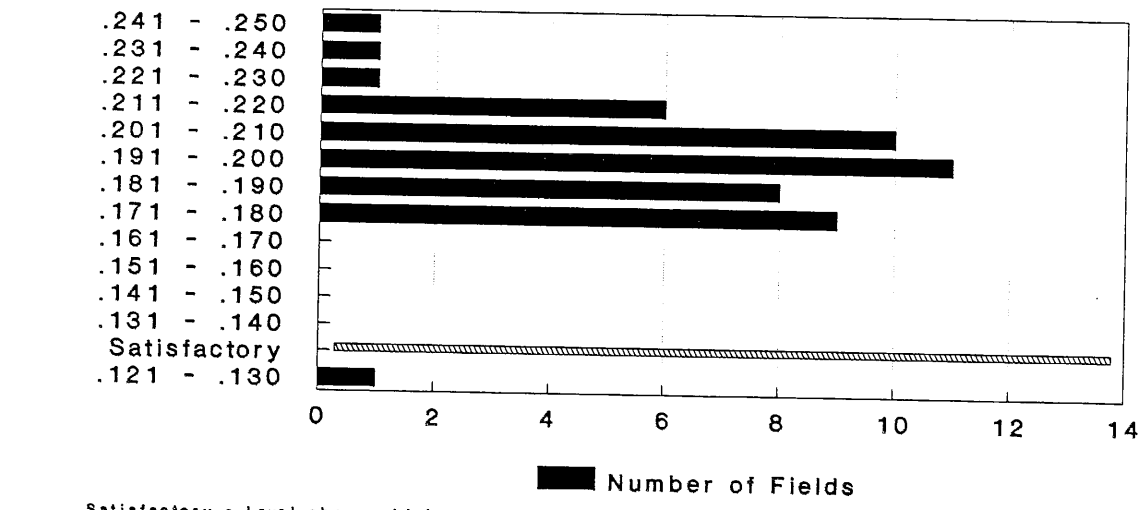
Nutrition Survey 1988
Phosphorus (P)



Satisfactory = Level above which no response expected from adding phosphorus

Figure 4

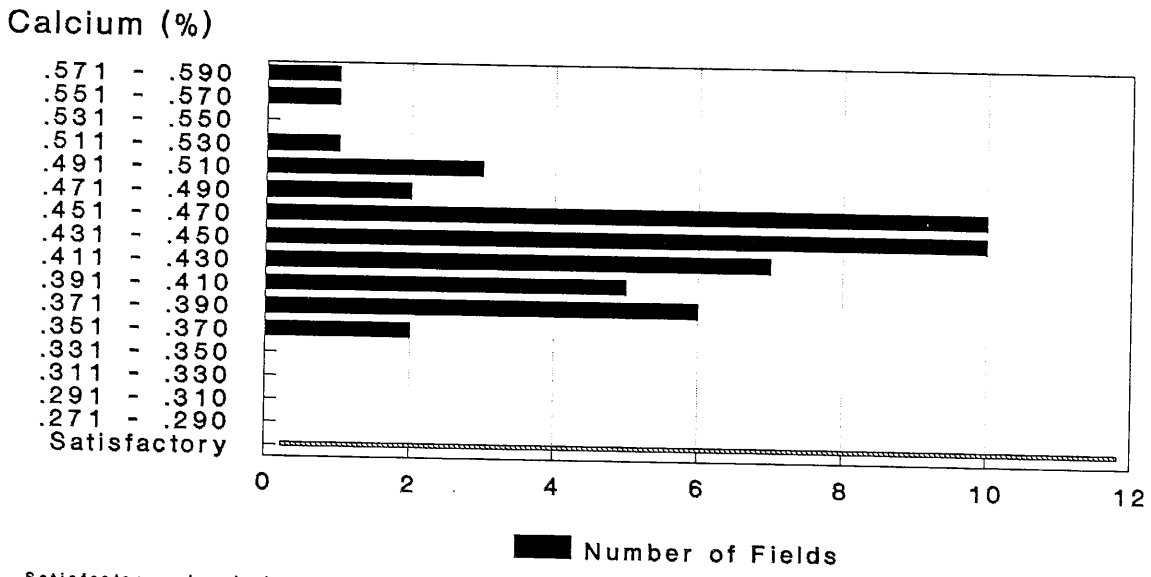
Nutrition Survey 1988
Magnesium



Satisfactory = Level above which no response expected from addition of magnesium

Figure 5

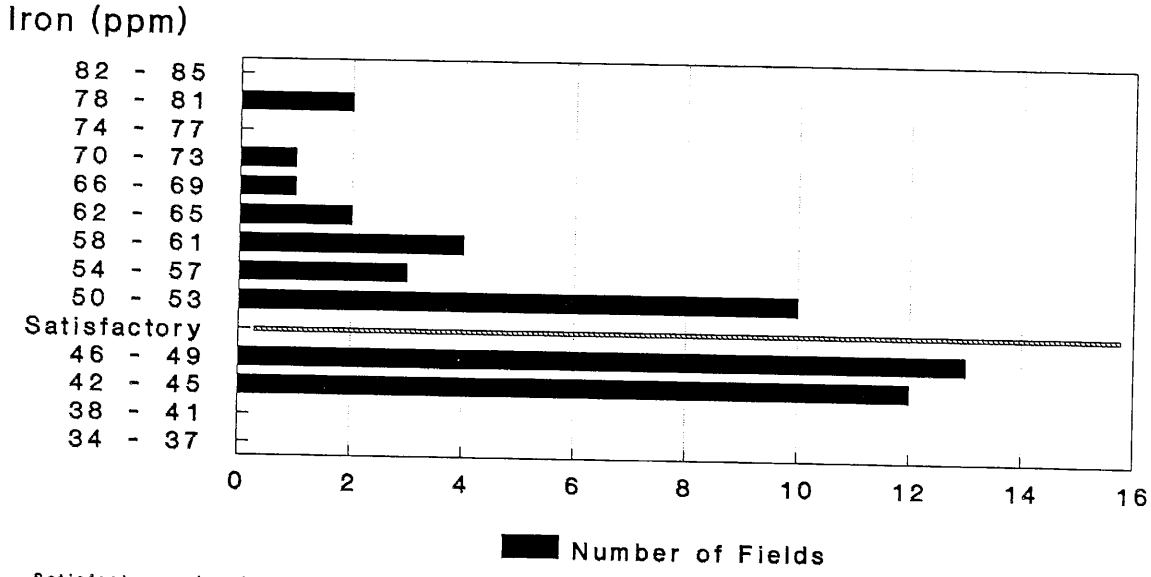
Nutrition Survey 1988
Calcium



Satisfactory = Level above which no response expected from addition of calcium

Figure 6

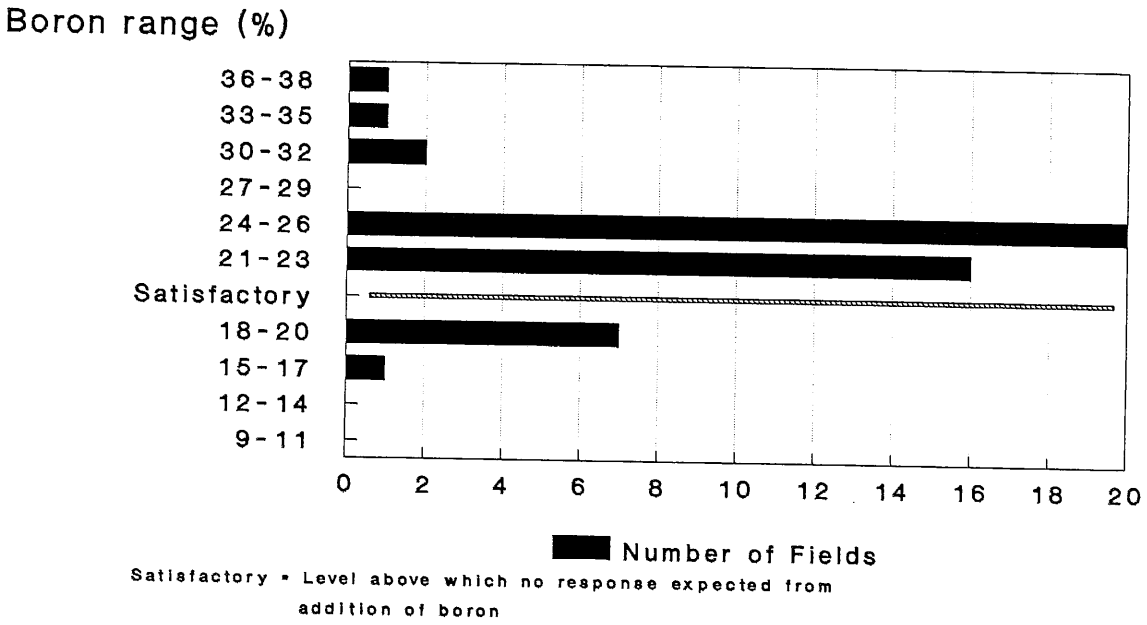
Nutrition Survey 1988
Iron



Satisfactory = Level above which no response expected from addition of iron

Figure 7 **Nutrition Survey 1988**

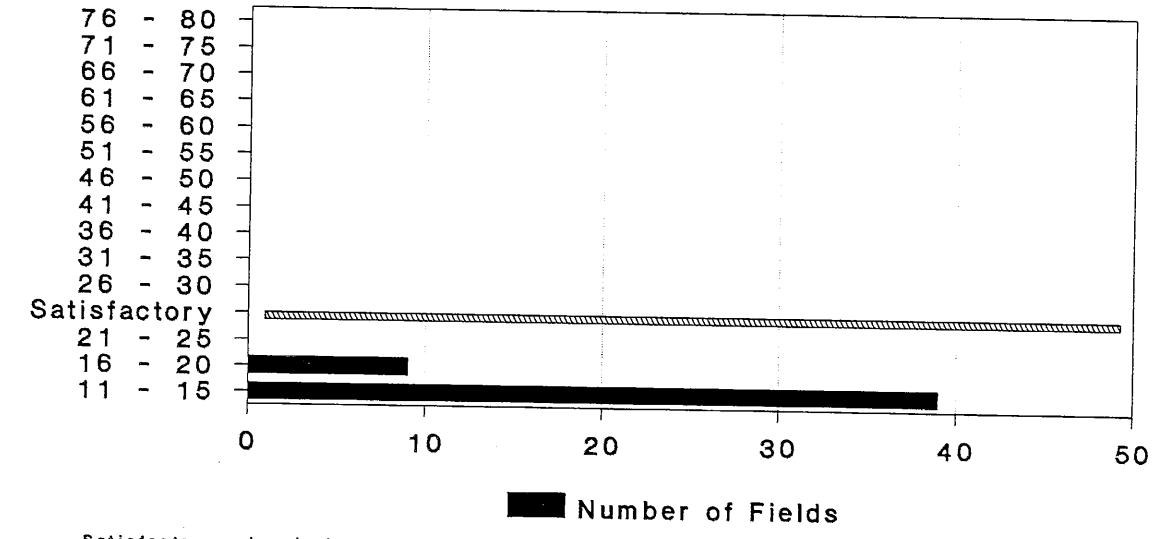
Boron



Satisfactory = Level above which no response expected from addition of boron

Figure 8 **Nutrition Survey 1988**

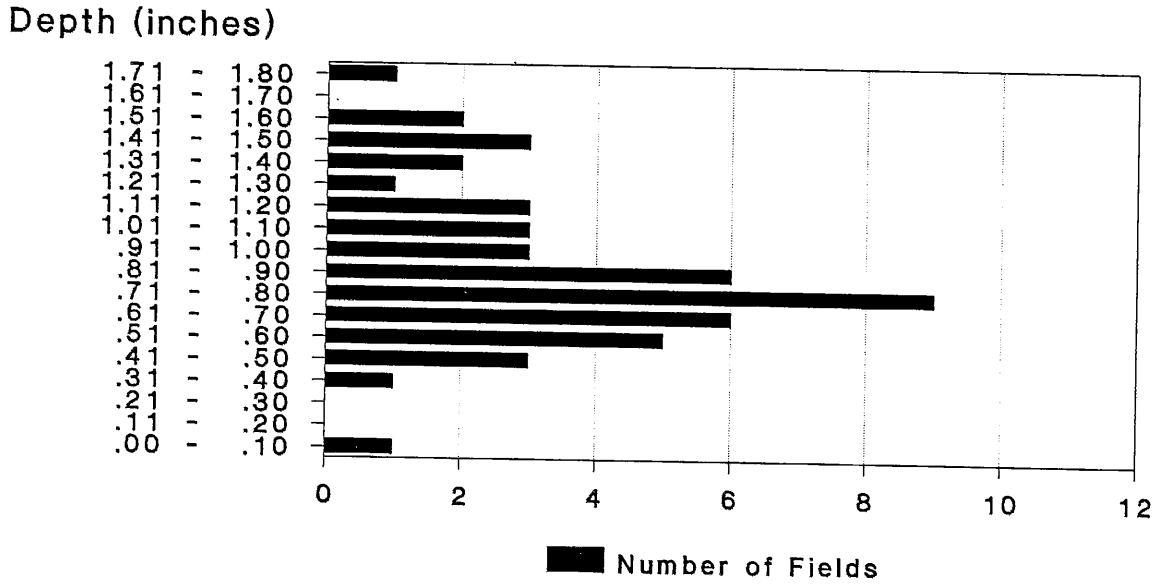
Zinc



Satisfactory = Level above which no response expected from addition of zinc

Figure 9

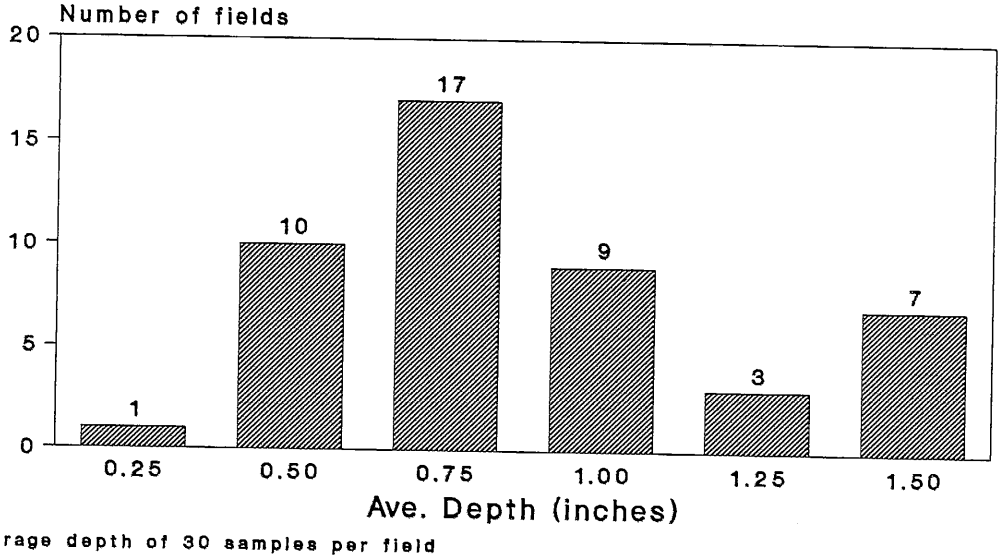
Fertility Survey 1988
Organic Pad Depth



Average depth of 30 samples per field

Figure 10

Fertility Survey 1988
Organic Pad Depth



Average depth of 30 samples per field

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATORS: JOHN M. SMAGULA
SUSAN ERICH

TITLE: PHOSPHORUS DOSE/RESPONSE CURVE

METHODS: Please refer to 1988 project proposal outline PROJECT - 2.

Changes in procedures include:

- Fields were selected for their range of phosphorus concentration and adequate nitrogen. No fertilizer will be applied except phosphorus.

- Plot size was changed to 10 ft x 100 ft, with a 10 ft alley between plots and 5 ft between split plots (years of application) (Please see figure Illustrating Block Design).

- Pretreatment yield data was not collected.

- Phosphorus rates have been changed to 0 (control), 20, 40, 60, and 80 lb actual phosphorus/acre.

RESULTS:

Fields were visited in August to assure relatively uniform plant cover and yield. After fields were harvested, 4 blocks were established so that rocks and bare spots fell in the alley ways as much as possible.

A letter describing the experiment and what is expected from cooperating growers was sent to each of the growers and managers of the fields (please see attached copy).

CONCLUSIONS:

RECOMMENDATIONS:

Oct. 25, 1988

Mr. Joe Lamar
Box 4160
Dresden, ME 04342

Dear Joe,

I would like to thank you again for cooperating in the Phosphorus Study sponsored by the Maine Blueberry Commission and the University of Maine Agricultural Experiment Station. You probably would like to know more about the experiment and what your role in it's success might be.

THE EXPERIMENT

The goal of this study is to determine if blueberry plants, which are low in phosphorus (P) as indicated by leaf tissue analysis, will respond to applications of phosphorus fertilizer by producing higher yields.

Nine fields were selected from the 1987 Nutrition Survey for this study. All 9 fields had adequate nitrogen but phosphorus levels fell into one of three categories: very low phosphorus, low phosphorus or adequate phosphorus. Including fields with adequate phosphorus will test the accuracy of the current standard for phosphorus.

I have enclosed a figure entitled 1989 Phosphorus Study - Block Design so you will get a better idea of how the experiment will be conducted on your field. The figure illustrates one block or "group" of treatment plots that makeup the experiment. White PVC pipe driven to ground level marks the location of each block. You will find 4 blocks marked out in your field.

Four levels of phosphorus will be applied. They are indicated on the figure as:

0P = 0 lb Phosphorus/acre
20P = 20 lb Phosphorus/acre
40P = 40 lb Phosphorus/acre
60P = 60 lb Phosphorus/acre
80P = 80 lb Phosphorus/acre

We also want to know if repeated applications will continue to give yield increases. Therefore, some plots will only receive phosphorus the first prune cycle in 1989, some will receive phosphorus two consecutive prune cycles, 1989 and 1991 and some will receive phosphorus all three prune cycles, 1989,1991, and 1993.

THE GROWER'S ROLE

What can you as a cooperating grower do to help make this experiment a success?

Weed Control

Good field management is important to the experiment. We want to harvest the plots as uniformly as possible with a mechanical harvester so good weed control is important. Fields with excessive weed problems were not used in the 1987 Nutrition Survey, so your field should not have a serious weed problem. However, even a few woody weeds in the experimental plots can cause problems during harvest. Any woody weeds should be controlled using a sideswipe and Roundup (Glyphosate). (see Blueberry Fact Sheet No. 237)

Velpar should be applied to control grasses and flowering weeds so that the applied fertilizer is taken up solely by the blueberry plants (see Blueberry Fact Sheet No.238). We know that weed competition will influence the results. We also know that applying Velpar at excessive rates will result in damage to blueberry plants and probably effect their uptake of nutrients and yielding ability. Velpar treatments should be applied accross the plots.

Fertilizer

No fertilizer should be applied within 50 ft. of the experimental plots. The application of fertilizer on the experimental plots would result in false results and "confuse the hell out of us!"

Pruning

You should prune your field at the correct time. Timely pruning will assure early stem growth and the best utilization of the applied phosphorus fertilizer. Fall pruning after dormancy (leaf drop) is considered to be the best time to prune by flail mowing or burning. Pruning should be done accross the plots.

Bees for pollination

Adequate insect pollination is necessary for the experiment to be a success. The application of phosphorus fertilizer may increase the flowerbud formation on the stems in your field and therefore increase the potential yield. However, this "potential" yield may not result in an "actual" yield increase if adequate pollination doesn't cause the extra flowers to develop into fruit. Placing 1-2 Beehives near the plots will provide adequate pollination for the experiment.

Harvest

Your cooperation and good communication will help us harvest the treatment plots before rakers come to harvest the rest of your field. We will be mechanically harvesting the plots where possible. All the berries, except for a small sample for determining the effect of phosphorus treatments on fruit quality, will be winnowed and stacked in the field so you can haul them to the processor.

Records

It is important that you keep accurate management records about this field. Basically, we need to know what, when and how much of anything has been applied to this field. I enclose a field record sheet to be used for this purpose.

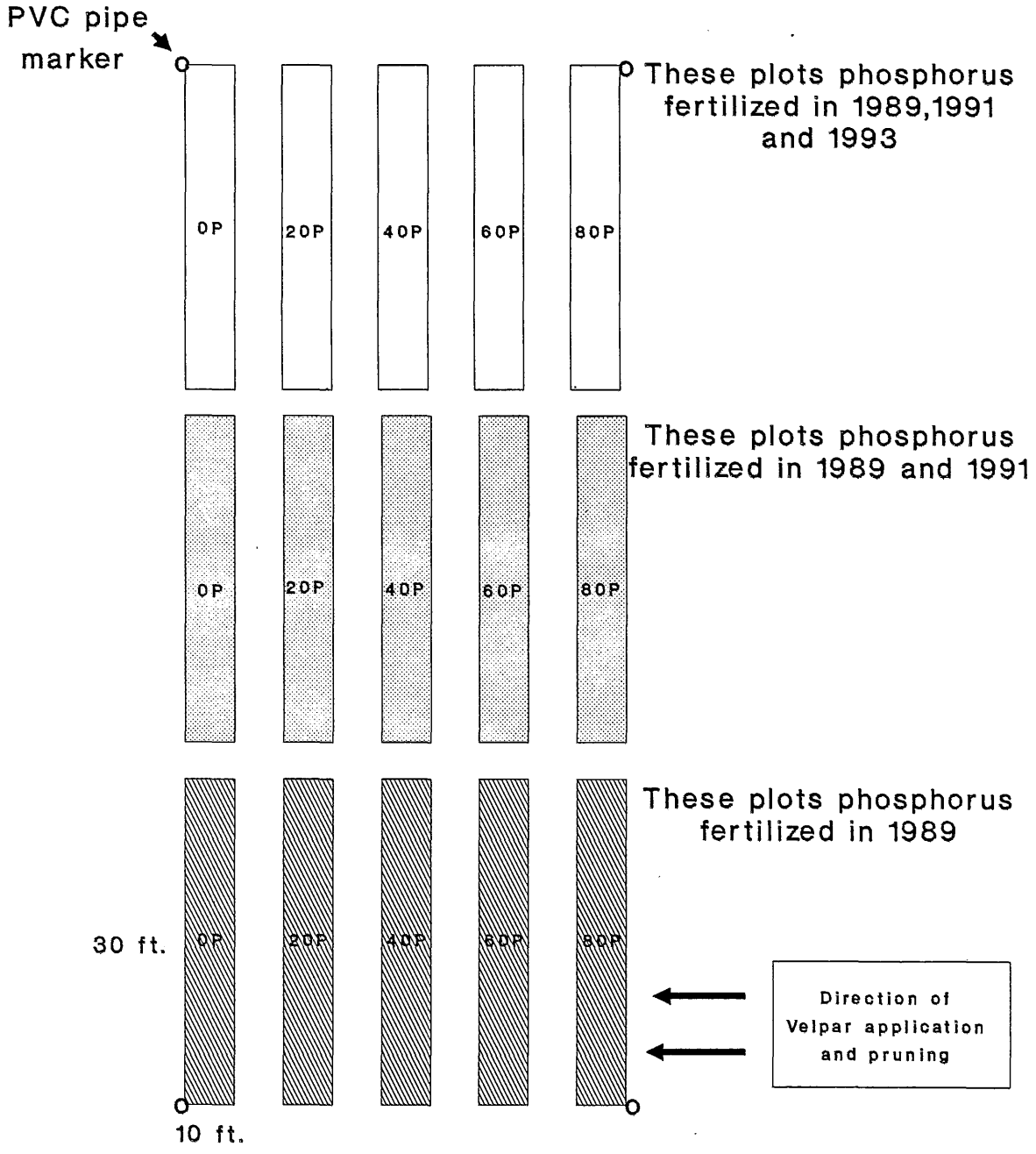
I can be reached at 416 Deering Hall, University of Maine, Orono, ME 04469 (Phone 581-2925) if you have any questions or comments about the project.

Thankyou again for your cooperation.

Sincerely,

John M. Smagula
Prof. Horticulture

1989 Phosphorus Study
Block Design



BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATORS: JOHN M. SMAGULA
Mike Goltz

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

METHODS: Please refer to 1988 project proposal outline PROJECT - 3.

RESULTS:

Mulch Study Highmoor Farm - 1988

There was no interaction between effect of mulch source and seedling type. This suggests that the effect of the mulches was similar for all plant material.

Dry weight measurements of above-ground shoots and leaves indicated that seedlings mulched with bark or sawdust grew the most (see table 1 and figure 1). Underground shoot or rhizome growth (expressed on a dry weight basis) was best under bark mulch, but also high under sawdust.

The number and length of rhizomes which developed in response to the various mulch sources is shown in figure 2 and table 2. The pattern of rhizome development (primary, secondary, tertiary, etc.) appears in table 2 and figure 3. The number and length of major rhizomes produced by the seedlings was greatest under bark mulch. The number of branches off these rhizomes (primary branch or Br1 N) was also greatest under the bark mulch treatment. Secondary and tertiary branching were also high for the sawdust mulch treatment. The rhizome number, length and total dry weight was much less under cedar and wood chips, compared to bark mulch; and the pattern of branching also suggests these mulches are not as good at encouraging the filling-in of bare spots in blueberry fields.

Significant differences were also found among the seedling crosses. This helps to explain why some clones in commercial blueberry fields appear to be more vigorous in their growth and spread while growing right next to each other.

CONCLUSIONS:

The survival of lowbush blueberry seedlings is greatly improved by mulching, regardless of the source. The subsequent growth and spread of these plants is significantly affected by the type of mulch used. Measurements made photographically have documented differences in the area covered by seedlings growing under these mulch sources. Digging, counting and observing the development patterns of the rhizomes has given us insight into why the differences exist. Bark and sawdust encourage not only more rhizome growth but also more branching. This leads to surfacing of rhizome tips and the production of aerial shoot. It is on these aerial shoots that future flower buds will develop, producing fruit.

The results of this study help to explain difference found in our study of the effect of mulches placed alone the edges of existing clones (see report No 4).

RECOMMENDATIONS:

Plant material introduced into lowbush blueberry fields to stabilize blueberry soil or to increase cover and productivity should be mulched. Bark and sawdust are superior mulches with regard to encouraging rhizome development and subsequent spread of planted blueberries.

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

Treatment	Tops (gm dw)	Rhizome (gm dw)
Control	15	0.04
Bark	45 a[z]	45 a
Chips	26 b	19 b
Sawdust	46 a	37 a
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

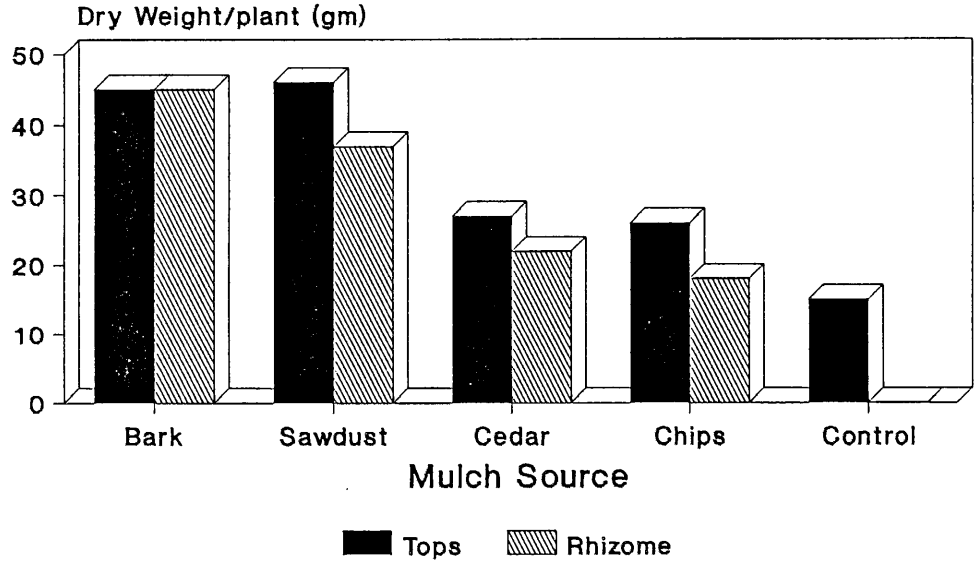
Table 2. Effect of mulches on rhizome number and length

Treatment	Rh N	Rh L	Br1 N	Br1 L	Br2 N	Br2 L	Br3 N	Br3 L	Br4 N
Control[z]	1.5	11	0	0	0	0	0	0	0
Bark	15.5a[y]	592a	32a	644a	21a	287a	7a	88a	1.3ab
Chips	9.3b	380b	16b	305c	8b	124b	3a	17b	0.2b
Sawdust	9.1b	389b	23b	529ab	20a	336a	8a	117a	1.7a
Cedar	7.1b	292b	17b	359bc	11b	142b	7a	36b	0.6ab

Rh N = Mean rhizome number/plant, Rh L = Mean total rhizome length (cm)/plant, Br1 = Branch 1,Br2 = Branch off Br1, Br3 = Branch off Br2.
[z]Survival of controls was too low to include in Statistical analysis.
[y]Means not followed by the same letter differ at the 5% level according to Waller's Test.

Figure 1

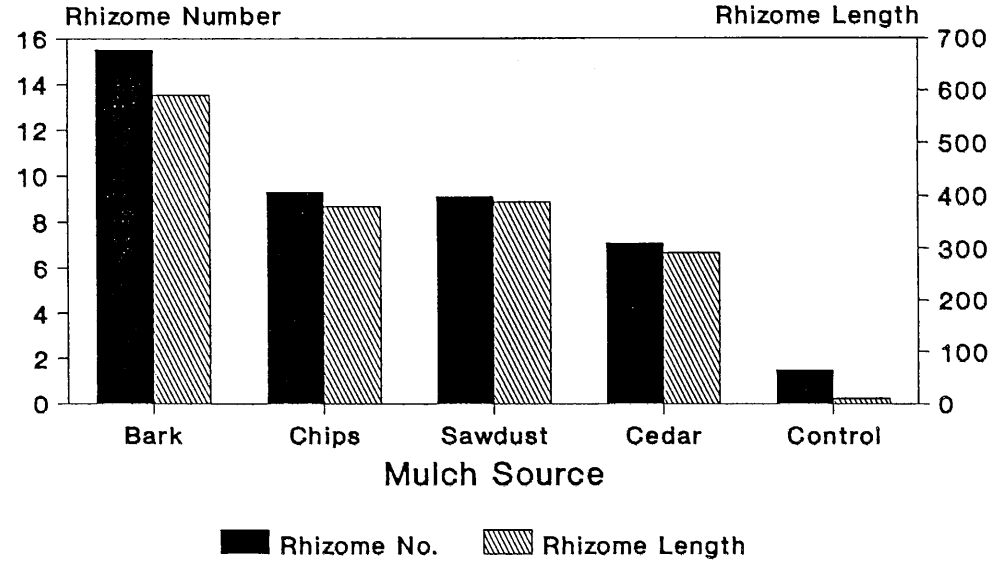
Mulch Study Highmoor
Top and Rhizome Growth



1988 Data

Figure 2

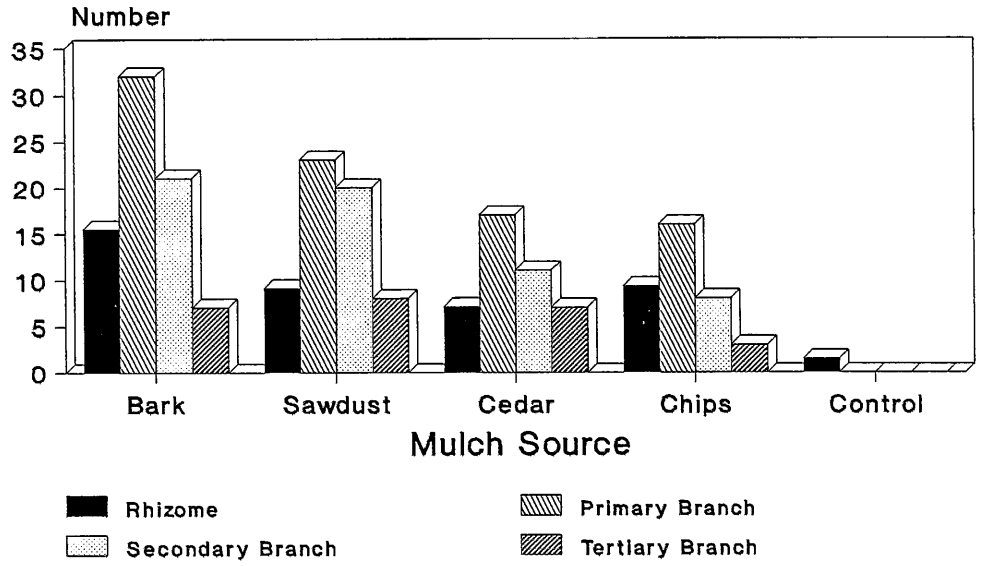
Mulch Study - Highmoor
Rhizome Number and Length



1988 Data

Figure 3

Mulch Study - Highmoor
Rhizome Development



1988 Data

BLUEBERRY ADVISORY COMMITTEE
PROJECT PROPOSAL OUTLINE
PROJECT - 4

MAY 1, 1988 to APRIL 30, 1989

PRINCIPAL INVESTIGATOR: John M. Smagula

TITLE: INFLUENCE OF MULCH SOURCES ON CLONAL SPREAD

METHODOLOGY: Please see 1985 research report for details. Research/Demonstration plots were established in Deblois in 1984 with Soil and Water Conservation Commission Challenge Grant and MAES funds. Bark, rough peat moss or paper company residual was applied to the edge of clones to encourage lateral spread. Photographs of permanent Quadrats established in 1984 at the edges of the clones should be taken this year to determine the influence of the mulches on spread.

ANTICIPATED RESULTS:

The influence of mulching bare spots in blueberry fields on spread of clones will be determined.

The importance of mulch source will be evaluated.

IMPACT OF RESEARCH/BENEFIT TO THE BLUEBERRY INDUSTRY: This information will indicate to growers whether applying mulch to bare spots will encourage spread of existing clones.

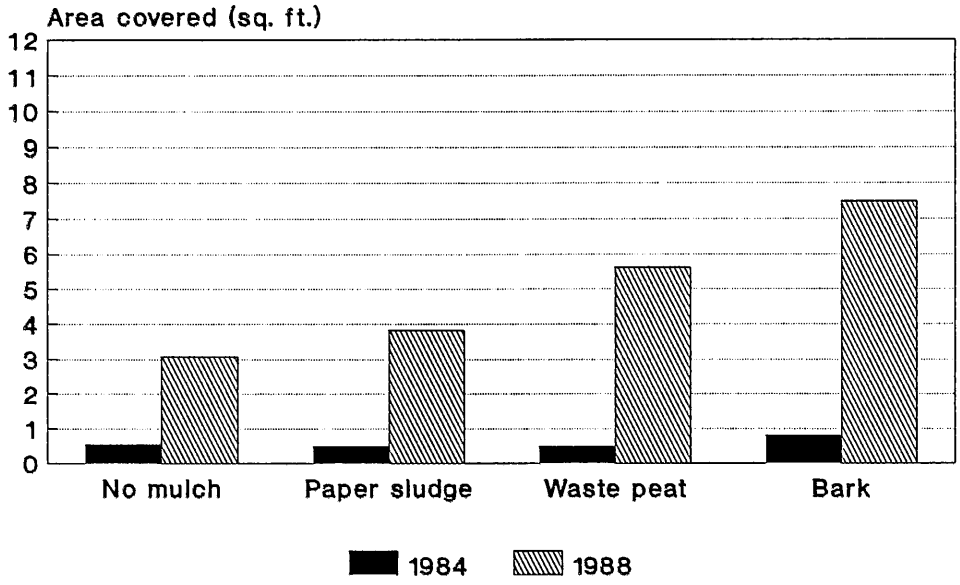
PROJECT CONTINUITY: This project has not been funded by the Blueberry Tax

BUDGET REQUESTED FROM BLUEBERRY TAX FUNDS

	Base Program Budget	Project
a. Salaries (student help)	$9,000	
b. Materials and supplies		$100
c. Equipment		
d. Equipment maintenance	1,200	
e. Rental fees	600	
f. Services		
g. Travel	200	50
TOTAL	$11,000	$150

Figure 1

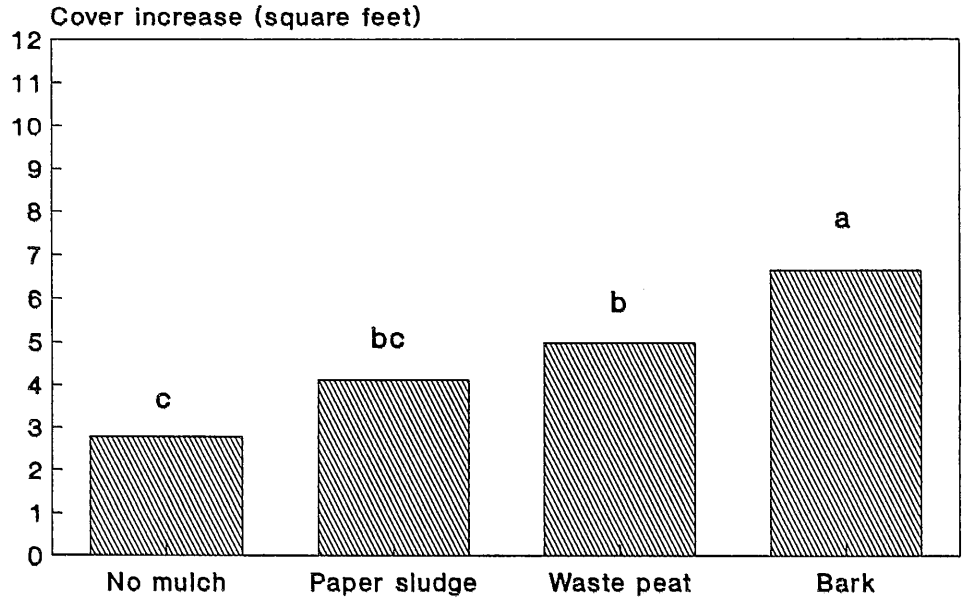
Clonal Spread Mulch Study
1984 + 1988



P-1, Average of 7 Clones

Figure 2

Clonal Spread Mulch Study
SCS - Deblois



Data = 1988-1984

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATORS: JOHN M. SMAGULA

TITLE: EFFECT OF SURFACE MULCHES ON STABILIZING LOWBUSH BLUEBERRY SOIL IN BARREN AREAS

METHODS: Please refer to 1988 project proposal outline PROJECT - 5.

RESULTS:

Photographs of the quadrats have been taken. The area covered in 1988 has not been determined.

CONLUSIONS:

RECOMMENDATIONS:

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATORS: JOHN M. SMAGULA

TITLE: NITROGEN-PHOSPHORUS STUDY

METHODS: Please refer to 1988 project proposal outline PROJECT - 6.

DAP (diammonium phosphate) which contains 18% nitrogen and 46% phosphoric acid was applied at the rate of 0, 5.7, 11.4, 17.1 or 22.8 diammonium of actual phosphorus per acre and not 0, 10, 20, 30, or 40 as indicated in the proposal. DAP also supplied similar amounts of nitrogen per acre.

RESULTS:

Nutrient Concentrations

Nitrogen and phosphorus leaf concentrations increased with increasing amounts of DAP applied (figure 1). Nitrogen was adequate (above 1.6%) without fertilization (control) and increased with additional nitrogen fertilizer. Application of increasing amounts of phosphorus raised the phosphorus level in leaf tissue, but even at the highest rate (22.8 diammonium P/acre) the satisfactory level (.125%) was not attained.

Growth Characteristics

The average stem length was increased by application of DAP (figure 2) but branching was not affected. Flower bud formation increased by about 1 flower bud per stem at the highest rate of application (figure 3).

Yield

The fertilizer treatments did not affect yield (figure 4).

Pruning practice

Pruning practice did not have an effect on response to fertilizer treatments described above. Mowed plots had stems with a greater average length (10.1 cm) than burned plots (9.4 cm), but the branching and average number of flower bud were comparable. Yields were consistently lower in the mowed plots compared to the burned (figure 5).

CONCLUSIONS:

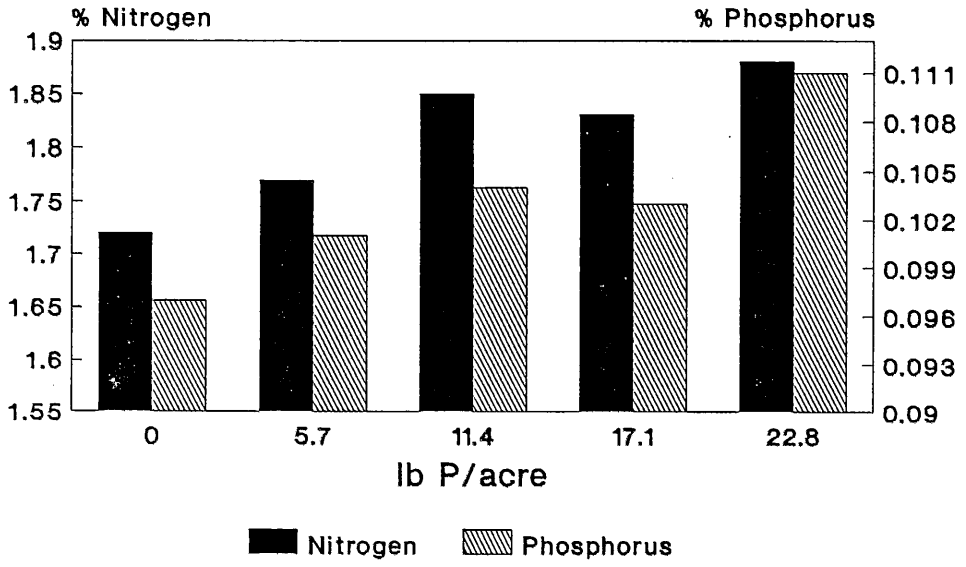
A slight response to phosphorus applied as DAP was found in this study. Although no yield response was documented, a small increase in average stem length and potential yield (increase in flower buds formed) was found. If the linear increase in leaf phosphorus concentration continues with increased rates of fertilization, we can predict that about 50 lbs of phosphorus per acre would raise the leaf concentration to .125% (see figure 6). This suggests that higher phosphorus rates might be appropriate in the Phosphorus Dose/Response Study than previously thought. Higher rates of DAP should be applied in 1989 to verify this prediction and to evaluate the affect raising leaf phosphorus levels has on actual yield.

RECOMMENDATIONS:

Recommendations should not be made until higher rates of phosphorus are applied and more data are collected. The data presented in this report do suggest, however, that greater amounts than 22 lbs of actual phosphorus will be needed on fields with similar low levels of leaf phosphorus.

Figure 1 1987 Phosphorus Study

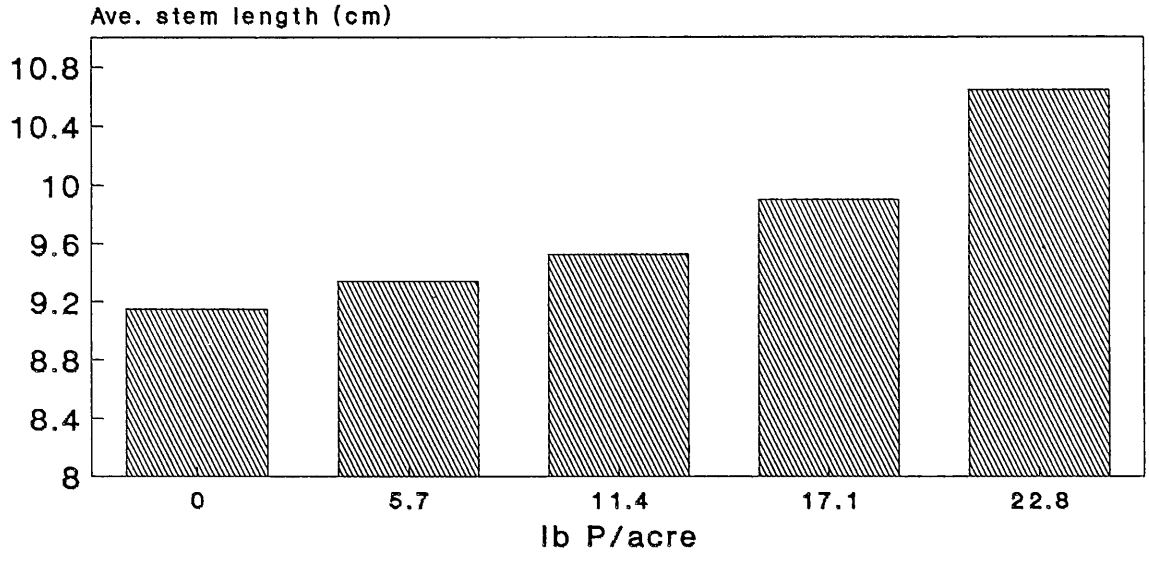
Leaf tissue concentration



DAP fertilizer (18-46-0)

Figure 2 1987 Phosphorus Study

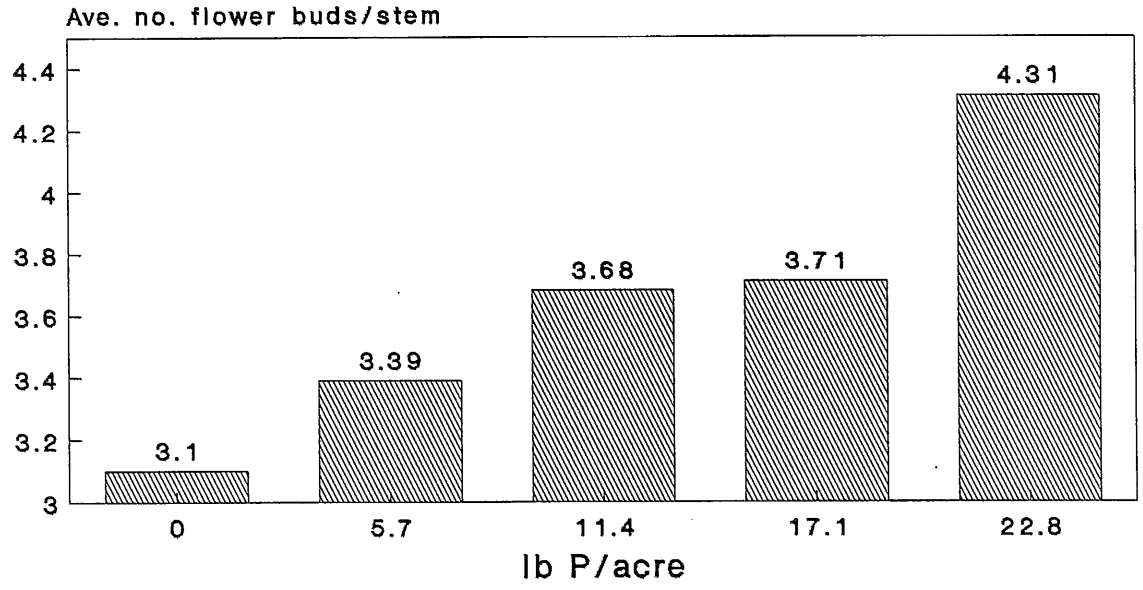
Stem length



DAP fertilizer (18-46-0)

Figure 3

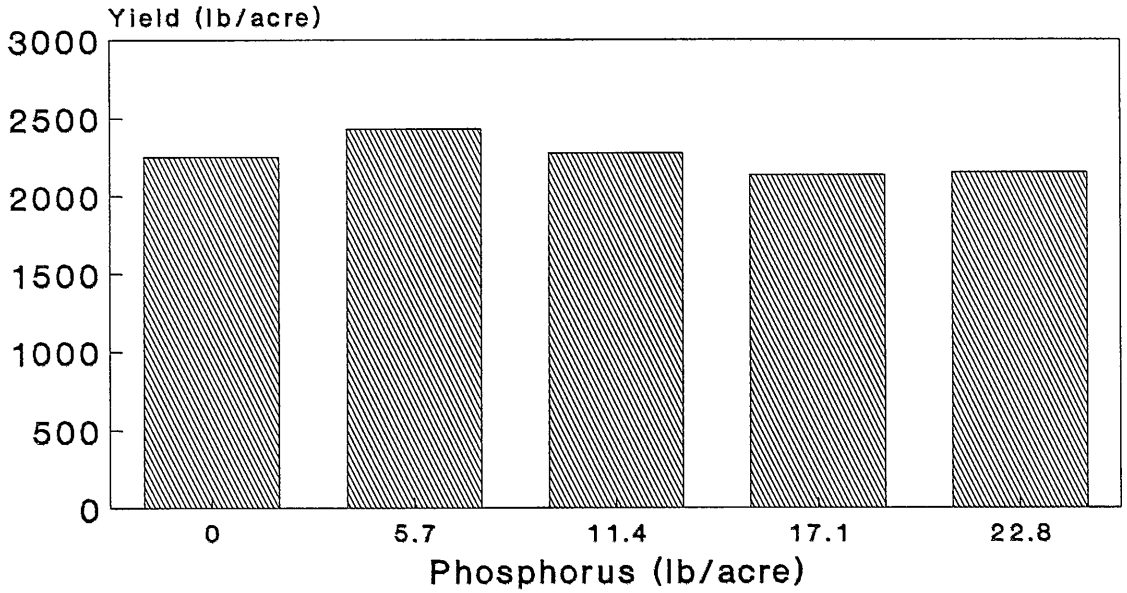
1987 Phosphorus Study
Flower bud formation



DAP fertilizer (18-46-0)

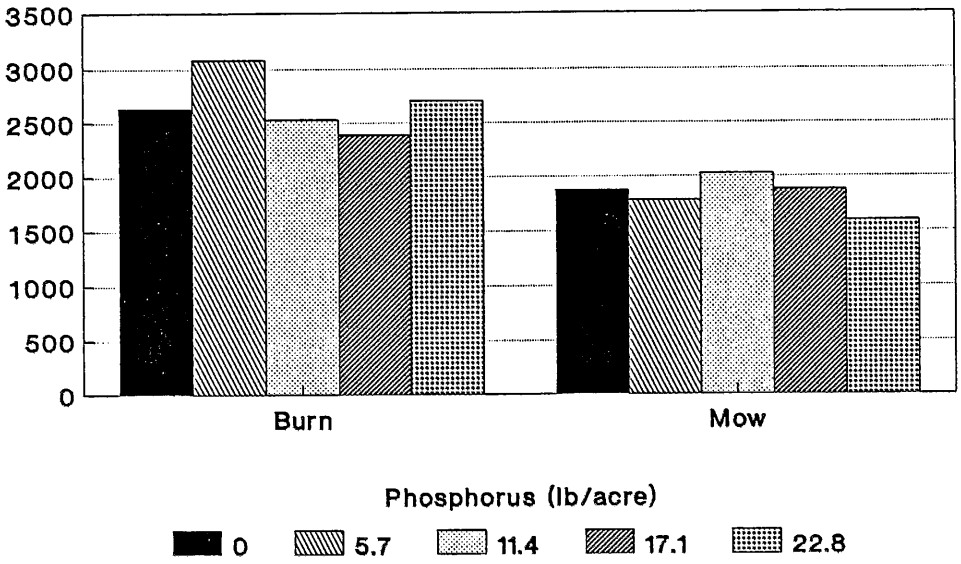
Figure 4

1987 Phosphorus Study
Yield



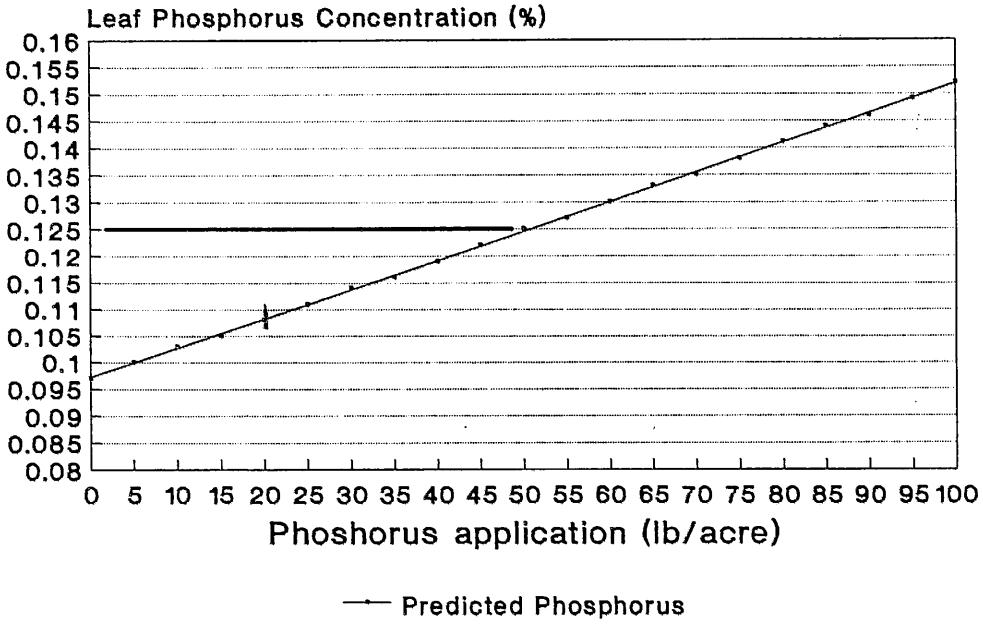
DAP fertilizer (18-46-0)

Figure 5 1987 Phosphorus Study
Yield



DAP (18-46-0)

Figure 6 Leaf Phosphorus Prediction



MAINE BLUEBERRY COMMITTEE
RESEARCH REPORT

DATE: August, 1988 to February, 1989

INVESTIGATORS: Joan M. King, M.S. candidate in Food Science
Rodney J. Bushway, Professor of Food Science
Alfred A. Bushway, Associate Professor of Food Science
Paul R. Hepler, Associate Professor of Horticulture
and Cooperating Associate Professor of Food Science

TITLE: Changes in Sugars and Organic Acids of Blueberries During Development, Preprocess Lag Time and Storage.

METHODS: Organic acids were extracted and quantified by the method of Bushway et al, 1984. The acid samples were purified for high-performance liquid chromatographic analysis by using the method of Spanos and Wrolstad, 1987. Simple sugars were quantified using a high-performance liquid chromatography method developed by Bushway et al, 1981. The whole berry sugars were extracted using the method of Richmond et al, 1981. Core, periphery and surface sugars were analyzed by the methods of Benner, 1987. Drip, texture, color, soluble solids and pH of the drip and puree were also analyzed by established methods of Benner, 1987.

The blueberries for the storage study were obtained from Guptil's and Maine Wild. Two 30 lb. boxes of IQF berries were stored at each temperature (-11°C, -21°C, and fluctuating between -11°C and -21°C). One 30 lb. box of berries was handpicked at each of the processors' fields. Berries were analyzed for sugar migration by measuring the changes in sugar content of the cores, peripheries and surfaces. Textural changes were measured using a shear press with the Instron. Moisture content was also analyzed. The blueberries were analyzed every two weeks.

The blueberries for the maturation study were obtained from Wyman's and were all handpicked. Berries were separated into four color stages (green, green-red, red-red-blue, and blue). All of the stages were picked each week for three weeks. The preprocess berries were obtained from all three processors.

RESULTS: In the maturation study, there was a significant difference between the stages in sugar content, with sugar content increasing through development. There was a slight difference in sugar content between stage four of the handpicked berries and the preprocess raked berries. The raked berries contained less sugar than the handpicked. A higher sugar content was found in the preprocess raked berries of Maine Wild than in Wyman's or Guptil's. This may be due to the length of time that the preprocess berries were at warm temperatures. All of the organic acids in the blueberries have not yet been identified. There are three organic acids and one of them is citric acid. The organic acids seem to decrease through the stages of development.

In the storage study, significant differences were found for temperature, time, and the interaction of temperature x time at the 95% confidence level for all of the analyses except the b value for color of the drip and moisture content. Both of these were nonsignificant for the temperature x time interaction. As shown by figure 1, moisture remained relatively stable over time, with handpicked having the least moisture. Drip loss was significant for the temperature x time interaction, as shown by figure 2, where drip loss becomes less over time for all of the temperatures. Handpicked berries had the least drip loss. Figure 3, texture analysis, shows that for the -11°C and fluctuating temperatures the berries became tougher, and remained relatively stalbe for the -20°C and handpicked berries.

Sugar analysis also showed significant differences for temperature, time and temperature x time. Figure 4, the periphery sugars, showed a definite increase over time for all temperatures. For the core sugars the -11°C and fluctuating berries showed a drop in sugar over time as did the handpicked berries. The -20°C berries stayed relatively stable. Figure 6, surface sugars, showed that overall there was little change in surface sugar over time except for the increase at 2 to 4 weeks for -20°C, -11°C and fluctuating berries. Overall for whole berry sugar there was a slight decrease in sugar content as shown by figure 7.

There were significant differences for the third order interaction of temperature x time x processor for all analyses except the a value for drip color, moisture, surface sugar and core sugar. Closer examination of temperature x processor interaction showed that there was no significant difference between processors for any of the sugar analyses at any temperature, except the periphery sugars which had a significant difference between processors for the fluctuating berries. Drip loss was significant between processors for the -20°C and -11°C berries, but was not significant for handpicked and fluctuating berries. The texture of all the stored berries had no significant differences between processors for any temperature, whereas moisture content did show significant differences between processors for all temperatures.

CONCLUSIONS: As expected the handpicked berries had less moisture and drip loss and less textural changes than the processed berries. Also there was no significant difference between the processors for the handpicked berries in drip loss and texture. This showed that all of the berries before picking and processing were similar, except in moisture content and possibly pH.

Textural analysis showed that the adverse temperatures were the cause of the toughening of the berries. There was no difference due to processing for any of the temperatures. There were significant differences due to processing for moisture content. This difference could cause significant differences in other analyses such as pH, soluble solids and color. Processing had no

significantly different effects on sugar content in general, except for in the periphery sugar analysis with the fluctuating berries.

Sugar was concentrating in the perpheries of the berries. There were large increases over time for periphery sugar content, since there were slight differences in core and surface sugars over time for -20°C and handpicked berries, there may be chemical changes associated with sugar content in the peripheries for these temperatures, not sugar migration. For the -11°C berries it was observed that ice crystals were forming on the surface and the bereris were clumping. The -11°C berries were also shriveling. The shriveling was due to the water migrating to the surface. The fact that the sugar content in the cores decreased as the surface sugar and periphery sugar increased shows sugar migration in the -11°C berries.

These results will be more thoroughly analyzed statistically and the study will be finished and reported in a graduate thesis by summer and a copy will be provided to the Maine Wild Blueberry Commission.

RECOMMENDATIONS: Raking does affect the sugar content of the blueberries. There is less sugar in raked berries than in handpicked. Further analysis will show if the same is true for organic acids or not. IQF blueberries retained their quality best when stored at -20°C or lower. At optimum temperatures there is still some adverse changes over time which are most likely related to chemical changes within the blueberry, possibly including changes in pectin and the breakdown of other constituents. Textural changes may also be looked at more closely so they can be controlled and the berries can be kept at the highest quality possible in storage.

FUTURE WORK: The results of this research would indicate that factors occurring during harvesting have a major influence on frozen blueberry quality. During the next year the following research should be conducted (1) a second year of the study to investigate the formation of and changes in the concentration of the organic acids and sugars found in blueberries during maturation, (2) identification of the organic acids in blueberries, (3) a comparison of the effect of harvesting method (raking and mechanical harvesting with handpicking as a control) on frozen blueberry quality, (4) development of rapid immunological screening methods for pesticide residues in blueberries, and (5) look at the quality of some of Jack Smagula's blueberries that have been treated with different nitrogen levels.

Figure 1. MOISTURE CONTENT

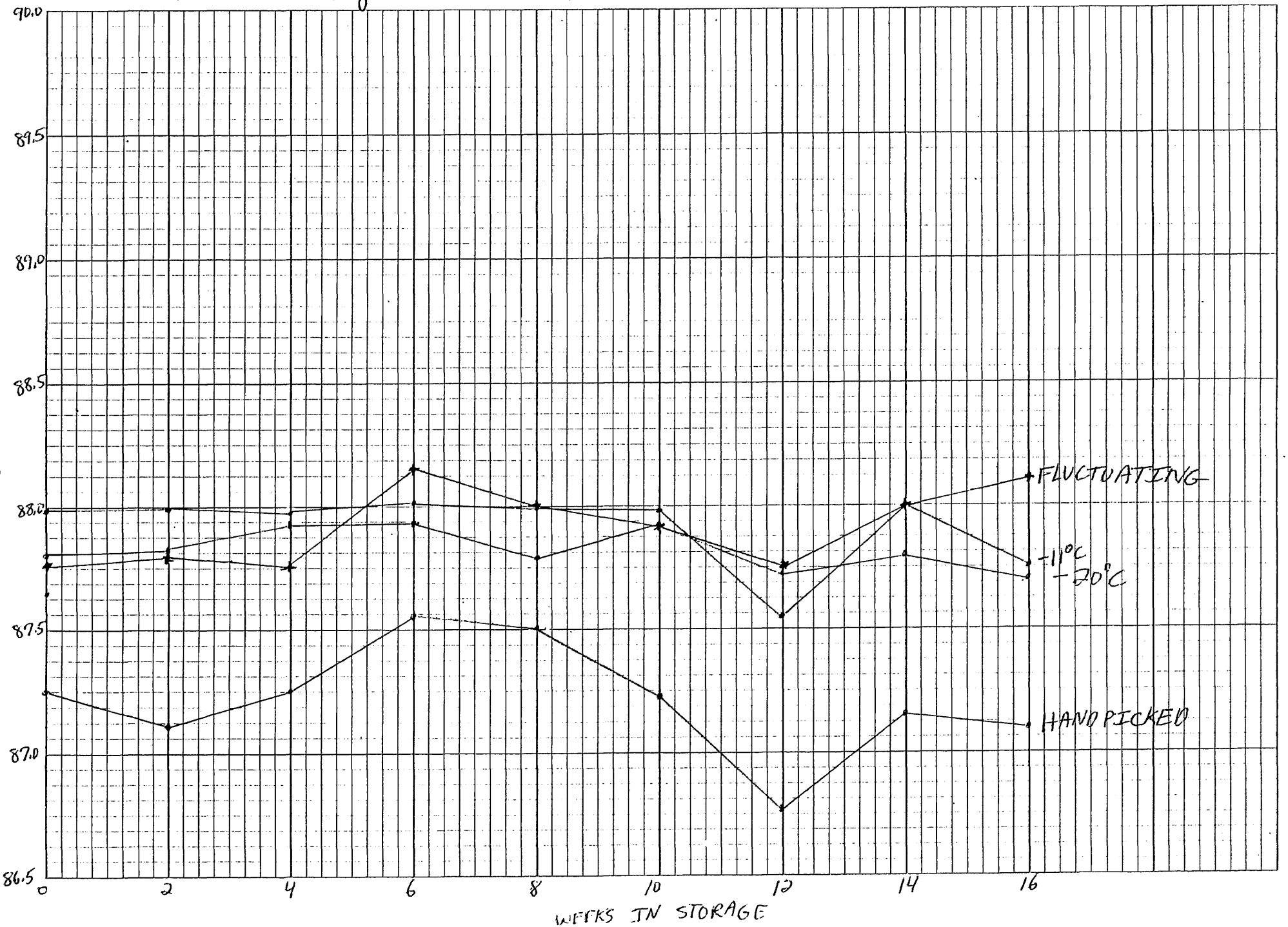
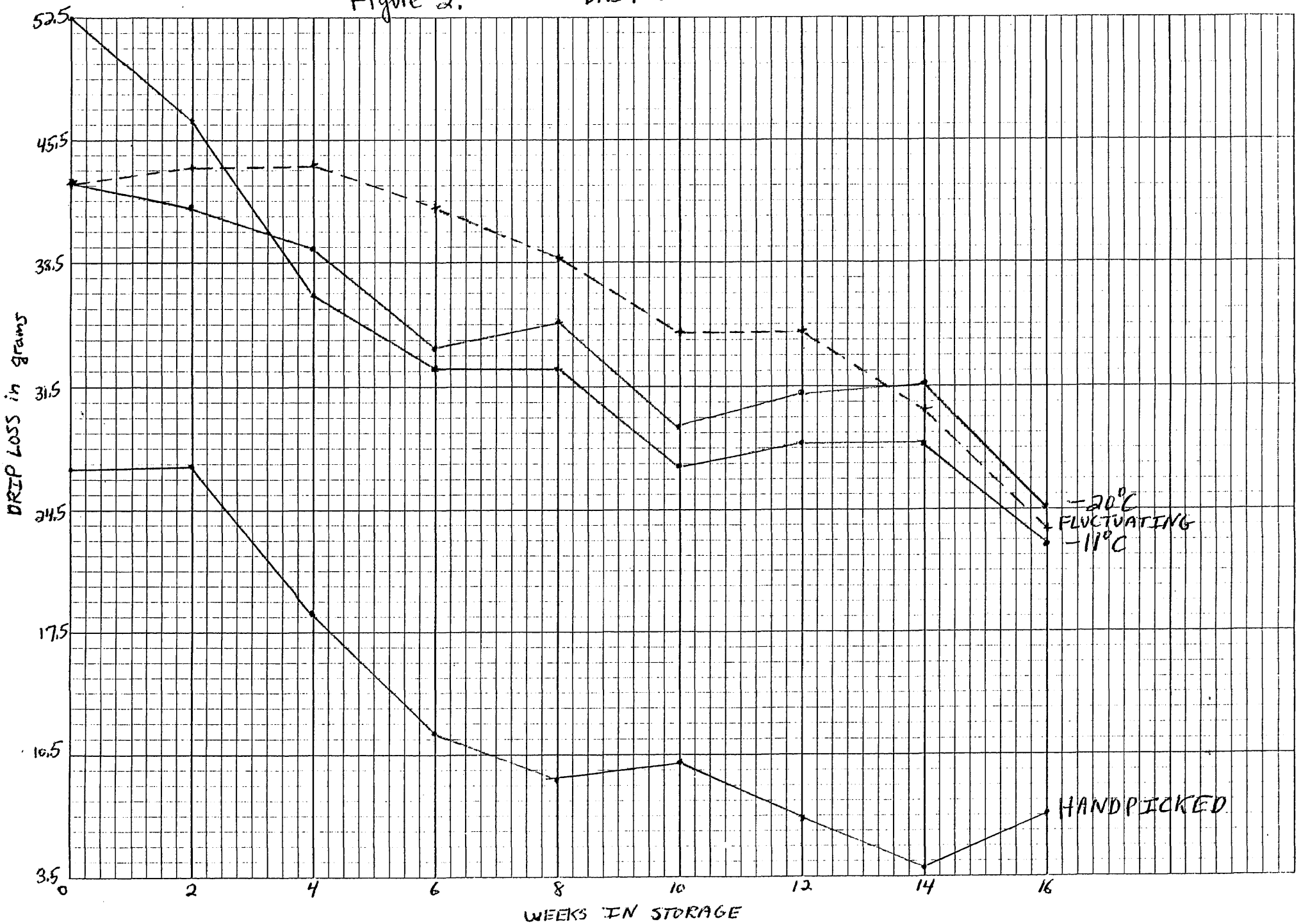


Figure 2. DRIP LOSS



8 Squares to the Inch

Figure 3. Instron - Texture Analysis

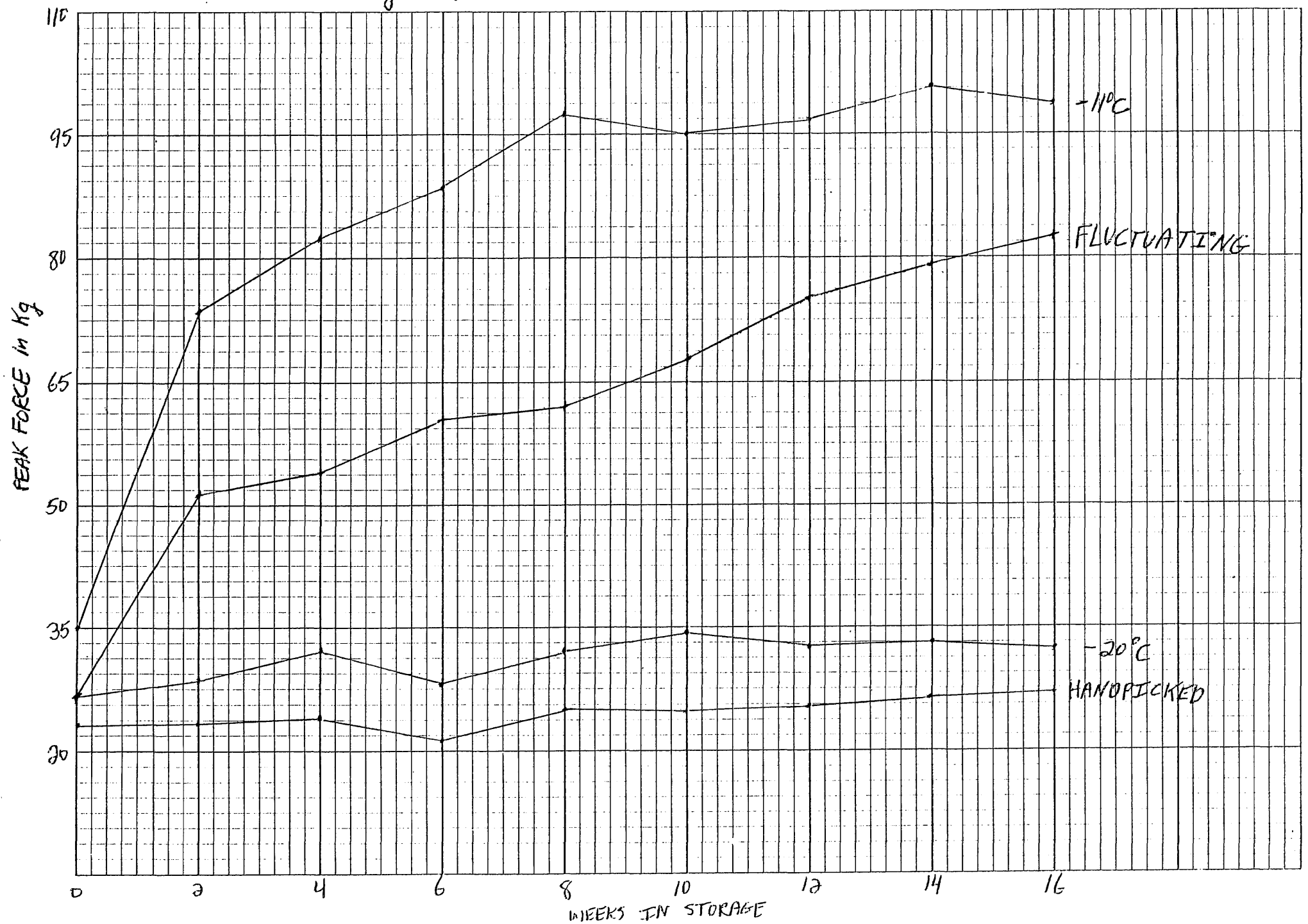


Figure 4. PERIFERY SUGARS

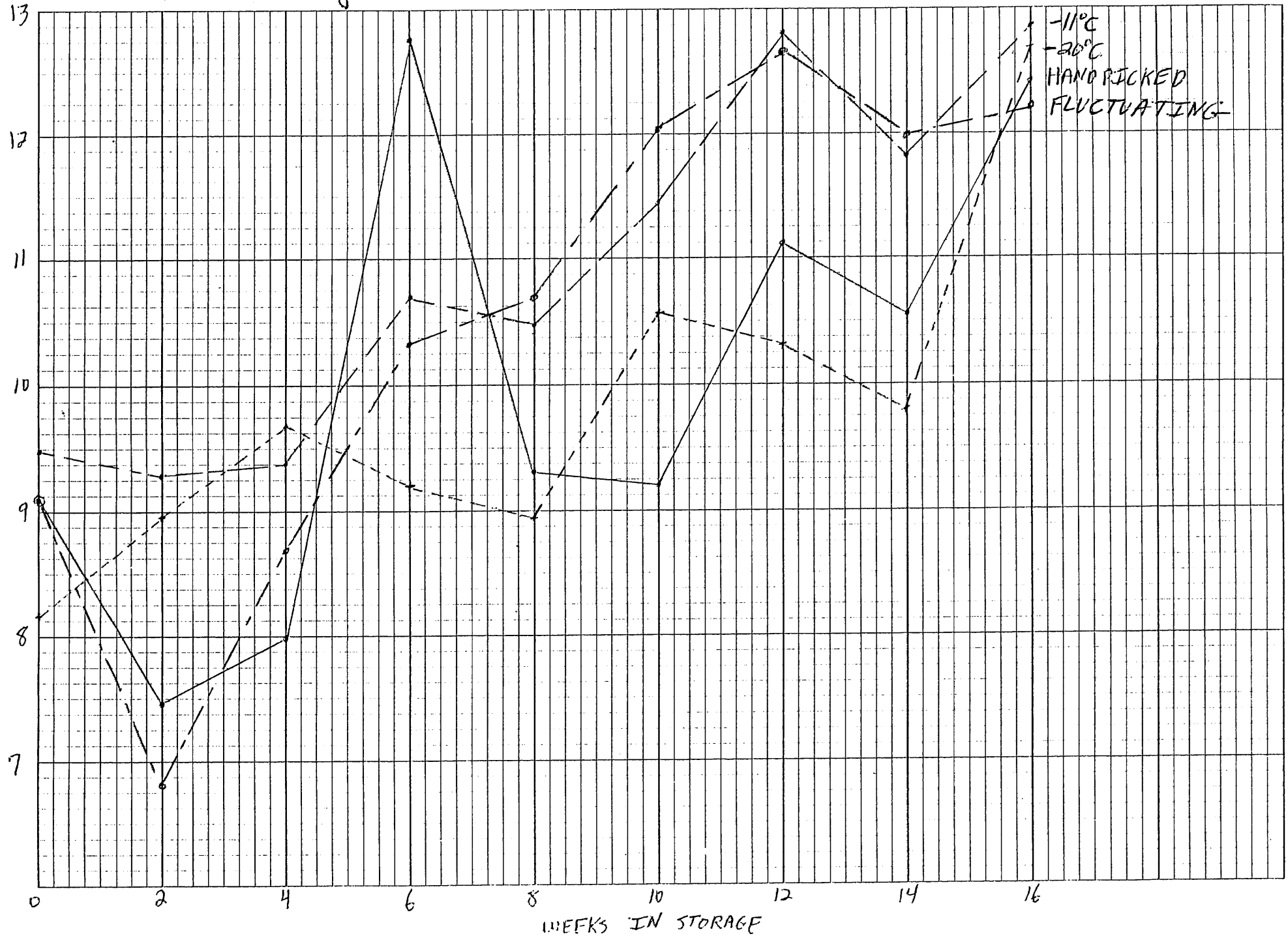


Figure 5. CORE SUGARS

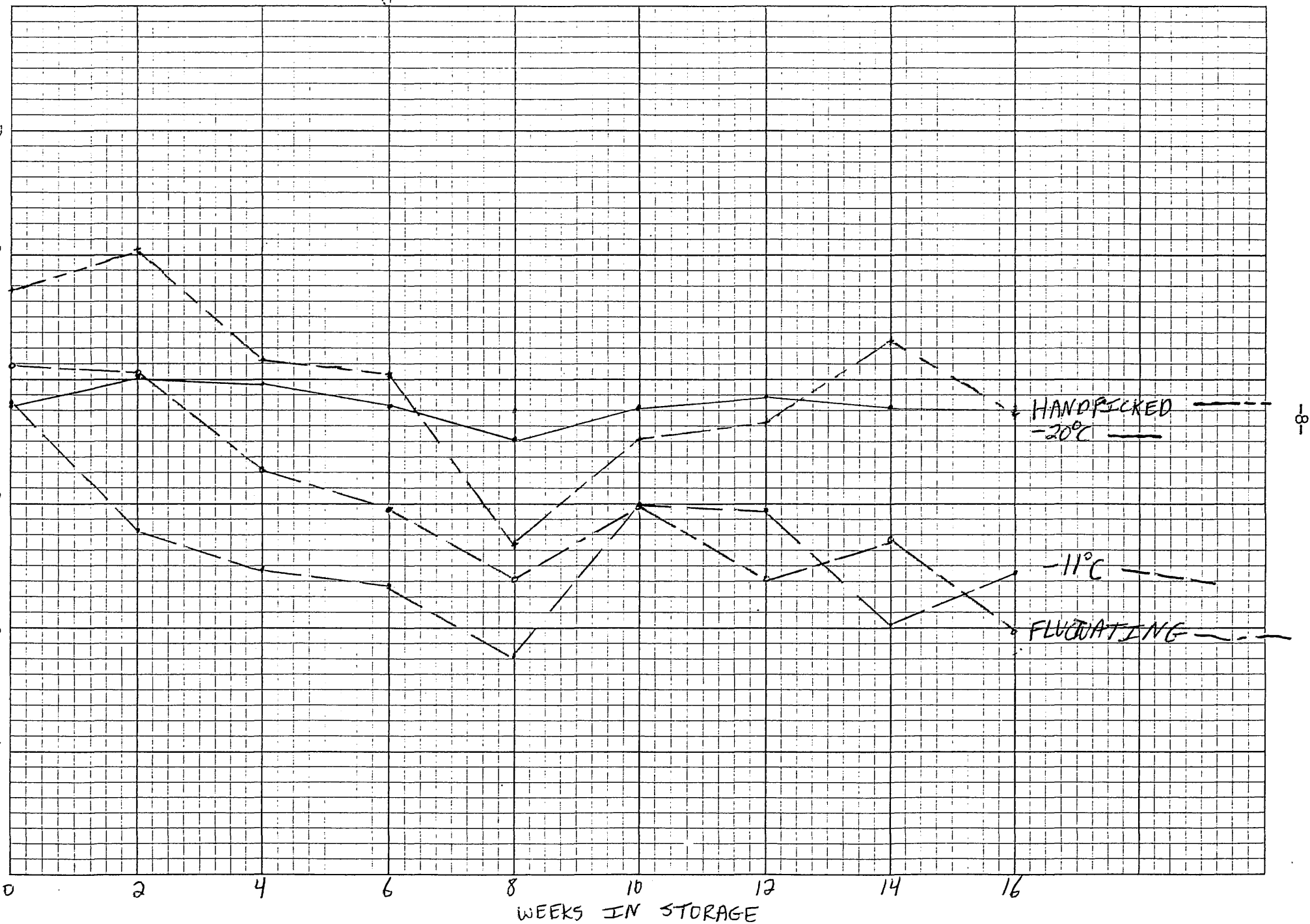


Figure 6. SURFACE SUGARS

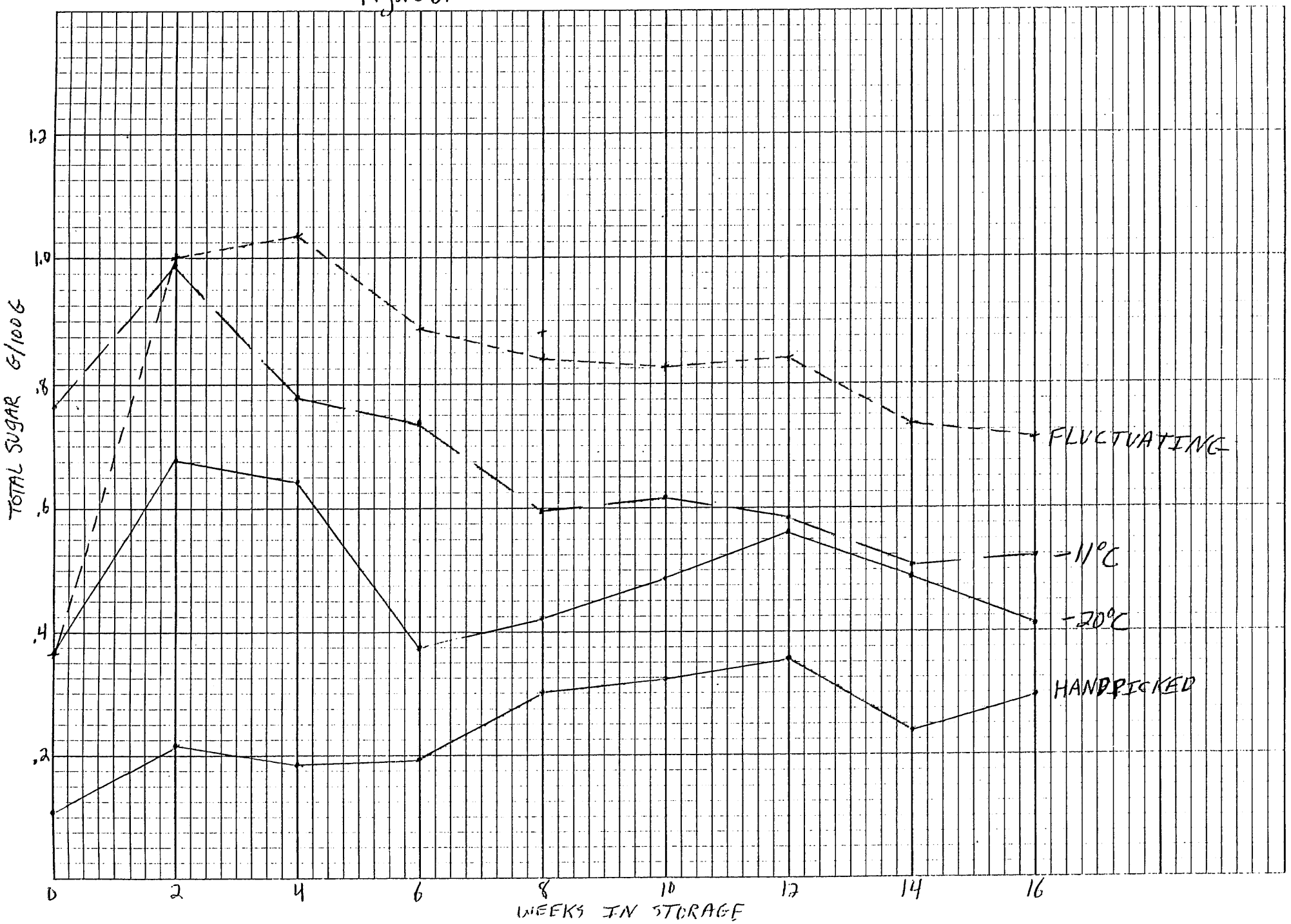
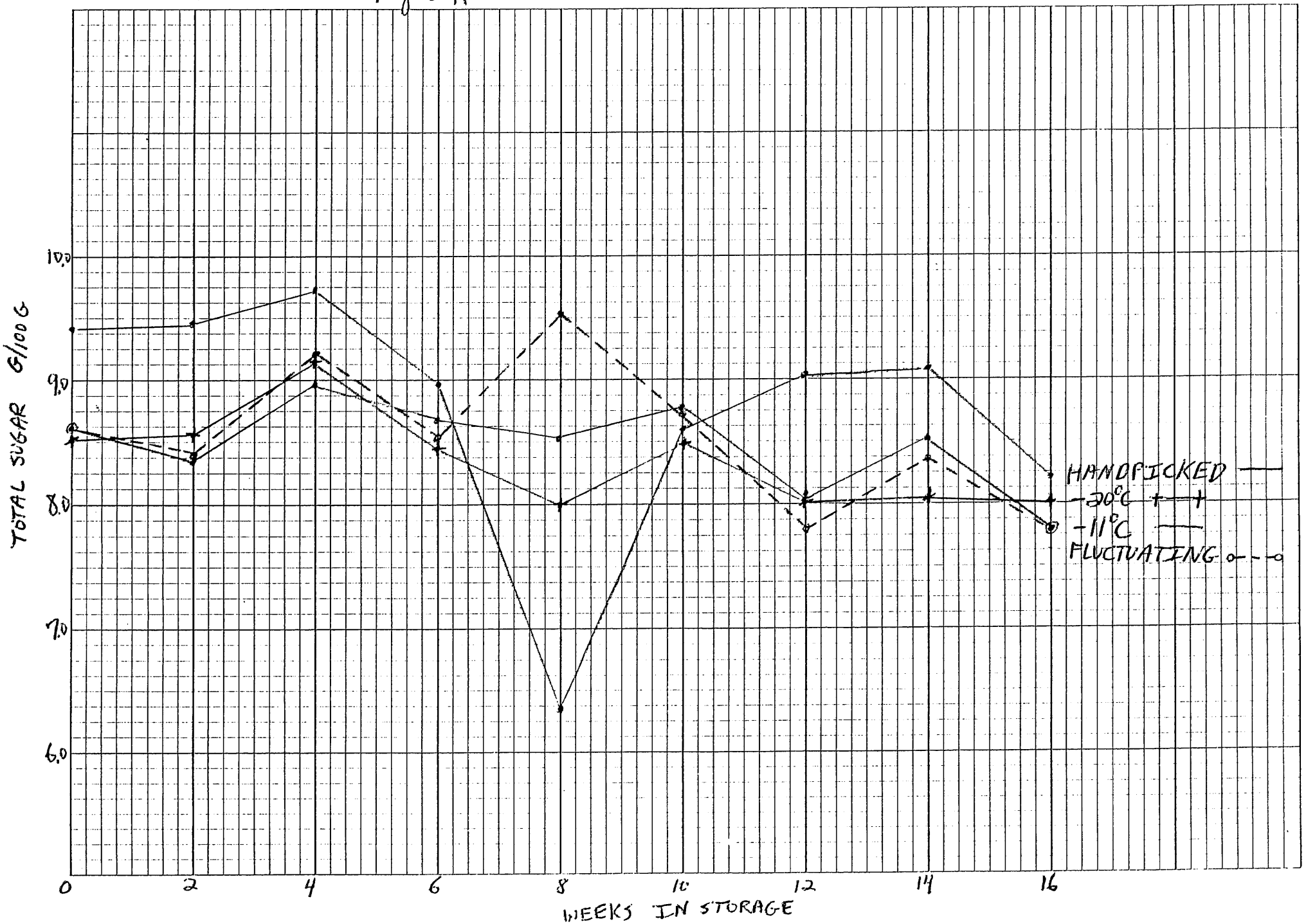


Figure 7. WHOLE BERRY SUGAR



TITLE: Characterization of Pectin in Blueberries

RESULTS: Various methods have been used to extract pectin from blueberries. The extracts of each method must be analyzed for actual pectin content and the pectin must be analyzed for structural components.

RECOMMENDATIONS: This research will be worked on this Spring and should be continued this Summer and Fall. Pectin could be a very important source of dietary fiber for diabetics. Studies have shown that the blood glucose level of diabetics can be lowered when pectin is ingested in a meal. Pectin has also been shown to lower blood cholesterol levels. Pectin works without decreasing mineral absorption as some high fiber diets do. Studies should be done to analyze the pectin content of blueberries, which could be a good source of dietary fiber.

Pectin also has very important chemical characteristics which should be determined. Pectin is different in structure for every fruit, and its functions depend on its chemical structure. By knowing the chemical structure of blueberry pectin, keeping quality of frozen and canned blueberries could be controlled, i.e. berry firmness. Other blueberry products could also be improved.

FUTURE WORK: With the recently published research relating dietary fiber (particularly some forms of soluble dietary fiber) to lowered serum cholesterol levels, further research should be conducted on the characterization of the pectins found in blueberries.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

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: Study at 2 locations

Cover and frequency of blueberry and open ground increased over the control the first year of application (Table 1). Grasses were drastically reduced compared to the control the first year of treatment. Grass species were not separated but the predominant species were Wild Oat grass, Canada Bluegrass, Northern Panicum and Muhly grass. Nine other weed species showed a reduction in cover and frequency with the treatment (Table 1). Species which were present but showed no significant effect from treatment include: sourtop blueberry, birch, sweetfern, bush honeysuckle, poplar, bracken fern, wintergreen, dogbane, yarrow, daisy, bunchberry, black-eyed susan, blue flag, lambkill, spagnum moss, willow, clover, and violets.

The decrease in weed cover from the hexazinone treatment resulted in an increase in blueberry stem density, length, and number of buds (Table 2) which produced substantial increases in blueberry yield (Figure 1). The higher yields in 1987 compared to 1985 are attributed to more favorable growing conditions.

Study at 14 locations

Open ground increased and grasses and six species showed a significant decrease with hexazinone treatment (Table 3). Grass cover was reduced by the second hexazinone treatment. Only bunchberry and dogbane increased in cover and frequency with hexazinone treatment. Other species which were rated but showed no effect from treatment include: at 100% occurrence, blueberry, ~~bunch~~choke berry, poplar, cinquefoil; at 92 to 50% occurrence, bracken fern, bush honeysuckle, birch, lambkill, aster, rose, red maple, spagnum moss; at 43 to 29% occurrence, red sorrel, huckleberry, violets, black-eyed susan, wild lilly of the valley, St.johnswort and 16 other species with occurrences less than 21%. The number of blueberry stems or their length did not increase with a second treatment but the number of buds increased, indicating a potential for higher yields (Table 4).

CONCLUSION: Hexazinone application resulted in a decrease in weed competition and an increase in blueberry growth and yield. Fifteen to 40% of the hexazinone treated fields were open ground, if mulch could be applied and high yielding blueberry plants established in these areas then weed competition could be reduced and blueberry productivity increased.

RECOMMENDATIONS: Alternative control strategies will need to be developed for bunchberry and dogbane which increased with hexazinone use.

RVEL89.DOC

Table 1. Effect of hexazinone on species composition and frequency on two locations, treated in 1984 and 1986.

Year	Hexazinone (Kg/ha)	Cover(Frequency) T-18	Aurora	Cover(Frequency) T-18	Aurora	Cover(Frequency) T-18	Aurora	Cover(Frequency) T-18	Aurora
		Blueberry		Open ground		Grasses		Aster	
1984	0	41.7 (97)	16.3 (80)	12.4 (67)	17.3 (73)	76.8(100)	72.8(100)	0.0 (0)	2.0 (46)
1984	2.2	57.5(100)	50.0(100)	33.3 (97)*	41.4 (97)*	11.2 (53)**	14.7 (63)**	0.0 (0)NS	0.0 (0)*
1986	0	44.4(100)	16.6 (90)	14.8 (97)	20.6 (87)	57.9(100)	52.7 (97)	0.0 (0)	8.3 (80)
1986	2.2	62.9(100)	45.5 (97)	26.0(100)**	35.6 (97)NS	9.3 (77)**	6.8 (63)**	0.0 (0)NS	0.0 (0)**
Significance		Location ** Treatment **		Location * Year,Treatment interaction *		Year * Year,Treatment interaction *		Year, Location Treatment-interaction **	
		Bunchberry		Lambkill		Pin cherry		Cinquefoil	
1984	0	7.3 (47)	0.0 (0)	2.8 (30)	4.1 (30)	5.9 (57)	0.0 (0)	0.0 (0)	11.2 (87)
1984	2.2	0.1 (3)	0.1 (3)	1.5 (27)	1.8 (10)	0.6 (7)	0.0 (0)	0.0 (0)	1.2 (13)
1986	0	7.4 (40)	0.0 (0)	3.2 (27)	3.6 (27)	6.3 (53)	0.0 (0)	0.0 (0)	11.8 (83)
1986	2.2	1.1 (10)	0.0 (0)	1.7 (10)	0.2 (7)	0.0 (0)	0.0 (0)	0.0 (0)	0.1 (3)
Significance		Treatment **		Treatment *		Location ** Treatment **		Location ** Treatment **	
		Blackberry		Goldenrod		Medowsweet		Strawberry	
1984	0	5.3 (17)	10.1 (50)	1.2 (30)	17.8 (90)	1.9 (13)	2.4 (30)	0.0 (0)	4.8 (60)
1984	2.2	0.5 (3)	0.1 (3)	0.0 (0)NS	0.0 (0)**	0.0 (0)	0.1 (3)	0.0 (0)	0.0 (0)
1986	0	2.9 (20)	5.9 (47)	2.6 (40)	3.0 (37)	1.9 (13)	1.8 (20)	0.0 (0)	4.1 (50)
1986	2.2	0.0 (0)	0.0 (0)	0.0 (0)NS	0.0 (0)*	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Significance		Treatment*		Treatment, Year, Location-interaction**		Treatment **		Location * Treatment *	

NS = nonsignificant, * = 5% level, ** 1% level of significance.

Table 2. Effect of hexazinone on blueberry growth, treated in 1984 and 1986.

Year	Location	Hexazinone treatment (Kg/ha)	Total / 0.1m			Average	
			Number	Legnth (cm)	Buds	Legnth (cm)	Buds
1984	Aurora	0	16	150	36	9.8	2.5
1984		2.2	44	352	108	8.2	2.7
Significance			*	*	**	*	NS
1984	T-18	0	33	379	62	11.8	2.1
1984		2.2	37	392	114	10.8	3.4
Significance			NS	NS	**	NS	**
1986	AURORA	0	40	263	37	7.0	1.0
1986		2.2	83	515	110	6.3	1.3
Significance			**	**	**	NS	*
1986	T-18	0	59	344	103	6.0	1.7
1986		2.2	116	868	340	7.6	3.2
Significance			**	**	**	**	**

NS = nonsignificant, * = 5% level, ** = 1% level of significance.

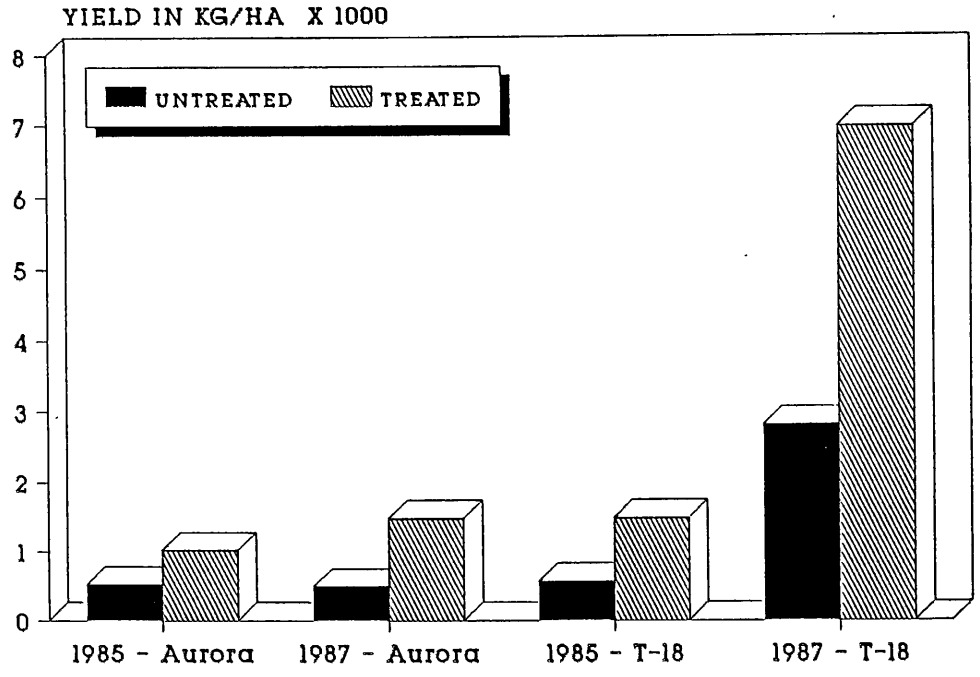


Figure 1. Effect of hexazinone on blueberry yield on two locations treated in 1984 and 1986. All treatments significant except 1987 - T-18 where no test was available.

Table 3. Effect of hexazinone on species composition and frequency on 14 locations, treated in 1983 or 1983 and 1985.

Year	Hexazinone (Kg/ha)	Cover(Frequency) Once	Twice	Cover(Frequency) Once	Twice
		Open ground		Grasses	
1980	0	6.6 (61)	7.0 (55)	10.1 (60)	5.8 (43)
1985	2.2	20.0 (97)	25.4 (99)	8.4 (80)	2.9 (27)
Occurance		100		100	
		Goldenrod		Willow	
1980	0	2.3 (52)	1.7 (18)	0.5 (18)	1.0 (20)
1985	2.2	0.4 (9)	0.1 (2)	0.1 (1)	0.0 (0)
Occurance		100		100	
		Wintergreen		Medowsweet	
1980	0	0.7 (32)	1.1 (23)	3.7 (37)	3.8 (30)
1985	2.2	0.0 (0)	0.0 (0)	0.7 (10)	0.2 (4)
Occurance		100		100	
		Raspberry		Sweetfern	
1980	0	0.4 (8)	0.1 (4)	2.5 (22)	2.1 (17)
1985	2.2	0.1 (1)	0.0 (0)	1.1 (2)	0.1 (2)
Occurance		57		71	
		Bunchberry		Dogbane	
1980	0	1.5 (14)	1.8 (17)	0.0 (0)	0.0 (0)
1985	2.2	11.5 (39)	5.9 (29)	2.2 (21)	1.7 (17)
Occurance		92		57	

All treatments significantly different, group differences significant for grasses only.

Table 4. Effect of hexazinone on blueberry growth over 14 locations, treated in 1983 or 1983 and 1985.

Hexazinone treatment (Kg/ha)	Total / 0.1m (1985) Number	Legnth (Cm)	Buds	Average Legnth (Cm)	Buds
2.2	82	657	137	8.6	1.8
2.2+2.2	79	656	170	8.4	2.4
Significance	NS	NS	**	NS	**

NS = nonsignificant, * = 5% level, ** = 1% level of significance

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of Setyhoxydim (POAST) for Bunchgrass Control

METHODS: As indicated in 1988 project proposal outline 1.

RESULTS: The use of Dax or Ammonium sulfate did not enhance the activity of sethoxydim on the bunchgrass grass in this experiment. Later applications of sethoxydim in August and September resulted in less suppression of bunchgrass.

CONCLUSION: Little grass suppression was obtained with the later applications so that early, i.e. June and July, applications of sethoxydim are better than the later applications.

RECOMMENDATIONS: 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. The postemergence applications should be used as a secondary or follow-up application as opposed to the primary treatment.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist
Delmont C. Emerson, Farm Manager

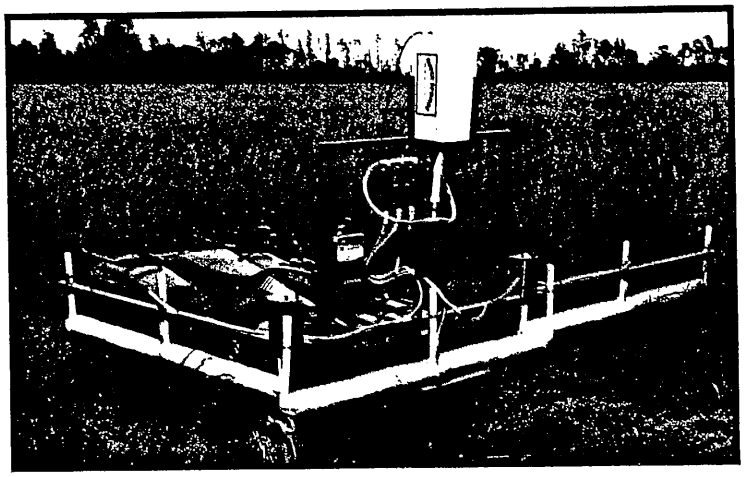
TITLE: Evaluation and modification of commercial wipers.

METHODS: As indicated in 1988 project proposal outline 5. Modifications made on the Super Sponge Weed wiper unit 4W-15 include the addition of wheels and modifying the arms so they will fold up for transport. The row wick wipers did not get mounted or evaluated. Dogbane and bracken fern plants were wiped with a 10% solution of ROUNDUP in June at Blueberry Hill farm and square meter subsamples were counted. Recounts will be made in June of 1989 to determine efficacy.

RESULTS: Good coverage was observed with a minimum amount of drip but the wiper did not follow the contour of the land well.

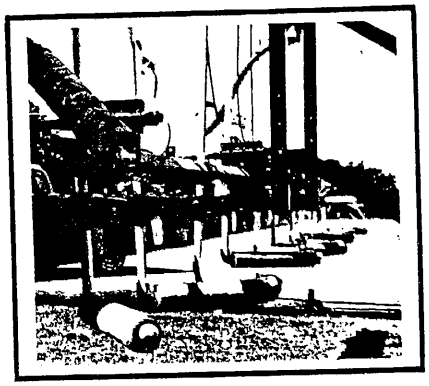
CONCLUSION: The flow metering provided good coverage and drip control but further modifications to improve the ability to follow the contour of the terrain and rear mounting are needed to improve its effectiveness.

RECOMMENDATIONS: Further modifications need to be made and more extensive field trials done before recommending the use of this wiper. The row wick wipers need to be mounted and compared to the super sponge model.



4W-15

Super Sponge Weed Wiper



Row Wick Wiper

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BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

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

METHODS: As indicated in 1987 project proposal outline 6.

RESULTS: All herbicides, except pronomade, produced a significant reduction in grass vigor and height of the oatgrass in 1987 but only hexazinone and terbacil produced a reduction in height in 1988 (Table 1). Hexazinone gave the most suppression at the lowest rate but terbacil and atrazine provided comparable results. No increase in blueberry yield was obtained with the use of any of the herbicides on the oatgrass.

Hexazinone provided the greatest suppression and reduction in height of bunchgrass and increased blueberry yield at the 4 lb/a rate (Table 2). Terbacil provided some suppression of bunchgrass but the other herbicides were ineffective.

CONCLUSION: Hexazinone provided the best suppression of either grass, but terbacil and atrazine also provided control of oatgrass. Yield increases have been obtained with terbacil and atrazine in earlier studies so the lack of response may be because of the density of the grass in the field. Bunchgrass was suppressed best by the 4 lb/a rate of hexazinone, but control not complete. The lack of activity of the fall application of pronomide on either grass may have been due to the high levels of organic mater (> 10%) found in the fields.

RECOMMENDATIONS: Terbacil could be used in rotation with hexazinone to suppress oatgrass but not bunchgrass. Atrazine provided good suppression of oatgrass, but is not registered for use in lowbush blueberries in Maine. Registration of atrazine should be persued to provide an alternative herbicide for oatgrass. A preemergence application of a high rate of hexazinone combined with a postemergence herbicide may be required to adequately control bunchgrass.

Table 2. Effect of preemergence herbicide applications on bunchgrass vigor and blueberry yield, Bucksport 1987-1988.

Herbicide	Rate lb/a	Grass rating 1987	Grass rating 1988	Blueberry Yield kg/ha	Grass height(cm) 1987	Grass height(cm) 1988
Pronamide	0	0	0	1177	56	28
	1	0	0	999	52	29
	2	0	0	899	59	28
	4	0	0	688	59	27
Significance		NS	NS	NS	NS	NS
Hexazinone	0	0	0	722	59	30
	1	0.3	0.4	729	54	30
	2	2.7	1.9	594	51	31
	4	6.8	5.7	1621	38	32
Significance		L**	L**	L*	L**	NS
Terbacil	0	0	0	816	54	30
	1	0.5	0.2	1005	51	28
	2	0.8	0.5	799	50	28
	4	3.5	1.9	1465	41	33
Significance		L**	L**	NS	L*	NS
Simazine	0	0.5	0	1465	53	28
	4	0.0	0	577	55	30
	8	0.1	0	804	56	34
	16	1.5	0.6	937	48	26
Significance		NS	NS	NS	L*	Q*
Atrazine	0	0	0	649	52	27
	4	0.2	0	760	59	26
	8	0.4	0.4	1310	58	29
	16	1.4	0.4	370	62	32
Significance		NS	NS	NS	L*	NS

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

Table 1. Effect of preemergence herbicide applications on poverty oatgrass vigor and blueberry yield, Deblois 1987-1988.

Herbicide	Rate lb/a	Grass rating 1987	Grass rating 1988	Blueberry Yield kg/ha	Grass height(cm) 1987	Grass height(cm) 1988
Pronamide	0	0	0	2057	61	53
	1	0.6	0	1724	55	54
	2	1.6	0	1391	54	51
	4	2.6	0.4	2502	51	59
Significance		NS	NS	NS	NS	NS
Hexazinone	0	0	0	2531	55	58
	1	8.3	6	2758	39	49
	2	8.5	8.5	4018	17	29
	4	9.8	9.7	1615	2	6
Significance		L**	L**	NS	L**	L**
Terbacil	0	0	0	1593	53	55
	1	8.2	7.3	2953	23	22
	2	9.0	8.5	1682	15	19
	4	9.6	9.2	2553	4	9
Significance		L**	L**	NS	L**	L**
Simazine	0	0.8	0	1323	52	52
	4	2.9	0.3	1079	53	53
	8	3.6	0.7	1607	47	57
	16	6.6	2.1	1665	36	49
Significance		L**	L**	NS	L**	NS
Atrazine	0	2.0	0	1610	50	55
	4	7.0	5.3	2797	36	46
	8	8.5	7.7	2631	25	39
	16	9.3	9.0	2597	11	15
Significance		L**	L**	NS	L**	L**

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

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Effect of rate and formulation of hexazinone (VELPAR) on bunchberry.

METHODS: As indicated in 1988 project proposal outline 6 except that both liquid VELPAR and a granular 75% ULV formulation were applied to the same plot. Because of the low volume the granuar formulation was difficult to apply uniformly on the small plot, a one acre area was treated with 4 lb/a (active ingredient) VELPAR ULV mixed with 30 lb/a urea in a granular spreader to provide a more uniform distribution. Weed cover transects were taken on the treated area in August 1988 and will be compared to transects taken in 1986-87 to determine the effectiveness of the treatment

RESULTS: Counts were taken on the bunchberry and plots will will be recounted in July 1988. A comparison with 1986-87 data (Table 1) on the one acre treated with the granular hexazinone indicates that there is a consistant suppression of bunchberry and and a slight reduction of blueberry cover. Open ground increased and other species decreased with the treatment.

CONCLUSION: Need to get count plot data to determine if increasing the rate of hexazinone will reduce bunchberry.

RECOMMENDATIONS: None at this time.

RVELRAT89.DOC

Table 1. Effect of treatment on blueberry and weed density - Jonesboro, 1988.

Treatment(86) + 4lb/a Velpar(88)	Species (Percent cover)									
	Blueberry		Bunchberry		Dogbane		Lambkill		Cinquefoil	
	87	88	87	88	87	88	86	88	87	88
Untreated(1)	42	25	23	4	6	2	0	0	13	0
Mow+Mulch(2)	45	56	10	7	4	2	7	0	23	0
Chemical(3)	37	41	28	7	0	2	0	0	<1	0
Chemical+Mulch(4)	35	24	30	15	2	<1	0	2	2	2
Significance	NS	B	B	NS	B,C	NS	B	NS	B	NS

	Grass		Ground		Violet	
	87	88	87	88	87	88
Untreated(1)	29	0	17	73	8	2
Mow+Mulch(2)	15	0	13	38	2	0
Chemical(3)	8	0	35	50	2	0
Chemical+Mulch(4)	<1	<1	40	61	0	0
Significance	A,C	NS	B	C	A,C	NS

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 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Bracken fern control alternatives.

METHODS: As indicated in 1988 project proposal outline 7 .

RESULTS: The treatments did not decrease fern density or affect yield (Table 1).

CONCLUSION: Fall application of hexazinone or mowing in the crop year did not decrease fern cover or increase yield.

RECOMMENDATIONS: Continue experiment with consecutive hexazinone treatments (spring 88, 89) and mowing (summer 88, 89). Persue the registration of asulam in non-crop year for bracken fern control.

Table 1. Effect of mowing and fall hexazinone application on bracken fern cover and blueberry yield, T-24 - 1988.

Treatment	Burn	Crop	
	Fern/meter	Fern/meter	Yield (Kg/ha)
Untreated	8.1	3.5	1480
Mow	6.7	3.3	1304
Hexazinone	4.3	3.2	1602
Significance	NS	NS	NS

NS = nonsignificant

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

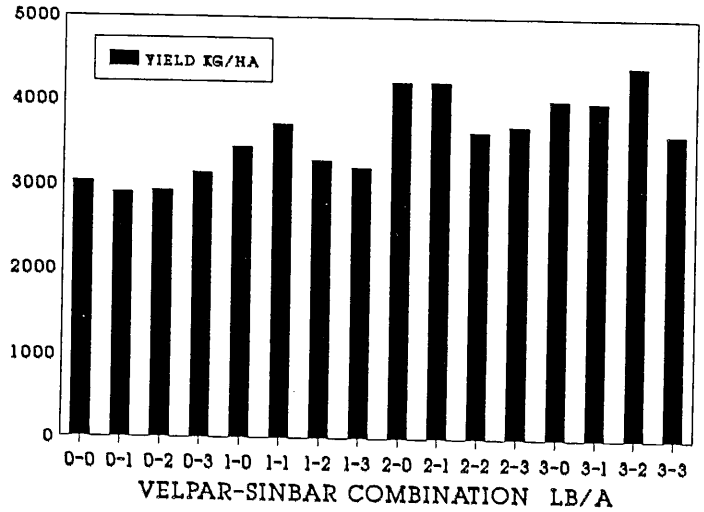
TITLE: Hexazinone (VELPAR) and terbacil (SINBAR) combinations for weed control.

METHODS: As indicated in 1987 project proposal outline 8, except that yields were hand harvested.

RESULTS: Carryover ratings are essentialy the same as 1987 results showing that increasing rates of hexazinone reduced dogbane, bunchberry, St. Johnswort and bracken fern. In 1988 there is a slight increase in blueberry cover (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 and may have stimulated St.Johnswort in the second year. Higher rates of hexazinone with no or low rates of terbacil gave the best yield response (Figure 1).

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: Higher rates of hexazinone are needed to suppress dogbane, bunchberry and bracken fern and should be used if these weeds are present.



RHXTB89.DOC

Table 1. Main effect of hexazinone and terbacil on blueberry and weed cover - Cooper, treated 1987, evaluated 1988.

Herbicide	Rate lb/a	Species Percent cover			
Hexazinone		Blueberry	Dogbane	Bunchberry	St. Johnswort
	0	64	26	15	7
	1	75	18	13	4
	2	70	15	11	2
	3	79	6	5	1
Significance		L**	L**	L*	L**
Hexazinone		Bracken	Grass	Ground	
	0	11	7	20	
	1	6	<1	21	
	2	5	<1	17	
	3	1	0	16	
Significance		L**	L*	NS	
Terbacil		Blueberry	Dogbane	Bunchberry	St. Johnswort
	0	63	20	16	2
	1	71	16	10	5
	2	74	17	7	1
	3	70	13	13	6
Significance		NS	NS	NS	L*
Terbacil		Bracken	Grass	Ground	
	0	7	5	20	
	1	6	1	17	
	2	5	<1	15	
	3	4	1	20	
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 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of hexazinone (VELPAR) with spot treatments of glyphosate (ROUNDUP) or sethoxydim (POAST) for bunchgrass control.

METHODS: As indicated in 1988 project proposal outline 8 except that fluazifop-P (FUSILADE) was added as a spot treatment and spot treatments were applied on one date, 7/25/88. Ten additional clumps were treated in an area adjacent to the block on 3 dates, 7/25, 8/30, and 9/29/88 to determine the relative efficacy of each treatment over time. Initial clump heights were measured and clumps will be remeasured and rated for efficacy in July 1989.

RESULTS: Increasing the hexazinone rate reduced the number of grass clumps per plot and grass height but also increased the amount of blueberry injury (Table 1).

CONCLUSION: Carryover ratings and yield data need to be collected before any conclusions are made.

RECOMMENDATIONS: None at this time.

Table 1. Effect of hexazinone and spot treatment on bunchgrass and blueberries - Surry, 1988.

Treatment	Bunchgrass		Blueberry
	Clump/plot	Height(cm)	Rating (0-10)
Hexazinone (lb/a)			
0	25	47	0
2	16	27	1.1
4	3	5	5.6
Significance	**	**	**
Untreated	20	28	2.3
Glyphosate	10	25	2.3
Sethoxydim	13	25	2.3
Fluazifop-P	16	25	2.1
Significance	*	NS	NS

Rating 0=no effect, 10=dead, **=highly significant, *=significant, NS=nonsignificant.

RHXSPGR.DOC

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Directed sprays of glyphosate (ROUNDUP) for bunchberry control.

METHODS: As indicated in 1988 project proposal outline 9.

RESULTS: Final applications put on in September, subplots will be recounted and yields obtained in 1989.

CONCLUSION: None yet.

RECOMMENDATIONS: None yet.

RBUNDR89.DOC

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

INVESTIGATOR: David E. Yarborough, Associate Scientist

TITLE: Evaluation of sulfonyl urea herbicides for bunchberry control.

METHODS: As indicated in 1988 project proposal outline 10.

RESULTS: Final applications put on in September, subplots will be recounted and yields obtained in 1989.

CONCLUSION: None yet.

RECOMMENDATIONS: None yet.

RSUFBN89.DOC

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

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 by increasing rates of chlorimuron applied either at emergence in May or at tip dieback in July (Table 1). More injury was observed with the treatments applied at emergence. Injury consisted of a red colorations on the leaves and an appearance of shorter plants but no tissue death was seen. Although total stems and total length were not reduced, total and average buds were reduced with the higher rates of chlorimuron (Table 1). Average stem length was reduced by the chlorimuron treatments at emergence but not by the later treatments. The 18 and 35 g ai/ha rate increased total and average buds at emergence and average buds at tip die-back.

Chlorimuron did not reduce the number of bunchberry stems but the treatment at emergence resulted in a decline in blueberry yield as the chlorimuron rate was increased (Table 2).

CONCLUSION: Blueberry injury was observed with the chlroimuron treatments and blueberry yield was depressed by the higher rates of chlorimuron at emergence. The addition of a surfactant and the higher rates of chlorimuron did not increase efficacy on the bunchberry but resulted in increased injury to the blueberry.

RECOMMENDATIONS: Canadian researchers reported that another sulfonyl urea herbicide, sulfometuron, applied in the fall at 150 to 200 g/ha was the most effective herbicide in reducing bunchberry in lowbush blueberry fields. Phytotoxicity to the blueberries was noted but it was comparable to hexazinone. Results from several experiments were variable and further studies are needed before any conclusions are made. Further research on timing and rates are being conducted to determine if the sulfonyl urea herbicides will provide consistent suppression of bunchberry in lowbush blueberry fields.

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

Timing	Rate g ai/ha	Blueberry	Bunchberry	Blueberry Total			Blueberry Average	
		Rating (0-10)[a]		Number (0.1m)	Legnth (cm)	Buds (0.1m)	Legnth (cm)	Buds (stem)
Emergence - May								
	0	0	0	54	454	122	8.8	2.8
	18	2.6	1.4	63	362	188	6.0	3.1
	35	2.4	0.8	61	316	167	5.5	3.5
	70	5.2	4.0	51	254	144	4.6	3.2
	140	5.8	4.2	65	320	81	4.9	1.3
Significance		L**	L**	NS	NS	Q**	Q**	Q*
Top dieback -July								
	0	0	0	59	424	112	7.2	1.9
	18	1.4	1.0	43	332	87	7.7	2.6
	35	1.2	0.8	48	408	82	8.5	1.9
	70	2.2	2.0	37	276	44	6.5	1.1
	140	1.4	1.4	62	425	23	6.8	0.3
Significance		L**	L**	NS	NS	L**	NS	L**

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

Table 2. Effect of timing of chlorimuron on bunchberry stand and blueberry yield, Jonesboro 1988.

Timing	Rate g ai/ha	Bunchberry / 0.1m			Blueberry
		1987	1988	Change	Yield kg/ha
Emergence - May					
	0	21	27	6	8560
	18	28	22	-6	8053
	35	28	17	-1	7022
	70	26	33	7	4182
	140	30	20	-10	3617
Significance		NS	NS	NS	L*
Tip dieback - July					
	0	13	18	5	5640
	18	21	35	14	4844
	35	19	29	10	5524
	70	26	30	4	3311
	140	11	10	-1	3876
Significance		NS	NS	NS	NS

* = 5% level, L = linear trend NS = nonsignificant.

BLUEBERRY ADVISORY COMMITTEE
RESEARCH REPORT

DATE: January 1989

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

TITLE: Seedling Pruning Study

METHODS: As indicated in 1988 Blueberry Advisory Committee Research Report.

RESULTS: Plant cover increased steadily over the study. The cross 4161 x Augusta spread more rapidly than Augusta x 4161. Plants spread was slightly greater if they were not pruned (Table 1).

CONCLUSION: In this study the seedling source was the most important factor influencing plant spread. The final pruning and evaluation will need to be made before a final conclusion can be reached.

RECOMMENDATIONS: Will be made when study is completed.

Table 1. Effect of time of pruning and cross on blueberry plant cover, planted at BBHF, Jonesboro May 1985, evaluated August 1988.

YEAR	Cover(% ft sq)	Treatment	Cover(% ft sq)	Cross	Cover(% ft sq)
1986	36	mow 1986	43	4161 x Augusta	72
1987	47	mow 1987	47	Augusta x 4161	58
1988	56	unmowed	50		

All differences significant.

BLUEBERRY ADVISORY COMMITTEE

RESEARCH PROGRESS REPORT

Date: May, 1988 to April 30, 1989

Investigators: Michele Marra and Tom DeGomez

Title: Blueberry Harvester Trials

Methods:

Measurements of harvested yield/strip, time/strip, and subsamples of dropped and split berries were taken on .25 acre strips (up to 5 replications) at each of four locations for the Darlington, Bragg, and hand raking crews. The experimental design used was the split-split plot design, although the number of replications varied by treatment. Measurements were taken for the Nimco harvester at only the first two locations due to the machine owner's time constraints.

Both high (6,000 lbs./ac.) and low (3,000 lbs./ac.) yield and high and low stem locations were chosen to determine if these factors affected the relative profitability of the technologies. Operating and ownership cost data were collected independently of the trials to assess the relative profitability of the different technologies. The economic analysis was performed using budgeting, partial budgeting and break-even analysis techniques.

Results:

The relative profitability of each mechanical harvesting technology when compared to hand raking crews depends on the expected price of blueberries, the expected yield of the harvested acreage, the total acreage to be harvested per season and the assumed wage rate for all labor, including the box rate for the hand raking crews.

Current Wage and Box Rates

The most important factor seems to be the expected blueberry price. When analyzed assuming the expected blueberry price is $.41/lb. (past three years' average price), none of the mechanical harvesters were more profitable than the hand rakers at current wage rates, regardless of total harvested acreage if potential yield is expected to be low. On high yielding acreage with a high expected price, the Nimco and Bragg harvesters were less profitable than hand raking, but the Darlington was slightly more profitable at all total acreages.

If a lower blueberry price is assumed ($.30/lb.), then the Nimco and Darlington harvesters were more profitable than the hand rakers at all acreages with low yield, and the Bragg was more profitable than the hand rakers if total seasonal harvested acreage exceeded approximately 20 acres. For high yielding acreage and the lower blueberry expected

price, the Bragg and Darlington harvesters dominated the hand rakers, and the Nimco was more profitable than the hand rakers at more than 35 harvested acres.

If average yield is assumed (4,800 lbs./ac.), the mechanical harvesters were uniformly more profitable than the hand rakers at the lower blueberry price, and the hand rakers were more profitable at the higher blueberry price, regardless of the total harvested acres.

Higher Expected Wage and Box Rates

Looking to potential future scarcity of labor for blueberry harvesting, we analyzed the relative profitability of the technologies assuming a higher wage rate for all labor, increasing each wage rate by $.50/hr. and increasing the box rate paid to the hand rakers from $2.75 to $3.50 per box. Under these assumptions, assuming a low expected blueberry price of $.30/lb., all of the mechanical harvesters were more profitable than the hand rakers regardless of potential yield or total acreage. If the higher blueberry price is assumed ($.41/lb.), then the relative profitability depends on yield and total acreage. For low yielding fields, the Darlington and Nimco were more profitable than the hand rakers at all acreages; the Bragg above 80 harvested acres. For high yielding fields, the Bragg and Darlington were more profitable than the hand rakers, and the Nimco was not, regardless of total acreage harvested.

Figures 1 - 8 illustrate the break-even points for each harvester in terms of total seasonal acreage harvested under various key assumptions. A full report of the results of the field trials will be available to the industry in April, 1989.

Note that all of the results are conditioned upon the field conditions of the plots chosen for the trials. These plots were all relatively flat, rock-free fields on the blueberry barrens. If fields are rougher or rockier, then the results would tend toward higher relative profitably for the hand raking crews, then probably toward the smaller machines.

Conclusions:

The results presented here are preliminary, and conclusions will be drawn when the full report is complete.

Recommendations:

The field trials should be conducted again in two years' time to allow for full participation of the Nimco harvester after planned modifications to it are made. Preliminary results indicate that each type of harvesting technology probably has a place in the wild blueberry industry, depending on price, wage rates, field conditions and total acreage to be harvested.

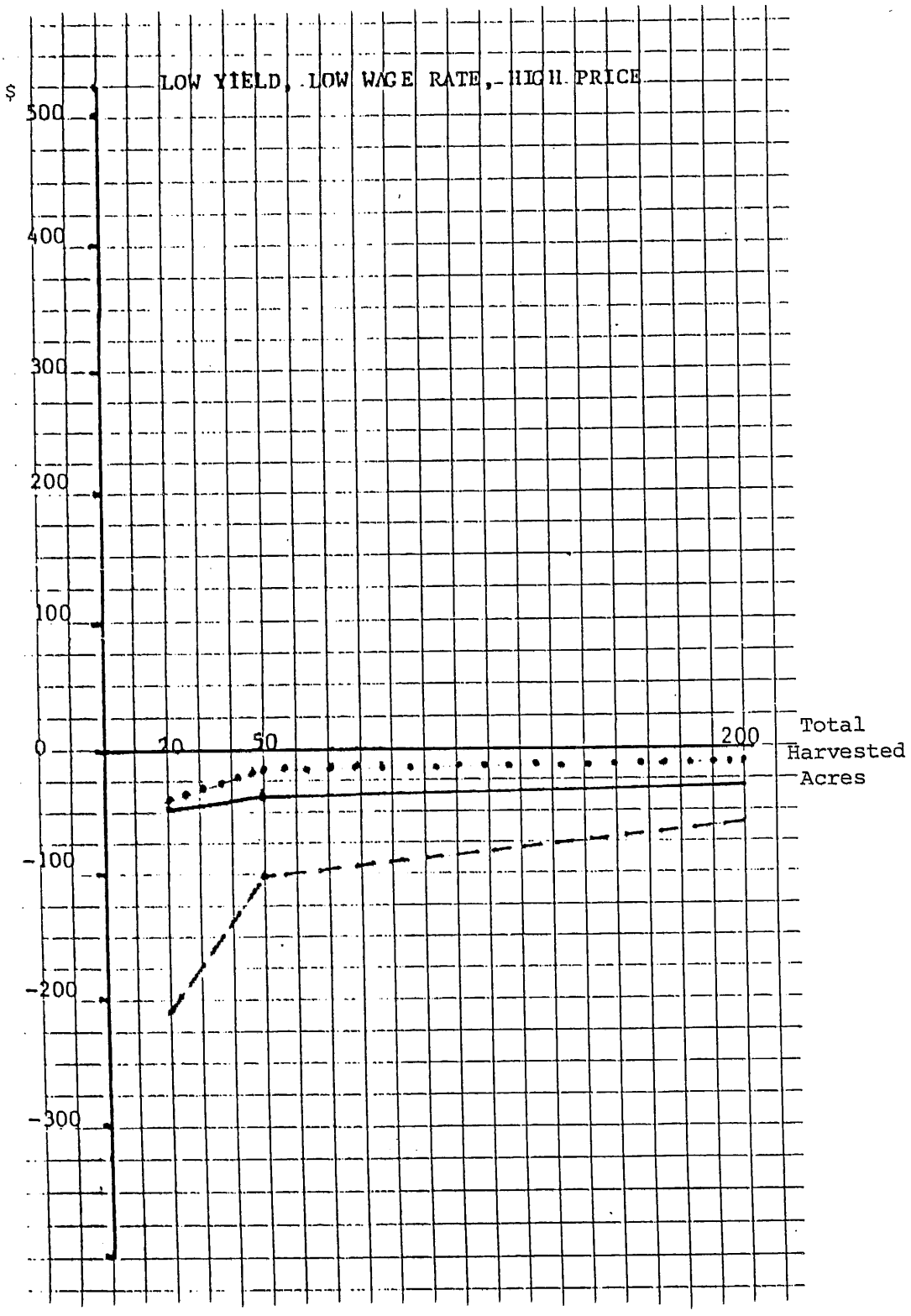


Figure 1. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming Low Yield, Current Wage Rates, and High Blueberry Price By Total Harvested Acres

Key: Bragg - - - , Nimco ....., Darlington _____

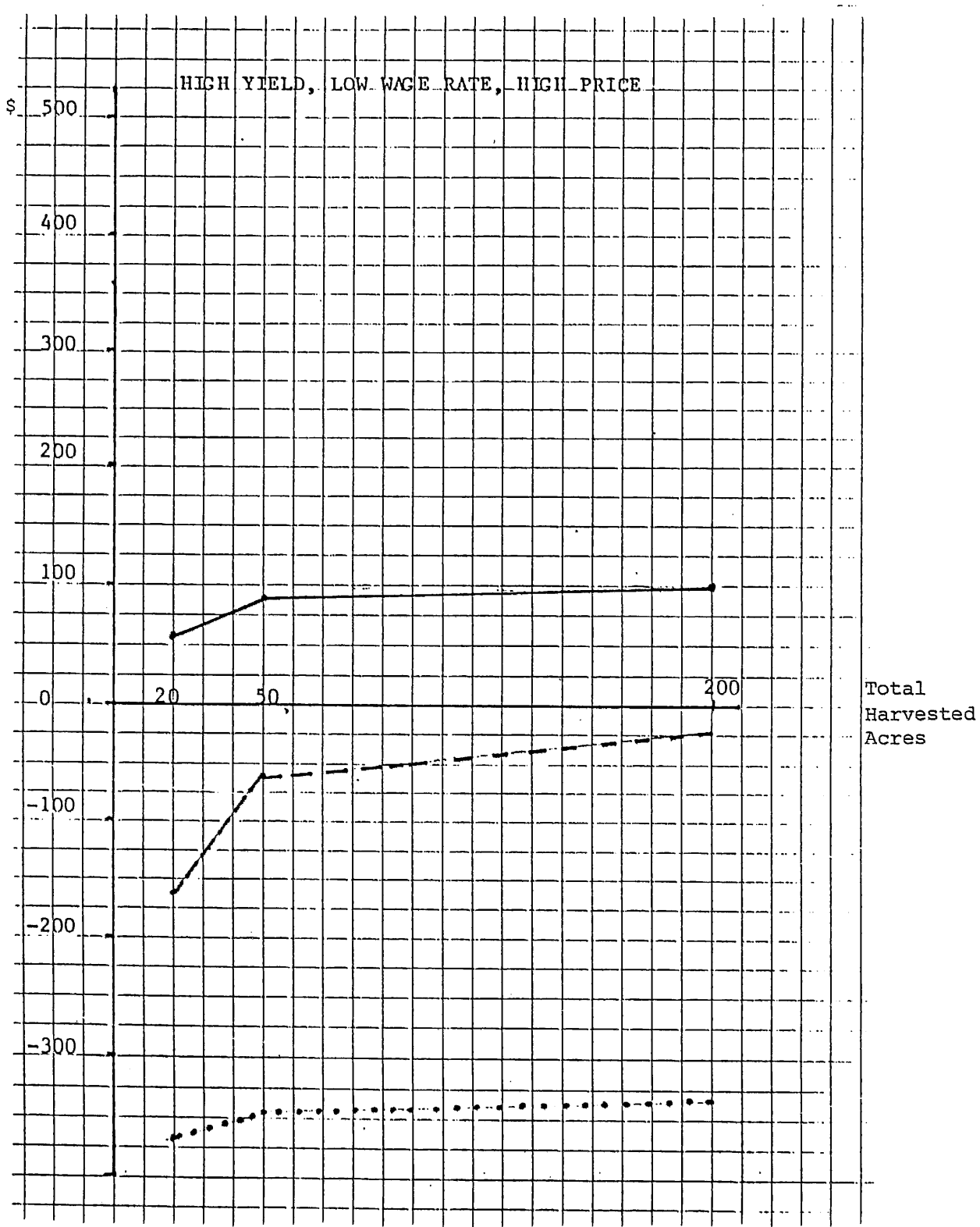


Figure 2. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming High Yield, Current Wage Rates, and High Blueberry Price By Total Harvested Acres

Key: Bragg - - -, Nimco .... , Darlington _____

LOW YIELD, LOW WAGE RATE, LOW PRICE

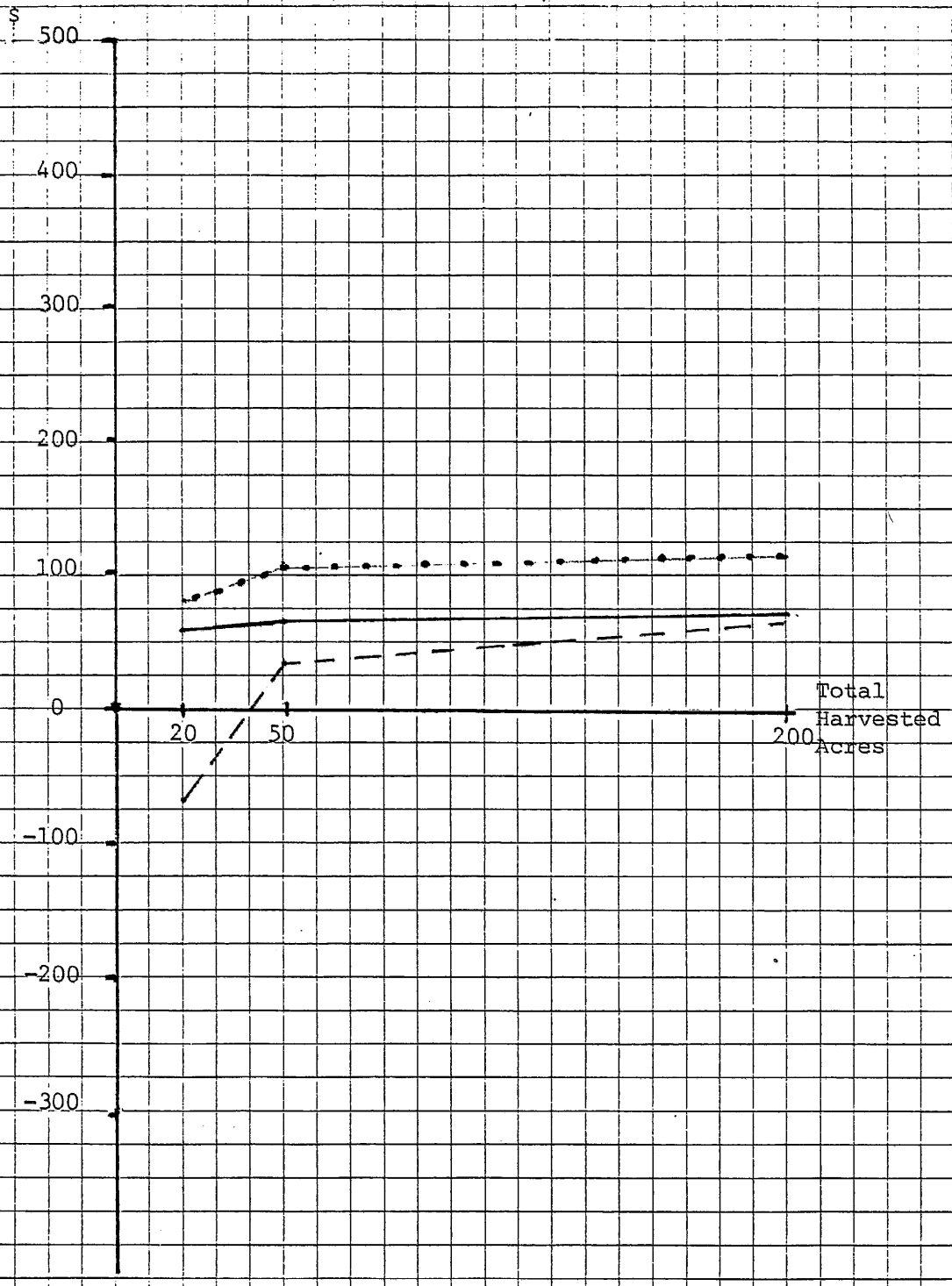


Figure 3. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming Low Yield, Current Wage Rates, and Low Blueberry Price By Total Harvested Acres

Key: Bragg - - - , Nimco ..... , Darlington

HIGH YIELD, LOW WAGE RATE, LOW PRICE

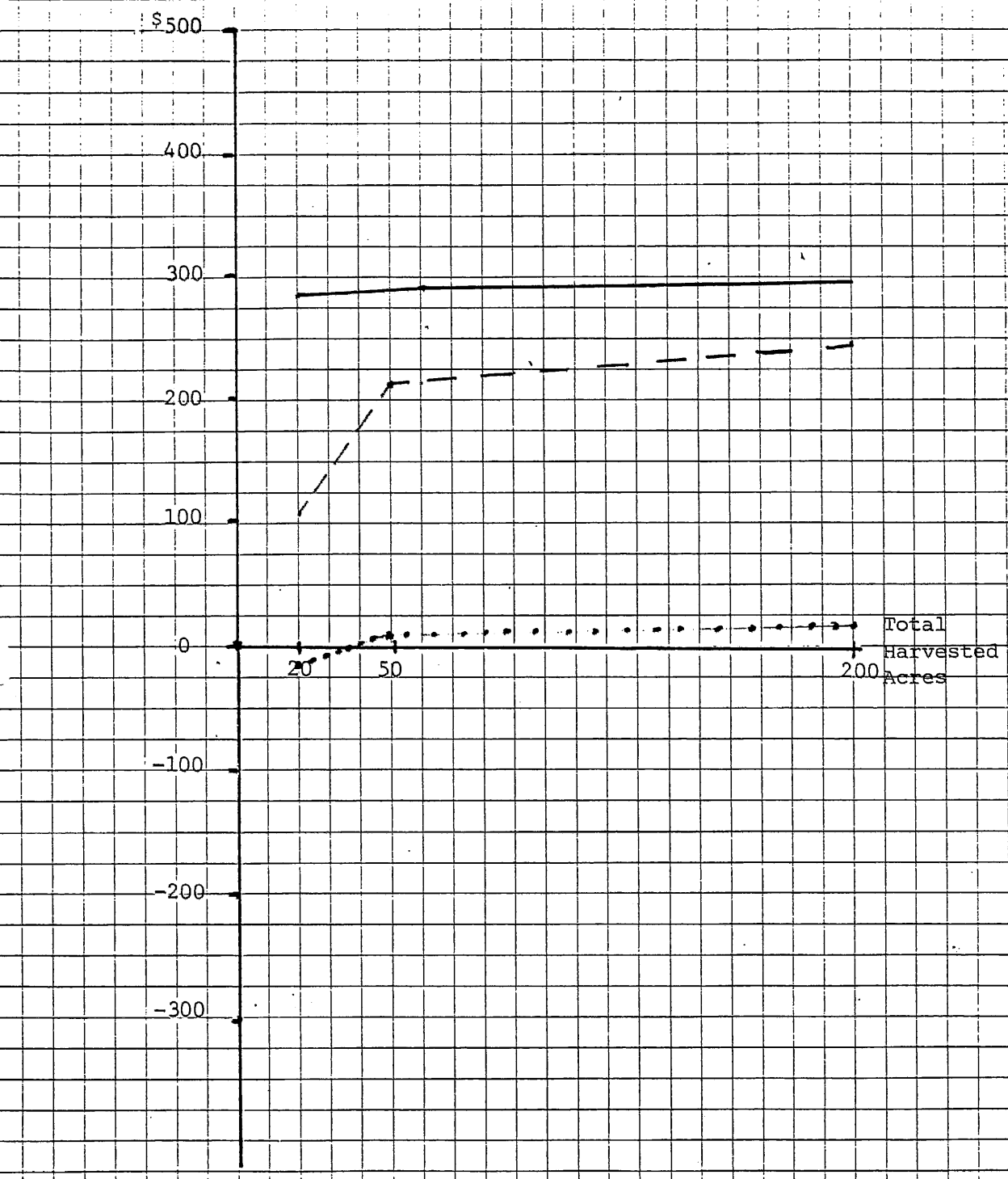


Figure 4. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming High Yield, Current Wage Rates, and Low Blueberry Price By Total Harvested Acres

Key: Bragg - - - , Nimco ..... , Darlington _____

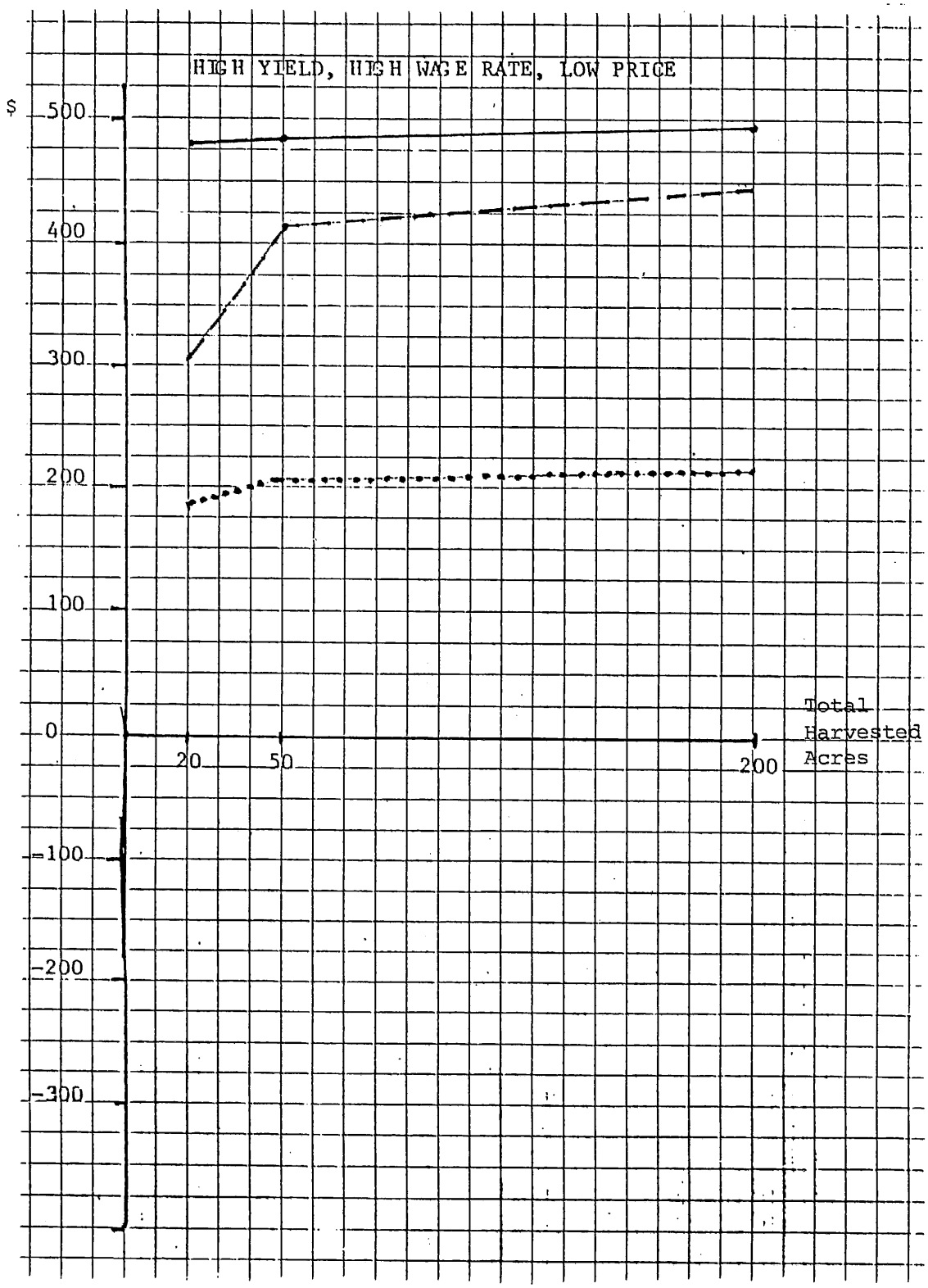


Figure 5. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming High Yield, Higher Wages, and Low Blueberry Price By Total Harvested Acres.

Key: Bragg - - - , Nimco ..... , Darlington _____

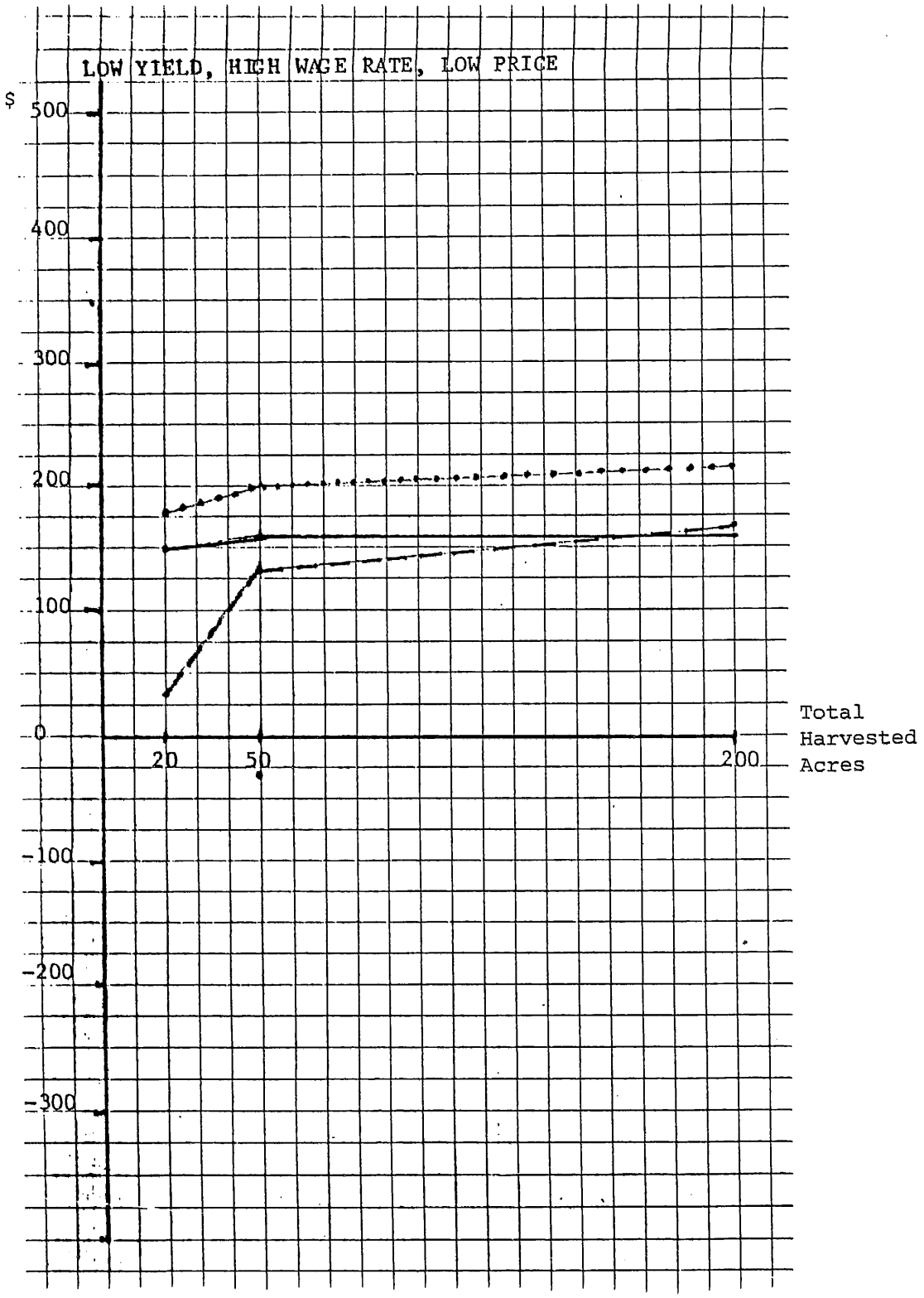


Figure 6. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming Low Yield, Higher Wages, and Low Blueberry Price By Total Harvested Acres.

Key: Bragg - - - , Nimco ..... , Darlington _____

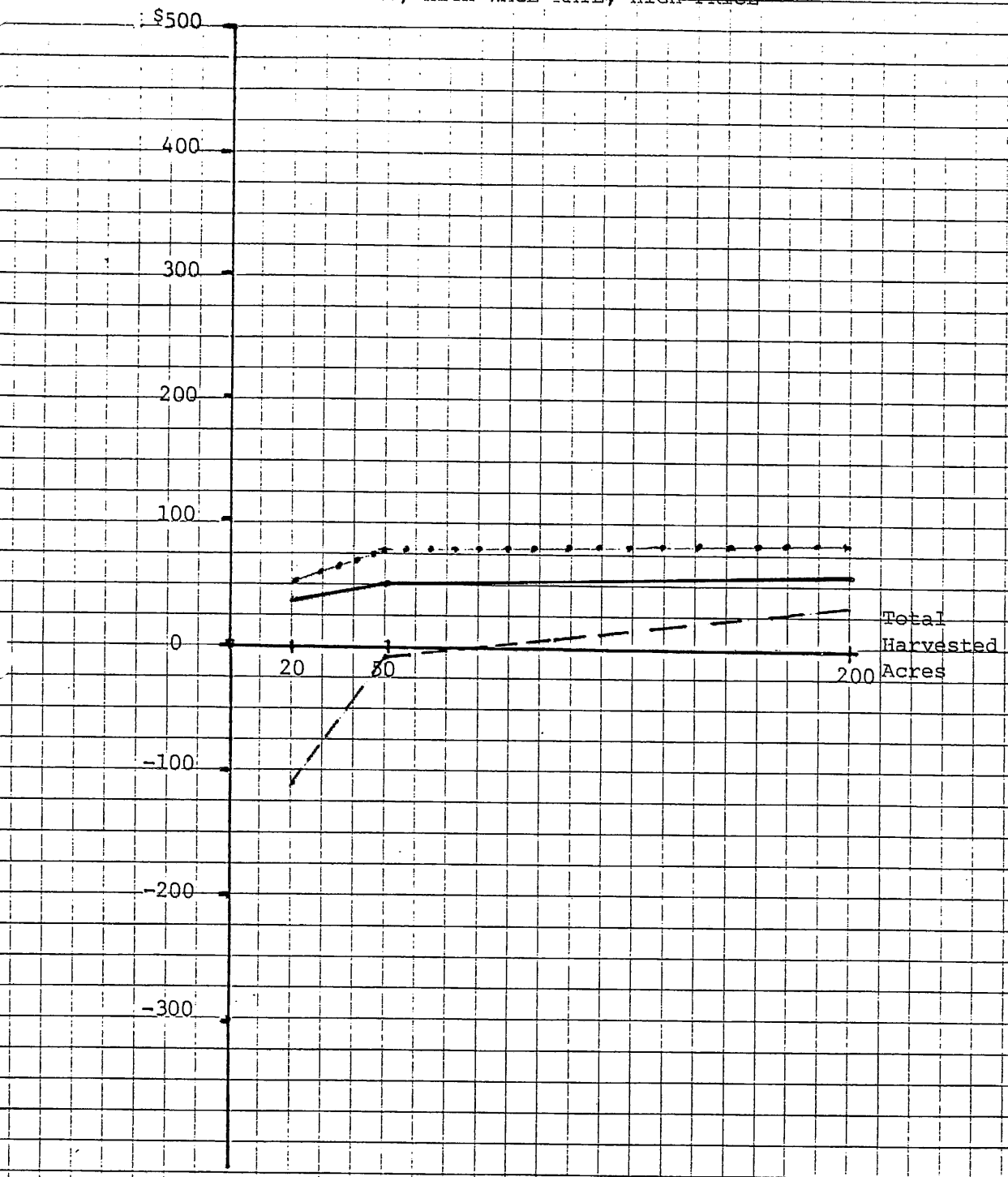


Figure 7. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming Low Yield, Higher Wages, and High Blueberry Price By Total Harvested Acres.

Key: Bragg - - -, Nimco ....., Darlington _____

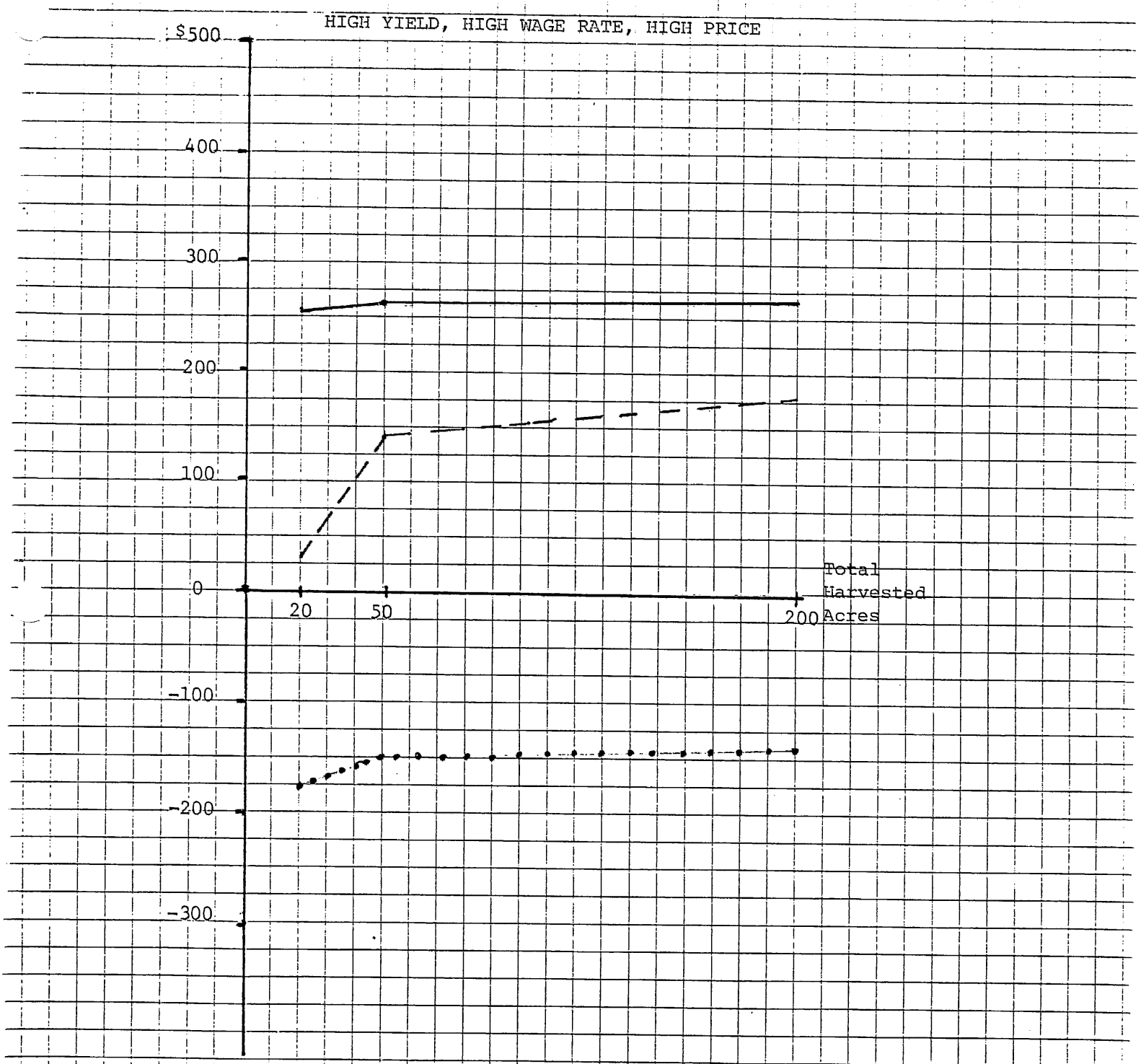


Figure 3. Per Acre Return Over Harvesting Costs Relative to Hand Raking for the Mechanical Harvesters Assuming High Yield, Higher Wages, and High Blueberry Price By Total Harvested Acres.

Key: Bragg - - - , Nimco ..... , Darlington _____

BLUEBERRY ADVISORY COMMITTEE
EXTENSION REPORT

Date: January 1989

Investigators: Tom DeGomez

Title: Blueberry Extension Program

Methods:

Two specific projects and the summer employee will be reported in the following narrative.

Project #1 - Leaf and soil sampling, demonstrations and analysis.

Specialized leaf sample submission bags were produced and made available to growers who wanted to take leaf samples. Seven soil sampling tubes were placed in county Extension offices in South Paris, Rockland, Ellsworth, and Machias. In addition nine sampling tubes were placed with the board of directors of the Washington County Blueberry Council (Council directors were given special training in sampling procedures so they could teach neighboring growers.)

Six demonstrations were held throughout the state to teach growers the methods and benefits of sampling their fields for nutrient levels. As a result of the demonstrations 75 samples were submitted by growers. As a follow up to the samples being submitted I sent out fertilizer recommendations. I am in the process of making individual visits to these growers to discuss the results of the samples and the recommendations.

Project #2 - Color Insect and Disease Fact Sheets

No color fact sheets were produced this year. We are in need of additional biological data on some of the insects in order to proceed with the printing. I would like to hold the funds over for one more year in hope that the needed information will be available by fall of 1989.

Summer Employee -

The availability of a summer helper was of tremendous help. He was invaluable while setting up and carrying out the machine harvester experiment. Additional duties included updating mailing lists, stuffing growers guides, assisting at field demonstrations, plot maintenance, nutritional survey and general office help.