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Blueberry Progress Reports

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BLUEBERRY PROGRESS REPORTS

MAINE LIFE SCIENCES AND AGRICULTURE EXPERIMENT STATION
AND
MAINE COOPERATIVE EXTENSION SERVICE

Prepared for

THE MAINE BLUEBERRY COMMISSION

and the

UNIVERSITY OF MAINE BLUEBERRY ADVISORY COMMITTEE

March 1982

R E P O R T S

Weed Control in Lowbush Blueberry Fields

Personnel:

Amr A. Ismail, David E. Yarborough, Delmont C. Emerson

Mission of Project:

To improve blueberry production and facilitate harvesting by developing new or improved methods of controlling weeds in lowbush blueberry fields.

Specific Objectives:

1. Evaluate herbicides for the control of grasses, sedges, and flowering herbaceous weeds (goldenrod, etc.).

2. Evaluate herbicides for the control of woody weeds (hardhack or meadow sweet, barrenberry, poplar, etc.).

3. Develop or improve equipment and methods for application of herbicides for selective control of weeds in lowbush blueberry fields. Emphasis is to reduce amount of herbicides used, and minimize effect on non-target areas.

Status of Current Research:

1. Hexazinone at 0, 1.1, 2.2 or 4.5 kg/ha by 0, 50 or 100 kg/ha N was applied in a split block design on five commercial lowbush blueberry fields in Aurora (2), Hancock, Centerville and Orland in May, 1980. Visual observations of blueberry stand, herbicide injury to blueberries, grass control and counts of Spiraea and Solidago plants were made in the summer of 1980. Blueberry stem samples were collected in the fall of 1980, counted, measured and the number of flower buds was determined. Yields from three locations were obtained in August, 1981. These plots are being maintained without additional herbicide or fertilizer application. Evaluation of carry-over effect of herbicide treatments, identification of invading plant species, assessment of changes in blueberry stand as well as other variables are to be assessed in 1982 and 1983.

2. Hexazinone at 0, 0.6, 1.1, 2.2 kg/ha by 0, 50, 100 kg/ha N was applied in a splitblock design on 13 commercial blueberry fields in Waldoboro (2), Union, Penobscot, Eastbrook, Orland, Cooper, Ellsworth, Lamoine, Jonesboro, Meddybemps, Columbia and Cutler in May of 1981. Visual observations of blueberry stand, herbicide injury to blueberries, grass control and counts of Spiraea, Solidago and other prominent weeds present were made in the summer of 1981. Data are being summarized and analyzed. Soil samples were obtained in the spring of 1981 and soil organic matter and pH will be determined to test for a correlation between soil characteristics and efficacy of control. Blueberry stem samples were sampled in the fall of 1981 and are being counted and measured. Yield samples will be taken in the summer of 1982.

Status of Current Research (continued):

3. A study is under way in cooperation with Dr. Steve Skinner, Department of Agricultural Resource Economics, to provide cost/benefit analysis of the use of hexazinone for weed control in lowbush blueberry fields.

4. A study is under way in cooperation with Dr. Rodney Bushway, Department of Food Science, to determine nutrients and vitamin contents of blueberry fruits. Also, to determine the effect of hexazinone application on certain nutrients in blueberry fruits.

5. A study to compare the efficacy of cutting, cutting and stump spraying with 2,4-D in oil or the placement of hexazinone (10% active) pellets for controlling woody weeds in lowbush blueberry fields was initiated in the summer of 1981. Experimental sites are located on T-18 M.D. and T-19 M.D. on the barrens. Five species including red maple, cherry, willow, trembling aspen and birch were selected for the study. Each species received 3 treatments at 4 rates each replicated 10 times. Initial observations on efficacy were made in the summer of 1981. A final evaluation of survival will be made in July, 1982. An economic analysis (cost/benefit study) of the results will also be performed so that both economic and efficacy information may be used to determine the optimal treatment.

6. A comparison between the effects of mechanical cutting versus 4 rates of: 2,4-D in oil or water, fosamine, hexazinone, glyphosate and dicamba; all applied by a hand held wiper (clapper) on planted barrenberry plants was initiated in the summer of 1981 at Blueberry Hill Farm in Jonesboro. Treatments were applied in an RCB design with 10 replications. Visual effects of treatments were recorded in 1981 and final observations to determine barrenberry plant growth and survival will be made in the summer of 1982.

7. The effect of 4 rates of glyphosate applied by a commercially available hand held wick wiper on planted barrenberry plants being evaluated at Blueberry Hill Farm in Jonesboro. Herbicide was wiped on barrenberry leaves and stems in August, 1981. The extent of injury to barrenberry plants was assessed visually in 1981 and plant growth and survival will be determined in the summer of 1982.

8. Three 1 hectare plots were established in Spring Pond area in Deblois in 1980 to determine the efficacy of treatments with endothall followed by glyphosate for controlling barrenberry under commercial growing conditions. Two sites were treated on newburn and one after harvest. The newburn sites will be pruned in the spring and regrowth evaluated in 1982. The site treated after crop was pruned with no visual effect noted. Stem sample and yields will be obtained in the fall of 1982 for final evaluation of treatment effects.

9. A study is under way at Blueberry Hill Farm in Jonesboro, to determine the effectiveness of an antidessicant agent in providing protection for blueberry flower buds from winter injury.

Significant Research Accomplishments:

1. In a study to determine the efficacy and interaction of hexazinone and nitrogen on weeds, blueberry growth and yield, hexazinone at 0, 1.1, 2.2 or 4.5 kg/ha ai and nitrogen (from urea) at 0, 50 or 100 kg/ha were applied preemergence, after pruning, in five commercial lowbush blueberry fields.

   Nitrogen application did not influence blueberry plant stand. No significant herbicide by fertility interaction on weed control or blueberry plant stand was found. Hexazinone was effective in controlling several weed species and caused a significant linear decline in grass, meadowsweet (Spiraea latifolia) and goldenrod (Solidago sp.) populations. A linear increase in visual injury to blueberry plants was associated with the rate of hexazinone applied. Blueberry stem density and flower buds showed increases associated with hexazinone application. Results were reported in the Proceedings of the Northeast Weed Science Society, Vol.36:185 (1982).

2. The efficacy of hexazinone on certain weeds present in a commercial lowbush blueberry field in Jonesport and on blueberry growth and yield was evaluated in 1980 through 1981. Hexazinone was applied preemergent, after pruning, at 0, 1.1, 2.2, 4.5 or 9.0 kg/ha ai.

   Visual assessments indicated that a highly significant quadratic decline in grasses was associated with an increase in hexazinone rate. Hexazinone at 1.1 kg/ha provided more than 90% grass control. Visual injury to blueberry plants showed a highly significant linear increase associated with increasing rates of hexazinone. Counts of weed populations showed a significant linear decline in the numbers of meadowsweet (Spiraea latifolia) and goldenrod (Solidago Sp.) with an increase in hexazinone rate. Various degrees of control of sheep laurel (Kalmia angustifolia), willow (Salix Sp.), trembling aspen (Populus tremuloides), rose (Rosa Sp.) and black chokeberry (Pyrus melanocarpa) were observed. However, plant populations and distribution were inadequate in experimental plots for suitable statistical analysis.

   Hexazinone treatments did not influence the density of blueberry plant stand. However, the number of flower buds exhibited a quadratic response to increases in herbicide rate. Blueberry yield showed a highly significant quadratic trend in response to hexazinone rate. An increase of more than 50% in blueberry yield was noted with hexazinone application and associated effective weed control.

   The findings of this study indicate that hexazinone provided excellent control of several common weed species in a lowbush blueberry field accompanied by a significant increase in blueberry yield. Findings are reported in the Proceedings of the Northeast Weed Science Society, Vol. 36:186 (1982), and will be fully presented in a planned publication in the Canadian Journal of Plant Science, hopefully in 1982.

3. Meadowsweet (Spiraea latifolia) is a weed which is increasing in distribution and density in Maine's lowbush blueberry fields. A study was conducted in a commercial blueberry field in Deblois with a severe infestation of meadowsweet. Hexazinone was applied preemergent at rates of 0, 2.2, 4.5, or 6.7 kg/ha in May, 1980. Meadowsweet stand was counted before treatment, pruned by fire, and new stems counted in August, 1980. Hexazinone at 2.2 kg/ha was highly effective at controlling meadowsweet with little injury to blueberries. Results are reported in Proceedings of the Northeast Weed Science Society, Vol.35:190-192

(1982).

4. Several herbicides, including dicamba, fosamine, glyphosate, 2,4-D+dicamba, and 2,4-D in oil and water were selectively applied to 3 year old aspen (Populus tremuloides) growth with a segmented weed roller in August, 1979. Plants were counted before treatment, treated with herbicides, pruned by fire in the spring of 1980 and new growth counted in summer of 1980. Glyphosate, fosamine and dicamba treatments reduced aspen stand, but 2,4-D +dicamba or 2,4-D in oil or water did not. Glyphosate provided the most effective control of aspen, but injury to blueberry stems associated with this treatment were observed. These findings are published in the Proceedings of the Northeast Weed Science Society, Vol.36:193-198 (1982).

5. Glyphosate and 2,4-D were applied on 2 dates after blueberry leaf drop to compare their effectiveness for lambkill control. Experimental plots were located in a commercial blueberry field on T-19 M.D.. Lambkill plant stand decreased with increasing rates of glyphosate or 2,4-D. A late application of glyphosate was more effective than 2,4-D in reducing lambkill plant stand. Increasing the rate of glyphosate resulted in a greater number of blueberry stems, more flower buds per stem and a higher yield. Glyphosate applications reduced the length of reemerging lambkill stems, but 2,4-D did not. Glyphosate was as effective in reducing lambkill stand at 2.2 kg/ha as 2,4-D was at 4.5 kg/ha. Results were published in the Journal of the American Society for Horticultural Science, Vol. 106(3):393-396, (1981). Lambkill and blueberry plant stand was sampled 4 years after treatment. Both 2,4-D and glyphosate treatments still showed a reduction in lambkill plant stand and blueberry plant stand showed an increase associated with glyphosate treatment.

6. Blueberry and barrenberry stems were sampled in 1980 from experimental plots treated in 1976 with endothall then glyphosate to evaluate carry-over effect. The reduction in barrenberry stems associated with 2.2 kg/ha glyphosate was still evident four years after treatment. There were no changes in blueberry plant stand due to treatments.

Impact of Research:

This research provides essential information on the ability of certain herbicides and mechanical cutting to control specific weeds, and the effect of these applications on blueberry plant growth and yield.

Blueberry growers will benefit by being able to control certain weeds in blueberry fields, improve their productivity, increase ease of harvesting, reduce costs, and improve the quality of the blueberry pack.

Research Plans for 1982:

PLANS SHALL BE FINALIZED AFTER BUDGET ALLOCATION.

POSSIBLE RESEARCH/DEVELOPMENT ACTIVITIES INCLUDE:

I. Continue existing experiments:

   1. Determine carry-over effect of hexazinone application for Spiraea and Solidago control in five locations, identify resistant and invading species.

2. Complete hexazinone by fertility study initiated in 1981 in 13 locations.

3. Complete barrenberry control study where several herbicides (2,4-D in oil and water, fosamine, hexazinone, glyphosate, dicamba) were applied by a clapper and cutting to established planted barrenberry plants in Jonesboro.

4. Complete barrenberry control study where glyphosate was applied with a rope wick wiper to planted barrenberry plants in Jonesboro.

5. Complete barrenberry control study with endothall and glyphosate in spring pond area in Deblois.

6. Complete economic assessment (costs/benefits) of hexazinone application for weed control in lowbush blueberry fields in cooperation with Dr. Steve Skinner.

7. Complete anti-dessicant study.

8. Complete the study on the efficacy of cutting, vs. 2,4-D stump spray vs. gridballs on maple, cherry, willow, aspen and birch.

9. Maintain long term established plantings of blueberries and barrenberries for future research needs.

II. Initiate New Studies to:

1. Determine efficacy of air application of hexazinone for weed control in lowbush blueberry fields.

2. Determine efficacy of fall application of hexazinone for lambkill control - suggested area-TW-19.

3. Compair efficacy of spring vs. fall application of hexazinone for weed control.

4. Evaluate the efficacy of spot treatment of hexazinone using spot gun applicator with a soil injector. This method would reduce amount of herbicide used, and minimize potential injury to blueberries by placing the herbicide in the root zone of target species.

5. Determine efficacy of preemergence application of hexazinone for barrenberry control - suggested area - Spring Pond, Deblois.

6. Explore the potential of atrazine for weed control in lowbush blueberry fields.

Pruning of Blueberries

Personnel:

Amr A. Ismail, David E. Yarborough and Delmont C. Emerson

Mission of Project:

To improve blueberry production, reduce energy consumption and pruning cost.

Specific Objectives:

1. Evaluate the effectiveness of various pruning methods (mechanical, thermal, etc.) and time of pruning (fall vs. spring) and influence of fertilizer on plant growth, yield and soil organic matter.

2. Evaluate promising pruning equipment; mowers and burners.

3. Develop or adapt flail mowing equipment for pruning lowbush blueberries.

Status of Current Research:

1. A long term field study to compare the effects of flail mowing to oil burning in the spring and fall was initiated in 1978. The effect of these treatments on soil organic matter, acidity, and blueberry plant stand, growth, leaf nutrient contents, flower bud formation and yield were obtained for one production cycle. Differential pruning treatments were reimposed in the fall of 1980 and spring of 1981. They will be applied again in the fall of 1982 and spring of 1983.

2. An experiment designed to test the interaction of fertility and pruning on growth and yield of the lowbush blueberry was initiated in cooperation with Dr. John Smagula in the summer of 1980. Pretreatment soil samples and yield data were obtained in 1980. Pruning and fertilizer treatments were applied in the spring of 1981. A severe infestation of the spanworm defoliated large portions of the experimental plots in 1981. Since the injury to plants was extensive, no meaningful data could be collected. The experiment was terminated in 1981.

3. Modifications of a commercial straw spreading machine have been completed.

4. Development and evaluation of an efficient burner head that will consume less fuel oil during burning blueberry fields is under way.

5. Trials are at an early stage for the development of an ignition (lighting) system for burner heads.

Significant Research Accomplishments:

1. It was shown over several years, in several studies, and under commercial field operations, that close flail mowing provides a practical and economical means for pruning lowbush blueberries. Significant amounts of fuel oil and, in turn, dollars can be saved by blueberry growers whose fields permit mechanical pruning of blueberries.

Significant Research Accomplishments (continued)...

2. Modifications were successfully made to a commercially available flail mower to better meet the needs (challenges) for use in lowbush blueberry fields. A trailing system for a gang of three modified flail mowers was developed. Now, several hundred acres are annually pruned by flail mowing.

3. A mechanical straw spreader was modified to better meet the needs of blueberry growers. Two models of the modified straw spreader are commercially built and available in Maine. The new straw spreaders spread 30-40 bales of straw, hay, or meadow hay on an acre of blueberry ground in 12-15 minutes. Several of these straw spreading machines are now in use by blueberry growers in Maine, New Brunswick and Nova Scotia.

4. A modified home fuel oil burner was evaluated in 1981 as an alternative head for the Woolery burner. The effects of varying air and oil pressure on the oil flow and combustion temperature of the flame were determined. From these tests, a potentially more efficient burning system was identified. Considerable work is still needed to explore the feasibility of using this system for burning blueberry fields. This study also identified a pressing need for basic research on the temperature and duration of flame exposure needed for effective and efficient pruning of above ground blueberry tissue.

Impact of Research:

Burning with fuel oil is currently the most practical method of pruning blueberries but is costly and destructive to the organic material on the surface of the soil. Fuel oil is a nonrenewable resource that is rapidly increasing in cost and becoming less readily available.

This research provides information on the effectiveness and practicality of different pruning methods and equipment. With improvements in weed control practices and fertility management, it may become possible to reduce the frequency of burning (possibly every 3 or 4 years) or substitute mowing for burning as a pruning method. The development of a more efficient burner would help reduce production cost and conserve energy.

Research Plans for 1982:

PLANS SHALL BE FINALIZED AFTER BUDGET ALLOCATION.

POSSIBLE RESEARCH/DEVELOPMENT ACTIVITIES INCLUDE:

1. Continue to evaluate the long term effects of mechanical versus thermal pruning on blueberry plant stand, growth and yield and monitor changes in soil organic matter and acidity.

2. Conduct experiments to provide basic information on the amount and duration of heat required for pruning blueberry plants.

3. In cooperation with Mott Mower Company, evaluate their new flail mower system. Mott is expected to provide us with 5-2 feet flail mowers with a trailing system designed for pruning lowbush blueberries. The new mowers will be powered by hydraulic motors.

Research Plans for 1982 (continued):

4. In cooperation with Brouwer Turf Equipment Limited evaluate reel mowers (mechanically driven through the tractor's PTO) for mowing lowbush blueberry plants.

5. Test an ignition system for lighting burner heads.

6. Further explore the use of the home fuel burner head developed in 1981.

SUMMARY REPORT

1981 BLUEBERRY FRUIT FLY MONITORING IPM PROGRAM

by

AMR A. ISMAIL

EXTENSION BLUEBERRY SPECIALIST

The blueberry fruit fly Rhagoletis mendax is a major insect pest of the lowbush blueberry in Maine. The fly deposits a single egg within the blueberry. The developing larvae, if found in sufficient quantities, would cause condemnation of the fruit in interstate shipment. Most of the 20,000 acres of blueberry fields harvested annually are treated with aerial applications of Azinophosmethyl (Guthion) to prevent larval contamination in the blueberries. There is a need to develop methods to reduce or eliminate unnecessary pesticide use.

Research findings at the University of Maine at Orono pointed out that monitoring for the presence of the fruit fly in the field can serve to determine when and if pesticide application is necessary. A tentative action threshold of 3 to 5 flies per trap was identified. In 1980 the Maine Cooperative Extension Service conducted a program for monitoring the presence of blueberry fruit fly on 47 fields in 26 towns in Washington and Hancock Counties. The findings indicated that a significant decrease in insecticide use could be realized by monitoring fields for the fruit fly. The action threshold may be increased to six flies during one trapping period and ten flies cumulative.

An integrated pest management program focusing on monitoring the blueberry fruit fly was again conducted in 1981. The objectives were to:

A. Reduce or eliminate, if possible, the use of insecticides for blueberry fruit fly control while maintaining fruit quality.

B. Educate and obtain cooperation from blueberry growers and concerned citizens for the attainment of a viable and effective pest management program.

The contributions of Dr. Howard Forsythe, Jr., Professor of Entomology, Department of Entomology and Dr. Jim Dill, Pest Management Specialist, Cooperative Extension Service are acknowledged. Their suggestions in planning, conducting the program and reviewing the findings were invaluable.

Fifty-nine fields located in 28 towns were monitored in the 1981 project. Participants were selected from 95 respondents to a mail survey sent to blueberry growers by the Extension Blueberry Specialist. Field size ranged from 3 to 300 acres with a total of 1954 acres. Nine fields totaling 980 acres were located in the blueberry barrens in Washington County and 50 smaller fields totaling 874 acres in Washington and Hancock Counties. The fields were chosen to provide wide distribution throughout the two counties. They were then grouped into geographical areas when possible.

Fruit fly presence was monitored using Pherocon AM Insect Traps (Zoecon Corp.). The traps were placed in the fields during the week of June 15, 1981. Scouts checked the traps for flies at 3 to 5 day intervals. Fruit flies were identified and sexed, removed from the traps and tallied. When counts above the threshold were found, the grower was advised of his alternatives. Fly traps which showed signs of physical deterioration were replaced.

Data were collected on several variables in each field. The variables included: terrain, presence of weeds, rocks and surrounding vegetation. The presence of blueberry maggot was determined from berries collected in August from trap sites with (1) the largest, (2) smallest and (3) intermediate numbers of fly captures.

Dates of initial fly captures and dates when the action threshold was exceeded varied according to geographical location. Fruit flies were captured in the Blue Hill area and on the barrens during the first week of monitoring (June 23 to June 27). Flies continued to first appear on traps in fields in these two areas over a 3 week period. The action threshold was first exceeded in individual fields located in these two areas.

The action threshold was exceeded on 27 (1,272 acres) of the 59 test fields. These 27 fields were considered 'problem' fields. The 32 fields (583 acres) where the threshold was not exceeded were considered 'non-problem'

fields. The 'problem' fields with numbers of fruit fly captures exceeding the threshold tended to occur in discrete geographical areas. The action threshold was either exceeded in all fields in a given geographical area or was not exceeded in any field. The action threshold was exceeded in all fields monitored on the barrens. The 32 fields where the action threshold was not exceeded show that a reduction in insecticide use for blueberry fruit fly control is feasible.

In the 'non-problem' fields none of the larval counts in berry samples exceeded the economic rejection level of over 4 larvae per quart. In the 'problem' fields larval counts of up to 40 maggots per quart were recorded. The action threshold used in the 1981 fruit fly monitoring program can be used with confidence. No larval counts above 3 per quart were found from fields where the threshold was not exceeded. When the action threshold is exceeded, immediate response is required to prevent larval infestation in the berries.

No significant differences were found between 'problem' and 'non-problem' fields as relates to overall field characteristics, i.e., presence of weeds, rocks, anthills, estimate of crop yield, surrounding vegetation or unmanaged blueberries or the dominant weed species. The terrain, presence of rocks or anthills, and crop estimates at trap sites had no relationship to the number of fly captures. Seven plant species (aspen, birch, bunchberry, grasses, honeysuckle, lambkill, and willow) when dominant at trap sites had no significant relationship to number of fly captures. However, the presence of sweet fern, cherry, barrenberry, hardhack and rhodora as dominant weed species at trap sites did influence the number of fly captures.

No adverse health effects were detected by determination of cholinesterase enzyme activities in blood samples from field scouts and pesticide applicators tested in this study.

Two hundred and fifty growers attended a Blueberry School that was held

at four geographic locations in the blueberry producing areas of the State. At the School, the principles of integrated pest management and the specifics of the blueberry fruit fly monitoring project were discussed by the research entomologist and the Extension blueberry specialist.

During the growing season, three field days were held where growers learned of fruit fly identification, trap placement in the field and progress of the project. Two press conferences were held before and during the project execution. Articles about the project appeared in all major newspapers in the State and were discussed by the three TV stations in eastern Maine. Several radio interviews and discussions were presented by the Extension blueberry specialist on radio stations in Machias, Ellsworth, Bangor, and Rockland. Blueberry growers, Maine Blueberry Commission, concerned citizens and environmentalists, the State Board of Pesticide Control, and the Commissioner of the Department of Agriculture, Food and Rural Resources all agree that it was a worthwhile and successful project.

PHYSIOLOGY AND CULTURE OF THE LOWBUSH BLUEBERRY

Personnel:

Project Leader: John M. Smagula
Research Associate: Edward J. McLaughlin

Mission of Project:

To develop effective methods of increasing plant cover that will permit more intensive management and increased yields from natural and cultivated blueberry fields.

Specific Objectives:

a) Study the effect of N fertilization on clonal spread.

b) Evaluate long term effects of N and NPK fertilizer on plant growth and yield.

c) Study the interaction of fertility and pruning practices on soil characteristics and lowbush blueberry growth and yield.

d) Study nutritional responses of the lowbush blueberry in new plantings as related to early establishment.

e) Evaluate the growth of lowbush blueberry seedlings in several containerized growing systems and their subsequent establishment in a field planting.

f) Establish plantings in commercial lowbush blueberry fields to assess problems and economic feasibility of improving plant cover.

g) Study the effect of growth regulator formulations on growth and rhizome production of the lowbush blueberry.

h) Refine procedures for tissue culture propagation of selected high yielding clones.

i) Study the effect of mycorrhizal associations on growth and development of the lowbush blueberry.

Status of Current Research:

a) The effect of N fertilization on the rate of clonal spread is being studied in Hancock and Eddington, Maine. This work is partially supported by Tennessee Valley Authority (TVA) funding. Urea is being applied during the burn year at 0, 40, and 80 lbs. N/A to treatment plots within each of 6 clones located on McGinley's farm, Eddington, and 6 clones located on Merrill's land in Hancock. Clonal spread,

winter injury, plant stand, stem length and branching, flower bud formation, concentration of nutrients within leaves, and yield are being measured during successive production cycles between 1978 and 1984.

b) Long term fertility research plots (1955-71) established by Professor Moody Trevett received the original fertilizer treatments (control, N, or NPK) in spring 1981. Data collected in 1974-76 indicated that N and NPK treatment plots had double the plant stand and yield compared to the control; however, there was no difference between N and NPK treatments.

Stems sampled in fall 1981, will indicate the effect of these treatments on stem length, branching and flower bud formation.

c) An experiment designed to study the interaction of fertility and pruning practices on soil characteristics and lowbush blueberry growth and yield was established in August 1980, on the barrens. Treatment plots were established and base line yield data collected. Treatments consisted of 5 rates of nitrogen (0, 40, 80, 120, 160 lbs. N/A) applied preemergence after fall pruning by oil-fire or mowing. Plant stand, flower bud formation, stem length and branching, winter injury, concentration of nutrients within leaves and yield were to be determined. Soil samples were to be taken in April, July and November at 0-1, 1-2, and 2-3 inch depths and analyzed for NH_4-N, total N, P, K, Ca and Mg and used for correlations with leaf analysis.

Soil samples taken in May before fertilization and analyzed for NH_4-N, indicated that a gradient of NH_4-N exists in the upper three inches of blueberry soil, most being found in the upper inch.

An infestation of span worm devastated the plots and made it impractical to continue the experiment, even from the standpoint of soil analysis.

d) Three experiments were established at Blueberry Hill Farm in the spring 1980, to study the effect of fertility on growth and establishment of seedlings and rooted cuttings planted into plowed land. Plant material employed in experiment 1, 2 and 3 were, two-year-old seedlings, two-year-old rooted cuttings and one-year-old rooted cuttings, respectively. Fertilizer treatments were 50, 70, 100 or 200 lbs. N from a complete (21-7-7) liquid fertilizer applied at 10 lbs. N/A every 16, 12, 8 or 4 days, respectively. These treatments were continued in 1981.

All plant material appeared to respond to fertility treatments but the greatest response was observed in the experiment involving seedlings. Half of the plants in each treatment plot were dug in September 1980 and the dry weight of aerial portions and rhizomes were determined. Application of 10 lbs. N/A from a 21-7-7 liquid fertilizer every 8 days (total 100 lbs N/A) resulted in the greatest growth and rhizome production. The remaining plants were photographed from above to determine the area covered by each. This non-destructive measurement was used again in 1981 to follow the rate of spread and help establish future planting distances.

Area measurements confirmed that application of 10 lbs. N/A (total 100 lbs. N/A) every 8 days resulted in the greatest growth and area covered. In some cases the plants spread to a width of 2 feet, suggesting that 18 inches is a suitable planting space for seedlings.

The response of rooted cuttings to these same fertilizer treatments will be evaluated in 1982 by determining the dry weight of aerial portions and rhizomes.

An experiment to determine the importance of application frequency was established at Blueberry Hill Farm in spring 1981. Seedlings were planted in May and received 100 lbs. N/A from a complete (21-7-7) liquid fertilizer through 10 applications (weekly), 5 applications (every two weeks), 2 applications (June 4 and July 6), and a single application on June 4. One treatment plot received 100 lbs. N/A from Mag Amp (7-40-6), a slow release fertilizer, as suggested by Burleigh Crane.

e) Several containerized systems for mass production of seedlings are being evaluated. In 1979, Augusta x 4161, 4161 x Augusta and 4161 x 2827 crosses were made. Seeds were extracted from the fruit, treated with GA_3 and sown in flats of sand and peat in the Orono greenhouse. Uniform seedlings were transplanted in spring 1980, into 300 cells of each of 5 container types (Can-Am Multi Pot, Spencer-Lamáire Root trainer "Fives", Illinois Tool Works "One Way" Injection Container, Plant-A-Plug #2, Plant-A-Plug #5), with standard flats used as controls. In September, dry weight measurements were made on 18 randomly selected seedlings from each container type to evaluate growth under greenhouse conditions. In the spring 1981, seedlings from each container type were planted in 2 replicated field experiments to evaluate the effect of container type on establishment and winter survival (frost-heaving).

Seedlings grew larger (dry weight) when transplanted into wooden flats, Plant-A-Plug #5, or Can-Am containers, compared to the other containers tested. The effect of container type on winter survival and frost-heaving will be evaluated in spring 1982.

f) Seedlings from 3 controlled crosses (Augusta x 4161, 4161 x Augusta, 4161 x 2827) were grown in Can-Am containers and transplanted June 1981, into a field having about 44% plant cover which is owned by the Wyman Company and located at one end of the airstrip in Deblois. Yield data was collected in 1980. This area will be intensively managed with high fertility, irrigation and weed control. Progress toward increased plant cover and increased yield will be monitored for several years.

g) Fruit production in a young field planting diverts energy from vegetative growth and delays establishment. Methods to prevent flowering or flower bud formation are being evaluated. The effect of Gibberellic acid (GA_3) on flower bud formation was studied in an experiment at Blueberry Hill Farm. A replicated field planting of 2 clones established in 1979 received GA_3 treatments (0, 500, 1,000, 1,500, or 2,000 ppm) in July 1980 at the tip dieback development stage. A second application was made to half the plants one week later. The effect of GA_3 treatments on flower bud formation, plant height, winter injury and yield was evaluated in spring 1981.

GA_3 reduced flower bud formation and fruit production at all concentrations and two applications were more effective than one. Plant height also increased with increasing concentration of GA_3 especially when two applications were applied. The percentage of shoot tips with winter injury (tip dieback) also increased as GA_3 concentration increased and was higher with two applications. The effect of GA_3 treatments on total plant growth, and rhizome production will be determined in 1982.

The effect of time of application of GA_3 on flower bud formation is being studied in an experiment at Blueberry Hill Farm. A replicated field planting of 4 clones, established in 1980, received 1000 ppm GA_3 on July 7, July 14, July 21, or July 28, 1981. Flower bud formation will be assessed in spring 1982.

h) Procedures for tissue culture propagation of the lowbush blueberry have been established. Graduate student John Frett has completed his MS degree and is now a Ph.D. candidate at the University of Georgia working in the area of tissue culture. Three clones were successfully multiplied through tissue culture techniques. About 400 plants of one clone have been rooted and established in a field planting at Blueberry Hill Farm in 1981.

Two high yielding clones selected from a commercial field owned by the Merrill family are being cultured. The rate of establishment (growth and rhizome production) of tissue culture plants and rooted softwood cuttings will be compared in 1982.

i) The effect of mycorrhizal associations on growth and development of the lowbush blueberry is being studied. In spring 1980, seedlings were grown in media inoculated with Pisolithus tinctorius, after 15 weeks growth root sections were stained to determine if a mycorrhizal association had formed. Slides of the stained root sections are presently being scanned; to date there is no evidence an association has formed.

Attempts to obtain pure cultures of Clavaria, a fungus seemingly associated with the lowbush blueberry in commercial fields, to date have been unsuccessful.

Pure cultures of fungi known to form mycorrhizal associations have been established and fungal stocks increased to usable numbers. Cultures obtained from Dr. Stribley at the Rothamsted Experiment Station, England, and Dr. Zak at the Forest Sciences Laboratory, Corvallis, Oregon, are being tested in an experiment to determine if these fungi will form mycorrhizal associations with the lowbush blueberry. Seedlings grown aseptically in petri dishes were inoculated with 6 specific fungi in January 1982 and will be evaluated for infection in April 1982.

Significant Research Accomplishments

Nutrition

a) N fertilization (40 or 80 lbs. N/A) has not had a major influence on the rate of lateral spread of 6 clones at each of two field locations during

the first three years of a six-year-long study. Growers cannot therefore expect to meaningfully increase field cover in a few years by doubling the standard fertilization rate (40 lbs. N/A).

b) A study of nutritional responses of lowbush blueberry seedlings in a plowed soil had indicated a dramatic response to frequent applications of small amounts of a complete fertilizer (21-7-7). A minimum planting distance of 1.5 feet between plants has been established since plants filled in completely by the third year of growth under intensive management. Rhizome production paralleled aerial growth in response to fertilizer applications.

New Plantings

a) Evaluation of several containerized systems for mass production of seedlings revealed that growth in the greenhouse was influenced by container type. Seedlings grew best when transplanted into wooden flats, Plant-A-Plug #5 or Can-Am containers, compared to the other containers.

b) Gibberellic acid (GA_3), significantly reduced flower bud formation and fruit production of two clones in a field planting. The effect of aerial growth and rhizome production is being measured and will determine the usefulness of GA_3 in reducing the time of establishment of field plantings.

c) A field planting of about 400 tissue culture propagated plants has been established at Blueberry Hill Farm. Two high yielding clones from a commercial field owned by the Merrill family have responded well in culture and will be rooted for establishment in a field planting. A comparison of tissue culture plants and rooted cuttings of the same clones will indicate whether tissue culture plants will reduce the time of establishment of asexually propagated plants.

d) Seedlings have been successfully inoculated with 6 specific fungi known to form mycorrhizal associations with ericaceous plants. Evaluation of their roots in April 1982 will determine if associations with the lowbush blueberry have formed.

Research Plans for 1982:

The following studies will be conducted during 1982:

a) Effect of N fertilization on clonal spread (TVA project).

b) Evaluate long term effects of N and NPK fertilizer on plant growth and yield.

c) Interaction of fertility and pruning practices on soil characteristics and lowbush blueberry growth and yield.

d) Nutritional responses of the lowbush blueberry in new plantings as related to early establishment.

e) Establish plantings in commercial lowbush blueberry fields to assess problems and economic feasibility of improving plant cover.

f) Investigate interaction of fertility and moisture on plant growth, rhizome production and early establishment of new plantings.

g) Effect of growth regulator formulations on growth and rhizome production of the lowbush blueberry.

h) Refine procedures for tissue culture propagation of selected high yielding clones.

i) Effect of mycorrhizal associations on growth and development of the lowbush blueberry.

BLUEBERRY DISEASES: INCIDENCE AND CONTROL

Personnel:

Frank L. Caruso, Michael G. Zuck, Mark D. Milam

Mission of Project:

To study the prevalence and causal agents of diseases of the lowbush blueberry, and to determine the effectiveness of the present means of disease control.

Specific Objectives:

1. Survey blueberry fields under different cultural practices for the prevalence of diseases.

2. Determine the effectiveness of presently utilized control measures against *Botrytis* (blossom and stem blight).

3. Investigate the causal agents involved in the "leaf spot complex" and assess clonal susceptibility/resistance.

4. Evaluate the cost effectiveness of applications of benomyl for control of *Botrytis* blossom and stem blight.

Status of Current Research:

1. Fifteen lowbush blueberry fields (most in crop year) in Washington and Hancock counties were again monitored for the occurrence of diseases from May until September, 1981. Comparisons could be made at each location between sectors which had been burned and sectors which had been flail-mowed to control weeds. Transects marked off in 1980 were used in one to two acre plots. Observations of the diseases in a .36 m^2 (2 sq. ft.) area adjacent each stake (stakes at 7.5 meter or 25 foot intervals) were made each month, as well as an assessment of the degree of infection by each plant pathogen. Questionable problems were sampled and brought back to Orono for microscopical examination and isolation of the causal organism.

2. Greenhouse studies currently in progress are aimed at determining the optimal time of application for a single benomyl (Benlate) treatment. Of particular interest is the question of whether a period of peak susceptibility occurs during blossom; and if so, should benomyl be applied before, during, or after this period of susceptibility?

3. Eight fungal species were isolated from leafspots collected in July of 1980 and 1981. These potential pathogens have been maintained on potato dextrose agar plates. Three isolates have been tentatively identified as Gloeosporium spp., and one isolate has been identified as Fusarium spp. Other isolates are being grown under different regimes of light in order to stimulate spore production to facilitate identification. Two methods are being used to inoculate blueberry tissue, in order to fulfill Koch's Postulates (which would implicate any or all of the fungi as causal agents of the leafspot): inoculation of potted plants on the greenhouse bench; and inoculation of excised stems and incubation in the laboratory.

4. As part of the joint project undertaken by the Experiment Station with funding from the National Agricultural Pesticide Impact Assessment Program (NAPIAP), a two-year cost-effectiveness study was begun during 1981 aimed at establishing the economic impact of Botrytis blossom blight on Maine's blueberry industry. Producing fields in Washington, Hancock, Waldo, Oxford, and Knox counties were surveyed during bloom and counts made of the percent infected blossoms. Data from this survey will be used to estimate the percent reduction in maximum potential yield caused by Botrytis blossom blight during the two year study; thus, it will be possible to calculate the level of disease at which a single application of benomyl becomes cost-effective. In addition to the Botrytis survey, a yield study was initiated at Blueberry Hill Farm during 1981. The purpose of this research was to determine whether a yield response occurs when one, two, or three sprays of benomyl (1 lb/A) are applied during bloom. Both the Botrytis survey and the yield study were carried out in pairs of mowed versus burned fields, so that buildup of disease in mowed fields could be detected, if present.

Significant Research Accomplishments:

1. Possible trends can be seen after a second year of disease observations. These trends are only tentative ones at best; they will be much more meaningful after a third year of the survey. It appears that there is a greater incidence of Botrytis blossom and stem blight, powdery mildew, anthracnose, and leafspotting in mowed fields versus burned fields. Red leaf disease occurs to the same extent in both types of blueberry fields. Other diseases (rust, mummy berry, witches broom, mosaic) have not been observed an adequate number of times to discern patterns of disease incidence as related to cultural practice employed.

2. Strains of Botrytis cinerea, the cause of blossom and twig blight, were again isolated at Blueberry Hill Farm from fields with a history of heavy benomyl application. These strains were screened for indications of the buildup of resistance in the fungal populations. Preliminary screening indicated that some isolates were able to grow on culture media containing 5 parts per million benomyl, which is the criterion for the establishment of fungicide resistance in most fungi. However, these isolates were lost to contamination during a severe outbreak of mites in our incubators last summer, making final confirmation of benomyl-resistance impossible.

3. Leafspot lesions have been induced on several excised blueberry leaves in the laboratory by different fungal isolates, and on an occasional leaf on a greenhouse plant. Wounding may be necessary for infection to occur. Reisolations hope to recover the causal organism(s), which will be reinoculated onto other blueberry plants.

4. Preliminary data from the Botrytis survey indicated that the reduction in yield potential in Maine blueberry fields caused by blossom blight was below 1%. No significant buildup of blight was detected in mowed fields, and a slight reduction in blight was seen in commercial fields which received one spray of benomyl, as compared with those which received no spray. Data from the yield study indicated a possible positive yield response in benomyl-treated plots at Blueberry Hill Farm. However, clonal variability may have accounted for much of this response. A second year's data is necessary to verify this finding.

Research Plans for 1982:

1. The blueberry disease survey will be continued for the third year. Diseases will be recorded along the established transects in both mowed and burned fields. In addition, stakes will be set at regular intervals along the line of demarcation separating the burned area from the mowed area. This will allow direct comparisons between mowing and burning practices in the same clones. Stakes will be set up to insure that clones do not overlap within the observed area. Fields may be added or subtracted from the survey, depending on the practices employed at the individual sites.

2. Greenhouse timing studies of the use of benomyl to control Botrytis will be continued, and be followed by field studies at Blueberry Hill Farm. Field studies will be conducted under screened cages and in the open, using varying levels of natural inoculum (spores). In this way it will be possible to gain an understanding of whether spores or weather conditions constitute the most important factor contributing to blossom blight in Maine. All field studies will be geared towards answering the question: Should only one spray of benomyl (1 lb/A) be applied to lowbush blueberries, when is the best time for application? Botrytis populations at Blueberry Hill Farm will again be monitored for the confirmation of benomyl resistance. A new research project will be aimed at the development of an "index of susceptibility" in blueberry for Botrytis. This indexing scheme could eventually be used to characterize the resistance or susceptibility of high yielding clones currently under development in the U.S. and Canada. In addition, it will be possible to use such an indexing system to characterize existing clones with respect to the percentage of clones they contain which are highly susceptible or resistant to the pathogen. Thus, it may be possible to numerically estimate the risk of Botrytis infection in any given field and make the according control recommendations.

The basis of the index will be to artificially inoculate flowering stems under laboratory conditions with known strains of the fungus. Disease incidence will be based on the % infected flowering stems; disease severity will be based on the number of blighted flowers per cluster; and disease progress will be based on the rate at which infection occurs and symptoms appear. The index of susceptibility will be based on all three combined factors for each tested clone.

3. Studies will be continued on the elucidation of the leafspot "complex;" additional attention will be focused on the possible involvement of bacteria and/or viruses in the affected plants.

4. The cost effectiveness study begun in 1981 will be continued on essentially the same basis in 1982. Larger plots will be used to study yield response to benomyl applications at Blueberry Hill Farm, so that clonal variability will be less likely to influence the data.

Control, biology, and ecology of insects affecting lowbush blueberries

Personnel:

Leader - H. Y. Forsythe, Jr.
Research Assistant - Kathy Flanders

Mission of Project:

To protect the blueberry crop from economic losses due to insects.

Specific Objectives:

1. Evaluate insecticides and other strategies for control of blueberry maggot and secondary insect pests.
2. Survey for, identify, and study insect pest problems in blueberry fields under the newer production practices.
3. Provide research necessary to make the IPM program on blueberry maggot more efficient and effective.

Status of Current Research:

The serious outbreak of the blueberry spanworm in Hancock and Washington Counties caused the initiation of a "crash" research program in 1981. Priority objectives were the development of a reliable larval monitoring procedure, a larval "action" threshold, and effective control measures. Sweeping the blueberry plants with a net at various times of the day was investigated primarily because of its simplicity and reliability. An "action" threshold was tentatively identified by relating larval numbers with degree of plant defoliation. Eight insecticides at various rates were screened for larval control in a series of 5 laboratory tests from May 13 through June 2. A field control test was conducted with the best materials. Additional studies were conducted on the loss in yield caused by spanworm injury, on a moth monitoring procedure, and on the life history of the insect (number of instars of the larvae; times of the season the larvae, pupae and moths were present; rearing procedures; and distribution and severity of the infestation).

A regular survey of a number of blueberry fields under different management systems was also undertaken in 1981. Various insects were collected by sweeping with a net and were identified. Laboratory screening tests with insecticides were conducted for gypsy moth larvae, strawberry rootworm adults, and grasshoppers; a field test of 5 insecticides was also set up for grasshopper control. A controlled laboratory test was initiated to determine the type of injury caused by grasshopper feeding.

Six insecticides and formulations were tested by ground and air applications for control of the blueberry maggot. Generally low numbers of maggots in the 3 locations did not allow any definite conclusions as to efficacy of the materials. A "trapping-out" study was also conducted on the

blueberry maggot in 5 fields. Zoecon AM traps (set up in the same manner as in the IPM program) were set in a 50-foot interval grid net work in 1-acre plots in each field in an attempt to remove enough flies to effect satisfactory maggot reduction. Various aspects of the blueberry maggot IPM program were also studied in an attempt to refine the monitoring and decision-making procedures. Specifically, studies were conducted to determine the presence of maggots in winnowing refuse, the seasonal presence of maggots in the berries, and the relation of the attractiveness of the Zoecon AM traps to localized maggot infestations.

Significant Research Accomplishments:

Blueberry spanworm larvae were found to defoliate plants and eat flower buds mostly at night from early May through mid June. A daylight action threshold of about 5 larvae per 10 sweeps was tentatively identified. The most effective insecticides for all larval instars were Guthion, Imidan, and Dylox; a tolerance for Dylox on blueberries is currently being pursued. Guthion and Imidan were effective against spanworm moths present in June and July. Additional studies indicated (1) that moth populations could be monitored by counting flying moths disturbed during a walk by a person through low weedy patches, and (2) that there is a direct relation between percent defoliation and percent yield reduction. Data on larval instars, and severity and distribution of the outbreak are still being compiled and evaluated. No significant progress was made in rearing the adult moths and finding the eggs.

A survey of blueberry insect pests revealed the presence of 2 damaging adult populations of a new pest, the strawberry rootworm. Adult beetles fed on blueberry plants throughout the month of May, causing damage to the flower buds. Other pests were also identified, such as the blueberry flea beetle (adults and larvae), thrips, gypsy moth larvae, at least 2 species of sawfly larvae in May (counts up to 50 larvae/10 sweeps), and various cutworm species (0-2 larvae/10 sweeps). Grasshoppers were numerous in many fields, in spite of intensive insecticide applications for other insects. By late June most grasshoppers were more or less fully grown. Grasshoppers were found to feed on blueberry leaves and fruit; Sevin, Guthion, and possibly Imidan provided good control. At Vienna Mt., a leaf curling midge (probably the blueberry tipworm) caused considerable plant injury in June and July; symptoms of the injury was similar to thrips' injury symptoms. Also from Vienna Mt. a leaf tier larva reached maturity by mid to late June, causing plant injury to both bearing and vegetative plants.

For insecticidal control of the blueberry maggot, generally Imidan, Guthion, Dylox, and Supracide appeared to give satisfactory control. It also appeared that the "trapping-out" procedure utilized in the 1981 study was generally not consistently effective enough to be used as a means to reduce the maggot level to an acceptable degree. Research input into refinement of the blueberry maggot IPM program indicated that the maggot population decreased to less than 4 maggots per quart in 7 of 8 fields by mid August and that maggots were found in winnowing refuse.

Impact of Research:

Control of insect damage is essential for the commercial production of blueberries. Before new insecticides can be registered for use, the materials must be tested for rate and time of application, control effectiveness, environmental hazards, and effect on production and quality. Vital to any insect control recommendation is the need to develop adequate biological and life history information for a better understanding of the pests concerned. Sampling methods, thresholds, and economic importance are also essential in the decision-making process to control the pest or not.

The extensive data collected on the blueberry spanworm in 1981 should aid in fulfilling the objectives listed above and enable growers to take appropriate control actions in 1982, if necessary. Some aspects of the objectives were addressed for the strawberry rootworm, grasshoppers, and blueberry maggot. Input into refinement of the blueberry maggot IPM program should aid in making the program more efficient.

Research Plans:

1. Develop more complete information on the biology, life history, economic importance, and control of the blueberry spanworm. Refine monitoring procedures.

2. Survey blueberry fields, especially those under the newer production practices, for secondary insect pests. When found, the insects will be identified and pertinent biological data, monitoring procedures, and control strategies and/or insecticides will be developed as necessary.

3. Evaluate ground and air applied insecticides and/or bait plus insecticide for control of the blueberry maggot. Studies will also be conducted to refine procedures for the IPM project on blueberry maggot (e.g. infestation sources in commercial fields).

MAINE COOPERATIVE EXTENSION SERVICE

FY 1981

~~PLANNING~~/REPORTING NARRATIVE

MCES Unit Plant and Soil Sciences — Program Area Agr. & Nat. Res.

Brief Title (optional) Blueberry Extension Program (Integrated Pest Management) — Program Component Crop Productio

Prompters*	Narrative
Clientele Problem Need, how determined	Blueberry growers apply insecticides routinely for blueberry fruit fly (maggot) control regardless of need.
Extension Objective(s) Clientele changes related to solution	Blueberry growers will understand and participate in a fruit fly monitoring program to reduce use of insecticides.
Actions What done, staff involved, time expended	A fruit fly monitoring project encompassing 59 fields in 28 towns in Hancock and Washington Counties and covering approximately 2,000 acres was initiated in 1981. Discussion of philosophy and practices of IPM were held at Blueberry School with 250 growers in attendance. Three field days were held. Newspaper articles were written and press conferences held to discuss the project. Amr A. Ismail - 120 days.
Evaluation Educational effectiveness of project, evidence, how measured	An awareness of IPM philosophy and methods as well as an interest in reducing use of insecticides for blueberry fruit fly control was documented by results of questionnaire, growers participation in the program, their input and comments.
Results Who benefits, how, impacts in terms of jobs, income, savings	Fewer blueberry fields were sprayed with insecticides for fruit fly control in 1981 as a result of the monitoring program. The 1981 blueberry "spraying season" was considerably less controversial than those of the previous five years with considerably less social and legal and political problems.

Please use one sheet per planned/reported item. Do not exceed one sheet.

*Prompters are placed in left column to simplify writing of narrative. Statements need not be placed directly opposite prompters.

PLANNING NARRATIVE/REPORTING NARRATIVE

MCES Unit Plant and Soil Sciences — Program Area Agr. & Nat. Res.

Brief Title (optional) Blueberry Extension Program (Pesticide Application) — Program Component Crop Productio

Prompters*	Narrative
Clientele Problem Need, how determined	Blueberry growers applying restricted use pesticides need to be certified before purchase or use of these pesticides.
Extension Objective(s) Clientele changes related to solution	Increase blueberry growers knowledge and skill in handling and using pesticides.
Actions What done, staff involved, time expended	Conduct training sessions and provide information on types, safe handling, application, and storage of pesticides. Amr A. Ismail - 20 days.
Evaluation Educational effectiveness of project, evidence, how measured	A change in growers attitude and practice of using pesticides as indicated by a response to a questionnaire and field observations.
Results Who benefits, how, impacts in terms of jobs, income, savings	Approximately one hundred and fifty blueberry growers were certified or recertified for the use of restricted use pesticides.

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MAINE COOPERATIVE EXTENSION SERVICE

FY 1981

~~PLANNING~~/REPORTING NARRATIVE

MCES Unit Plant and Soil Sciences — Program Area Agr. & Nat. Res.

Brief Title (optional) Blueberry Extension Program (Blueberry Industry Organization) — Program Component Crop Productio

Prompters*	Narrative
Clientele Problem Need, how determined	Maine wild blueberry industry was losing its traditional markets in the United States. There is a need to regain these domestic markets and to explore opportunities in international markets.
Extension Objective(s) Clientele changes related to solution	Maine blueberry industry will form with other wild blueberry growers and processors an international marketing/promotion organization.
Actions What done, staff involved, time expended	Information on wild blueberry production and markets were compiled. Several meetings with leaders of the wild blueberry industry in North America were held in Maine, New Brunswick, Nova Scotia and Quebec. An industry steering committee was formed. Forming an international association was explored and acted on. Amr A. Ismail - 40 days.
Evaluation Educational effectiveness of project, evidence, how measured	Comments and input from participants.
Results Who benefits, how, impacts in terms of jobs, income, savings	Wild Blueberry Association of North America/Association Des Bleuets Sauvages Des L'Amerique Du Nord (WBANA) was formed and incorporated in the United States and Canada. It is an international association of wild blueberry producers and processors with representatives from Maine, New Brunswick, Nova Scotia, Prince Edward Island, Quebec and Newfoundland. Approximately $70,000 in dues were collected in 1981. An industry oriented information brochure on wild blueberries was prepared. WBANA gathered crop and market information in the United States, Canada and Europe. The group participated in the International Baker Show in Las Vegas and plans to participate in an International Food Show (ANUGA) in Cologne, West Germany. The position of Maine's wild blueberries were enhanced in the domestic markets. More wild blueberries were exported in 1981 to Europe and Japan.

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MAINE COOPERATIVE EXTENSION SERVICE

FY 19 81

~~PLANNING~~/REPORTING NARRATIVE

MCES Unit Plant & Soil Sciences

Program Area Agr. & Nat. Res.

Brief Title (optional) Blueberry Extension Program (Pruning/Energy Conservation)

Program Component Crop Production

Prompters*	Narrative
Clientele Problem Need, how determined	Maine blueberry growers use one million gallons of fuel oil annually to burn/prune their fields.
Extension Objective(s) Clientele changes related to solution	Blueberry growers will reduce energy use and save in costs of pruning by using more efficient burning methods and/or flail mowing.
Actions What done, staff involved, time expended	Information on efficient use of burners, straw spreading machines and flail mowing equipment were provided in the Blueberry Newsletter and research findings were discussed during Blueberry School and farm visits. Field days were held to demonstrate new and modified pruning equipment. Amr A. Ismail-40 days.
Evaluation Educational effectiveness of project, evidence, how measured	Changes in growers actions were evident by their adoption of new pruning methods as well as responses to questionnaire and participation in field days.
Results Who benefits, how, impacts in terms of jobs, income, savings	Approximately two thousand acres of blueberry land were pruned mechanically by flail mowing instead of burning with fuel oil. Blueberry growers saved an estimated 100,000 gallons of fuel oil. By adopting some mechanical pruning methods Maine blueberry growers saved approximately half a million dollars in pruning costs. Several straw spreading machines have been built and will be used for the first time in the 1981-1982 pruning season.

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PLANNING/REPORTING NARRATIVE

MCES Unit Plant and Soil Sciences | Program Area Agr. & Nat. Res.

Brief Title (optional) Blueberry Extension Program (Small Fruits Training) | Program Component Crop Production

Prompters*	Narrative
Clientele Problem Need, how determined	Extension agents need training in the area of small fruits production. This need was determined by survey and direct communication from agents.
Extension Objective(s) Clientele changes related to solution	Increase knowledge of Extension agents about small fruits production practices and educational material available on the subject.
Actions What done, staff involved, time expended	Form a small fruit group to facilitate communication and determine needs, objectives and action. Two training field days were held to discuss and demonstrate growing strawberries and highbush blueberries. A two day in-service training session is scheduled to be held in November. Amr A. Ismail - 20 days.
Evaluation Educational effectiveness of project, evidence, how measured	In progress.
Results Who benefits, how, impacts in terms of jobs, income, savings	Extension agents are improving their subject matter knowledge in the area of small fruits.

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COOPERATIVE EXTENSION SERVICE

MAINE — FY 19.81

PLANNED AND EXPENDED EXTENSION PROFESSIONAL STAFF DAYS BY PROGRAM AREAS AND PROGRAM COMPONENTS

County,
Department, Plant & Soil Sci. Period Covered (Check) ..... October - December ..... April - June .....X..... Full Year
or School ..... January - March ..... July - September

PROGRAM COMPONENTS	PROGRAM AREAS									
	ANR Days		CRD Days		HE Days		4-H Days		Total Days	
	Planned	Expended	Planned	Expended	Planned	Expended	Planned	Expended	Planned	Expended
1. Crop production	138	260								
2. Livestock production										
3. Bus. mgt. & economics										
4. Agr. mkg. & farm supplies										
5. Ecol., nat. res. & envirn.										
6. Mech. sc., tech. & engnr.										
7. Safety										
8. EFNEP-										
9. Food and nutrition										
10. Pers. & fmly. res. mgt.										
11. Family life, etc.										
12. Textiles & clothing										
13. Human health										
14. Housing & home envirn.										
15. Leadership development										
16. Org. devel. & maintce.										
17. Comp. comm. planning										
18. Comm. ser. & faclts.										
19. Econ. manpower, career dev.										
20. Govt. oper. & finan.										
21. Leisure & cult. educ.										
TOTAL BY PROGRAM AREA										

Staff days allocated to administration, management, staff development, etc., are to be allocated to relevant program components and program areas.

Amir T. Ismail
Submitted by

PLAN OF WORK - FY 1982 - AMR A. ISMAIL

EXTENSION BLUEBERRY SPECIALIST

(October 1, 1981 - September 30, 1982)

1. Problem:

Input from growers and personal observations indicate a need to increase yield in blueberry fields by adopting better cultural practices such as: weed, insect and disease control (where needed), and honeybees for pollination. There is also a need to reduce production costs, increase production efficiency and acquire better understanding of pesticide use and handling. Traditional U.S. markets are being lost to highbush blueberries and other fruits.

2. Objectives:

A. Blueberry growers will be able to adopt cultural practices that will increase blueberry yield per acre.

B. Blueberry growers will increase knowledge and skills in pest management and pesticide use.

C. Blueberry growers will reduce energy use and save in costs of pruning by using more efficient burners and/or flail mowing.

D. Blueberry growers and processors will explore and improve their marketing alternatives.

3. Actions:

Blueberry growers meetings, field demonstration plots, Blueberry Newsletter, correspondence, limited farm calls, field days, newspaper articles, radio and TV interviews, and applied studies.

4. Evaluation:

Questionnaire, interviews, growers participation in activities and their comments, and extent of actual field application of management practices.

5. Expected Results:

A. Reduce accidents and misuse of pesticides in blueberry production, less legal problems, and reduce injury to man, blueberry plants and the environment.

B. Blueberry growers will save an estimated amount of 200,000 to 300,000 gallons of fuel oil annually (or 300,000-500,000 dollars). Also, reduce air pollution and increase organic matter content in their fields over the long run.

C. By adopting latest research findings in the area of weed control, Maine blueberry growers could increase their average production by an estimated 25% or 4 to 5 million pounds with a total return of 3-4 million dollars to Maine's economy (growers, pickers, shippers and packers).

D. Marketing opportunities and demand for blueberries will increase.