PROGRAMME ET RÉSUMÉS /
PROGRAM AND ABSTRACTS

Rencontre annuelle 2010 / 2010 Annual Meeting

WILDBREW
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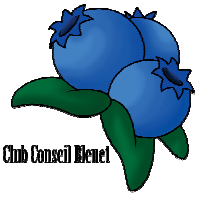

Agriculture, Pêcheries et Alimentation Québec

21 octobre 2010 / October 21, 2010
Loews Le Concorde
Québec, Qc

PROGRAMME / PROGRAM

7h30-8h00	**Inscription / Registration**
8h00-8h10	**Mot de bienvenue / Welcome**
8h10-8h30	**Effet de l'Application de Ca et de Mg sur la Productivité du Bleuet, sur les Concentrations en Éléments Nutritifs des Feuilles et sur le Sol** Jean Lafond, AAC
8h30-8h50	**Variable Rate Sprayer for Spot Application of Agrochemicals in Wild Blueberry Fields** David Percival, NSAC
8h50-9h10	**Application Fractionnée de la Fertilisation Azotée dans la Culture du Bleuet Nain Sauvage et Suivi de l'Azote du Sol** Jean Lafond, AAC
9h10-9h30	**Spring Weed Control: Product Screening Results** Gavin Graham, NB
9h30-9h50	**Fall Weed Control: Rhodora and Lambkill Control** Gavin Graham, NB
9h50-10h10	**Rimsulfuron/Nicosulfuron Use in Wild Blueberry** Nathan Boyd, NSAC
10h10-10h40	**Pause / Break**
10h40-11h00	**Effects of Pre-Emergence Herbicides for Controlling Weeds in Wild Blueberry** David Yarborough, University of Maine
11h00-11h20	**Effects of Post-Emergence Herbicides for Controlling Weeds in Wild Blueberry** David Yarborough, University of Maine
11h20-11h40	**Efficacy of Organic Biopesticides in Control of Mummy Berry Disease on Wild Blueberries in Maine** Seanna Annis, University of Maine
11h40-12h00	**Septoria and Rust Disease Suppression Technologies for Wild Blueberry Production** David Percival, NSAC
12h00-13h30	**Dîner / Lunch**

13h30-13h50	**Blueberry Field Characteristics Influence Blueberry Flea Beetle Distribution and Damage** Josiane Goguen, University of Moncton
13h50-14h10	**Expérimentation du Concept de Production Forêt/Bleuets dans un Modèle de Gestion Intégrée des Ressources au Saguenay–Lac-Saint-Jean par la Corporation d'Aménagement Forêt Normandin (CAFN)** Luc Simard, AGIR
14h10-14h30	**Optimisation d'une Régie de Production du Bleuet Nain Comportant une Rotation de 3 ans au Québec** Michel Champagne, Les Bleuets Sauvages du Québec
14h30-14h50	**Évaluation du Taux de Réussite de Bouturage de l'Airelle à Feuille Étroite (*Vaccinium angustifolium* ait.) à Partir d'un Rhizome Prélevé et Planté en État de Dormance** Marie-Pascale Beaudoin, MAPAQ
14h50-15h10	**Les Anthocyanes dans les Bleuets Sauvages du Québec: Identification et Évaluation de leur Potentiel Antioxydant** Sylvain Savard, CRIQ
15h10-15h40	**Pause / Break**
15h40-15h50	**Guide de Production du Bleuet Sauvage dans une Perspective de Développement Durable** Sophie Gagnon, Agrinova
15h50-16h40	**Rapport de la Production / Extension Reports** **Maine :** David Yarborough **PEI / IPE :** Chris Jordan **New-Brunswick / Nouveau-brunswick :** Michel Melanson **Nova Scotia / Nouvelle-Écosse :** Peter Burgess **Québec:** André Gagnon
17h00	**Cocktail dînatoire ouvert à tous / Cocktail reception for all**

RÉSUMÉS / ABSTRACTS

Effet de l'Application de Ca et de Mg sur la Productivité du Bleuet, sur les Concentrations en Éléments Nutritifs des Feuilles et sur le Sol

JEAN LAFOND

Agriculture et Agroalimentaire Canada, Ferme de recherche, Normandin, Qc, G8M 4K3 Canada
Courriel: jean.lafond@agr.gc.ca

Le bleuet nain sauvage est généralement établi sur des sols sableux, acides et bien drainés. Ces sols sont peu fertiles mais la mince couche de matière organique qui repose sur le sol minéral contribue fortement à la disponibilité des éléments nutritifs et à la capacité de rétention en eau. Au cours des dernières années, les rendements en fruits ont augmenté significativement avec l'amélioration des pratiques culturales, soit principalement la lutte efficace des mauvaises herbes et la gestion de la fertilisation. Cependant, avec cet accroissement de la productivité, les concentrations foliaires en Ca et en Mg ont tendance à être sous les seuils minimales des concentrations optimales établies. Ainsi, l'objectif de l'étude a été de déterminer l'impact de l'apport de Ca et de Mg sur la culture du bleuet, sur les concentrations en éléments nutritifs dans les feuilles et sur le sol. Quatre doses de Securcal (source de Ca) et de sel d'Epsom (source de Mg) ont été appliquées au printemps de l'année de végétation. Une fertilisation en NPK a été appliquée selon les recommandations. Le pH du sol a augmenté significativement de 0.5 et 0.2 unité avec les apports de Ca dans les couches de sol 0-5 et 5-20 cm. La teneur en Ca du sol a augmenté significativement avec les apports de Ca dans les trois couches de sol tandis que les apports de Mg ont augmenté la teneur en Mg dans les deux premières couches de sol de surface. Les concentrations en N, P, K et Ca des feuilles ont augmenté significativement avec les apports de Ca. Les apports de Mg ont augmenté la concentration en Mg des feuilles mais a diminué la concentration en B. Les rendements en fruits ont diminué significativement avec les apports de Ca (3949 à 3550 kg ha^{-1}). La densité de tige et le nombre de bourgeons floraux ont également diminué avec les apports de Mg. Quoique les apports de Ca aient permis d'accroître les concentrations en éléments nutritifs dans les feuilles, il demeure que la culture n'en a pas bénéficié en terme d'accroissement de productivité.

Effect of Ca and Mg Application on Wild Lowbush Blueberry Yields, Leave and Soil Nutrients

JEAN LAFOND

Agriculture and Agri-Food, Research Farm, Normandin, Qc, G8M 4K3 Canada
E-mail: jean.lafond@agr.gc.ca

Wild lowbush blueberry is generally established on sandy, acidic and well drained soils. In recent years, fruit yields increased significantly with the improvement of agricultural practices, primarily with better weed control and fertilizer management. However, with this increase in productivity, Ca and Mg foliar concentrations tend to be under the minimum threshold established optimal concentrations. Thus, the objective of the study was to determine the impact of the application of Ca and Mg on the blueberry productivity, on leave nutrient concentrations and on soil nutrients. Four rates of Securcal (source of Ca) and Epsom salt (source of Mg) were applied in the spring of the sprout year. NPK fertilizers were applied at recommended rates. Soil pH increased significantly from 0.5 to 0.2 unit with Ca application in the soil layers 0-5 and 5-20 cm. Soil Ca increased significantly with Ca application in the three soil layers, while Mg application increased soil Mg in the first two layers of topsoil. Leaf N, P, K and concentrations increased significantly with the Ca application. Mg application increased leaf Mg concentration but decreased leaf B concentration. Fruit yields decreased significantly with Ca application (3949 to 3550 kg ha^{-1}). Stem density and number of flower buds were also reduced with Mg application. Although Ca application had resulted in increased of leaf nutrient concentrations, the crop productivity was not positively affected.

Variable Rate Sprayer for Spot Application of Agrochemicals in Wild Blueberry Fields

QAMAR ZAMAN[1], DAVID PERCIVAL[2] AND TRAVIS ESAU[1]

Departments of Engineering[1] and Environmental Sciences[2], Nova Scotia Agricultural College, Truro, NS, B2N 5E3 Canada
E-mail: dpercival@nsac.ca

A cost-effective automated prototype variable rate (VR) sprayer was developed for control of 8 individual nozzles on a 6.1-m sprayer boom for in-season, site-specific application of agrochemicals on weeds. The sprayer boom was divided into 8 sections and mounted behind an all-terrain vehicle (ATV). The variable-rate control system consisted of 8 ultrasonic sensors (one per spray section) mounted on a separate boom in front of the ATV, Dickey John Land Manager II controller and flow valve, solenoid valves and an 8-channel variable rate controller interfaced to a Pocket PC (PPC) using wireless Bluetooth® radio with Windows Mobile® compatible software. This type of VR sprayer does not use prescription maps, but relies on sensors to provide real-time weed detection information which is used to dispense correct agrochemical rates for the weeds. The sprayer can be used for in-season, spot application (SA) of agrochemicals by activating specific boom sections where the weeds have been detected.
Wild blueberry fields were selected in Central Nova Scotia to evaluate the accuracy of the VR sprayer. Water sensitive papers (targets) were stapled to weeds randomly selected in two tracks of each field. The percent area coverage (PAC) of the sprayed targets with both SA and uniform application was calculated by an imaging system. Based on these results, the VR sprayer was cost-effective, efficient and accurate enough for spot-application of agrochemicals usage in wild blueberry fields. The weed patches were mapped with an RTK-GPS receiver in test tracks before and after kaolin (colored dye additive) application in the spray liquid to evaluate the performance accuracy of the VR sprayer. These maps showed that chemical was sprayed on all targets (weed patches) precisely in selected tracks in both fields. The chemical saved with SA was 69.22% with 22.67% weed cover and 82.50% with 18.13% weed cover in field 1 and in field 2, respectively.

Spring Weed Control: Product Screening Results

GAVIN GRAHAM

New Brunswick Department of Agriculture and Aquaculture, Fredericton, NB, E3B 5H1 Canada
E-mail: gavin.graham@gnb.ca

Sixteen separate spring weed control trials in wild blueberry were evaluated by the New Brunswick Department of Agriculture and Aquaculture in 2010. Fluazifop-p-butyl and sethoxydim adequately controlled many grass species evaluated, including ticklegrass (agrostide scabre, *Agrostis scabra*), poverty oatgrass (danthonie à épi, *Danthonia spicata*) and Canada bluegrass (pâturin comprimé, *Poa compressa*). Lower rates generally suppressed grasses while higher rates had control, although the difference in application rates was less evident with sethoxydim. Nicosulfuron/rimsulfuron suppressed most grasses but early crop injury was detected. Foramsulfuron plus UAN had adequate grass control, with no significant difference detected in early evaluations of different product formulations. Flumioxazin applied in early spring controlled hair cap moss (perce-mousse, *Polytrichum commune*) in the sprout year, with regrowth in the crop year. The addition of a non-ionic surfactant improved control. Other researchers have found increased moss control from late fall application timings for flumioxazin, so both spring and fall timings should be evaluated in a single trial. A high rate of hexazinone had excellent sheep sorrel (petite oseille, *Rumex acetosella*) control. Lower use rates of hexazinone should be evaluated to determine if rate causes the reduced control noted by producers. Propyzamide suppressed sheep sorrel populations when applied in the fall of the sprout year. Nicosulfuron/rimsulfuron or two applications of mesotrione controlled black bulrush (Scirpe noirâtre, *Scirpus atrocinctus*) while suppressing hawkweed (épervière, *Hieracium* spp.). Hexazinone/DPX-MAT controlled hawkweed while clopyralid and terbacil suppressed populations in the sprout year. Two applications of mesotrione or terbacil at a high rate controlled rough cinquefoil (potentille de Norvège, *Potentilla norvegica*) and many other products suppressed populations. The combined use of hexazinone and mesotrione improved goldenrod (verge d'or, *Solidago* spp.) control at lower hexazinone use rates. No benefit was shown at high

hexazinone rates. Mesotrione tank mixes with both fluazifop and sethoxydim showed no difference in bracken fern (grande fougère, *Pteridium aquilinum*) or tufted vetch (vesce jargeau, *Vicia cracca*) control, either with or without additional non-ionic surfactant.

Fall Weed Control: Rhodora and Lambkill Control

GAVIN GRAHAM
New Brunswick Department of Agriculture and Aquaculture, Fredericton, NB, E3B 5H1 Canada
E-mail: gavin.graham@gnb.ca

Lambkill (crevard de moutons, *Kalmia angustifolia*) and rhodora (rhododendron du Canada, *Rhododendron canadense*) are potentially difficult to control weeds in wild blueberry fields. They are generally present at high densities before establishment of the field and can interfere with production during subsequent cropping years. In the late fall, blueberry plants are dormant while lambkill remains green, allowing for an application of glyphosate to control the weed. Previous rate and surfactant research with glyphosate has determined 900 g ai/ha of the potassium salt formulation combined adequate weed control and crop safety. Lambkill regrowth in the following crop season was noted, so the combined use of fall glyphosate and spring hexazinone timing was evaluated in a factorial design. Limited lambkill control was found from all hexazinone timings, likely due to weather conditions following application. Glyphosate adequately controlled lambkill in both the sprout and crop seasons, which resulted in a two-fold increase in crop yields. The potential for a User Requested Minor Use Label Expansion (URMULE) for this use will be explored. Rhodora control is limited to dicamba, which has crop injury and application limitations. Herbicide rate, mowing timing, water volume and tank mixes were examined to increase rhodora control while improving blueberry crop safety. Higher dicamba rates had higher levels of rhodora control, although these rates compromised blueberry safety. The addition of 2,4-D ester increased crop injury and weed control. Evaluation of 2,4-D ester and dicamba rates different than current recommendations did not result in a significant improvement over the labelled rate ranges. Higher water volumes had decreased crop injury in limited trial experience. No difference was found in spring or fall mowing timing, or between fall mowing or burning. Applications within one year old crop stands in newly cleared fields tended to increase crop injury, as compared to results from two-year fields in established blueberry production. Tank mixes
of dicamba with glyphosate have shown promise and should be evaluated further.

Rimsulfuron/Nicosulfuron Use in Wild Blueberry

NATHAN BOYD

Nova Scotia Agricultural College, Dept. of Environmental Science, Truro, NS, B2N 5E3 Canada
E-mail: NBOYD@nsac.ca

Ultim 75DF (rimsulfuron/nicosulfuron) is registered for use as a spot spray on black bulrush (*Scirpus atrovirens* Willd.) in wild blueberry. Trials were conducted in commercial blueberry fields in Nova Scotia, Canada to: (1) determine the impact of application date on wild blueberry susceptibility to Ultim, (2) evaluate Ultim efficacy on annual and perennial grasses, and (3) identify the adequate dose and application volume needed to control annual and perennial grasses. Damage to blueberry plants was low at all sites and yield parameters were unaffected. Blueberry plants were most susceptible at the mid June application timing and least susceptible at early application timings (mid to late May). Grass control tended to be variable across sites with greater efficacy at the 400 L ha^{-1} application volume versus 200 L ha^{-1}. Ultim applied at 33.7 g product ha^{-1} provide 70 to 100% tickle grass (*Agrostis scabra* Willd.) control. A minimum of 90% control was consistently achieved if the rate was doubled. Witch grass (*Panicum capillare* L.) control ranged between 90 and 100%. Preliminary observations suggest that in some situations Ultim may also adequately controls sheep sorrel (*Rumex acetosella* L.). Our research suggests that Ultim could be registered for broadcast applications in wild blueberry fields for control of tickle grass and witch grass. We recommend that Ultim be applied at 33.7 g product ha^{-1} in 400 L water ha^{-1}.

Effects of Pre-Emergence Herbicides for Controlling Weeds in Wild Blueberry

D.E. YARBOROUGH AND J.L. D'APPOLLONIO

University of Maine, Orono, ME, 04469, USA
E-mail: davidy@maine.edu

A study to assess the effects of pre-emergence herbicides on wild blueberry cover, phytotoxicity and broadleaf and grass weed cover with an RCBD design with 6 replications: a check, Velpar L 6 pt/a, Velessa 4.8 pt/a, Velessa 4.8 pt/a+HM9679 surfactant 1 qt/a, Alion at 5 or 10 oz/a, Sinbar WP 2 lb/a, Sinbar WDG 2 lb/a, Sinbar WDG 2 lb/a+Callisto 6 oz/a, Prowl H2O 6.3 qt/a, and Matrix 4 oz/a were applied on 11 May 2010. Plots were evaluated at one, two, four and eight weeks post-treatment and were analyzed using a nonparametric median two-sample exact test with α=0.05. Treatments were compared individually to the check, to the standard Velpar, and to each other where relevant. Velessa had less broadleaf weed cover compared to the check by four and eight weeks post-treatment, while Velessa+adjuvant had less cover at eight weeks only. Otherwise, there were no significant differences in blueberry cover, phytotoxicity or grass cover. There were no significant differences for any cover or phytotoxicity for Velessa or Velessa+adjuvant compared to Velpar or each other. The Alion 10 oz/a treatment had lower blueberry cover at one, two and eight weeks post-treatment compared to the check and at one and eight weeks post-treatment compared to Velpar. The Alion 5 oz/a treatment had less broadleaf weed cover compared to the check by week eight, while the 10 oz/a treatment was less than the check by four and eight weeks. The 10 oz/a pre-Alion treatment had less broadleaf weed cover than Velpar at one week after treatment. Grass cover in both Alion treatments was lower than the Velpar treatment by eight weeks post-treatment. There was higher blueberry phytotoxicity in the Alion 10 oz/a treatment than the check or the 5 oz/a treatment at four weeks post-treatment, but lower phytotoxicity than the 10 oz/a post-emergence treatment at two, four and eight weeks. Sinbar WDG+Callisto suppressed broadleaf weeds compared to the check at two, four and eight weeks post-treatment. At four and eight weeks post-treatment, all three Sinbar treatments had less grass cover compared to Velpar; Sinbar WDG also had less grass cover than the check. There were no significant differences in blueberry cover or phytotoxicity compared to the check or Velpar. Sinbar WDG had higher blueberry cover than Sinbar WP at four weeks post-treatment, and it also had less broadleaf weed cover than Sinbar WP at four and eight weeks post-treatment. Otherwise, there were no significant differences in any cover or phytotoxicity for Sinbar WDG versus Sinbar WP or Sinbar WDG+Callisto. Prowl had less blueberry cover and broadleaf weed cover than the check at two and eight weeks post-treatment, and less blueberry cover than Velpar at four and eight weeks. Prowl also had less grass cover than Velpar at eight weeks after application. Prowl had higher phytotoxicity compared to the check and Velpar at four weeks post-treatment. Matrix had lower grass cover compared to Velpar at weeks four and eight; otherwise there were no significant differences in blueberry cover, phytotoxicity, broadleaf weed cover or grass cover. This study illustrated that there are several viable options to Velpar, both currently registered and in development, that may be used in rotation to effectively control weeds without significant injury to wild blueberries.

Effects of Post-Emergence Herbicides for Controlling Weeds in Wild Blueberry

D.E. YARBOROUGH AND J.L. D'APPOLLONIO

University of Maine, Orono, ME, 04469, USA
E-mail: davidy@maine.edu

A study to assess the effects of post-emergence herbicides on wild blueberry cover, phytotoxicity and broadleaf and grass weed cover with an RCBD design with 6 replications: a check, Alion at 5 or 10 oz/a, Sinbar WP 2 lb/a and Sinbar WDG 2 lb/a either left on leaves at treatment or washed off immediately with 91 gal/a water, Quinstar 4L 1.5 pt/a+COC 2 pt/a, and Matrix 4 oz/a+COC 1% v/v were applied on 10 June 2010. Plots were assessed one, two, four and eight weeks post-treatment and were analyzed using a nonparametric median two-sample exact test with α=0.05. Treatments were compared individually to the check and to the standard Velpar applied pre-emergence at 6 pt/a on 11 May. Alion at 10 oz/a had less blueberry cover than the check at four weeks. There was

also less blueberry cover in the Alion 10 oz/a treatment compared to Velpar at weeks four and eight, but less in the 5 oz/a treatment at week eight only. At four weeks broadleaf weed cover was lower in both Alion treatments than the check. Grass cover in the Alion 5 oz/a treatment was higher than the check and Velpar at four weeks, but the 10 oz/a treatment was lower than the check by week eight. Both Alion treatments had more phytotoxicity compared to the check and Velpar at all evaluations. The 10 oz/a treatment also had more phytotoxicity than the 5 oz/a treatment at weeks two and eight. There was more blueberry cover at one and two weeks post-treatment in the Sinbar WDG and WP treatments compared to Velpar. Sinbar WDG wash-off had less blueberry cover than the check at two and four weeks post-treatment compared to the check, while Sinbar WP wash-off had less at four weeks only. At one week Sinbar WP had less broadleaf weed cover than the check; by week four, all Sinbar treatments had less than the check but by week eight only Sinbar WDG did. Sinbar WDG wash-off had more broadleaf weed cover than Velpar at two weeks. The Sinbar WP post-emergence treatments had lower grass cover than the check at two weeks after treatment, and all Sinbar treatments had lower grass cover by eight weeks. All Sinbar treatments had lower grass cover compared to Velpar by eight weeks but also had more phytotoxicity to blueberry at all evaluations, and more than the check at weeks one, two and four. There were no significant differences in blueberry cover between Sinbar WDG or WP left on versus washed off. Matrix had more blueberry cover than the check at one week, but by week four it had less. Matrix also had more broadleaf weed cover compared to Velpar at one and four weeks post-treatment but by eight weeks Matrix had lower grass cover compared to both the check and Velpar. Matrix had higher blueberry phytotoxicity than the check at one and four weeks, but was higher than Velpar at weeks one and eight only. Quinstar had no differences in blueberry cover compared to the check or Velpar but it had greater phytotoxicity than Velpar on all evaluations, and more than the check at weeks one, two and four. Quinstar had lower broadleaf weed cover compared to the check at four weeks, and higher cover compared to Velpar at week one. Quinstar grass cover was less than both the check and Velpar at eight weeks. This study illustrated that there are several viable options to Velpar, both currently registered and in development, that may be used in rotation to effectively control weeds without significant injury to wild blueberries.

Efficacy of Organic Biopesticides in Control of Mummy Berry Disease on Wild Blueberries in Maine

KRISTEN MCGOVERN, SEANNA ANNIS, AND DAVID YARBOROUGH

School of Biology and Ecology, Department of Plant, Soil and Environmental Sciences, University of Maine, Orono, ME, 04469, USA
E-mail: sannis@maine.edu

Monilinia vaccinii-corymbosi is the prevalent disease of wild blueberry (*Vaccinium angustifolium*) in Maine. Currently, organic growers burn when pruning to decrease inoculum in order to reduce the incidence of this disease. We evaluated the efficacy of biological and cultural (mulch) controls on the primary infection stage of this disease in different fields and years. Biological controls tested include compost teas, and commercial products containing *Trichoderma harzianum, Bacillus pumilus, B. subtilis, Streptomyces lydicus* and plant extracts of neem (*Azadirachta indica*), garlic (*Allium sativum*), giant knotweed (*Reynoutria sachalinensis*), and citrus. Biological control materials were applied to plots in randomized complete block designs (4 to 8 blocks) in fields with a history of this disease. Incidence of primary infection was measured as the proportion of stems with mummy berry blight symptoms on leaves or flowers. The proposed primary mode of control for the biological control agents was leaf surface colonization. In 2005 and 2006, we determined the number of applied and surviving fungal and bacterial colonies per gram of treated leaf from field plots treated with various biopesticides, including compost teas and commercial products containing *T. harzianum, B. pumilus, B. subtilis*, and extracts of neem or garlic. The number of fungal and bacterial colonies on leaves treated with the biopesticides tested in 2005 and 2006 did not correlate with mummy berry disease incidence. There was no significant control of mummy berry blight with applications of compost teas and commercial products containing *T. harzianum, B. pumilus, S. lydicus* or extracts of neem or garlic. Application of peat mulch before leaf bud break did decrease disease in one of two field trials, possibly by preventing emergence of cups from germinating mummy berries. In 2010 field trials, Procidic (citrus extract) significantly controlled mummy berry disease compared to the control in both field trials. Serenade Max (*B. subtilis*) and Regalia (extract of giant knotweed) significantly controlled disease compared to the controls in one of two field trials, and all three materials will be retested in 2011.

Septoria and Rust Disease Suppression Technologies for Wild Blueberry Production

DAVID PERCIVAL AND E. BEATON

Department of Environmental Sciences, Nova Scotia Agricultural College, Truro, NS, B2N 5E3 Canada
E-mail: dpercival@nsac.ca

Leaf disease trials have been conducted for the past six years at commercial field sites in Nova Scotia, New Brunswick and Prince Edward Island with emphasis on (i) the physiological impact of these diseases on the wild blueberry, (ii) sprout and cropping phases of production field trials focusing on the suppression of *Septoria* and rust; and (iii) the tolerance of Septoria to active ingredients contained in fungicides used in the wild blueberry industry. Results from the physiological studies showed the damaging nature of these diseases on the ability of the wild blueberry to manufacture carbohydrates (sugars) and floral buds and the necessity of maintaining an effective canopy throughout the production cycle. With the sprout phase of production, results indicated the continued effectiveness of Bravo® and also the effectiveness of prothioconazole in suppressing *Septoria* and rust. Results from the crop phase of production reiterated the necessity of monitoring for *Septoria*, and the benefits to leaf retention, harvestable yield and berry quality when using Pristine™ or penthiopyrad. Laboratory studies examining the sensitivity of Septoria isolates to varying active ingredient concentrations indicated that tolerance to propiconazole existed with some of the isolates examined, and attention should also be given to other moderate to high risk active ingredients presently being used by the wild blueberry industry. Therefore, results from these trials have provided insight into the damaging nature of these leaf diseases, the necessity for due diligence in monitoring fields during susceptible infection periods, and potential suppression technologies for use in wild blueberry production.

Blueberry Field Characteristics Influence Blueberry Flea Beetle Distribution and Damage

JOSIANE GOGUEN AND GAÉTAN MOREAU

Université de Moncton, Moncton, NB, Canada
E-mail: jg9406@umoncton.ca

Landscape attributes such as microclimate and plant distribution, largely determine animal species occurrence and abundance. Therefore, when scouting for insect pests in heterogeneous agricultural fields, it may be essential to account for changes in landscape attributes to obtain accurate population estimates. However, scouting often requires random sampling, which may be inadequate if the species does not exhibit an even or random distribution.
The Blueberry flea beetle (*Altica sylvia*) is one of many insect pests found in blueberry fields of Eastern Canada, as well as in Maine and Massachusetts. Here, as part of a larger study where the objective is to improve suppression of this insect by permitting an earlier prediction of outbreaks, we examine whether random sampling is appropriate for this specific insect. Six fields of North Eastern New Brunswick were sampled intensively to examine *A. sylvia* distribution with respect to field attributes. Results indicate that *A. sylvia* larvae and defoliation are influenced by field characteristics such as field edges, plant diversity, and plant spatial distribution.

Expérimentation du Concept de Production Forêt/Bleuets dans un Modèle de Gestion Intégrée des Ressources au Saguenay–Lac-Saint-Jean par la Corporation d'Aménagement Forêt Normandin (CAFN)

LUC SIMARD

Agence de gestion intégrée des ressources, Normandin, Qc, G8M 4L7 Canada
Courriel: lsimard@groupeagir.com

Le Décret 93-2004 du ministère des Ressources naturelles et de la Faune du 4 février 2004 balisait le développement de bleuetières sur les Terres du domaine de l'État sous CAAF. Pour la région Saguenay-Lac-Saint-Jean, c'est la Corporation d'aménagement forêt Normandin (CAFN) qui a été désignée comme organisme autorisé à réaliser des expérimentations. Le Décret s'inspirait des conclusions du comité interministériel chargé d'analyser les différentes avenues possibles pour que les terres du domaine de l'État contribuent davantage au développement de l'industrie du bleuet. Le comité a proposé plusieurs recommandations formulées dans un rapport rendu public le 17 septembre 2002. Le modèle d'agroforesterie de production de bleuet par bandes alternées (42m forêt/60m bleuet), développé par la CAFN au début des années 2000, est celui qui a été retenu comme présentant la meilleur voie de développement afin faire cohabiter les deux ressources. Il permet de produire du bleuet sur près de 60% du territoire et la bande forêt est suffisamment large afin de maintenir la possibilité forestière d'une forêt de pin gris naturelle (non aménagée).
La présentation vise à dévoiler les principaux résultats du projet de recherche *Expérimentation du concept de production forêt/bleuets dans un modèle de gestion intégrée des ressources au Saguenay–Lac-Saint-Jean* qui s'est déroulé sur le territoire de la Corporation d'aménagement forêt Normandin (CAFN) de 2005 à 2010. Le projet visait à documenter divers aspects du nouveau concept d'aménagement de bleuetières en bandes alternées développé par la CAFN. Pour atteindre cet objectif, le projet de recherche fut divisé en différents axes de recherche et la CAFN s'est adjoint la participation de plusieurs expertises afin de faire de ce projet un succès. Les différents projets de recherche sont regroupés selon six axes d'orientation :

1. Optimisation forestière;
2. Optimisation agricole;
3. Impacts environnementaux;
4. Optimisation du milieu de production;
5. Développement durable;
6. Utilisation optimale du territoire.

Les résultats au niveau de l'axe qui portait sur le volet forestier sont fragmentaires en raison de l'échelle de temps que l'on considère lorsque l'on traite d'aménagement forestier. L'effet chablis ne s'est pas manifesté suite à l'aménagement du dispositif. Il s'agit d'une donnée importante qui démontre que le vent a peu d'emprise sur les bandes forêt. Au niveau agronomique, les différents dispositifs présentent des conditions similaires pour ce qui est des températures et des risques de gel. La localisation des sites semble avoir une influence plus importante à ce niveau. L'épaisseur et l'uniformité du couvert hivernal sont des avantages indéniables apportés par le modèle forêt/bleuet. Il permet de protéger efficacement les plants du gel hivernal. L'analyse des rendements des premières expérimentations permette de croire que les bleuetières forêt/bleuet peuvent se comparer avantageusement à des bleuetières conventionnelles du même cycle de production. Le volet faunique de la recherche a démontré que le concept d'aménagement forêt-bleuet est un compromis intéressant pour préserver la biodiversité des pinèdes grises. Le suivi des pesticides dans la nappe phréatique a permis quant à lui de constater que la concentration en hexazinone pouvait varier rapidement suite aux épandages. Le concept forêt/bleuet est très bénéfique du point de vue du développement durable. Il présente des avantages indéniables en termes de protection du paysage, d'acceptabilité sociale, d'habitat pour la faune et de partage équitable d'une ressource collective. L'expérience de la CAFN a démontré que le développement des deux ressources par un seul gestionnaire est garant du succès de l'aménagement de bleuetières de type forêt/bleuet.

Optimisation d'une Régie de Production du Bleuet Nain Comportant une Rotation de 3 Ans au Québec

MICHEL CHAMPAGNE

Les Bleuets Sauvages du Québec, St-Bruno, Qc, G0W 2L0 Canada
Courriel: MChampagne@wild-blueberries.com

Une très large proportion de la culture du bleuet nain au Québec est régie par une rotation de deux ans, mais certains producteurs font parfois un cycle de trois ans en ajoutant une seconde année de récolte. Les rendements observés lors de la deuxième année de récolte sont souvent très décevants, mais il arrive parfois que ceux-ci soient bons. Plusieurs résultats de recherches antérieures ont démontré que la fertilisation azotée pourrait contribuer grandement à améliorer les rendements. Par ailleurs, chez certaines cultures fruitières, il semble qu'une récolte tardive en première année pourrait influencer l'état des réserves en azote et donc les rendements de l'année suivante. D'autre part, la visibilité des fleurs dans les champs pourrait influencer la quantité de pollinisateurs qui sont attirés par le champ. L'abeille domestique, qui est le pollinisateur le plus utilisé en bleuetière, peut voyager jusqu'à 2,5 km de la ruche et pourrait être davantage attirée par des champs de première année que par un champ en deuxième année où les fleurs sont cachées sous le feuillage. Il pourrait alors être préférable d'utiliser un insecte comme la mégachile, qui butine sur de plus courtes distances (120 mètres du dôme), pour polliniser les champs en deuxième année de récolte.
Afin de comparer les rendements obtenus entre des rotations de 2 ans et de 3 ans, nous avons mené un projet de recherche en trois volets sur trois sites dans la région du Saguenay Lac Saint-Jean. Tout d'abord, le volet 1 porte sur l'influence de la fertilisation appliquée à diverses étapes de la rotation sur le rendement. Il présente un dispositif à 30 parcelles combinant les deux types de rotation (2 et 3 ans) avec trois périodes d'application d'engrais pour un total de six traitements répétés 5 fois. Les rendements seront évalués à une date similaire à chaque année de récolte selon le traitement. D'autre part, le volet 2 cherche à déterminer l'importance de la date de récolte sur le rendement d'une seconde année de production. Il compare cinq dates de récolte répétées quatre fois pour un total de 20 parcelles. Les rendements des parcelles de seconde année récoltés à une même date seront mis en relation avec les rendements récoltés à dates variables lors de la première année de récolte. Enfin, le volet 3 tente d'évaluer l'efficacité de deux types de pollinisateurs (abeille et mégachile) selon l'année de récolte (première et seconde), soit quatre traitements répétés quatre fois. Le pourcentage de mise à fruit sur 30 tiges et le rendement dans des parcelles de 10 m^2 seront évalués à distances variables des ruches ou dômes (10, 20, 40, 80 et 120 m). L'utilisation d'une rotation sur trois ans au lieu de deux aura comme avantage de diminuer les coûts de production et d'augmenter les rendements à l'hectare. Elle permettra aussi de doter le producteur ou l'agronome d'outils pouvant permettre de déterminer si un champ peut être récolté une seconde année consécutive ou s'il doit être fauché.
Nos résultats préliminaires dans le volet 1 démontrent qu'il semble y avoir une corrélation entre la quantité d'azote présente dans les feuilles lors de la première année de récolte et les rendements en deuxième année.

Évaluation du Taux de Réussite de Bouturage de l'Airelle à Feuille Étroite (*Vaccinium angustifolium* ait.) à Partir d'un Rhizome Prélevé et Planté en État de Dormance

MARIE-PASCALE BEAUDOIN, ANDRÉ GAGNON ET ANDRÉE TREMBLAY

MAPAQ, Direction régionale du Saguenay-Lac St-Jean, Alma, Qc, G8B 5W2 Canada
Courriel: pascale.beaudoin@mapaq.gouv.qc

Dans les bleuetières de bleuet nain, nous constatons des zones dénudées (érosion, gel hivernal, pratiques culturales) plus ou moins importantes occasionnant des pertes de rendement non négligeables. L'objectif du projet est de valider la possibilité d'utiliser les boutures de rhizome en état de dormances afin de regarnir ou augmenter la densité de ces zones peu productives. Nous avons donc prélevé et implanté des sections de rhizomes (5 et 10 cm) en période de dormance. Les paramètres mesurés sont; la survie des rhizomes, l'effet de la saison d'implantation (automne et printemps), l'émergence des tiges, la longueur des tiges, la longueur des rhizomes

utilisés, le diamètre des rhizomes et le degré d'enracinement. Les résultats et nos observations préliminaires nous permettent de croire qu'il sera possible de poursuivre notre expérimentation afin de valider d'autres facteurs tels : la croissance du rhizome, le temps écoulé avant la première floraison, les effets de la fertilisation, le temps écoulé avant la première fructification, le rendement en fruits, le taux de recouvrement, etc. Aussi, les parcelles pourront servir de site de démonstration pour le transfert de cette technologie dans les bleuetières commerciales.

Les Anthocyanes dans les Bleuets Sauvages du Québec: Identification et Évaluation de leur Potentiel Antioxydant

SYLVAIN SAVARD

Centre de recherche industrielle du Québec (CRIQ), Direction de l'écoefficacité industrielle et de l'environnement, Québec, Qc, G1P 4C7 Canada
Courriel: sylvain.savard@criq.qc.ca

Les effets bénéfiques du bleuet nain sur la santé humaine sont attribués à leur forte teneur en anthocyanes. Dans cette étude, les anthocyanes ont été extraits des bleuets, purifiés puis analysés pour en déterminer la composition par HPLC/MS/MS. Par la suite, des essais in vitro ont été réalisés afin d'évaluer leur capacité à inhiber l'oxydation de la lipoprotéine de faible densité (LDL).
Les résultats obtenus ont démontré la présence d'au moins 49 anthocyanes différents dans les extraits de bleuets nains provenant du Lac-St-Jean. Tous les échantillons analysés ont révélés la présence de 5 des 6 anthocyanidines (aglycone des anthocyanes) les plus répandus habituellement retrouvés dans les fruits et légumes.
Les essais in vitro d'inhibition de l'oxydation du LDL ont permis d'établir que les anthocyanes extraits des bleuets sont potentiellement capable de protéger les molécules organiques complexes contre les modifications oxydatives induites par des substances oxydantes (stress oxydatif).

Anthocyanins in Wild Blueberry of Quebec: Identification and Antioxidant Activity

SYLVAIN SAVARD
Centre de recherche industrielle du Québec (CRIQ), Direction de l'écoefficacité industrielle et de l'environnement, Québec, Qc, G1P 4C7 Canada
E-mail: sylvain.savard@criq.qc.ca

The health benefits of wild blueberries are attributed to their high anthocyanins content which is strongly correlated to their highest antioxidant capacity. In this work, anthocyanidins were extracted from wild blueberry, purified by solid phase extraction and characterized by HPLC/MS/MS. Subsequently, the potential of anthocyanins extracted from wild blueberries to prevent low density lipoprotein (LDL) oxidative alteration induced in vitro was assessed.

Guide de Production du Bleuet Sauvage dans une Perspective de Développement Durable

SOPHIE GAGNON

Agrinova, Alma, Qc, G8B 7S8 Canada
Courriel: sophie.gagnon@agrinova.qc.ca

Le *Guide de production du bleuet sauvage dans une perspective de développement* durable est un outil qui se destine aux producteurs et intervenants de la production du bleuet sauvage. Le Syndicat des producteurs de bleuet du Québec a mandaté Agrinova et une équipe de travail composée du MAPAQ, du Club Conseil Bleuet, du CRAAQ et d'une quinzaine d'intervenants et spécialistes pour mettre à jour les outils existants, comme la *Trousse de production et de démarrage dans la production du bleuet sauvage (MAPAQ 2000).* L'objectif était de retrouver dans un document unique l'ensemble de l'information disponible concernant tous les sujets touchant à la

production, et ce, dans le souci du développement durable de cette production. Grâce à l'aide financière du SPBQ, du CDAQ, des MRC Maria-Chapdelaine, Domaine du Roy et du Fjord, de l'Association des producteurs de bleuet de la Côte-Nord et du MAPAQ, le guide a été produit et sera publié à la mi-novembre 2010.

Persistence and Natural Occurrence of a Soil Dwelling Entomopathogenic Fungus in Maine Blueberry Fields

Matthew S. Jones, Frank Drummond, Judith Collins, and Eleanor Groden

School of Biology and Ecology, University of Maine, Orono, ME USA

Studies initiated in 1997, 1998, 1999, 2000, and 2010 were designed to assess persistence of *Beauveria bassiana* in blueberry field soils and its relative abundance between fields across blueberry growing regions. In 1997, 1998 and 1999 studies were conducted where soil was inoculated with *B. bassiana* as an aqueous soil drench, GHA strain in either the late summer or the early spring. Subsequent to inoculation soil cores were taken, serial dilutions were made and plated out on selective media (Dodine addition) to determine the relative abundance of *B. bassiana* conidia through time and vertically with soil depth. The half-life ranged from 41-45 days. This study was repeated in the spring of 2000 with a much larger sample size of ten fields and the resulting half-life was only 22 days. Soil analysis was conducted in each of the 10 fields to determine if soil characteristics could explain variation in conidial decay rates. Magnesium was the only element that was correlated with conidial decay, a slight negative correlation at $P < 0.10$. In 1999 persistence of conidia was measured on blueberry foliage. The half-life of conidia on the foliage was less than 1 day. In 1997 and again in 2010 soil samples were collected from 3 and 12 blueberry fields respectively to determine the density of *B. bassiana* in blueberry fields. In 1997 where only three fields were sampled the range in conidial density was 0 to 9,333 conidia / gram of soil. This is a very high rate considering that an application of conidia at the recommended rate would be 15,942 conidia / gram of soil. In 2010 a study that has not been fully analyzed included 12 fields representing four levels of blueberry management intensity (n=3). Relative conidial density and the factors that might affect population levels will be discussed.

Insecticide Efficacy Trials

Judith A. Collins and Francis A. Drummond
School of Biology and Ecology, University of Maine, Orono, ME 04469
Email: collinsj@maine.edu

Two new materials have shown promise for control of various blueberry pest insects. Delegate® WP (spinetoram) is registered by EPA as a reduced-risk material. A spin-off of spinosad, it is a broad-spectrum insecticide offering the advantage of low toxicity to beneficial insects and a longer residual than spinosad as well as short reentry and preharvest intervals. Our initial trials have shown it to be effective against both blueberry spanworm and blueberry flea beetle larvae. Assail® 30 SG or acetamiprid is a new generation neonicotinoid insecticide that is systemic and moves into the plant through the roots and also through the leaf cuticular surface. Strawberry rootworm, blueberry spanworm, blueberry flea beetle, and blueberry thrips have all been successfully controlled with this material. Trials in 2010 focused on applications of reduced rates of these materials. Effective control at lower rates will make these materials more attractive to growers.

Potential for the Entomopathogenic Fungus, *Beauveria bassiana*, as a Management Tool for the Blueberry Fly, *Rhagoletis mendax*.

Francis A. Drummond, Judith Collins, and Jennifer Lund

School of Biology and Ecology, University of Maine, Orono, Maine
E-mail: fdrummond@maine.edu

Laboratory studies conducted in 1996 suggested that the entomopathogenic fungus, *Beauveria bassiana* (strain GHA) formulated as Mycotrol™ had potential as a bio-insecticide for control of blueberry fly, *Rhagoletis mendax*. In 2009 and 2010 studies were conducted to assess the efficacy of several methods for use of Mycotrol - O as a control tactic. We investigated the use of Mycotrol-O as a soil drench at two rates (1.25 L / ha and 2.5 L / ha) for control of emerging flies. Foliar application of Mycotrol-O using 2.5 L / ha was also evaluated in the field with treatments of Mycotrol-O applied both in the morning and in the evening. In addition Mycotrol-O was applied at a separate farm to investigate potential effects on blueberry fly alone and in combination with GF-120 (Naturalyte), a currently recommended natural insecticide used by some organic growers in Maine. A fourth study was conducted to assess the impact of non-target organisms that are exposed to soil drenches of Mycotrol-O. Are results suggest that while blueberry fly is very susceptible to *Beauveria bassiana* in the laboratory, there is little potential for its use as a control tactic. The foliar exposure study also showed that flies do develop mycosis when exposed to blueberry foliage with inoculum; however, inoculum decays quickly in the field so that by 72 hr after application little mycosis occurs. This suggests that if Mycotrol-O is to work multiple applications must be made. However, the weather during these trials was extremely wet (wetter than the summer norm) and so spores may have been washed off of the foliage. A good result was that no apparent detrimental effects of Mycotrol-O application could be found in soil dwelling arthropods associated with lowbush blueberry.

2010 Wild Blueberry Update for Nova Scotia

PETER BURGESS

AgraPoint International, Bible Hill, NS, B6L 2H5 Canada
E-mail: p.burgess@agrapoint.ca

Nova Scotia had a relatively mild winter, which resulted in lower than normal winter damage throughout most of the province. The bud numbers in the fall appeared strong so the crop potential looked positive going into the spring. March and April were warm and dry, and this led to abnormally early plant development in many areas of the province. Some areas of the province were 3 weeks early reaching 40-50% F2 stage and as a result some farmers were applying monilinia controls well before the beginning of May. May became cool and damp, which appears to be the norm for Nova Scotia the last few years. This slowed down crop development, but also extended the pollination time, as many fields began to flower in early May. Although native pollinators were plentiful this spring, many areas had poor pollination weather and some yields appeared to suffer as a result.

There were several challenges this spring. The early plant development caught some growers off guard. Some were not able to get their Velpar applications applied, and a few that did apply late got some damage. In many fields, the low areas appeared to have a delayed development. This was not relatable to insect damage or pesticide applications. It appears air temperatures, soil temperatures, soil moisture and perhaps frost combined to slow development in these areas. These areas also did not appear to have the same number of buds or flowers as other areas of the field.

Overall spring leaf feeding insect pressure was low. This was not expected considering the relatively easy winter. However the dry March and April combined with the cool damp May could have helped reduce spring leaf feeders. There were several light frosts in early May and into June that seemed to affect some areas but was not a huge impact on the crop as a whole.

The low farm gate price of 2009, lead to many producers drastically reducing inputs in 2010. As a result there was a surplus of hives for pollination until late into pollination. Velpar usage was reduced from previous years, some of it by design while some of the reduction due to timing issues. Many growers who cut back on inputs substantially and got lower yields as a result.

The crop was extremely variable throughout the province. Some small areas received near record yields while some of the major producing areas were 10-20% below average. At this point it is still difficult to tell the exact yield, but we are estimating around 30 million pounds.
Late in 2010, sprout year fields were generally under high leaf rust pressure. This combined with some fields having poor weed control, could lead to some low yields in 2011. Nova Scotia has been struggling for over 6 years to maintain a provincial average yield of over 2000 lbs/acre.

AFFICHE / POSTER

Bumble Bee Pollination of Lowbush – Revisiting the Issue

Frank A. Drummond

School of Biology and Ecology, University of Maine, Orono, ME USA

We conducted a four-year study from 1995-1998 in central coastal Maine and showed that bumble bees at the stocking rate of 3-4 colonies (250 bee colonies) per acre provided equivalent pollination and yields to fields solely stocked with honey bees at a rate of 3 hives / acre. The yields in those years compared to the previous six-year average yield ranged from 96 – 118% for the bumble bee stocked fields and 75 – 104% for the honey bee stocked fields. Research conducted between 2005 and 2010 confirms our earlier findings and those of Desjardins and Olivereira (2006) that commercial bumble bees of the species *B. impatiens* are good pollinators of lowbush blueberry. This research also confirms that stocking densities of at least 10 colonies / ha will provide pollination equal to similar stocking densities of honey bees. Current rental prices of honey bees and purchase prices of bumble bees suggest an economic
benefit in favor of bumble bees.

Yield Variation among Clones of (*Vaccinium angustifolium* Ait.) as a Function of Kinship, Self-Comparibility, and Combining Ability

Daniel J. Bell[1], Lisa J. Rowland[1], John Stommel[1], Dapeng Zhang[2], and Frank A. Drummond[3].

[1]U.S. Department of Agriculture, Agricultural Research Service, Henry A. Wallace Beltsville Agricultural Research Center, Genetic Improvement of Fruits and Vegetables Laboratory, Bldg. 010A, 10300, Baltimore Ave. Beltsville, MD 20705; [2]U.S. Department of Agriculture, Agricultural Research Service, Henry A. Wallace Beltsville Agricultural Research Center, Sustainable Perennial Crops Laboratory, Bldg. 010A, 10300, Baltimore Ave. Beltsville, MD 20705; [3]University of Maine, School of Biology and Ecology, Deering Hall, Rm. 305, Orono, ME 04473.

We have successfully demonstrated that Expressed Sequence Tag-Polymerase Chain (ESTs) reaction markers, originally designed from expressed genes in highbush blueberry, are suitable for use in genomics applications in lowbush blueberry. Since lowbush blueberry is wild, nothing is known of parentage in wild populations. These markers provide some insight as to the genetic structuring of fields. We have shown that the distribution of genotypes within fields appears to be random; an insight that has heretofore been impossible to obtain. This is highly germane since lowbush blueberry is susceptible to inbreeding depression which has been hypothesized as a possible source of yield variations in pockets of closely related individuals who likely exchange pollen with their near neighbors due to honey bee flight patterns. An ongoing pollen flow study is underway to model these distributions. We have shown that self-compatible clones are generally good yielders in outcrosses. This, coupled with the moderate heritability of high yield phenotypes allows us to advise growers to screen for self-compatible clones and to look for specific combinations of those crosses which demonstrate hybrid vigor. 'Seed' families might be generated which could be deployed into bare areas of fields and perhaps even to generate entire new fields. A molecular approach to screening for self-compatible clones is currently underway.

Preliminary Analysis of Genetic Diversity in Lowbush Blueberry (*Vaccinium angustifolium* Ait.) across its Native Range

Lee A. Beers[1], Frank A. Drummond[1], Lisa J. Rowland[2]

[1]School of Biology and Ecology, University of Maine, Orono, ME 04469
[2]Genetic Improvement of Fruits and Vegetables Laboratory, USDA/ARS Beltsville, MD 20705

Lowbush blueberry (*Vaccinium angustifolium* Ait.) is unique in its cultivation. Wild plants colonize open areas, either natural or man-made. Without planted varieties it is left to chance and selection what genotypes will populate a field. Population screening of clones in blueberry fields and surrounding, non-cultivated, wild plants would provide an indication of genetic diversity present in lowbush blueberry. Identification of clones more resistant to abiotic and biotic stresses could form a base for germplasm improvement ultimately providing new varieties. Previous work has shown blueberry fields to be more genetically similar the closer they are in proximity to each other. Significant diversity of blueberry fields can be found in close proximity between fields (12km). We are proposing a research study to assess genetic diversity in lowbush blueberry across its native range. Sampling lowbush blueberry populations over a north-south transect across its geographic range will be initiated in spring 2010. Population samples collected at different sites will be compared using EST-PCR markers developed for highbush (*Vaccinium corymbosum*) species, but have also proven useful in lowbush studies. We will report on the initial findings at this meeting. Clones from multiple populations across North America will also be brought back to the University of Maine's Blueberry Hill Farm for "common garden" experiments on cold hardiness. Studying genetic diversity of lowbush blueberry fields could identify more stress resistant populations or show variation in regards to yield.

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