2011 Annual Winter Meeting of the American Cranberry Growers Association

Rutgers University EcoComplex

Bordentown, NJ

Thursday
January 27, 2011

RUTGERS
New Jersey Agricultural Experiment Station

Presentation Summaries

ACGA Winter Meeting Program
Thursday, January 27, 2011

8:00-8:30 Registration and Coffee

8:30-8:40 Welcoming Remarks– **Stephen Lee IV, President, ACGA**
Treasurer's Report **- Shawn Cutts**

8:40-9:00 **2010 Cranberry Statistics**
Troy M. Joshua, USDA, NASS

9:00-9:30 **Cranberry Weed Control Update**
Bradley Majek, Department of Plant Biology and Pathology, Rutgers University

9:30-9:55 **Performance of Rutgers' cultivars in commercial beds and thoughts on their nutrition requirements**
Nicholi Vorsa and Jennifer Johnson-Cicalese, P.E. Marucci Center for Blueberry & Cranberry Research & Extension, Rutgers University, Chatsworth, NJ 08019

9:55-10:25 **Entomology Research in Cranberries: An Update**
Cesar Rodriguez-Saona, Department of Entomology, Rutgers University

10:25-10:40 Break

10:40-11:05 **Photosynthetic Response to Heat Stress and Effect of Irrigation in Cranberry**
Chenping Xu (Research Associate), *Jennifer Johnson-Cicalese (*Research Associate), *Nick Vorsa* (Professor), and *Bingru Huang* (Professor), Department of Plant Biology and Pathology, Rutgers University

11:05-11:35 **Pesticide Safety**
Ray Samulis, Burlington County Agricultural Agent, Rutgers University

11:35-12:00 **Cranberry Resistance to Fungal Pathogens: USDA-SCRI Grant Update**
James Polashock, Research Plant Pathologist, USDA-ARS, *Mariusz Tadych, James White, Nicholi Vorsa*, Department of Plant Biology and Pathology, Rutgers University, and *Jennifer Johnson-Cicalese*, Research Associate.

12:00-1:00 Lunch

1:00-1:45 **Scald and Climate Change**
Paul J. Croft, Meteorologist, School of Environmental and Life Sciences, Kean University, Union, New Jersey

1:45 **Adjournment**- *ACGA Board of Directors Meeting*

CRANBERRY WEED CONTROL REPORT FOR 2010

B. A. Majek

RAREC Rutgers Agricultural Research and Extension Center,
Rutgers University, Bridgeton, NJ 08302

A section 18 Emergency exemption for the use of quinclorac (Quinstar 4L), also know by its code number BAS 514OH, by New Jersey growers to control dodder in 2010 was granted bye EPA. In the past year, Ocean Spray Inc. discovered that the active ingredient was not labeled in Europe use on for food crops. Since Ocean Spray Inc. does not segregate cranberry products for domestic use and for export, the company prohibited Ocean Spray growers from using quinclorac. Almost all New Jersey cranberry growers sell to Ocean Spray Inc., so very little quinclorac was used on New Jersey cranberry bogs. In addition, research with quinclorac on growers' bogs was curtailed in 2010 at the request of Ocean Spray Inc. due the concern about detectable residue in the crop.

Research conducted in previous years indicated that a late spring application initially controlled dodder, but recovery was evident by August. Dodder bloom was delayed from late July to mid August, but not prevented. The application of quinclorac in July did not control dodder. Two applications of quinclorac, in late spring and in July was the only treatment that provided season long dodder control. Research was conducted at two sites in New Jersey where dodder was a problem in past years, but lack of a weed population in 2010 resulted in phyotoxicity evaluations only. No injury to the crop was observed at any site where quinclorac was applied.

Weed research at Rutgers Blueberry and Cranberry Research Center, Chatsworth, New Jersey, evaluated tank-mixes of Quinstar 4L and Callisto, two herbicides with similar application times and different weed control spectrums. Neither herbicide injured cranberries when applied alone nor when tank-mixed and applied in late spring or in July, the two timings when the herbicides would be applied to cranberries for weed control. In addition, a new experimental herbicide, BCS-AA10717 from Bayer was evaluated. The new Bayer herbicide did not injure cranberries when applied in early spring before new growth was evident, but injury was observed when

cranberries were treated in July. This herbicide has provided excellent weed control in tree fruit studies, and is similar to Casoron in chemical structure. Additional research is needed on BCS-AA10717 to determine its weed control potential in cranberries.

PERFORMANCE OF RUTGERS' CULTIVARS IN COMMERCIAL BEDS AND THOUGHTS ON THEIR NUTRITION REQUIREMENTS

Nicholi Vorsa and **Jennifer Johnson-Cicalese**

P.E. Marucci Center for Blueberry & Cranberry Research & Extension, Rutgers University, Chatsworth, NJ 08019

Crimson Queen® variety (tested as NJS98-23) was derived from a cross made in 1988 between 'Stevens' and 'Ben Lear'. The maternal parent Stevens (derived from a McFarlin x Potter cross) is the most widely grown cultivar due to its reliable productivity. The pollen parent Ben Lear is a 1910 native selection from Berlin, WI having early, deep coloration, and large fruit size. First established in trials in 1993, Crimson Queen has exhibited significantly higher yields, higher anthocyanin content (red pigment), and larger fruit size as compared to Stevens.

Demoranville® variety (tested as NJS98-35) named in honor of Dr. Irving Demoranville was derived from a Ben Lear x Franklin (derived from an Early Black x Howes cross) cross made in 1988. First established in trials in 1993, Demoranville has exhibited significantly higher yields, higher anthocyanin content (red pigment), and larger fruit size as compared to Stevens.

Mullica Queen® variety (tested as CNJ97-105-4) was derived from a cross between 'LeMunyon' and '#35' (derived from a Searles x Howes cross), and represents a genetic background unrelated to that of Stevens or Ben Lear. Mullica Queen has exhibited significantly higher yields and slightly higher anthocyanin content (red pigment), and has an earlier flowering phenology, as compared to the cultivar Stevens.

Commercial plantings

The first full production commercial beds of Rutgers' Crimson Queen, Demoranville, and Mullica Queen varieties were planted in the spring of 2006. Three beds of Crimson Queen, and one bed each of Mullica Queen and Demoranville were planted in Wisconsin in Jackson and Monroe counties in a sand base. One bed of Crimson Queen was planted in Plymouth Co., Massachusetts. In 2007, Crimson Queen was planted in a 7 acre, native soil bed composed of sand and 2% organic matter in Burlington Co. In 2008, the Mullica Queen and Demoranville varieties were also planted in similar sized beds at this location in New Jersey. All these beds were planted with rooted cuttings, plants originating from stolon segments that were grown by Integrity Propagation LLC, Chatsworth, NJ. The planting density was typically one plant per square foot, with a few beds planted at slightly higher density. The plants from Integrity Propagation represent 'Foundation Level' stock plants derived from 'Breeders Stock' potted plants. All 'Breeders Stock' material has been confirmed with DNA fingerprinting, as well virus indexed (including Blueberry Scorch Virus and Tobacco Streak Virus), to provide the highest quality cranberry plants.

Variety trials in Wisconsin, New Jersey, and Massachusetts indicated that the yield potential of these varieties were greater than the principal cultivars Stevens and Ben Lear. Initial production data from commercial beds indicates that this increased yield potential has been realized.

Nutrition requirements of Crimson Queen, Demoranville, Mullica Queen

These three cultivars were selected for fruit production under higher nitrogen (N) inputs. Yields of over 600 bbl/ac have been realized with Crimson Queen and Mullica Queen, and over 550 bb/ac for Demoranville. The N demand of producing cranberry beds, as determined by the 'Cranberry Nitrogen Balance Sheet' (see *Nitrogen for Bearing Cranberries in North America*, EM 8741, June 2000, Ed. J. Hart, Oregon State University), requires additional N for larger crops. It has been determined that for a 200 bbl/ac crop 15-20 lb of N is removed by the fruit. Thus, for every 100 bbl/ac, 7.5 – 10 lbs N is removed by the fruit. A 400 bbl/ac crop would remove 30-40 lbs N/ac and a 600 bbl/ac crop would remove 45-60 lbs N/ac in the crop alone. The greatest demand for N occurs during bloom, fruit set and bud set (for subsequent year's crop), e.g., typically mid June – early August in New Jersey. Thus maintaining an adequate supply of N during this developmental period is critical not only for the present year's crop, but also for the subsequent year's crop.

Obviously, the N requirement for a given bed depends on a number of factors including soil type (% organic matter), soil temperature, water requirements, plant biomass, crop set (a function of bloom density and pollination), etc. For example, a Demoranville bed in Wisconsin yielding 559 bbl/ac in 2010, was fertilized with 64 lb/N, and exhibits very good bud set for the 2011 crop. Whereas, comparable Stevens beds had about 40 lb/N applied. A Crimson Queen bed yielding 628 bbl/ac in 2009, yielded only 170 bbl/ac in 2010. The grower suggests that one reason there was such a large decline in crop in 2010 may be because the N demand in 2009 was much greater than expected. Thus, because of the high yield potential with these new varieties, nutrition management is a critical issue - plant status and N needs should be carefully monitored.

ENTOMOLOGY RESEARCH IN CRANBERRIES: AN UPDATE

Cesar Rodriguez-Saona[1], Dan Schiffhauer[2], Robert Holdcraft[1], and Vera Kyryczenko-Roth[1]

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[2] Ocean Spray Cranberries Inc, Chatsworth, NJ 08019

PRE-BLOOM CONTROL OF SPARGANOTHIS FRUITWORM IN CRANBERRIES, 2010 FIELD TRIAL.

This test evaluated the efficacy of a pre-bloom application of Delegate WG, Intrepid 2F, Assail 30SG, and an Assail 30SG-Intrepid 2F combination for *Sparganothis* fruitworm larval control in cranberries. The test was conducted in a commercial cranberry bog, cv. 'Stevens,' located in Chatsworth, New Jersey. Each treatment plot was 1.2 m by 1.2 m (1.49 m^2), replicated 10 times in a CRD. Insecticide applications were made with R&D CO_2 backpack sprayer, using a 2-liter plastic bottle. The sprayer was calibrated to deliver 102 gal of vol per acre at 30 psi, using a single T-jet vs 110015 nozzle, yielding 141.8 ml per plot. Treatments were applied on 20 May. Control plots received no insecticide. Plots were examined 7 DAT (27 May). All uprights with signs of larval infestation were clipped, bagged, and taken to the lab for examination under magnification. The number of surviving larvae and number of damaged uprights per plot were counted. Data were analyzed using ANOVA and means separation by Fisher's LSD test at $\alpha = 0.05$. Data were log (x) or log(x+0.1) transformed prior to analysis.

Delegate provided best *Sparganothis* fruitworm control based on 94% decrease in larval survival and 56% reduction of damaged uprights compared to controls (Table 1). Intrepid also reduced larval survival by 79 and 50% when applied alone or in combination with Assail compared to controls, respectively (Table 1).

Table 1.

Effects of insecticides on *Sparganothis* fruitworm larvae and damage in cranberries

Treatment	Rate/Acre	No. per Plot (Mean±SE)			
		Larvae		Damaged Uprights	
Control	-	8.0 ± 2.1	a	18.1 ± 3.6	a
Delegate WG	6 oz	0.5 ± 0.2	b	7.9 ± 1.0	b
Intrepid 2F	16 floz	1.7 ± 0.6	b	11.2 ± 1.6	ab
Assail 30SG + Intrepid 2F	5.3 oz + 8 floz	4.0 ± 0.9	b	14.4 ± 1.9	ab
Assail 30SG	5.3 oz	7.1 ± 1.6	ab	17.6 ± 4.3	a

Means within a column followed by different letters are significantly different (P≤0.05)

RESIDUAL TOXICITY OF ASSAIL, DELEGATE, INTREPID, AND RIMON IN THE FIELD EMPLOYING FOLIAGE BIOASSAYS IN THE LABORATORY.

This experiment tested the efficacy of Rimon, Delegate, Intrepid, Assail, and three combinations of Assail and Intrepid in controlling spotted fireworm larvae in cranberries. The experiment was conducted in a cranberry cv. 'Early Black' field located at the Rutgers PE Marucci Center for Blueberry and Cranberry Research and Extension in Chatsworth, New Jersey. Plots were 60 x 60 cm each, replicated 10 times in a CRD. Each plot was separated by a 15 cm buffer zone. Applications were made with R&D CO_2 backpack sprayer, using a 1-liter plastic bottle. The sprayer was calibrated to deliver 50 gal of vol per acre at 30 psi, using a single T-jet VS 110015 nozzle, yielding 17.4 ml per plot. Treatments were applied on 20 July. Control plots received no insecticide. On 3 July, 27 July, and 10 August (3, 7, and 21 DAT, respectively) 4–5 insecticide-treated uprights were inserted in florists' water picks, enclosed in a ventilated 40-dram plastic vial, and secured on Styrofoam trays. For assays with 1st instars, 8–10 vials each containing 1–3 larvae were setup for each treatment. Each vial was considered a replicate. For 3rd instars, 5–10 vials each containing one larva were setup for each treatment. Spotted fireworm larvae used in assays were from a colony kept at the Rutgers PE Marucci Center. Plants and insects were then placed in the laboratory at ~25°C, on a 15:9 L:D cycle. Mortality was assessed at 7 days after setup. Percent of live larvae were analyzed using ANOVA and means separation by Fisher's LSD test at $\alpha = 0.05$. Percent data were arcsine square-root transformed prior to analysis.

Compared to untreated controls, Delegate significantly reduced survival of first instars 3 and 7 DAT by 93 and 75%, respectively (Table 2). Intrepid also reduced larval survival compared to controls but only by 50 and 55% on 3 and 21 DAT, respectively (Table 2). Rimon and Assail had no effect on 1st instar fireworms. No treatments showed significant control of third instars (data not shown).

Table 2.

Treatment	Rate/Acre	% Live Larvae (Mean±SE)		
		3 DAT	7 DAT	21 DAT
Untreated Control	-	50.0 ± 10.2 AB	40.0 ± 16.3 AB	100.0 ± 0.0 A
Rimon	12 floz	53.3 ± 11.3 A	70.0 ± 15.3 A	90.0 ± 10.0 AB
Delegate	6 oz	3.3 ± 3.3 C	10.0 ± 10.0 B	85.0 ± 10.7 AB
Intrepid 2F	16 floz	25.0 ± 8.3 BC	50.0 ± 16.7 AB	45.0 ± 13.8 C
Assail 30 SG	5.3 oz	53.3 ± 7.4 A	80.0 ± 13.3 A	100.0 ± 0.0 AB
Assail + Intrepid	5.3 oz + 6 floz	43.3 ± 7.1 AB	70.0 ± 15.3 A	90.0 ± 6.7 AB
Assail + Intrepid	5.3 oz + 8 floz	41.7 ± 8.3 AB	60.0 ± 16.3 A	80.0 ± 8.2 AB
Assail + Intrepid	5.3 oz + 10 floz	33.3 ± 11.1 AB	70.0 ± 15.3 A	70.0 ± 8.2 B

Means within a column followed by different letters are significantly different (P≤0.05)

PHOTOSYNTHETIC RESPONSE TO HEAT STRESS AND EFFECT OF IRRIGATION IN CRANBERRY

Chenping Xu, **Jennifer Johnson-Cicalese**, **Nick Vorsa**, and **Bingru Huang**

Department of Plant Biology and Pathology, Rutgers University

Cranberry (*Vaccinium macrocarpon* ait) growth declines during the summer season, when temperatures increase to above the optimal level of about mid-70°F. Cranberry plants are particularly sensitive to temperatures above 90^{o}F. Excessive heat during summer months has been associated with poor yield in cranberry. Typical physiological symptoms of heat injury in cranberry are leaf wilting or dehydration, and depression of photosynthesis. These physiological changes limit carbohydrate accumulation, and may result in a reduction in berry production. Previous studies suggested that heat stress in cranberry is associated with midday depression of photosynthetic rates.

The objectives of the project were 1) to examine physiological responses of cranberry varieties to high temperatures and to irrigation during hot summer days in the field, and 2) to investigate temperature levels limiting photosynthesis in cranberry in a controlled-environment growth chamber.

This report provides a summary of these studies.

Objective I - Field study

In order to compare photosynthetic rate between varieties, Stevens and the Demoranville® variety, and the effect of irrigation on photosynthetic rate under field conditions, we determined hourly changes in photosynthetic rate from 10:00 to 17:00 on August 20th, 27th, 31st and September 1st, 2010 in field plots at the Marucci Cranberry Research Center. On August 20th the highest canopy temperature was about 34^{o}C (93.2^{o}F) at 14:00, and photosynthetic rate declined in both varieties after 13:00 when the canopy temperature was 33^{o}C (91.4^{o}F). However, photosynthesis declined more slowly in Demoranville than in Stevens. On August 27th the highest canopy temperature was about 26 ^{o}C (78.8 ^{o}F), photosynthetic rate declined after 14:00 and there was no difference in photosynthetic rate between Stevens and Demoranville. On August 31st the canopy temperature was about 35^{o}C (95^{o}F) at 13:00 and it was still 34^{o}C (93.2^{o}F) at 16:00. Before 12:00 there was no difference in photosynthetic rate between Stevens and Demoranville. However, photosynthetic rate started to decline in Stevens after 12:00 while it started to decline after 13:00 in Demoranville, and Demoranville had higher photosynthetic rate than Stevens during the rest of the day.

Field water cooling experiment - On September 1st, the canopy temperature had already increased to 33^{o}C (91.4^{o}F) by 12:00. Irrigation was applied to the foliage from 13:30 to 14:00. After irrigation, the canopy temperature decreased, the photosynthetic rate temporarily increased in both varieties and the difference between the two varieties was not significant. However, after 16:00 the canopy temperature increased to 33^{o}C (91.4^{o}F) and Demoranville had higher photosynthetic rate than Stevens. Our results indicate that without heat stress Stevens and Demoranville had similar photosynthetic rate, but Demoranville had a higher photosynthetic rate than Stevens under heat stress (canopy temperature about 33^{o}C (91.4^{o}F)). Irrigating during heat stress reduced canopy temperature and increased photosynthetic rate.

Objective II - Growth chamber study

In order to examine photosynthesis response to temperature, plants were exposed to increasing temperatures in a growth chamber. Plants of Stevens were maintained at 75^{o} F for 3 days, then the temperature was increased by 5^{o}F every 3 days. After 3 days of exposure to 95^{o}F or 100^{o}F, plants were transferred to 75^{o}F for 3 days of recovery. The photosynthetic rate was determined at each temperature treatment.

Photosynthetic rate did not change as temperature increased from 75 to 90^{o}F, but started to decline at 95^{o}F and 100^{o}F, suggesting that temperature of 95^{o}F or above caused inhibition of cranberry photosynthesis. Short-term (3 days) exposure of 95 or 100^{o}F, however, was not lethal, as photosynthetic rate recovered three days after plants were returned to the normal temperature (75^{o}F).

The difference among varieties in photosynthetic response to heat stress was also studied in growth chambers. Plants of Stevens, and the Demoranville®, Crimson Queen®and Mullica Queen® varieties were maintained in growth chambers set at 75^{o}F for 3 days, and then the temperature gradually increased to 95^{o}F. Once at 95^{o}F, the photosynthetic rate was determined every 5 days during the next 15 days. The photosynthetic rate started to decline at 10 days of heat stress in all four varieties. Among the varieties examined, Stevens had lowest photosynthetic rate under heat stress.

CRANBERRY RESISTANCE TO FUNGAL PATHOGENS: USDA-SCRI GRANT UPDATE

James Polashock[1], Mariusz Tadych[2], James White[2], Nicholi Vorsa[2], , and **Jennifer Johnson-Cicalese[2]**

[1] Research Plant Pathologist, USDA-ARS

[2] Department of Plant Biology and Pathology, Rutgers University

All of our Field Fruit Rot Resistant (FFRR) results to date have been based on 'naturally occurring' fungi in the field. Since the fungi that cause fruit rot vary from year to year, field to field and location to location, we believed this would give us an idea of 'broad spectrum' resistance/susceptibility. This approach has worked well and we have identified individuals and families that exhibit FFRR. However, now that we have made progress in sequencing the cranberry genetic code and have a preliminary draft of the entire genome, we have an opportunity to try and identify gene regions associated with resistance. Thus, we need a better method to inoculate and evaluate fruit for resistance to specific pathogens. Previous attempts using spray-inoculation of fungal spores were unsuccessful. In addition, some of the fungi that cause fruit rot do not readily sporulate. As an alternative, we developed a method for direct inoculation using infected toothpicks. Wooden toothpicks were sterilized and placed either on solid medium or in liquid medium in which the desired fungal species was growing. The following fruit rot fungi were used: *Coleophoma empetri*, *Colletotrichum acutatum*, *Colletotrichum gloeosporioides*, *Phyllosticta vaccinii*, *Physalospora vaccinii*. Once colonized, the tips of the toothpicks were cut off and inserted into ripening fruit of susceptible and resistant selections and varieties. Toothpicks were left in the fruit to plug the wound and prevent desiccation. Fruit rot progression was monitored and recorded as lesion diameter. This method of inoculation worked well and several reactions were identified including susceptibility (fungi grew unimpeded), resistance (fungi grew slowly), and in some cases production of phenolic compounds as evidenced by increased pigmentation. Interestingly, selections and varieties previously identified as being FFRR, were not resistant to all fungi tested using this method of inoculation. Data are still being analyzed, but we are confident that this method will allow a more precise identification and quantification of resistance across a wide array of germplasm.

To characterize (spatial and temporal) the fungal community in cranberry, fruit samples at different developmental stages were collected from six genetically diverse FFRR and susceptible selections, as well as from eight individuals in populations segregating for resistance. The samples were surface sterilized and plated on potato dextrose agar medium amended with three

antibiotics to inhibit bacterial growth. A total of 3150 fruit samples, *i.e.*, 1276 in the ovary stage (early to late bloom, collected weekly) and 1874 in the fruit development stage (fruit set to full maturity of fruit, collected every other week) were collected and plated between June 11 and September 22, 2009. Our results show that 84.4% of samples were infected by fungi. A total of 5056 fungal isolates were obtained. In the ovary stage, 62.2% of samples were colonized by fungi and a total of 866 fungal isolates were recovered; from later stages of fruit development (fruit set to full maturity), 99.6% of samples were colonized by fungi and a total of 4190 isolates were obtained. The isolated fungi were represented by 48 different fungal morphotypes. *Phyllosticta elongata* (18%) was the most frequently isolated fungus, followed by *Glomerella cingulata* (14%), *Phomopsis vaccinii* (12%), *Phyllosticta vaccinii* (11%), *Mycosphaerella* sp. (7%), *Physalospora vaccinii* (6%), *Cladosporium* spp. (5%), *Alternaria* spp. (4%), *Penicillium* spp. (4%) and *Colletotrichum accutatum* (1%). Another 38 fungal morphotypes were rare and/or singleton species and represented 18% of all fungal isolates obtained. The number of fungal morphotypes isolated in the first week of collection (June 11) was 16, and increased gradually to reach a peak of 34 morphotypes in week 10 of collection (August 11). The number of morphotypes then slowly decreased to reach 22 morphotypes in week 16 of collection (September 22, *i.e.*, the last day of collection). Our results also show that there was no difference in frequency of fungal infection of cranberry fruit between resistant versus susceptible selections. We collected a total of 1756 fruit samples from resistant selections, and 1394 fruit samples from susceptible selections; fungi infected 84.9% and 83.9% of the samples, respectively. However, the diversity of fungal species was different and statistically significant differences were found between resistant and susceptible selections. These data are still being analyzed.

SCALD AND CLIMATE CHANGE

Paul J. Croft, Meteorologist

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Scald occurrence and the resulting damage to cranberries – whether in the field or in later harvesting and storage – have been documented to have significant impacts on cranberry production and fruit quality and yields. While "heat" and "sun" scald lead to similar losses, their occurrences have not been specified well enough to offer growers a high degree of confidence in various management practices designed to avoid, mitigate, or prevent scald. In addition, the complexity of the cranberry cycle and production process suggests many competing factors and confounding variables that may lead to positive as well as negative interactions and feedbacks. A comprehensive understanding of these processes, presented within the context of a conceptual model, is imperative to determine, assess, and manage the scald risk.

However, the occurrence of environmental conditions conducive to scald – whether enhanced or diminished by management practices or not, a secondary concern arises as to the susceptibility of a cranberry growing region to scald. While the climate of cranberry growing regions do vary considerably in the United States (and around the world), the natural variability of climate – and changes in local climates – create the potential for a longer-term and possibly increasing threat of scald events. In order to predict and assess these threats requires improved knowledge of the existing climate impacts and variability and their relationship to the historical occurrence of scald as compared to anticipated changes in climate as predicted by computer models of the atmosphere.