

WISCONSIN CRANBERRY BOARD, INC.

2008 PROGRESS REPORT SUMMARIES

The following progress reports were provided to the Wisconsin Cranberry Board, Inc. by the individuals and groups that received project funding during the 2007-08 fiscal year. These reports were presented to the WCB at or prior to the Budget Meeting on April 2, 2009. Copies of the full reports can be obtained from the authors or from the Wisconsin Cranberry Board, Inc. office.

Crop Research

Pesticide Screening for Cranberries

Principal Investigator: Jed Colquhoun, UW Madison, Department of Horticulture

Cooperators: Dan Mahr, UW Madison, Patricia McManus, UW Madison, Jack Perry, UW Madison

Objectives: (1) The objective of the pesticide screening project is to identify and implement insect, disease and weed management strategies that adequately control pests while maintaining crop safety. Research focuses on new active ingredients and modes of action that are economical, manage the risk for resistance, reduce environmental and health safety risks, and would be supported in product registration by the agri-chemical industry and regulatory groups. Exploration of new, improved uses for currently registered products is also a component of this project's efforts. Grower education on efficacious and economical uses of registered pesticides is the applied component of this project.

Summary: In the 2008 growing season, a total of 38 field studies were conducted, including 21 herbicide evaluations, 12 insecticide evaluations, and 5 fungicide trials. Total pesticide treatments evaluated were nearly 200. Herbicide research focused on: 1) new pre-emergent and post-emergent herbicides; 2) control of specific problematic weeds, such as dodder, dewberry and Solomon's Plume; and, 3) a refinement of Callisto use in cranberry. Of particular note, a candidate herbicide that is currently in the registration process (but not yet legal for use) was identified that controlled dodder. This product will continue to be supported through the registration process. Insecticide research focused on new product evaluations for tipworm, fireworm, flea beetle, and fruitworm control, as well as a refinement of recently registered insecticides. Fungicide evaluations focused on potential products for fruit rot control.

In addition to the aforementioned research, time has been invested this season in supporting use of recently registered pesticides such as Callisto, as well as troubleshooting potential pesticide-related production issues. Research results will continue to be communicated to the industry through regional and national newsletters, grower meetings, and field workshops.

Breeding Cranberry for High Yields and Ease of Culture When Grown Under Wisconsin Conditions

Principal Investigators: Brent H. McCown, Department of Horticulture, UW-Madison; Eric Zeldin, Researcher

Cooperators: Wisconsin cranberry growers, Ocean Spray Cranberries, Inc.

Objectives: Whole project: (1) To develop cranberry cultivars that have a consistently higher fruit yield per acre than "Stevens" when grown in Wisconsin. (2) To reduce the sensitivity of the yield of high color "Ben Lear" types to flooding/late winter injury. (3) To isolate some of the genetically determined components of yield, pest resistance and ease-of-culture of cranberry by a detailed study of carefully designed populations of seedlings from highly focused crosses. (4) To determine the inheritance of herbicide tolerance genes previously inserted into cranberry and then integrate such genetic engineering successes into the conventional breeding program.

2007-08 year: (1) Provide support and monitoring of 'HyRed' growers and propagators. (2) Further scale up and evaluation of the A-X15 selection. (3) Evaluation of second generation selections. (4) Evaluation of a tetraploid plots.

Summary: (1) HyRed expansion continued but slowed in 2008. Previous nurse plantings were mowed in 2008. WARF has issued propagator's licenses to both vine and plug propagators and both types of stock were commercially available in 2008. Sites were visited and few problems reported. (2) A-X15 is sibling of HyRed selected for large berry size. This selection was scaled up to a $\frac{3}{4}$ acre nurse bed and then into 2 acres of a renovated bed. Observations showed the new planting took well and good establishment was documented. (3) Second generation selections replanted in performance plots were selected based on heavy fruiting and fruit set. (4) In 2006 two tetraploid progeny were planted in a 7,000 sq. ft. mini bed designed to be a better test for fertility. In 2008 there was considerable fruit set but the number of uprights was still too low to provide a re-producible harvest. Fruit size and seed number per fruit were large.

Cranberry Weeds of Wisconsin

Principal Investigators: Teryl R. Roper, Department of Horticulture, UW Madison; Jed Colquhoun, Department of Horticulture, UW Madison

Objectives: To create a weed identification handbook for Wisconsin cranberry growers.

Summary: This project is nearly complete, with delivery of the finished product to the Wisconsin Cranberry Board, Inc. anticipated sometime in late spring 2009. The finished product will be an electronic version of the book that will be printed and made available to growers through the Board. Highlights of the progress include: Several thousand high resolution photographs were taken in the 2007 and 2008 growing seasons throughout Wisconsin cranberry marshes and with collected live plant samples in a photo studio setting. These photographs include details of all pertinent stages of growth ranging from seedlings to flower and fruit structure. Descriptions of about 200 species have been written with the technical assistance of a taxonomist at UW-Madison. These short, practical descriptions focus on characteristics that separate closely related species of similar appearance. We have hired a publications layout specialist and editor that is completing the layout of the book. The book currently contains almost 200 species, arranged by flower color. We have also engaged a scientific illustrator that is drawing pertinent identification details such as grass ligules. We will review the completed draft extensively and share with cranberry growers and consultants prior to publication. The ultimate end result will be a book bound in a resilient cover featuring extensive photographs, descriptions, and illustrations that will allow for simple and feasible weed identification.

Assessing the Biological Impact of IPM Adoption by the Wisconsin Cranberry Industry

Principal Investigator: Dan Mahr, UW Madison;

Other Investigators: Merritt Singleton, UW Madison; James Polashock, USDA ARS

Objectives: 1) Survey the beneficial natural enemies occurring in cranberry beds. 2) Determine if the adoption of IPM practices has resulted in the increase of natural enemies of cranberry pests. 3) Determine if the adoption of IPM practices has resulted in an increase in incidence of bluntnosed leafhopper or the false blossom disease.

Summary: To assess the biological impacts of IPM adoption, 14 cranberry farms were sampled (1) to determine the abundance of natural enemies present and (2) to survey for the potential presence of bluntnosed leafhopper, the vector of the causative mycoplasma of false blossom. Four of the farms were producing for the certified organic market and 10 were conventional farms. The conventional farms were spread along a continuum of degree of IPM adoption. Three sampling methods were used: sweep sampling during the pre bloom period, pitfall traps during the post bloom period, and yellow sticky traps throughout the season. Each farm was sampled once every two weeks.

For conventional farms, natural enemy numbers ranged from a low of 771 to a high of 2305 with an average of 1454. For organic farms, natural enemy numbers ranged from a low of 999 to a high of 2266 with an average of 1847. Organic farms averaged 27% more natural enemies than conventional farms. Correlation of natural enemy numbers in relation to Natural Enemy Toxicity Scores (based on insecticide products used and usage patterns for each farm) is still underway. The overall largest group of natural enemies was spiders, followed by parasitic insects, and then predatory insects. Total leafhopper counts (multiple species combined) sampled by yellow sticky traps varied from a low of 18 to a high of over 250 per farm. Numbers averaged 122 per conventional farm and 153 per organic farm. None of the leafhoppers caught in this survey were bluntnosed leafhopper, the vector of false blossom.

Annual Projects

Wisconsin Cranberry Crop Management Newsletter – Volume XXI

Project Coordinator: Teryl R. Roper, Department of Horticulture, UW-Madison

Cooperators: University faculty and staff, private cranberry consultants, Ocean Spray Cranberries, Inc., Cliffstar Corp.

Summary: Ten issues of the CCM Newsletter were published between May and September of 2008. Copies were sent at no charge to managers of all known cranberry marshes in the state. The newsletter was also made available on the internet and the text was distributed via the cranberry e-mail list as well.

Wisconsin Cranberry School - 2009

Project Coordinators: Wisconsin Cranberry Research and Education Foundation; WSCGA Education Committee; Teryl R. Roper, UW Extension.

Objective: To conduct a 2 day grower educational program for all Wisconsin cranberry growers focusing on improved farm management and business practices.

Summary: The WSCGA Education Committee met with UW Extension Faculty to evaluate previous schools and identify topics and speakers for 2009. The Wisconsin Cranberry School was held January 20-21 at the Stevens Point Holiday Inn Hotel and Convention Center. During the two day session topics relating to all aspects of cranberry production were presented with a Rutgers Entomologist Cesar Rodriguez-Saona as the featured speaker. Packets with relevant information were distributed to all attendees. Proceedings from the School are sent to all participants. The 2009 Wisconsin Cranberry School attracted over 450 growers and industry people.

Cranberry Weather Forecasts

Project Coordinator: Wisconsin State Cranberry Growers Association

Objective: To provide Wisconsin cranberry growers with accurate, regional weather forecasts.

Summary: The WSCGA worked with a private weather forecasting consultant to develop regional cranberry weather forecasts. These forecasts were available to growers via a toll-free number and online at the WSCGA website www.wiscran.org. Service was available from April 15 through October 31.

Harvest Communications Program

Project Coordinator: Wisconsin State Cranberry Growers Association

Objectives: (1) To provide targeted media with information on cranberries, cranberry products and information on the results of health related research on cranberry consumption. (2) Conduct fall harvest media campaign to educate the consuming public on the cranberry industry in Wisconsin.

Summary: The harvest communications program entailed working with a public relations firm to develop key messages and themes, strategies, a plan and execution of the planned activities. The activities included sponsorship of two Mr. Food episodes; a news release in conjunction with the crop projection announcement by USDA; an extended media outreach to target national and regional media including Associated Press; Cooperative effort with CMC to publicize tour by Japanese marketers; a general use of the website to communicate with media and track efforts and visits.

In 2008 the earned media efforts and Mr. Food segments generated more than \$7.7 million in publicity value, a \$6 million increase over last year's media effort. The efforts also resulted in \$2.57 million in advertising equivalency value, more than \$2 million over last year. Furthermore, the more than 650 media placements reached more than 20 million people, 4 million more people than in 2007. Additionally, these are conservative figures as some of the stories generated are not included in the value report, as the information was not available.

Brochure Printing

Project Coordinator: Wisconsin State Cranberry Growers Association

Objective: Provide members of the general public with information on cranberries through high-quality, professionally produced brochures.

Summary: The grant was used to print and distribute 17,800 copies of the 2008 Fall Harvest brochure, printing of 13,900 copies of the new recipe brochure and 9,350 copies of the Cranberry Activity Books.

Wisconsin State Fair Promotion Program

Project Coordinator: Wisconsin State Cranberry Growers Association

Objectives: (1) Provide information on cranberries and cranberry growing to visitors to the Wisconsin State Fair. (2) Promote consumption and sales of cranberry products at the Wisconsin State Fair. (3) Increase overall awareness of cranberries and their economic, environmental and cultural importance to the state. (4) Educate the public on the health benefits of cranberry consumption. (5) Educate the public on the many cranberry products available and their uses.

Summary: WSCGA contracted with the Wisconsin State Fair Park for space in the Wisconsin Products Pavilion. The booth space (10'x30') was divided into two components: the first being an educational display, the second a sales area for cranberry products. The grant was used for promotion activities at the Fair including media drops of products, interviews on air, daily cranberry cooking demonstrations, appearance by the cranberry mascot daily at the Fair.

Stock Photos

Project Coordinator: Wisconsin State Cranberry Growers Association

Objective: Acquire professional photographs and images to be used by media, researchers, in brochures and exhibits featuring cranberries.

Summary: WSCGA retained a photographer who shot photos of wildlife and cranberry blossom. The photos were added to the industry collection, catalogued and assembled in an electronic format.

Product Sample Products

Project Coordinator: Tom Lochner, Executive Director, WSCGA

Objective: Provide promotional samples of cranberry products for distribution.

Summary: WSCGA worked with cranberry handlers to secure sweetened dried cranberries which were then packaged into sample packets by the ODC in Wisconsin Rapids.

Cranberry Marketing Program – Paid Advertising

Project Coordinator: Wisconsin State Cranberry Growers Association

Cooperators: Milwaukee Brewer Radio Network

Objectives: (1) Conduct a paid advertising campaign to communicate health, environmental, tradition and economic messages on a regional basis. (2) Establish relationship between healthy sporting activities and cranberries. (3) Link cranberry growing tradition with other major state traditions. (4) Improve image of industry throughout the state.

Summary: Wisconsin's cranberry growers were again sponsors of an in game feature of each Milwaukee Brewer Baseball Radio broadcast on the statewide network. The feature "On Your Plate", the introduction of the umpires for each game was presented by Wisconsin's cranberry growers. The promotion also featured in game and post game mentions and Cranberry Night at Miller Park promotion.

Into the Outdoors

Coordinator: Tom Lochner, WSCGA Executive Director

Cooperators: Discover Media Works, WSCGA Public Relations Committee, WSCGA Education Committee

Objective: Create a multi-media communication tool highlighting the Wisconsin cranberry Industry in an entertaining and educational format. Into the Outdoors goes from adventure to adventure across the state of Wisconsin. Joining a diverse group of kids and adults from all locations Into the Outdoors introduces fishing, camping, environmental concerns and outdoor safety - just to name a few topics.

Summary: The WSCGA named a working group of members of the Education and Public Relations Committees to work on the project. WSCGA began working with the ITO staff in June, 2008 on concepts for the four segments, ideas and opportunities. Following those initial discussions it was determined the segments would be based on a theme of the four seasons. The first segment would be on the fall harvest, the second on winter activities (ice making and sanding), the third on springtime, (frost watch and wildlife on the marsh) and the fourth on summertime (bloom and pollination with bees). The first two segments have aired. fall harvest and winter activities.

Website Update and Redesign

Coordinator: Tom Lochner, Executive Director, WSCGA

Cooperators: WSGA Education Committee, WSCGA Public Relations Committee

Objective: Provide Wisconsin cranberry industry with state of the art presence on the World Wide Web.

Summary: The project entailed a full evaluation of the current site, including identifying areas of improvement for site optimization, navigation, usability and the like. The WSCGA organized a working group that consisted of growers who were members of the WSCGA Public Relations and Education Committees. This group first began its work by reviewing key elements of the site, discussing site organization and sharing new ideas to consider such as adding video, a photo library and/or a media page, etc. The group then retained Zeppos and Associates to assist in the design and development of an upgraded site. The new upgraded site debuted in April of 2008. It provided the industry with a tremendous resource to communicate with growers and the general public. The site includes a slide show featuring different scenes from cranberry growing season, the newly completed video "Wisconsin Cranberries Growing Strong" and regularly updated features of cranberries in the news. The site can be visited at www.wiscran.org.

Frost Hardiness the Cranberry Plant: A Guide to Manage the Crop During Critical Periods in Spring and Fall

Project Coordinator: Jiwan Palta, UW Madison

Cooperators: Beth Workmaster, UW Madison

Objectives: Develop and print a comprehensive guide for management of cranberry and frost protection.

Summary: A nineteen page bulletin is at the printers and will be available in time for the 2009 growing season. The bulletin is based on research conducted by Dr. Palta with previous WCB grants.

Operations and Promotions - Wisconsin Cranberry Discovery Center**Project Coordinator:** Lorry Erickson, Director, Wisconsin Cranberry Discovery Center**Objectives:** Educate the public about Wisconsin's role as the nation's leading producer of cranberries.**Summary:** The Cranberry Museum, Incorporated utilized the grant to support activities at the Wisconsin Cranberry Discovery Center in Warrens, Wisconsin. The funds were allocated toward general operations and promotion efforts. Over 22,600 visitors came to the Discovery Center in the 2008 season. These numbers are based on customer counts from the POS system at the Center. Special promotions were supported with the funding including a Cranberry Blossom Day, Public Harvest Tours, leisure tours, regular news releases (32 in total for the year) and other day to day activities at the Center.**Wetherby Cranberry Library Project****Project Coordinator:** Lorry Erickson, Director, Wisconsin Cranberry Discovery Center**Objectives:** Organize and catalog current material housed in the Wetherby Cranberry Library, develop a searchable database via internet and actively seek the addition of new materials to the collection.**Summary:** Since the hiring of a librarian to implement the project in May 2008, we have cataloged the existing materials at the Wisconsin Cranberry Discovery Center, a process that involved creating nearly 12,000 individual records; created the Wetherby Cranberry Library Digital Collection, the largest on-line repository of cranberry related items on the Internet. The collection features 400 unique objects, consisting of 2,500 .jpg images focusing on the history and importance of cranberry production in Wisconsin; established relationships with the Wisconsin State Historical Society, University of Wisconsin-Madison, Wisconsin Library Services and Wisconsin Heritage On-Line in order to further promote the importance of cranberry production in Wisconsin; integrated the Wetherby Cranberry Library Digital Collection into the Wisconsin Cranberry Discovery Center's Web site, thereby boosting the targeted audience's awareness of the Center and also making the collection more assessable and implemented both digital and archival protection strategies for the existing physical and digital collections.**Nutrition Education Initiatives 2008-2010****Project Coordinator:** Sherry Tanumihardjo, UW Madison**Objectives:** Support of reproduction of "How does your garden grow?" 2) Support to purchase fruit and juice for a human intervention trial to assess nutritional status of 59 women aged 19-30 years old. 3) Develop brochures on a variety of fruit for the intervention study that can be used by young women with a special emphasis on cranberry intake and urinary tract infection**Summary:** The project resulted in the printing and distribution of approximately 1000 booklets this year for education in 2009. Cranberry products were purchased and used in studies in women which ended September 2008. The third objective has been delayed as a result of a change in personnel in the lab. It will be reevaluated in 2009. Two papers as a result of the work have been accepted into peer reviewed literature. The educational objectives of both of these papers were supported by prior funding to the PI by WCB.1. Tanumihardjo SA, Valentine AR, Zhang Z, Whigham LD, Lai HJ, Atkinson RL. Strategies to increase vegetable or reduce energy and fat intake induce weight loss in adults. *Exp Biol Med.* 2009; (In press). Will be published in May.2. Valentine AR, Whigham LD, Tanumihardjo SA. Pedometers are perceived as useful tools for weight loss. *J Extension.* 2009; (In press). Will be published in April.**WISCONSIN CRANBERRY BOARD, INC. – CRANBERRY INSTITUTE
HEALTH RELATED RESEARCH - PROJECT REPORT SUMMARIES**

The Wisconsin Cranberry Board, Inc. and Cranberry Institute have partnered for the past six years to fund a variety of research projects related to the health benefits of cranberry consumption. Under this partnership the organizations issue a joint request for proposals. Researchers submit applications to the Cranberry Institute. The applications are reviewed by a Health Advisory Committee of the Cranberry Institute which makes recommendations for projects deserving funds. Those projects deemed worthy of funding are then jointly funded by Wisconsin Cranberry Board, Inc., the Cranberry Institute and other grower funding organizations. The Cranberry Institute then manages the research projects. In 2008 projects totaling \$96,250 were funded by the WCB through the CI. The following are summaries of the reports of the projects funded by the partnership in 2008.

Bioassay to detect anti-adhesive properties of cranberry metabolites in urine

Principal Investigator: Terri Anne Camesano, Ph.D. Worcester Polytechnic Institute

Summary:

Models previously showed that when E. coli bacteria are grown in either light cranberry juice cocktail, or proanthocyanidins that were extracted from the juice, the bacteria became impaired in their ability to form a biofilm. The experiments showed that bacteria grown without cranberry juice form biofilms within a few minutes, and the density of cells increases up to about 30 hours. When bacteria are grown in cranberry juice cocktail or PACs isolated from cranberry juice cocktail, biofilm formation is significantly and greatly reduced. There is almost no biofilm formation for any of the cultures in cranberry product. However, when they re-expose the bacteria to normal growth media that does not contain cranberry, they immediately regain their ability to form biofilm. This confirms that cranberry's effects on bacteria are reversible. This may be useful in designing a clinical therapy for people, since we know that they must keep drinking cranberry juice in order to receive the benefits.

Clinical experiments were done in collaboration with Dr. Amy Howell from Rutgers University. A volunteer was asked to consume either 16 oz. of cranberry juice cocktail or 16 oz. of water. The volunteer's urine was collected and pooled over 6 hours. They then exposed the urine to clinically isolated pathogenic strains of E. coli, for fixed periods of time. Within two hours, they saw a statistically significant decrease in the adhesion forces between E. coli, when exposed to the urine of the volunteer who had consumed cranberry juice cocktail. This is the first time that a molecular level investigation of adhesion forces has demonstrated that urine of a volunteer who has consumed cranberry juice contains molecules that decrease E. coli adhesion.

A summary of this work will be published in the Journal of Medicinal Food as: Role of Cranberry on Bacterial Adhesion Forces and Implications for E. coli-uroepithelial Cell interactions.

Investigations Into The Antiviral Effects Of Store-Purchased and Pure Cranberry (Vaccinium Macrocarpon) Juice Drinks On The Infectivity Of Rotavirus

Principal Investigator: Steven M. Lipson, St. Francis College

Objectives: The objectives of this study are to determine whether there are differences in the inhibitory effect of rotavirus infectivity in cell cultures by (manufacturer-supplied and store-purchased) cranberry juice drinks using post-treatment testing, the polymerase chain reaction, and cell physiological (e.g., tight junction integrity) testing methodologies.

Summary: The work has progressed to studies describing the antiviral effects of cranberry juice on the molecular level. Continued studies are underway to identify that minimal rotavirus titer which can be detected among cranberry juice pre treated post treated cell culture monolayers. These studies will add to the understanding and validity of their assay as a powerful tool to measure the anti-viral effect of cranberry juice in comparison to isolation of infectious virus in cell culture.

Cranberry Proanthocyanidins and Gut Immunity

Principal Investigator: Jess Reed, UW Madison

Summary: The results show that cranberry PACs maintain anti-inflammatory bioactivity in a cell culture model. These results are relevant to gut health because PACs readily complex with proteins in the food and gut and these complexes are not reversible. The results suggest that PAC/protein complexes could modulate the induction of gut immunity. Future research will focus on testing this hypothesis.

The Effects Of Cranberry On Delaying Pathogenesis Of A Mouse Model Of Alzheimer's Disease

Principal Investigator: Sige Zou, National Institute on Aging, National Institutes of Health

Objectives: This proposal is to assess the potential beneficial effects of cranberry on delaying the pathogenesis of Alzheimer's Disease (AD), a common neurodegenerative disease in elderly population. We will achieve this goal through the following three specific aims by employing a mouse genetic model of AD: 1) Evaluate the effect of cranberry on cognitive function of the AD mice. AD is characterized as a decline of cognitive function. 2) Assess the effect of cranberry on accumulation of β -amyloid plaque, a hallmark of AD. 3) Investigate the effect of cranberry on inflammatory response in the AD mice. Alterations of inflammatory response have been associated with the progress of AD.

Summary: To investigate the beneficial effects of cranberry on accumulation of β -amyloid plaque in AD mice, 3-month old AD mice and wild type control mice have been fed 1% cranberry extract in their drinking water daily for six months. There are totally four groups of animals including the controls for this project. Each group has more than six mice. Samples have been collected from these animals for molecular biology, biochemical and pathological analyses. Additional animals will be treated to obtain enough number of animals (approximately 10 per group) for completing the project. The project should be completed before the end of 2009.

Action of Cranberry Proanthocyanidins Against Bacterial Adhesion to Biomaterials and Mammalian Cells; Implications for Mitigation of Urinary Tract Infection, Prostatitis and Endocarditis

Principal Investigator: Natalie Tufenkji, McGill University

Objectives: The goals of the project are: (i) to examine the metabolic response of bacteria to PAC exposure; (ii) to investigate the antiadhesive and antiinvasive activities of PAC against bacterial pathogens interacting with endocardial, uroepithelial, and prostate epithelial cells; and (iii) to examine the influence of cranberry PAC on biofilm formation.

Summary: The experimental protocols have been improved to obtain high quality samples of bacterial RNA for the planned analysis. The first complete experiment with *E. coli* CFT073 should be completed by April 1, 2009. Current work also includes the development of fluorescence microscopy based techniques for imaging bacteria inside of and outside the kidney cells. The plan is to complete the imaging of the cells by April 1 to be able to submit findings for publication by the beginning of the summer.

Cranberry Flavonoid Consumption and biomarkers of lipid peroxidation and inflammation in subjects with Metabolic Syndrome (MeS)

Principal Investigator: Arpita Basu, Oklahoma State University

Summary: Six subjects with metabolic syndrome are currently enrolled in the study; 3 each in the control and placebo groups. Subjects are tolerating the placebo and juice well and have no complaints in the study. No changes in safety parameters like liver, renal or CBC we noted. Blood draws, anthropometrics and blood pressure are being done at initiation, 2 and 4 weeks of the study. The target date for completion is February 2010.

