



**Workshop for High Throughput qPCR
By Susie Siemsen**

In February, with support from the Specialty Crops Research Initiative project on necrotic viruses, I attended a workshop for the diagnostics of potato pathogens using high throughput molecular methods at the Dutch inspection agency (NAK) in Emmeloord, Netherlands. NAK performs the certification of 99,287 acres of seed potatoes and other seed crops. The MSU Seed Potato Certification lab, aka the Potato Lab, performs a similar service for Montana's 10,000 acres of seed potatoes.

Both certification schemes require field inspections and testing for potato viruses. Montana certification involves collecting over 3 million leaves and running 650,000 ELISA tests for viruses in the summer, as well as performing a winter grow out where 650 bags of 400 tubers are collected at harvest and planted in Hawaii, where the leaves are sent back for testing again. Our program has adapted to high throughput testing of leaves using leaf juice with the ELISA method and grower-designed leaf pressing trays. NAK is fulfilling the virus testing requirement by testing harvested tubers using DNA and RNA extractions with Real Time PCR (qPCR), a very contamination sensitive, labor intensive method. In addition, working with tubers instead of leaves introduces new obstacles to overcome such as space for bags, lifting the heavy bags, soil on tubers, reaction inhibitory compounds present in tubers, and space to do DNA/RNA extractions without contamination occurring. The Netherland growers submit around 1 million tubers in



Tuber processing lab with specialized tables.

bags of 200 each. Normally, our lab can process 2 bags of 200 tubers per day by qPCR, resulting in 40 tests. They run 20,000 qPCR tests for potato viruses and another 10,000 tests for bacteria. NAK processes hundreds of bags a day. The facility was capable of separating all their testing stations, limiting contamination. They have 213 permanent staff and hire around 100 temporary staff from August to November to handle the tuber testing. The temporary staff processes the tubers to get them ready for DNA/RNA extractions. Permanent staff performs the extractions and PCR with the help of highly automated lab equipment and 4 large robotic systems (>\$100,000 each) that are programmed to add reagents, samples, and set up the PCR plates. In addition to tuber testing, the facilities allow for screening soil for potato cyst nematodes, testing of leaf samples, greenhouse studies,



Robotic system for setting up qPCR

bordering the the Mediterranean Sea north of Tunisia. The Greeks had already invaded, taken over coastal land from the Sichels, and built temples nearer the Sea. Afterward, the Romans took over and redesigned the temples. Later the Berbers, then the Normans, then the Spanish, and finally the Italians (150 years ago) invaded and took over Agrigento on this island in the middle of the Mediterranean.

I, Florence Vaccarello Dunkel, a first generation immigrant from the village of



A real pizza, only parmesan cheese, anchovies from the nearby sea, fresh basil, and olives from a 1000 year old tree also nearby.

and printing certification tags. I was shown their facilities and the methodology that enables this massive undertaking. I was able to bring some ideas and methodology back to the Potato Lab with a good understanding of what it would take to gear up to that level of testing. High throughput testing is nothing new to the Potato Lab in that we process 10,000 ELISA plates in the summer; however, gearing up for testing with qPCR plates would be a big challenge, but never say never!

Exploring the Mystery of Malaria, Poverty, Subsistence in Southern Sicily

By Florence Dunkel

Wheat production thrived 2500 years ago in fields surrounding small villages in southwest Sicily, county of Agrigento,



Two Vaccarellos in Aragona, Luigi and his wife, and Florence Vaccarello Dunkel related but with no known common ancestor.



Greenhouses and winter wheat are so typical now of the spring landscape in Agrigento, Sicily.

Aragona, traveled there over Spring break to explore the logistics for this village to be an additional site for AGSC 465R Health, Poverty, Agriculture: Concepts and Action Research currently based in Mali and Montana. I also explored the value of this new site in regard to understanding the process of local elimination of cerebral malaria coupled with child nutrition issues and local cropping systems that I, along with my students, work with in Mali and other countries of sub-Saharan Africa. My trip was funded in part by a Faculty Enhancement Grant from the MSU Office of International Programs.

Just one hundred years ago, villagers in the county of Agrigento were suffering economically and their young children were dying from malaria. Couples typically lost 40 to 60% of their children as one or two year olds. Sheep, goats, olives, apricots, oranges, almonds, pistachio and a variety of garden vegetables along with wheat then as now were the typical crops. We discovered that in Aragona the farmers and villagers had been living there for at least 400 years and the same stem families were still there. Whereas these villagers had streamed into immigrant ghettos in Chicago, New Jersey, and

Rockford, IL in the early 1900s, the diaspora were now returning to Aragona.

Now the countryside is replete with solar farms in the valleys and wind farms on the top of escarpments along with the still standing castles of the Normans and the Spanish invaders. In Spring 2017, portable greenhouses extending the growing season were creating a white landscape in this small region that seldom ever experiences snow.

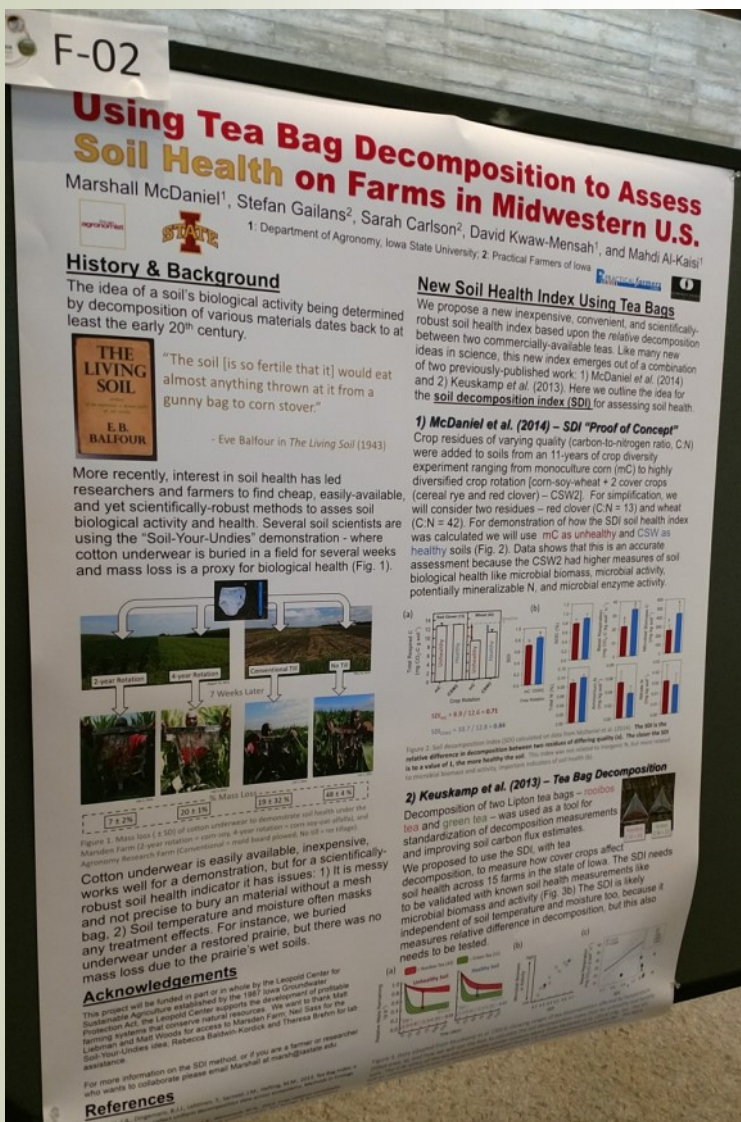
How has agriculture changed in these 100 years? And, how did they eradicate malaria? These are the questions we would like to answer.

Soil Health Conference By Andy Burkhardt

This February, I attended the 2nd annual Soil Health Conference in Ames, Iowa. There, I presented my first year's results from my ongoing research in nematode community structure in Montana barley systems. The conference brought in roughly 400 people, greatly increasing the attendance of its inaugural year. Attendees represented universities, industry, government agencies, non-profits, and many farmers from throughout the region.

While much of the work presented discussed cover crops in corn-soybean systems, there were many other topics ranging from concepts of soil biology to soil analytical techniques to government policy on soil and crop management for sustainable agriculture. I focused largely on the talks about soil biology and ecology, where many researchers discussed their work in the area and how it could be applied by farmers in Iowa and across the country.

While the conference was largely focused on Midwestern cropping systems, it was very informative nonetheless. Much of the research and work discussed can be applied or modified for the Northern Great Plains. While our challenges here are very different from central Iowa, the concepts presented are no less important across all agricultural systems.



While most of the focus was on research related to cover crops in corn-soybean systems, some novel ideas were presented. Dr. Marshall McDaniel of Iowa State University presented his poster on visualizing soil health through measuring the decomposition of tea bags, his idea to improve upon the 'Soil Your Undies' experiment by making it more scientific and repeatable."

It was an incredible opportunity to be able to attend the conference. I was grateful to be at a conference so well attended by farmers. Their questions and discussions during the talks were very insightful (and sometimes quite animated) as to what concerns them versus what concerns us as researchers and scientists. While a disconnect of sorts was apparent, the overlap in our goals was equally apparent.

2017 Field Days

Summer 2017 field days include:

Northern Agricultural Research Center,

Thursday, June 29: The field day begins at 4 p.m. with tours before and after dinner. The center is located about seven miles southwest of Havre on U.S. Highway 87. (406) 265-6115.

The MSU Arthur H. Post Agronomy Farm ,

Thursday, July 7: The Post Farm will begin tours at 8:30 a.m. followed by lunch. The Post Farm is located eight miles west of Bozeman on U.S. Highway 191. (406) 586-6819.

Central Agricultural Research Center,

Wednesday, July 12: The field day starts at 9 a.m. and includes a free lunch. The center is located 2.5 miles west of Moccasin on U.S. Highway 87. (406) 423-5421.

Northwestern Agricultural Research Center,

Thursday, July 13: The field day begins at 2 p.m., with dinner following the tour. NWARC is located near Creston on State Highway 35. (406) 755-4303.

Eastern Agricultural Research Center,

Wednesday, July 19: The field day begins at 9 a.m. The center is located one mile north of Sidney on State Highway 200. (406) 433-2208.

Western Agricultural Research Center,

Thursday, July 27: The field day starts at 4 p.m. with dinner at 5 p.m. and a tour following. WARC is located at 580 Quast Lane, Corvallis. (406) 961-3025.

Montana Ag Live Spring Schedule

April 2 - Steve VanTassel, Montana

Department of Agriculture Vertebrate Pest Specialist, "Do you love those little pasture rodents? If you don't, tune in to see what you can do to minimize their damage".

April 9 - Kevin McPhee, Montana State

University's new pulse crop breeder, "Variety development for peas and lentils, the new 'big kid' in the northern great plains agriculture".

April 23 - Chris Kelly, Montana Department of Agriculture hydrologist, "Montana's ground water monitoring program - keeping one of Montana's treasures sparkling".

May 7 - Bob Quinn, Organic producer from Big Sandy, "Organic production in Montana - transitioning from traditional to organic production".

May 14 - Jeff Littlefield, Biological control specialist at Montana State University, "The success of biological weed control efforts in Montana and how Montanans can utilize this technology to help with their weed control efforts".

May 21 - Myles Watt, retired Montana State University economist, "The effect of public debt on Montana's economy including the agricultural sector".

MSU's Honey Bee Research Site and Pollinator Garden—2017 Volunteer Days

Friday May 19th 1 - 5pm

Friday June 16th 8 - 11 am

LOCATION: MSU Horticulture Farm, turn west off of 19th onto Garfield, take left off of Garfield near white sign for MSU Hort Farm, continue on gravel road until you see Towne's Harvest Garden - the Pollinator Garden is east of that sign.

PARKING: It would be best if you park near the Horse Pavilion and walk over to the Pollinator Garden area, which is south of the Towne's Harvest Garden and near the barn where you pick up your community supported ag boxes, etc.

WHAT TO BRING: appropriate attire (hats, gloves, etc), cold drinks / water, planting tools and watering cans that have your name on them and/or are distinct enough that you can keep track of them. :)

WHAT TO EXPECT: weeding, planting, and garden maintenance activities.

RSVP: please email Michelle Flenniken (michelleflenniken@gmail.com), so that she knows how many people to expect, or feel

free to "just show up" without RSVPing. Thank you for your help!

Burns Hired for Faculty Position

Erin Burns recently graduated with a Doctorate in Plant Sciences. She has also accepted a position as Assistant Professor of Weed Science in the Department of Plant, Soil, and Microbial Sciences at Michigan State University. The position appointment is extension and research and she will be starting this spring.

Erin said, "I have very much enjoyed my time at MSU and believe my experiences and research here gave me the skill set needed to obtain this position. I look forward to this new challenge working in different cropping systems and the associated weed communities in these systems."

Her co-advisors Bill Dyer and Fabián Menalled said, "Erin has been an outstanding student and she certainly deserves this position at a top university. She will be sorely missed in our labs and we wish her the very best."

New Grad Students

Brian Ross (Flenniken Lab)



My name is Brian and I have joined Michelle Flenniken's lab where I will be researching Potato virus Y, specifically working to gain a better understanding of the molecular mechanisms occurring during the immune response to viral infection in plants.

I grew up in the Des Moines, Iowa area and received my B.S. in Biology from the University of Northern Iowa in 2016.

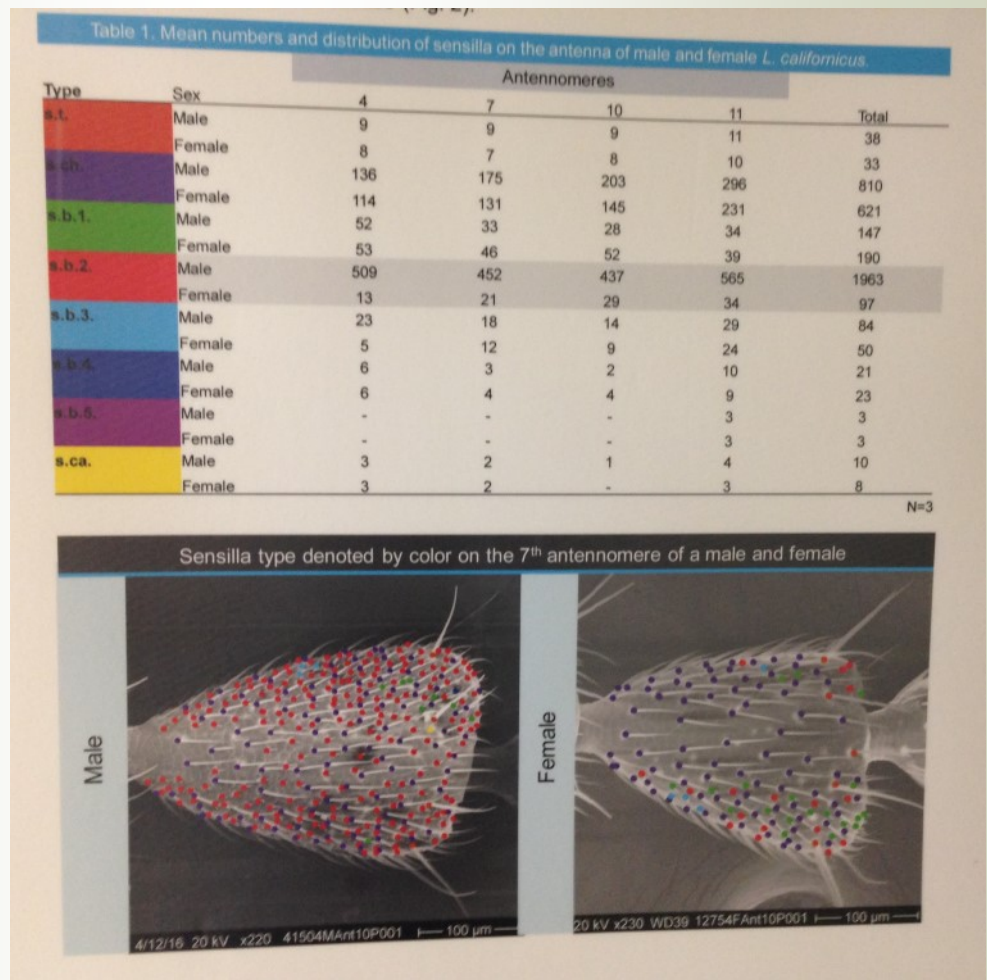
I am a member of the Molecular Biosciences Program here at MSU and outside of the lab I enjoy skiing, hiking, and other outdoor activities.

Dykgreve Receives Emerging Scholars Grant

By Kevin Wanner

I am happy to announce that Tember Dykgreve has received an MSU Presidential Emerging Scholars Grant for \$3,600, for her research in my lab. Tember has been conducting scanning electron microscopy (SEM) studies of click beetle antennae. The larval stage of click beetles, wireworms, are important pests of cereal and other crops grown in rotation. Pheromones can be an important non-pesticide tool used to manage insect pests. Pheromones can be used to monitor the activity of the insect pest, disrupt their mating or as a lure in attract and kill strategies. While click beetles are economic pests, pheromones have not been identified from any of our North American species.

Tember's project was to collect preliminary data to determine if the sugarbeet wireworm (*Limonium californicus*) uses a sex pheromone. In the insect world the females of many species will produce an attractive odor (termed a pheromone) that attracts males from a distance, for mating. If an insect species uses a sex pheromone, the male antennae (the equivalent of our nose) will almost always have specialized structures for detecting the female produced odor, that are missing on the female antennae (they do not need to find each other!). The tiny hairs that house the olfactory neurons are called sensilla. Tember's research found one type of sensilla (SB2) that was highly abundant on male antennae but mostly absent on female antennae, evidence that *Limonium californicus* does use a pheromone for mating behavior. Tember made a nice illustration that color coded the different sensilla and the abundance of red SB2 sensilla on the male antenna stands

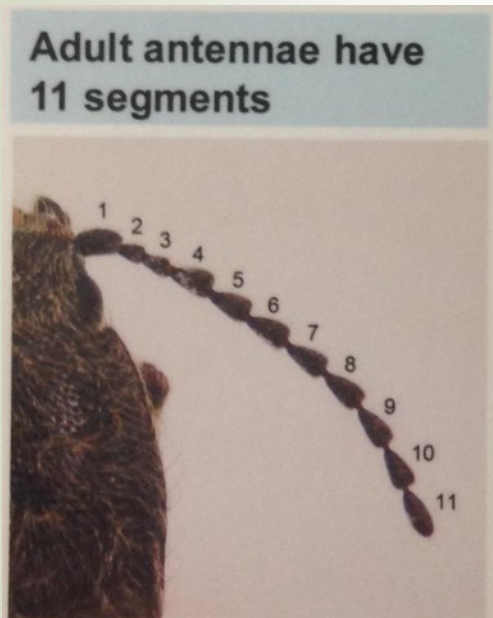


Top: Table summarizing the numbers of eight different types of sensilla found on male and female click beetle antennae.

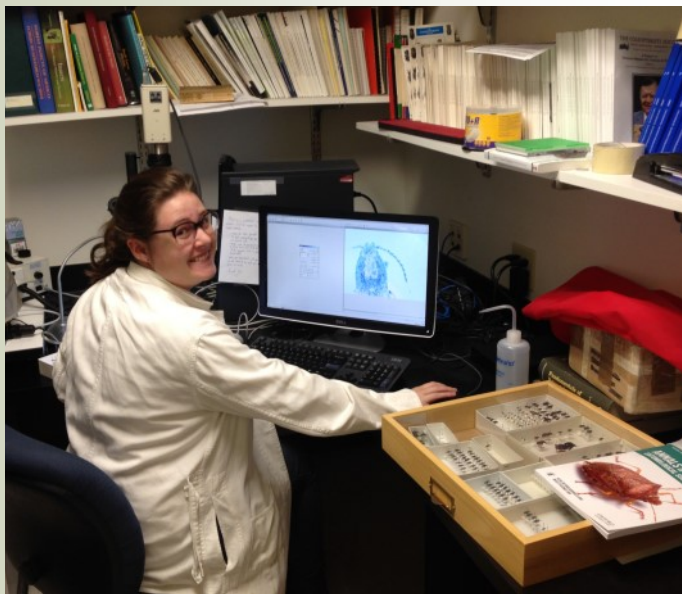
Bottom: SEM picture of sensilla on the 7th segment of the click beetle antennae. SB2 sensilla highlighted in red above are most abundant on the male antennae and most likely are responsible for detecting a female produced pheromone.



Adult *Limonium californicus* beetle.



The antennae has 11 segments.



Tember Dykgreve taking a photo of the adult click beetle.

out in comparison to the female antenna. A poster of Tember's project is located on the wall outside of lab333 in the Plant BioSciences building. Congratulations Tember!

Invited Lectures

Hikmet Budak, Keynote speech at Agri2017 Conference, San Antonio, Texas, "Next generation tools in agriculture and charting the future research plan". 9/11/17.

Hikmet Budak, Keynote speech at Plant and Animal Genome-Asia Conference, Seoul, South Korea, "Non-coding RNA world in wheat, a polyploid and complex genome". 5/30/17.

Grants

Michelle Flenniken received an NSF CAREER grant for her project entitled, "Elucidation of the Honey Bee Antiviral Defense Network".

Additional info about this grant from NSF website: (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503214)

CAREER: The Faculty Early Career Development (*CAREER*) Program is a Foundation-wide activity that offers the National Science Foundation's most prestigious awards in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization. Activities pursued by early-career faculty should build a firm foundation for a lifetime of leadership in integrating education and research. NSF encourages submission of *CAREER* proposals from early-career faculty at all *CAREER*-eligible organizations and especially encourages women, members of underrepresented minority groups, and persons with disabilities to apply.

Publications

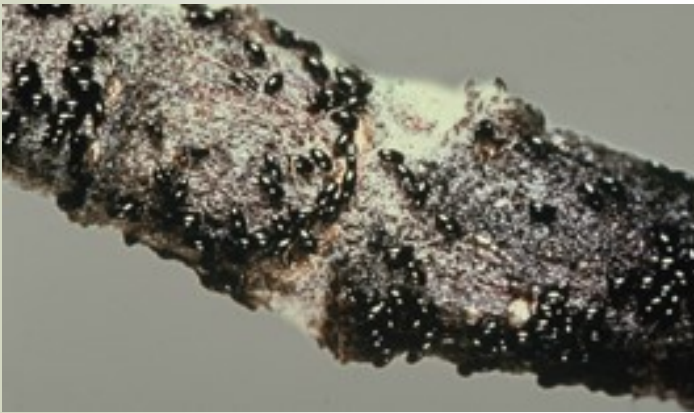
Florence Dunkel, "Incorporating Culture's Role in the Food and Agricultural Sciences" Elsevier, In Press.

Potshangbam, M., Devi, S.I., Sahoo, D., and Gary A Strobel, G.A. (2017), Functional characterization of Endophytic fungal community associated with the indigenous variety of *Oryza sativa* L. and *Zea mays* L. *Frontiers in Microbiology* 8: 1-15.

Dormant oil control of aphids

Toby Day and Dara Palmer

While traveling to orchards throughout Montana this spring, I have seen a ton of overwintering aphid eggs on trees. We are currently recommending the use of dormant oils in April to combat the aphids that are sure



Overwintering aphid eggs (<http://www.tfrec.wsu.edu/pages/opm/GAA>)



Green tip stage of bud development on an apple tree (http://treefruitdisease.blogspot.com/2014/04/at-last-its-new-season_1.html)

appear this year. Dormant oils are used to control certain insects such as aphids, scale, mites, leafhoppers, whiteflies and tent caterpillars. It can also be used as an effective control of powdery mildew and rust. They are especially effective for use on fruit tree insects as they are applied prior to bud break thus not interfering with fruit development.

Dormant oil, or horticultural oil, can be derived from sources such as neem or refined petroleum products (mineral oil) mixed with an emulsifying agent. The oil seeps into the insects airholes (spiracles) and cause it to suffocate and also can act as a poison, disrupting the insects metabolism. Application timing of dormant oils is key. As the name suggests, they are to be applied

while the plant is still dormant. However, even a delayed dormant oil when the buds are at green tip (buds open at tip and showing 1/6th of green) is recommended. Since horticultural oils are a contact insecticide the insect pest must be present and in a vulnerable stage of development for the oil to be effective, they provide no residual control. The development of insect resistance to dormant oils is rare, since the mode of action is mechanical rather than chemical.

When used properly, horticultural oils pose little to no threat to humans, animals and beneficial insects, making it a good companion to other biological control methods. Their ability to be mixed with other insecticides is desirable, providing a greater persistence of control. There are a few drawbacks to using dormant oils however. They can stain a surface like dark colored wood and siding, and they can cause phytotoxicity of plants when used improperly. Be sure to read the entire label to prevent both issues.

Pay special attention to what you are spraying as there are several tree species that are sensitive to oils such as: juniper, cedar, black walnut, Douglas fir, maples and spruce.

Recipe of the Month

Dijon Scalloped Potatoes

- 2/3 cup chopped onion
- 2 teaspoons canola oil
- 1 can (14-1/2 ounces) chicken broth
- 2 packages (3 ounces each) cream cheese, cubed
- 1 tablespoon Dijon mustard
- 3 medium russet potatoes, peeled and thinly sliced
- 2 medium sweet potatoes, peeled and thinly sliced
- 1-1/2 to 2 cups crushed butter-flavored crackers
- 3 tablespoons grated Parmesan cheese



2 tablespoons butter, melted
2 teaspoons minced fresh parsley

Preheat oven to 350°. In a Dutch oven, saute onion in oil until tender. Reduce heat to medium; stir in broth, cream cheese and mustard until blended. Remove from heat. Stir in potatoes.

Transfer to a 13x9-inch baking dish coated with cooking spray. In a small bowl, combine crushed crackers, Parmesan cheese and butter; sprinkle over the top.

Bake, uncovered, 50-60 minutes or until potatoes are tender. Sprinkle with parsley. Let stand 10 minutes before serving. Yield: 8 servings.

April Birthdays

John Sherwood	12
Mike Giroux	12
Alan Dyer	15
Toby Day	15
Whitney Harchenko	19
Matt Lavin	20
Andreas Fischer	25
Nina Zidack	26
Rebkah VanWieren	28
Dylan Mangel	29

