Montana IPM Bulletin

MONTANA STATE UNIVERSITY | EXTENSION

Spring 2013

Glyphosate-resistant kochia confirmed in Montana

Fabian Menalled, MSU Crop Weeds Specialist

In 2012 it was rumored that glyphosate (Roundup and other generic names) resistant kochia *(Kochia scoparia)* could be present in Montana. These cases were particularly worrisome as resistance to glyphosate in kochia had already been confirmed in southern Alberta (Canada), South and North Dakota, Colorado, Nebraska, and Kansas. Unfortunately, the bad news is that kochia resistance to glyphosate has been confirmed in Montana. While the extent and distribution of these resistant populations is still unknown, this confirmation brings new challenges to our approach to manage this weed, particularly in fallow fields.

Herbicide resistance is the innate ability of a weed biotype to survive and reproduce after treatment with an herbicide dose that would normally be lethal and it results from repeated use of the same herbicide. For example, an overreliance on glyphosate has resulted in the evolution of glyphosate-resistant weed populations.

In Montana, besides resistance to glyphosate, kochia has evolved resistance to other herbicides. In 1984, kochia found in railways first evolved resistance to Group 5 Photosystem II inhibitor herbicides such as atrazine. In croplands, kochia resistance to Group 2 ALS inhibitor herbicides including chlorsulfuron (Glean, Telar) and metsulfuron-methyl (Escort) was detected in 1989. In 1995, kochia resistance to Group 4 Synthetic Auxin herbicides including dicamba (Banvel) and fluroxypyr (Starane) was confirmed.

Kochia is an early-germinating summer annual broadleaf weed. It is a self- and cross-pollinated species with pollen moving between plants on the wind. Kochia plants can produce over 10,000 seeds and have a unique seed dispersal mechanism. After the plant has matured, kochia plants break off

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FIGURE 1. Tumbleweeds of mature kochia roll across a field and deposit seeds along the way to create meandering paths of new plants, seen above. (Photo by M.E. Bartolo, Bugwood.org.)

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at the ground and roll in the direction of a slope or wind as a tumbleweed, leaving trails of kochia plants (Figure 1). These traits could translate in a rapid spread of the glyphosate resistant plants. Yet, because seed longevity is relatively short, an early detection and rapid response approach can help reduce the spread of glyphosate-resistant kochia.

Controlling glyphosate-resistant kochia in non-crop fallow periods will require the use of soil-active, residual herbicides to target seedlings as they emerge in late fall or early spring. To have these soil-active herbicides in place prior to kochia emergence, they will have to be applied in the fall as a post-harvest treatment or early spring. The goal is to keep the fallow kochia-free from April through mid-July as its germination and establishment is unlikely after mid-July.

During the 2012 summer we screened several soil-active herbicides that could allow farmers to achieve control of kochia seedlings through mid-July in fallow fields. Our results indicated that treatments that included a burndown product such as paraquat (Gramoxone) tank-mixed with a soil-residual herbicide like atrazine, metribuzin (Sencor), or thiencarbazone plus isoxaflutole (Corvus) could provide successful control. Other options included utilizing soil-residual herbicides such as flumioxazin (Valor), sulfentrazone (Spartan), and sulfentrazone plus carfentrazone (Spartan Charge). Since auxin herbicides such as 2,4-D, dicamba, and fluroxypyr are used as post-emergence treatments for controlling kochia in cereal grain crops, it is advisable to not use them in fallow in order to reduce selection pressure on kochia populations since resistant populations to these herbicides have already been reported in Montana.

To reduce the risk of selecting for herbicide-resistant biotypes, producers should rotate among herbicides with different modes of action applied either as tank mixes, premix formulations, or sequential applications. To minimize the possibility of resistant plants escaping, thorough scouting prior and following the herbicide applications is necessary. Producers should also rotate management practices, such as the incorporation of timely cultivation. Finally, crop rotation is an excellent tool to reduce the selective pressure on herbicide-resistant weeds. More information on herbicide resistance can be found in the Montguide, *Preventing and Managing Herbicide-resistant Weeds in Montana* (MT200506AG).

Controlling cheatgrass with imazapic (Plateau®) on rangeland

Jane Mangold, MSU Invasive Plant Specialist

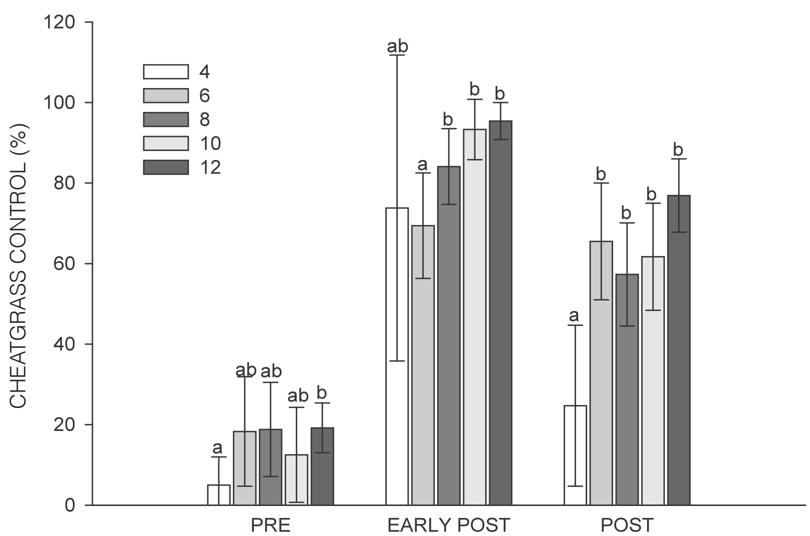

FIGURE 2. Cheatgrass control as affected by imazapic application timing and rate. Bars represent mean % control, and error bars represent 95% confidence intervals around the means. Means with different letters are different from each other within an application timing. Application rates in ounces Plateau®/acre are represented by the shades of gray fill as indicated in the legend.

Herbicides are one of the most commonly used tools for controlling cheatgrass *(Bromus tectorum)* on rangeland. Cheatgrass is a winter annual invasive grass. As a winter annual, most cheatgrass seeds germinate and emerge in the fall with the return of precipitation following seasonal drought that is typical in July through August. Cheatgrass overwinters as a seedling and resumes growth early in the spring when it takes advantage of early season soil moisture. By late spring to early summer, seed production occurs, the plant dies, and the seeds remain to begin the process again that fall. Spraying cheatgrass seedlings when they are most susceptible to herbicide is critical for effective control, but timing of applications can be complex because sometimes cheatgrass seedling emergence can continue fall through spring, depending on precipitation patterns.

The herbicide imazapic (Plateau®) has been the focus of research and on-the-ground management of cheatgrass in many areas of the western U.S. Imazapic is in the imidazolinone family of herbicides and interferes with amino acid synthesis. It has both soil and foliar activity, therefore it is labeled for both pre- and post-emergent application. In areas of the Great Basin and Intermountain West, imazapic has provided up to two years of cheatgrass control. Imazapic has been applied by both researchers and range managers in Montana with mixed results.

Researchers from across Montana compiled data from 25 herbicide trials that included imazapic. We evaluated imazapic efficacy across application rate, application

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Integrated management of foliar diseases in pulse crops

Mary Burrows, MSU Plant Pathologist

FIGURE 3. The power of plant resistance: chickpeas infected with ascochyta blight (L) and resistant peas (R).

Pulse crops are generally more susceptible to yield and quality losses due to disease than cereal grains. With the expansion in acres of peas, lentils, and chickpea in Montana, we will see the accumulation of disease-causing pathogens that could threaten the industry as a whole. We have seen this happen in the past with Ascochyta blight epidemics in 2000-2001 which essentially eliminated chickpea acres in the state, and with Fusarium wilt on pea which eliminated the pea canning industry in the Gallatin valley. So, as we look ahead, what are the main threats, and how can we avoid them?

The main threats are both above and below the soil line. We can look to our northern neighbors, and ask what their main disease threats are, and then we can look around us and see if we anticipate the same threats. There are many resources to learn about other pests of the pulse industry including the MSU Extension Plant Pathology website (http://www.msuextension.org/plantpath/) and your local county Extension office as starting places. Remember that every disease needs a susceptible host, a pathogen, and a favorable environment to be 'successful.' This is what we call the disease triangle: if you can eliminate any corner of that triangle, you can manage the disease. Management practices only alter risk, they will never eliminate disease as a possibility. Even given a high level of disease inoculum and a susceptible plant host, you still need a favorable environment (temperature, moisture) to get disease and spread of that disease in the crop.

Ascochyta blight is the foliar disease that receives major headlines in pulse crops. It can be extremely dramatic, defoliating susceptible plants in days. However, a number of management tools, when used together, make this a manageable disease. The first tool is crop rotation. A rotation of three to four years is recommended between any pulse crop, primarily for Ascochyta blight management. This gives the stubble from an infected crop the opportunity to break down so there is a lower disease risk. That said, planting downwind from infected stubble is a high risk activity, as spores can be windsplash-dispersed off of the stubble at least 500 meters, perhaps more. Spores can be windborne from infected plant tissues up to five miles or more. The species of fungi causing Ascochyta blight are distinct for each host (chickpea, pea, lentil) so the Ascochyta pathogen on lentil does not infect pea, for example. Technically you could follow peas with lentils from the Ascochyta perspective, but this isn't a good idea from the below-ground perspective, as close crop rotations favor root rot and damping off pathogens.

The second management tool is to use clean seed. The MSU Seed Lab offers Ascochyta testing in seed. If you get seed tested, the lab will plate 500 seeds on artificial media (a solidified nutrient solution), wait 10 days, and look for the pathogen. Different 'thresholds' for the different crops provide a way of informing about the relative risk of disease threat in the crop. The lab has zero percent tolerance on chickpea, and five percent for pea and lentil because they can tolerate more disease. Regardless, if one seed is infected out of 500, think of how many seeds go into an acre and how much potential inoculum goes into the field. In the 2013 crop year, about 75 percent of pea seed lots and 45 percent of lentil seed lots are coming in for testing with at least one seed infected. Not every infected seed will produce an infected seedling, but think of the sheer acres of seed being planted in the state. As we get more infected crop out there, we will start to see more issues. That brings us to additional management practices.

The third management practice option is crop variety. Choose the best adapted variety for your area, and something with tolerance or resistance to Ascochyta blight if it is available (Figure 3). Most pulse crop varieties are fairly susceptible to Ascochyta blight.

The fourth management practice is fungicides. Use a seed treatment at planting that has activity against Ascochyta blight. Mertect is the standard, but Stamina has shown excellent performance in trials at MSU and performs as good or better than Mertect. This product should be used in addition to standard seed treatments used for good emergence, which should be a blend of fungicides for Rhizoctonia and Fusarium root rots along with metalaxyl or mefanoxam for Pythium and Aphanomyces (oomycete fungi) which are significant in cool, wet springs. The caveat with fungicide use is the need to rotate chemistry so as not to develop fungicide resistance in the fungal populations. When Ascochyta blight of chickpea

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timing, and choice of adjuvant. Our rates included 4, 6, 8, 10, and 12 ounces Plateau®/acre; application timings were all in the fall and included pre-emergent, early post-emergent (cheatgrass at 1-2 leaf growth stage), and late post-emergent (cheatgrass at 3-4 leaf growth stage); adjuvants included methylated seed oil (MSO) and non-ionic surfactant (NIS). Imazapic efficacy ranged from less than 20 percent control to greater than 95 percent control of cheatgrass, and efficacy was primarily influenced by timing of application (see graph, Figure 2). Pre-emergent applications resulted in less than 20 percent cheatgrass control across all application rates. Cheatgrass control with post-emergent applications ranged from about 30 to 95 percent control, and control was most consistent across the different application rates in the early post-emergent applications. Efficacy was not highly dependent on the rate of imazapic applied except with late post-emergent applications where the lowest application rate (4 ounces Plateau®/acre) did not perform as well as higher rates. Imazapic efficacy was not influenced by choice of adjuvant. The results from this study indicate that imazapic applied at 4-8 ounces Plateau®/acre when cheatgrass is in the 1-2 leaf stage will provide control comparable to the 10-12 ounce rates.

The study described above led to further exploration of imazapic efficacy with a series of field and greenhouse studies. The field studies took place on cheatgrass-infested Conservation Reserve Program (CRP) land in Hill County and cheatgrass-infested rangeland in Sweetgrass County. We applied imazapic at different rates in the early to late post-emergent growth stage. Because some research and anecdotal evidence suggests plant litter can interfere with imazapic uptake by cheatgrass, we also tested whether raking prior to herbicide application improved control. Since some cheatgrass seedlings do not emerge until spring, we collected soil samples at increasing dates post-herbicide application to better understand how long imazapic persists in the soil and might therefore continue to provide control. Cheatgrass control was variable across sites and years, but in general a low application rate (4 ounces Plateau®/acre) was just as effective as a high application rate (12 ounces Plateau®/acre). At the CRP site, application rate became more important as timing of application was delayed, and a higher application rate was necessary to reduce cheatgrass below that of non-treated plots; this is similar to the results from the study that included 25 trials. Litter did not influence imazapic efficacy in our studies. Soil samples indicated that there was enough imazapic still left in the soil up to 180 days after application to decrease cheatgrass growth. This finding is encouraging because fall applications targeting 1-2 leaf seedlings will still have some activity on those seedlings that do not emerge until spring.

Other herbicides labeled for control of cheatgrass on rangeland include glyphosate (e.g. Roundup Pro®), imazapic plus glyphosate (Journey®), rimsulfuron (Matrix®), sulfometuron methyl + chlorsulfuron (Landmark®), sulfosulfuron (Outrider®), and propoxycarbazone-sodium (Canter R+P®) You can read more about cheatgrass biology, ecology, and management in range and croplands in an MSU Extension MontGuide http://msuextension.org/publications/AgandNaturalResources/MT200811AG.pdf.

(Integrated Management, continued from page 3)

became resistant to strobilurin fungicides in 2005, these ceased to be viable tools in the chickpea crop in Montana, North Dakota, and Canada. The Schutter Diagnostic Laboratory, in collaboration with NDSU, is monitoring for fungicide resistance development in the seed lots coming in for testing. The lab has seen very few isolates that we suspect may be tolerant to strobilurin fungicides, but we are performing further tests.

Other foliar blights to become concerned about in future years include Anthracnose and Stemphylium blights on lentil, and Botrytis (gray mold) and Sclerotinia (white mold) on all pulse crops. Most of these are seedborne and we are monitoring seed lots which are coming in for testing. The lab will let you know via the Ag Alert system and other media when these become a problem in the crop, and share how to recognize and manage the problem. Please submit samples or photos for diagnosis if you suspect these diseases so we can notify other growers in your area. Visit the diagnostic lab website for submission instructions at http://diagnostics.montana.edu and run a good sample to your county Extension agent, or submit the sample directly. A good sample includes a large clump of plants including roots that are sick but not dead, and a healthy comparison. Wrap the roots and soil in plastic and tie it off to preserve the foliar tissue for a longer time period (Figure 4). Put it in a loose plastic bag and treat it well, so plants would survive and be plantable when it comes to the lab or the county Extension office. Photos and as much information as you can provide are appreciated. Make sure photos are in focus, and include your name and contact information with sample submissions. If we don't know anything about the sample or who submitted it, we guarantee a slow response, and we'd prefer to help you make management decisions quickly.

FIGURE 4. A well-packaged sample for disease diagnosis.

Meet Your Specialist

Cecil Tharp, MSU Pesticide Education Specialist, Department of Animal and Range Sciences

Individuals that work with Cecil often ask, “Where are you from?” due to a curious accent. Cecil was born and raised in the oilfield country of Williston, North Dakota. He spent much of his youth fishing the banks of Lake Sakakawea as well as exploring the badlands and river-bottoms of eastern Montana. Williston was a much less populated oil town of only 12,000 people during his youth, as compared to current estimates of over 20,000. Cecil worked in construction as well as the oil sector prior to entering the North Dakota State University School of forestry at Bottineau in 1990.

Some of Cecil’s current hobbies include hiking, hunting, fishing and hockey, as well as racquetball. You may find Cecil snowshoeing the many mountain trails around Bozeman in the winter, or camping and fishing with his friends and family on Canyon Ferry or Hebgen Reservoirs.

Can you give us some background on your academic career?

I received a technical degree in Parks & Recreation Management from North Dakota State University in 1992 prior to receiving a bachelor’s degree in Biology from Montana State University (MSU) in 1994. While pursuing my master’s degree at MSU I studied the toxicity of imidacloprid towards grasshoppers and cereal leaf beetles. I’m currently pursuing a doctoral degree in plant science at MSU where I’m working on assessing low-risk chemical alternatives in the management of alfalfa weevil.

Can you describe your current position at MSU?

I am the coordinator of the private applicator program as according to the 2008 Memorandum of Agreement between MSU Extension and the Montana Department of Agriculture. This program assures that restricted use pesticides (RUP’s) are used by 6,100 Montana private applicators in a manner that is safe for human health and the environment. I assist 56 MSU Extension county training coordinators in providing pesticide education services, which have measurable impacts on Montana citizens.

Describe some past research you’ve conducted.

I arrived at MSU in November 2003 when I began an appointment as an Entomological Research Associate working with Dr. Sue Blodgett, Department of Entomology. Prior to this position I was employed as a Biological Technician at the USDA Agricultural Research Service at Brookings, South Dakota. In either position I studied new integrated pest management practices for managing agricultural insect pests. I created insect factsheets and insect diagnostic keys while investigating new and novel pesticide formulations for managing pests. I used this knowledge to respond to pest issues from concerned producers and ranchers across Montana and South Dakota.

What are some of the goals of your program?

My goals are to provide more resources for pesticide educators in the state, as well as providing education that significantly impacts pesticide applicators to invoke positive change. Because county pesticide educators (county Extension agents), are an integral part of the MSU Pesticide Education Program, I have created the annual pesticide education train-the-trainer program. This program brings in regional experts and covers key training topics in many areas of pesticide education. Trainers can take this information back to their county private applicators.

To increase the educational impacts of pesticide programs, I have conducted surveys across the state to better understand pesticide applicators. These surveys ask applicators various questions and can better enable pesticide trainers to reach their intended audience.

What have you learned from these surveys?

Applicators commonly expose themselves to high levels of pesticides. Thirty-one percent of private applicators surveyed indicate they were poisoned by pesticides at some point in their career. This may be due to 54 percent of applicators not wearing required PPE on the pesticide product label, and 71 percent of applicators removing chemically resistant gloves to repair spray equipment.

The surveys also indicate one in three applicators damage adjacent non-target crops at some point in their career. This may be due to most (71 percent) applicators spraying when they knew it was too windy at least once during their career.

The data is helpful in identifying behavioral deficiencies so pesticide programs can focus on remedies to these common situations.

What future goals do you have in mind?

I would like to create an endorsement for private applicators using fumigants, create more online training modules for trainers, and expand pesticide training surveys.

Fumigant private applicators receive little specialized training in fumigant applications. An endorsement for fumigant applicators will open the door for specialized trainings that better meet the needs of these applicators.

I’d like to expand the online training modules available to pesticide trainers. Currently, we have technical trainings over policies, procedures, and some core pesticide education areas. By expanding modules to include more core pesticide education topics trainers can use trainings locally without added speaker travel expenses.

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Ask the Expert

Q. Can you get Parkinson's disease from being exposed to pesticides?

A. Cecil Tharp says:

Parkinson's disease is a progressive neurodegenerative disease that leads to tremor, slow movements, poor balance and other symptoms. This disease affects about one million people in the U.S. The agricultural health study assessed over 90,000 private applicators and their families by evaluating pesticide use and associated health concerns. This study found a two-fold increase of Parkinson's disease in individuals that use pesticides more than 400 days in their lifetime. Parkinson's disease is also elevated in individuals having a high pesticide exposure event such as a spill in their lifetime. In the initial study, risk was strongly associated with the use of paraquat, cyanazine, trifluralin, and 2,4,5-T. A later study associated rotenone and once again, 'paraquat', with a 2.5 times increased risk of Parkinson's disease. It should be noted that exposure to many pesticides may not result in an increase in Parkinson's disease. Remember to protect yourself! A 90 percent decrease in pesticide associated health concerns was noted when applicators used personal protective equipment.

Q. How can I distinguish cheatgrass from Japanese brome?

A. Fabian Menalled says:

Cheatgrass *(Bromus tectorum)*, also known as downy brome, and Japanese brome *(Bromus japonicus)* are members of the grass family. In Montana, these two species occur in many habitats including croplands, rangelands, and urban settings. These two species have similar life cycles. They are both annuals that usually germinate in the fall, overwinter as seedlings, and resume their growth in the early spring. Unfortunately, at their seedling stage, the morphological differences between these two species are so subtle that it is almost impossible to distinguish them. However, it is easy to differentiate them at the mature stage. While cheatgrass has a slender and reddish inflorescence bearing 3 to 8 spikelets with awns, Japanese brome inflorescence is more compact and has shorter awns (Figure 5). Also while cheatgrass is covered in soft short hair, Japanese brome has more hairy leaves with longer hairs, especially on the underside of the leaf.

Q. What is fungicide resistance and how can I avoid it?

A. Mary Burrows says:

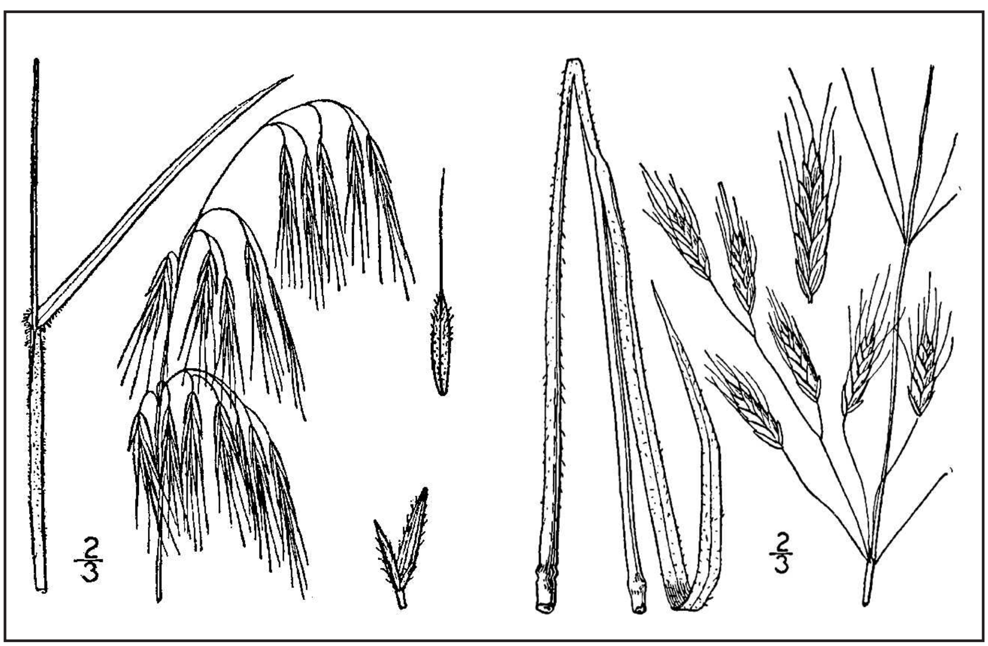
Fungicide resistance occurs when a fungal pathogen is no longer sensitive to a particular group of fungicides. Some fungicide groups are particularly well-known for the ability of pathogen groups to become resistant to them. This is due to their mode of action, or the way they kill the fungus. Fungicides target different steps in the biosynthetic pathways of fungi such as respiration, nucleic acid biosynthesis, and sterol biosynthesis, among others. The fungicide group, which represents the mode of action, is always found on the pesticide label. Pay very close attention to the fungicides you spray on the crop and do not exceed the amount or number of sprays indicated on the label. Don't always trust your applicator to keep track of what has been sprayed on the crop. If a product is not working, question whether the disease has been properly diagnosed, the application itself, and whether the population of fungus may have become resistant.

Q. I sprayed and seeded a weed-infested section of my land two years ago. There were many weedy annual plants the first two growing seasons, but very little of the grasses that I seeded. What can I expect this year?

A. Jane Mangold says:

Revegetation of weed-infested plant communities takes patience. It is not uncommon to see a flush of weedy annual species the first couple years after spraying and seeding, especially if the soil was disturbed during seeding. My experience with research plots suggests it takes about three to five years before you can expect the grasses you seeded to get big enough to be noticed. So, be patient and see what this summer brings. If you can't find any of your seeded species by the end of the summer, you may want to consider re-seeding again in the fall or next spring.

FIGURE 5. Cheatgrass (left) and Japanese brome (right) inflorescences.



Pest Management Tool Kit

From Fabian Menalled:
Crops and Weeds Field Day, June 27. Our annual Crop and Weed Field Day at the MSU Arthur Post Experimental Farm will be held on June 27. The Post Farm is located seven miles west of Bozeman. Participants will be able to visit research and demonstration plots of weed management, insect control strategies, nutrient dynamics, cropping systems, and crop traits. MSU faculty, staff, and students will be available to answer questions. Attendees are eligible to receive Certified Crop Adviser (CCA) Continuing Education Unit credits as well as commercial and private applicator pesticide recertification credits. Please save the date and contact Fabian Menalled (menalled@montana.edu) if you have any questions.

From Mary Burrows:
Diseases of Cool Season Legumes, http://msuextension.org/publications/AgandNaturalResources/EB0207.pdf

Small Grain Seed Treatment Guide, http://msuextension.org/publications/AgandNaturalResources/MT199608AG.pdf

Fusarium Head Blight (scab) of Wheat and Barley, http://msuextension.org/publications/AgandNaturalResources/MT200806AG.pdf

CCA Training. Huntley, August 7, 2013. Contact Clark Schmidt - clark.schmidt@basf.com

Richland Pulse Field Day, July 11. Contact Shelley Mills, smills@montana.edu

Froid Field Day, July 20. Contact Ann Ronning - aronning@montana.edu

From Jane Mangold:
New online courses cover plant anatomy and the diagnostic features of 32 state-listed noxious weeds. The first course covers plant anatomy terms critical to plant identification. The second course identifies diagnostic features of lesser known noxious weeds. The third course covers diagnostic features of noxious weeds common in many areas of the state. Each course ends with a challenging quiz of the material presented. The free online courses, which can take one to two hours per course to complete, are available to anyone interested in learning more about noxious weed identification. Private, commercial and governmental pesticide applicators can receive re-certification credits for completing the courses. To access the courses, go to http://msuextension.org/learn/invasiveplants.

Interested in receiving the monthly Weed Post, a two-page PDF featuring timely information about weeds and a crossword puzzle to reinforce the information presented in the Weed Post? If so, email Jane Mangold at jane.mangold@montana.edu. Previous Weed Posts can be viewed at http://www.msuextension.org/invasiveplantsMangold/extensionsub.html.

From Cecil Tharp:
If you find it difficult to remember how to calibrate your sprayers use this free mobile app that may be used with iPhone, iPod Touch, iPad and Android devices. Simply select the type of sprayer you want to calibrate (Broadcast or Banded), insert values in each input box, select what you want the app to calculate (Volume/Area or Catch/Nozzle), and tap 'Calculate'. Simply navigate to http://www.clemson.edu/extension/mobile-apps/index.html for more information.

Helena, May 3. Five private applicator credits. 2013 Spring Private Applicator Workshop. Located at the Lewis and Clark County Fairgrounds. For more information contact Brent Sarchet at (406) 447-8346 or see program agenda at www.pesticides.montana.edu/PAT/2013/2013%20spring%20private%20applicator-helena.pdf.

Billings. May 29. Five private applicator credits. Second Annual South-Central Weed Training. Located at the Yellowstone County Weed Shop. Register at (406) 256-2828 or see online agenda at http://www.pesticides.montana.edu/PAT/2013/13-277.html.

Region 1 private applicators within Lincoln, Flathead, Sanders, Lake, Mineral, Missoula, and Ravalli counties, October 7-11. Six private applicator recertification credits. 2013 Pest Management Tour. Exact locations to be announced. For more information contact Cecil Tharp - ctharp@montana.edu; 406-994-5067.

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Applicators may benefit from trainings that deliver IPM example scenarios they face on a daily basis. Are applicators surveying their fields? Are they using thresholds available for many pests? How often do they survey fields? How do you make pest control decisions? By firmly understanding applicator behavior patterns we may better deliver IPM information to applicators. What deficiencies exist in IPM education, and how can we address it within the MSU Pesticide Education Program?

How can farmers/ranchers benefit from my program?

Pesticide applicators can benefit from my program by using the resources available. Applicators can access the pesticide education publications available online at www.pesticides.montana.edu, attend an MSU pesticide education private applicator program, or contact the MSU Pesticide Education Program directly at (406) 994-5067; ctharp@montana.edu.

DO YOU HAVE A COMMENT OR QUESTION REGARDING THE MONTANA IPM BULLETIN?

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