Montana IPM Bulletin

MONTANA STATE UNIVERSITY | EXTENSION

Spring 2012

ANN RONNING. EARLY SPRING CROCUSES IN PASTURE.

INSIDE:

MONTANA Department of AGRICULTURE

Will Montana dodge the grasshopper "bullet" for a third season?

Kevin Wanner and Ruth O'Neill, MSU Extension Entomology

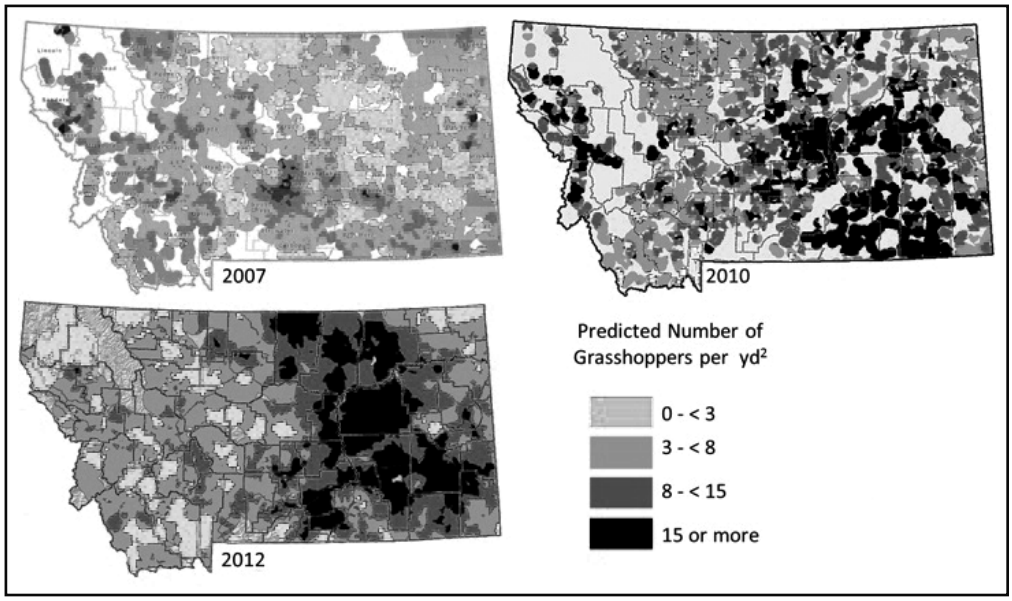
Grasshoppers are common across Montana, especially in the eastern prairie counties where they often damage rangeland and cropland. But since 2009 the grasshopper forecasts have been especially grim, with about 17 million acres under serious threat. These annual predictions are based on late-summer counts of rangeland grasshopper surveys conducted by the U.S. Department of Agriculture Animal and Plant Health Inspection Service (USDA-APHIS, Helena).

According to the USDA, over the past three years the western U.S. has been on the brink of an epic outbreak, of a severity we haven't seen since 1985. That was a year when hyper-abundant grasshoppers demolished huge swaths of Montana's rangeland, farmland, and prairie, leaving crops in ruins and sparing little forage for livestock and wild game. By August of 1985, masses of starving grasshoppers had moved into windbreaks and residential areas, in places as thick as 400 adult grasshoppers per square yard. The famished grasshoppers devoured the foliage (and sometimes the bark) of garden plants and shrubs, and clipped every blade of grass down to the soil. They ate holes in clothes hung out to dry, chewed the insulation off wiring, and bit people hard enough to break the skin.

But insects are affected by weather, and the last two cool and wet spring seasons suppressed the grasshopper outbreak in two ways. The cool weather increased grasshopper mortality and the extra moisture allowed grasses to recover better from feeding damage.

Will Montana dodge the grasshopper "bullet" again in 2012? The answer to this question likely depends again on the weather. The last two cold, wet springs suppressed but did not collapse the outbreak. The answer also depends on the number of egg pods overwintering in the soil. Unfortunately, grasshopper-friendly conditions later in the summer of 2011 saw 16 million acres of rangeland in Montana with 15 or more grasshoppers per square yard, and many egg-laying females were observed in the field. With so many nymphs hatching out in 2012, a hot and dry spring may mean the grasshopper outlook will again be severe.

Natural diseases are a wildcard for 2012 predictions. During prolonged cool weather,



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many developing grasshopper nymphs emerging in April, May and June are killed by a combination of factors stemming from delayed maturation and higher susceptibility to disease. Several lethal fungal diseases of grasshoppers such as Nosema and Metarhizium spread more easily in moist, overcast conditions. Whether natural grasshopper diseases have increased enough to affect the 2012 populations remains to be seen.

CONTROL: Grasshoppers are highly mobile because the adults of most species can fly. This means that chemical control over small acreages is not practical. However, there are steps you can take to protect your property:

- Grasshoppers lay their egg pods in fine gravel, sand, or silt. Some important pests, like the clear-winged grasshopper, gather to lay their eggs in a few small areas. Raking or disking these areas can significantly cut down on the numbers that hatch.
- Netting can be draped over valuable shrubs.
- Garden beds can be covered with "row cover" fabric, which allows sunlight and water in but keeps insects out.

On a larger acreage, the economics of treating for grasshoppers can be marginal, but the USDA has developed Reduced Agent Area Treatment (RAAT) strategies applied by ground or air, that minimize costs but maintain acceptable control levels. More information, including RAATs brochures, can be found on the USDA-ARS Sidney grasshopper website, http://www.sidney.ars.usda.gov/grasshopper/. For crops surrounded by grassland, one common strategy is to spray insecticide in a 150-foot band beyond the edge of the crop as a barrier. For spring and winter wheat, more information about control recommendations and economic thresholds can be found online on "The High Plains IPM Guide," http://wiki.bugwood.org/HPIPM. Dimilin 2L can be used on grasslands and a variety of crops and pasture. This product works well on immature insects, interfering with development. However, it is completely ineffective on adults.

Ask the Expert

Q. I read that glyphosate (Roundup) resistant kochia was identified in southern Alberta, Canada. Should I be concerned? What can I do?

A. Fabian Menalled says:
Yes, weed scientists in Canada have found glyphosate resistant kochia in southern Alberta, not far from the border. This is the first confirmation of glyphosate resistant kochia in an area adjacent to Montana. In Alberta, glyphosate resistance has been confirmed in at least 14 fields from different farms. These biotypes have multiple resistances to both Group 2 (imidazolinone and sulfonylurea) and Group 9 (glyphosate) products. Although glyphosate resistance has not been confirmed in Montana, this summer we will be conducting a series of trials to provide growers with alternatives in case these plants are found during this growing season. In the meanwhile, make sure to carefully monitor your fields for potential control failures and contain any escape.

Q. Which seed treatment is best?

A. Mary Burrows says:
I get a lot of questions about which seed treatment is the best one to use in various crops. We're in the process of updating the seed treatment guide for cereals and will get that published as a MontGuide shortly, but the short answer is the newer seed treatments on the market are generally better, and there are some products coming online in the next couple of years that are performing very well in MSU trials. If you want a list of seed treatments registered on your crop, NDSU keeps a guide that I use frequently (http://www.ag.ndsu.edu/extplantpath/publications-newsletters/fungicides) and you can always check websites such as CDMS (http://www.cdms.net/).

Q. Is it possible to burn winter ranges and dryland habitats without causing weed spread?

A. Jane Mangold says:
I wish I could give you a straightforward answer to your question, but systems are very complex and outcomes depend on many factors like existing plant community composition, invasive plants targeted for control, and stage of weed growth at time of burning. Environmental conditions at the time of the fire, such as season, air temperature and humidity, and moisture content of the vegetation can also play a role. It is generally believed that weeds increase with fire, but carefully-timed burns can reduce viable seed production of certain species. Weeds that regenerate from vegetative structures (not seeds), are harder to control with fire and typically are not good candidates to control with prescribed burning. You can read more about fire and invasive plants in "Wildland Fire in Ecosystems: Fire and Nonnative Invasive Plants," USDA-FS-RMRS General Technical Report RMRS-GTR-42-volume 6. You can access a PDF at http://www.fs.fed.us/rm/publications/titles/rmrs_gtr.html.

Q. Can I use a pesticide product to manage a pest not listed on the pesticide product label?

A. Cecil Tharp says:
Yes, according to FIFRA section 2(ee), a pesticide may be applied against any target pest not specified on the label (unless EPA has required that the pesticide may be used only for a specified pest). Applicators should be cautious when applying a pesticide product against a pest not on the pesticide product label, as there isn't any guarantee that the product will be effective in managing the target pest. Applicators should never apply a pesticide product on a crop / site not listed on the pesticide product label.

Q. I'm a noxious weed seed-free hay producer and have heard I can't use Milestone (aminopyralid) on my fields anymore. Is this true?

A. Jane Mangold and Cecil Tharp say:
The new Milestone label states "Hay from grass treated with Milestone within the preceding 18 months can only be used on the farm or ranch where the product is applied unless allowed by supplemental labeling." Because there is no supplemental labeling for Montana, if you use Milestone in your pastures or hay fields, you can only use that forage on your property. The herbicide is present in the hay and not chemically broken down when livestock digest it, therefore manure will contain active herbicide and can damage plants if used as compost.

Western Salsify: A new weedy threat?

Jane Mangold, MSU Invasive Plant Specialist

Western salsify (Tragopogon dubius), also known as goatsbeard, is an exotic plant of the Asteraceae family. Don't think you've ever seen this plant? Western salsify looks like a dandelion on steroids with yellow, dandelion-like flower heads born singly on 12-40 inch stems that are swollen and hollow below the flower head. Western salsify looks even more like a large dandelion when it sets seed, developing a fluffy sphere of seeds. Prior to bolting and flowering, the leaves can be readily mistaken for grass. However, they have a smoother and more rubbery-like feel than grass leaves and exude a milky juice when broken.

Native to Eurasia and northern Africa, western salsify was commonly used as a food plant (the root is edible) in northern Europe in the Middle Ages and subsequently spread all around the world. It was brought to North America around the turn of the 20th century. Western salsify is widespread across North America, and has recently become problematic in rangeland and Conservation Reserve Program lands (CRP) in north-central Montana where it has been observed to form dense stands. In a spring 2011 survey of three locations in north-central Montana, where western salsify has recently become problematic, 73% of the respondents replied that they have western salsify on their land (pasture, range, or CRP), and 54% of respondents replied that western salsify has been increasing.

Western salsify is a monocarpic perennial, meaning the plant dies after seed production, but seed production can happen in the first to fourteenth year (rarely). Seed production usually occurs after two to four years. Western salsify relies on seed production to maintain and spread populations. Seeds are easily blown by the wind with dispersal distances up to 825 feet. Seed viability can be as high as 95%. Germination peaks have been observed in the fall and the following spring. Light is not required for germination, and emergence is not inhibited by a canopy of vegetation or litter.

ALISON LANSVERK

Seedlings quickly gain access to light through competing vegetation or litter by the growth of long narrow cotyledons. Flowering usually begins in early to mid-June.

Various parts of western salsify are consumed by wildlife. In Oregon, western salsify was shown to be one of the most important plant foods of blue grouse. Flowering stalks and foliage are utilized by a variety of mammals. For example, pocket gophers frequently feed on salsify roots. Other mammals such as deer, antelope, squirrels, or rabbits may bite off one or more flowering stalks. Mature plants tend to be grazed less frequently.

As mentioned above, western salsify can be weedy in some situations. Very little information exists regarding western salsify control, probably because western salsify has only recently become problematic. Research in Canada estimated four years of control using picloram at one pint per acre and one year of control using dicamba at two quarts per acre. Herbicides currently labeled for western salsify control include Chaparral® (metsulfuron methyl + aminopyralid) at 3.0 to 3.3 oz/A, Cimarron® Plus or X-tra (chlorsulfuron + metsulfuron methyl) at 1.25 to 2 oz/A, and Escort® (metsulfuron methyl) at 1 to 2 oz/A. Small infestations of western salsify can be hand-pulled or dug. Research suggests burying seeds greater than three inches deep prevents emergence, so tilling may be effective, but not recommended unless tilling is followed by seeding of desirable plants. Western salsify is a common seed contaminant, so buying weed-free, high quality seed can help prevent introductions on cropland, pasture and conservation seedings.

To help develop management recommendations for western salsify on CRP, research trials were conducted in north-central Montana at three sites with varying degrees of infestation (1 plant/m^2 up to 34 plants/m^2). In spring and early summer 2010, a variety of herbicide treatments and mowing were applied, and plots were followed for two summers. Results suggested that dicamba (4 oz/acre) plus 2,4-D (10 oz/acre; LV-6 formulation) applied at the rosette stage provided near 100% control. Timing of herbicide application was very important in that the same treatment applied at flowering did not provide good control. Mowing was ineffective.

When compared to no management control, treatments significantly reduced western salsify flowering and rosette plants only at the severely infested site. This suggests there may be a threshold salsify population density below 34 plants/m^2 below which there is no benefit to management. Broadcast herbicide application to treat western salsify in such situations may not be necessary, but spot treatment of dense patches may prevent infestations from worsening. Conversely, low densities of salsify may be beneficial for wildlife habitat.

You can read more about western salsify and the research trial in a new MSU Extension publication "Western Salsify" (MT201113AG). The publication is free and can be downloaded or ordered through MSU Extension publications online at http://www.msuextension.org/store/; by calling (406)994-3272; or by sending an e-mail to orderpubs@montana.edu.

Ascochyta in pulse crops

Mary Burrows, MSU Plant Pathologist

Ascochyta blight in pulse crops is a potentially serious disease. Some of you may remember the Ascochyta blight epidemic in 2000-2001, which essentially eliminated chickpea acres from Montana for many years afterwards. Chickpea varieties, especially the kabuli types, are very susceptible to Ascochyta blight. Peas and lentils are more resistant as a general rule, but as we plant more pulse acres the disease pressure will also increase. Breeders have been making a lot of progress in developing resistant varieties adapted to our growing conditions, but integrated management including crop rotation, preventing introduction of the pathogen through seed transmission, irrigation management, and fungicide use remain extremely important.

There are a few things you should know about Ascochyta blight:

1. Ascochyta blight is caused by a fungus.

2. The fungus survives in seed and on crop residue.

3. The species of fungus are different on each crop, so what we call Ascochyta blight on lentil does not infect peas or chickpeas.

4. Ascochyta blight on chickpeas in Montana and North Dakota is resistant to strobilurin fungicides: products such as pyraclostrobin (Headline) and Azoxystrobin (Quadris) are still not recommended for this disease in chickpea. These products are still effective against Ascochyta blight in peas and lentils.

5. We recommend at least 3 years in the crop rotation between pulse crops because of Ascochyta blight and soil-borne root diseases.

6. You can get your seed tested for Ascochyta blight by contacting the Montana State Seed Testing Lab at (406) 994-2141; ask for an Ascochyta test when you submit your seed for quality measurements. The test takes 2-3 weeks, so we recommend submitting directly after harvest or very early in the new year to get results before planting.

ASCOCHYTA BLIGHT SYMPTOMS IN PEA (ABOVE), LENTIL (BELOW). BOTH PHOTOS BY S. MARKELL, NDSU.

7. Rotate fungicide chemistries (modes of action, or FRAC groups) on all crops so we do not see further fungicide resistance develop for this disease on all pulse crops.

8. The amount of Ascochyta blight in seed tests has been steadily rising in recent years (table, below). This is probably because we're planting a lot more pulse acres and not everyone recognizes and manages this disease.

If you have a seed test positive for Ascochyta blight, this does not necessarily mean you will get disease on the crop, but it increases risk. For any disease to develop, you need a susceptible crop (variety), the pathogen, and a favorable environment (wet, 60-75°F). We have a 'threshold' value – after you reach the threshold (0% for chickpea, 5% for pea and lentil) you should consider an action. In this case, that action is treating seed with LSP/Mertect for Ascochyta control in addition to normal seed treatment. Normal seed treatments help stand establishment and prevent damping off and root rot for 2-3 weeks after planting, but do not have proven efficacy against Ascochyta blight. LSP/Mertect will reduce the amount of Ascochyta in the seed lot, but will not eliminate it. We are currently testing both foliar and seed treatment products for efficacy against Ascochyta blight in lentil here at Montana State. Stop by the field day in Bozeman on July 18 if you want to see the field trials (See Pest Management Toolkit for information). Also, look for the "Disease, insect, and weeds of pulse crops" calendar we're putting together for 2013, funded by the Northern Pulse Growers Association – I always enjoy pictures of death and destruction on my wall, don't you?

For more information on disease of pulse crops, please visit:

The High Plains IPM Guide

http://wiki.bugwood.org/HPIPM:Pulse_Crops

Michael Wunsch's fact sheets on the NDSU-Carrington website

http://www.ag.ndsu.edu/CarringtonREC/Plant%20Pathology

Guide for scouting pulse crops for disease:

http://www.saskpulse.com/media/pdfs/Scouting_for_Diseases_in_Pulses.pdf

Pulse Info (IPM work group website)

http://www.ndsu.edu/pubweb/pulse-info/

Levels of seedborne ascochyta in pulse crop samples submitted to Schutter Diagnostic Laboratory, 2009-2012.

	Chickpea				Pea				Lentil			
	n	% above threshold	% with Asc	avg %	n	% above threshold	% with Asc	avg %	n	% above threshold	% with Asc	avg %
2009	2	0	0	0.0	57	12	26	0.2	25	4	12	0.1
2010	4	25	25	0.8	83	10	65	1.7	53	0	43	0.3
2011	14	43	43	0.5	107	5	85	1.8	163	12	47	4.0
2012	19	74	74	0.8	149	11	74	1.8	149	6	41	1.8

n = number of samples submitted for testing
% above threshold = % of samples above the threshold for ascochyta (0% chickpea, 5% pea and lentil)
% with Asc = % of samples with 1 seed of 500 or more with ascochyta
avg % = the average % of ascochyta in all seed samples tested

Meet Your Specialist

Fabian Menalled, MSU Cropland Weed Specialist, Land Resources & Environmental Sciences

Fabian Menalled received his bachelor of science in Biology in 1984 (yes, that makes him feel old!) from the University of Buenos Aires, Argentina, hence explaining his self-described "funny accent." He got his doctorate from the University of Massachusetts in 1995. Fabian began to call Bozeman home back in 2004. Originally from Buenos Aires, a city with more than 13 million people, Fabian really downsized in the move to Bozeman, but he settled into small town life just fine. Fortunately for him, his favorite thing about Bozeman is the snow. When not involved in research, teaching, or Extension activities at MSU, you might see him out running, biking, or skate skiing. Another activity he partakes in off-campus, albeit unwillingly, is mowing the lawn. He gladly welcomes any volunteers.

Fabian's main research interest is understanding the ecological underpinning of integrated weed management. He specializes in cropland weeds, but has also done research in non-cropping systems. Before coming to MSU, he worked at "the other MSU" (Michigan State University) and Iowa State University. He also worked and taught at the University of Buenos Aires for several years.

Q. What are some important areas of focus in your field?

A major challenge we are facing is herbicide resistance. In Montana, biotypes of five species (kochia, Russian thistle, Persian darnel, wild oat and green foxtail) have been confirmed to be resistant to different herbicides. In some cases these biotypes have developed cross and multiple resistance and created major management challenges. While we have not confirmed cases of glyphosate (Roundup) resistance in Montana, I am seriously worried about this issue. The extent and impact of herbicide resistance, coupled with the low number of new products being released in the market, highlights the need of focusing our attention in developing ecologically-based weed management programs.

Q. Describe some of your past research projects.

Before coming to MSU, I worked in many places ranging from Antarctica, to Costa Rica, to corn and soybean fields in the Midwest. Since I arrived at Montana State, I've participated in several research projects focused on the integrated management of agricultural weeds. Among them, impact of cropping systems on weed community composition, integration of biological control agents and herbicides to manage Canada thistle, role of pathogens and nitrogen availability in determining crop-weed competitive interactions, and screening new and existing products for crop safety and weed control.

Q. What are some of your current projects?

I'm very excited about a new project where we just started assessing the applicability of targeted sheep grazing to manage weeds and terminate cover crops. The preliminary results are exciting and encouraging. We are also working on the ecological consequences of herbicide resistance.

Q. How can farmers use your research to their benefit?

My goal is that the knowledge generated in our research helps Montana's growers in the design of sustainable weed management programs. To achieve this goal, I use the results we obtain in our research project to develop and deliver an educational program on the integrated management of agricultural weeds.

Q. What projects would you like to focus on in the future?

As I told you, we are just now starting a research project on targeted grazing. Hopefully, this will keep me busy for a while.

FABIAN MENALLED

Spring Preparation of Spray Equipment

Cecil Tharp, MSU Pesticide Education Specialist

Spring is a busy time for Montana applicators, with long hours focused on seeding, cultivating, fertilizing or preparing field equipment. Many applicators focus on purchasing pesticide products while neglecting to calibrate the output of spray equipment. A finely-tuned ground sprayer in the fall may deliver a vastly different spray output in the spring. Rusted nozzles, ruptured seals, or rust in the lines may lead to uneven spray patterns or a significant departure from desired target rates. This often leads to loss of revenue, toxicity toward beneficial plants, or limited efficacy toward targeted pests. Applicators can avoid costly application errors by following a few simple calibration steps in spring.

Pre-calibration. It is not uncommon for a leaky backpack sprayer to saturate unwary applicators with pesticide product while spraying. This dangerous situation can be alleviated if an applicator takes a few minutes to inspect his or her equipment. Check pumps, lines, hose clamps and fittings for leaks while assessing entire sprayer for rust, wear and breakage. An applicator should take considerable time inspecting nozzles. A nozzle is composed of four items including a spray tip, screen (strainer), cap, and nozzle body. Screens should be inspected for debris and replaced if necessary. Spray tip pattern should be assessed for uniformity by simply brushing nozzle from 6 – 20" (depending on type of nozzle) over concrete.

Table 1. Common backpack sprayer nozzles, uses and swath width.

Nozzle Type	Site / Use	Swath
Adjustable	Tree Spraying or Long distance Spot	Narrow
Flat Fan Spray	Paths, Gardens, and General	Moderate
Hollow Cone	Spot spraying, brush and small trees	Moderate
Jet Stream	Longer Range Spot Spraying	Narrow
Flood	High output nozzles	Wide Swath
No drift nozzles	Applying at low pressure	Moderate

Nozzle tips should be replaced or cleaned if the spray pattern seems uneven. Select nozzle tips which are rated for your application type (Table 1).

M.J. WEAVER 1999

Know your field Speed. By understanding ideal field speed, an applicator can ensure they are near the desired rate indicated on the pesticide product label. An applicator only needs to know the desired output of their sprayer (gallons per acre, GPA), nozzle flow rate, and nozzle spacing. Desired output of sprayer is indicated on the pesticide product label. Nozzle flow rate refers to the gallons per minute your nozzles deliver. The span between your nozzles indicates the width of your nozzle spray pattern in inches.

➤ For example, your product label recommends an output of 10 GPA, the distance between nozzles on your spray boom is 24" and your nozzle flow rate is 0.2 gallons per minute. With this equation you can determine correct field speed.

$$\textbf{Field Speed (miles per hour)} = \frac{\textbf{GPM x 5940}}{\textbf{GPA x W}}$$

- Field Speed = 0.2 x 5,940 / 10 x 24
- Field Speed = 1,188 / 240
- Field Speed = 4.95 miles per hour

Calibrating Handsprayers. The goal of calibration is to ensure that the output (GPA) of a sprayer equals the output which is recommended on the pesticide product label. The 128th-acre shortcut method can be used for calibrating a backpack sprayer.

1) Measure an 18 ½ ft. x 18 ½ ft. area which represents a 128th-acre.

2) Fill the backpack sprayer with water and increase pressure in the tank to a level that will be consistently maintained while spraying.

3) Time how long it takes to spray this 128th-acre area with water at a constant speed and pressure (Note: Ensure uniform coverage without dripping). Repeat three times and calculate the average time required (Example: 92 seconds to spray 128th-acre).

4) Spray into a measuring container for that amount of time. The number of ounces collected can be converted directly to GPA (Example: Collected 40 ounces from nozzle in 92 seconds, which equals 40 GPA).

Inaccurate calibration is often caused by not maintaining a consistent spray routine that is identical to the actual spray situation. It may be necessary to calibrate your sprayer while walking backwards, as walking backwards while spraying pesticides will minimize exposure. Always remember to keep pressure as even as possible while using gentle arcing patterns.

Calibration of Boom Sprayers. Accurate calibration of boom sprayers is a combination of assessing uniform nozzle flow and determining the output rate of your sprayer. You should always start with checking all nozzles on spray boom for uniformity.

Step 1. Nozzles may be worn or damaged, preventing uniform spray coverage. All nozzles across a boom need to be applying the same amount of liquid within a certain error range (usually 10% on either side of average). Clean and/or replace any nozzles that fall outside of the error range. When assessing nozzle uniformity follow these steps:

- Collect water from each nozzle for one minute. Measure volume.
- Determine average nozzle output.
- Determine the acceptable error range (usually within 10%).
- Replace or clean nozzles outside of 10% range and re-test.

Step 2. Determine the output of your boom sprayer using the shortcut method. With this method, one ounce discharge per nozzle equals one gallon per acre output. Preset course lengths must be obtained by comparing your nozzle spacing with Table 2.

Table 2. Defined course lengths.

Nozzle Spacing or Band Width	Course Length (ft.)
18”	227
20”	204
30”	136
36”	113
40”	102

If you have another nozzle width, use this formula to determine course length:

340.3 / nozzle spacing in feet.

➤ Example for 18” spaced nozzles: 340.3 / 1.5 ft = 227 ft

a) Define course length (example: 20” nozzle spacing = 204’ course length)

b) Travel course while timing at speed you will be spraying. Conduct the test 2 – 3 times and take the average time (example: traveled 204’ in 30 seconds)

c) Collect liquid from one nozzle for that amount of time (collected 30 ounces from one nozzle in 30 seconds).

d) Determine GPA. Ounces of liquid collected = Gallons Per Acre (example: 30 ounces = 30 GPA)

Adjusting your GPA. An applicator may adjust the output of the sprayer by adjusting spray speed or pressure. Doubling spray speed will decrease the output of the sprayer by ½, while decreasing spray speed will increase output of sprayer. Pressure may be adjusted to fine-tune your calibration. Nozzles can only operate between recommended pressure ranges. See the nozzle manufacturer guidelines for ideal pressure ranges for your nozzles.

Proper Tank Mixing. Once calibrated it is necessary to determine amount of solution to mix, amount of pesticide product to add to tank and area you can cover. You can also use the conversion chart to aid in tank mixing (Table 3).

Step 1. Use this formula to determine the amount of acres to cover with your tank.

➤ Sprayable Acres = Gallons in Tank ÷ Gallons Per Acre (GPA)

Step 2. To determine the amount of spray solution needed in tank, an applicator should multiply the output of the sprayer (GPA) by the number of acres to spray.

➤ Spray Solution Needed in Gallons = Gallons Per Acre (GPA) x Acres

Step 3. The amount of pesticide product (per gallon of solution) to add to the tank can be determined by dividing the recommended rate (must be in acres) by the output of your sprayer.

$$\textbf{Amount of Pesticide Product to add per Gallon of Solution} = \frac{\textbf{Product Label Recommendation (per acre)}}{\textbf{GPA (Gallons Per Acre)}}$$

➤ For example: Your product label recommends a rate of 8 oz / acre and your sprayer was calibrated at 20 GPA. 8 oz / 20 GPA = 0.4 ounces pesticide product per gallon solution. If you have a 5-gallon tank multiply 5 x .4 ounces. Add 2 ounces of pesticide product to the 5-gallon tank..

Reference Materials

Applicators can access the ‘MSU Calibration PocketGuides’ which can fit easily into an applicator’s wallet. These guides contain more detail regarding the shortcut methods for calibrating hand, boom and broadjet sprayers. Contact MSU Extension Publications at 406-994-3273 to order hard copies, or go online to the MSU Pesticide Education website at www.pesticides.montana.edu and select Reference Materials.

Table 3. Useful conversion factors.

Multiply	By	To Get
Acres	43,560	Square Feet
Cups	8	Ounces
Gallons	128	Ounces
Grams	.001	Kilograms
Grams	0.035	Ounces
Hectares	2.47	Acres
Kilograms	2.205	Pounds
Liters	.264	Gallons
Meters	3.28	Feet
Miles / Hour	88	Feet / Minute
Ounces	2	Tablespoons
Pints	.125	Gallons
Pints	16	Liquid (oz)
Pounds	16	Ounces
Pounds	453.6	Grams
Quarts	32	Ounces
Tablespoon	0.5	Ounces

Pest Management Tool-kit

From JANE MANGOLD:
Find publications and tools for land managers and high school/university curriculum about Ecologically-Based Invasive Plant Management (EBIPM) at http://www.ebipm.org/. The project is sponsored by USDA-ARS, Eastern Oregon Agricultural Research Center.

Interested in receiving the monthly Weed Post, a 2-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 FABIAN MENALLED:
Crops and weeds field day, July 18. Since 2004, the Dept. of Land Resources and Environmental Science organizes and coordinates the Annual Crop and Weed Field Day at the MSU Arthur Post Experimental Farm, located 7 mi. west of Bozeman. Research and demonstration plots of weed management techniques, pesticide application strategies, nutrient dynamics, cropping systems, and crop traits are open with faculty, staff, and students 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 July 18 date and contact Fabian Menalled (menalled@montana.edu) with questions.

From CECIL THARP:
Corvalis. May 19. 6 private applicator credits. Ravalli County Private Applicator Training. This 6-hr course is designed to train and certify individuals as private applicators. For information, contact the Ravalli County Extension Office at (406) 375-6611 or see online agenda at www.pesticides.montana.edu and select 'private applicator program.'

Ekalaka and Baker. May 23. 4 private applicator credits. Fallon/Carter County Private Applicator Trainings. These 4-hr private applicator courses deliver trainings on best spray practices, equipment selection, noxious weeds and recordkeeping. For information, contact the Fallon/Carter County Extension Office at (406)778-7110 or see online agenda at www.pesticides.montana.edu and select 'private applicator program.'

Non-target Plant Toxicity around the Home and Garden Website: navigate to www.pesticides.montana.edu by selecting the 'Non-target Plant Toxicity around the Home and Garden' weblink. Use this website to aid in identifying non-target pesticide injury.

From MARY BURROWS:
If you're interested in learning more about invasive species and potentially being that person who finds one first (!), take First Detector Training at http://firstdetector.org. Most first detections are made by those in the field, so keep your eyes sharp and learn how to submit a good sample to the diagnostic lab, especially if anything looks out of the ordinary.

To learn more about insects or if you need training materials for entomology, the First Detector Entomology Training Project is still in development, but content will be made available in three formats: wiki pages, scripted presentations, and e-learning modules. Wiki pages have been deployed first and can be accessed at http://wiki.bugwood.org/FD-ENT

The MSU Urban IPM Program sends out a newsletter twice a month in spring, summer and fall with topical information on pests in the landscape. You must have an e-mail account to receive the newsletter. Sign up on the Urban IPM website – www.urbanipm.org – by entering your e-mail address in the subscription area on the right center of the screen. A link to the archive with issues from last year are in the left navigation bar. The newsletter focuses primarily on plant pests. Contact Linnea Skoglund (urbanipm@montana.edu) with question and suggestions.

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

Send your questions or suggestions to:

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If you wish to have the Montana IPM Bulletin emailed to you for free, contact the MSU Pesticide Education Program office: ctharp@montana.edu.