

Wisconsin Crop Manager

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Online copy available at <http://ipcm.wisc.edu/wcm>

then it may be cost effective to irrigate only in dry years. In lieu of irrigation equipment, crop insurance would be the next best investment this year. The accompanying references will help in making that determination.

<http://www.wcc.nrcs.usda.gov/nrcsirrig/irrig-handbooks-part652-chapter11.html>

<http://www.ag.ndsu.edu/pubs/ageng/irrigate/ae92w.htm>

<http://www.agf.gov.bc.ca/resmgmt/publist/500series/580000-3.pdf>

Frost Impact on Corn at Early Growth Stages

Joe Lauer, UW Agronomy

Over the last couple of mornings (May 17 and 18) a light frost hit much of Wisconsin. Farmers are reporting frost damage to corn and other crops over widespread areas in northern Wisconsin and scattered low spots further south. Most corn growth stages are between just planted to V2-V3 (Ritchie et al., 1993). Farmers and agronomists usually do not worry about frost at these early stages of development. Early frost can have an impact on grain yield, but the trade-off between planting date impact on yield is greater than for frost damage impact on yield. Delayed planting further impacts profitability due to greater moisture and consequential drying costs.

Experiments were conducted in 2001, 2002, 2003, 2004, and 2005 to measure the impact of early defoliation on corn grain yield. Clipping treatments were applied at V2, V4 and V6. Clipping treatments consisted of cutting the plant at ground level with a scissors. Plants in the control treatment were not clipped. In another treatment, all plants in the plot were clipped. In another set of treatments, half of the plants were clipped in 2-, 4-, and 8-plant patterns. For example in the 2-plant pattern, the first 2 plants in the row were not clipped, the next 2 plants were clipped at ground level, the next 2 plants were not clipped, and so on.

Although these treatments do not fully simulate the light frost damage that recently occurred on corn over the last couple of evenings, they do provide some guidance on what a hard frost might do that completely defoliates the plant without killing it. Figure 1 describes the impact of complete defoliation on corn grain yield at the V2 stage of development. When all plants were clipped, grain yield

The decision to irrigate - Irrigation Economics

Scott Sanford, John Panuska, UW Biological Systems Engineering

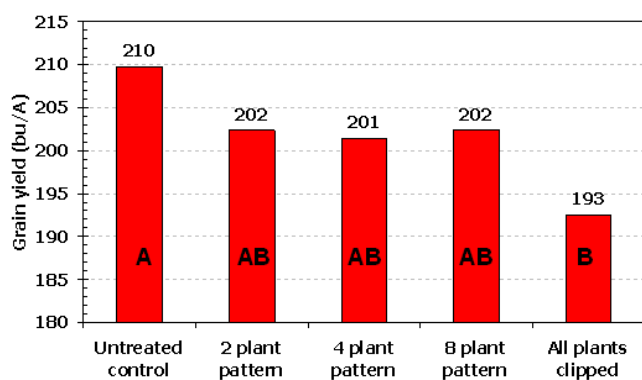
Given that some regions of Wisconsin (notably northern) have not received adequate rainfall thus far, questions on irrigation may arise. Included below are some helpful references for you and/or your clients to consult when considering the purchase of irrigation equipment.

The purchase of an irrigation system should be considered a long term investment/practice that increases the net farm income over dryland production. In Wisconsin, irrigation will be the most cost effective (higher return on investment) for high value crops (i.e. vegetable crops, fruits, seed). If a client has access to low cost equipment, has a water source and is growing a relatively high value crop,

decreased 17 bu/A from 210 to 193 bu/A (8%). When half of the plants were clipped in various patterns, grain yield was not affected; the trend was a decrease of 8 to 9 bu/A (4%).

These data indicate that frost early in development has relatively little impact on corn grain yield. If all of the leaves are removed from every plant in the field at the V2 stage of development and plants are not killed, then the expectation is that grain yield would decrease up to 8%. If the recent frosts were hard enough to kill plants then use the publication [UWEX 3353](#) for guidance on whether or not to keep a stand and what to look for when assessing plant health.

Figure 1. Impact of clipping corn leaves at V2. Experiments were conducted in 2001, 2002, 2003, 2004, and 2005 at Arlington, WI. Treatments consisted of clipping at ground level (or not clipping) consecutive plants in 2-, 4-, 8-, and all-plant patterns.



Further Reading

Carter, P.R. 1995. [Late-Spring Frost and Postfrost Clipping Effects on Corn Growth and Yield](#). Journal of Production Agriculture 8:203-209.

Lauer, J.G. 1997. [Corn replant / late-plant decisions in Wisconsin](#). University of Wisconsin Extension. Bulletin A3353.

Ritchie, S. W., J. J. Hanway, and G. O. Benson. 1993. [How a corn plant develops](#). Iowa State University CES 21.

Frost Damage and Crop Insurance Replant Provisions for Wisconsin Farmers

Paul Mitchell - Agricultural and Applied Economics, UW Madison/Extension

The nights this spring have been cool, with light frosts occurring in many parts of Wisconsin. Farmers have reported frost damage to corn and other crops over widespread areas in northern Wisconsin and for scattered low spots in areas further south. Farmers who bought federal crop insurance coverage such as actual production history (APH) or crop revenue coverage (CRC) have replant coverage as part of their policy (unless they bought catastrophic coverage only). This short bulletin overviews this replant coverage,

focusing on corn and soybeans. Remember, if you have questions, always contact your crop insurance agent.

Replant Provisions

If a crop stand is damaged early in the season so that the projected yield is less than 90% of the APH yield guarantee, a farmer can receive an indemnity for part of the actual cost of replanting (you must actually replant, not just accept the payment). The affected area must exceed 20 acres or 20% of the unit's acreage. The maximum indemnity is the chosen price election multiplied by 20% of the yield guarantee, up to 8 bu for corn, 3 bu for soybeans and 1 ton for corn silage. For 2007, the maximum price elections available for corn was \$3.50/bu, \$7.00/bu for soybeans, and \$25/ton for corn silage. Thus, the maximum replant payment an insured farmer can receive is \$28/ac for corn, \$21/ac for soybeans, and \$25/ac for corn silage. Farmers will not receive these maximums if they have low yield guarantees or did not choose the maximum price election.

The replanted crop has the same production guarantee as for the original plant date (i.e., no reduction for late planting is imposed). Note that the replant option is not available for all policies or crops, so contact your crop insurance agent for clarification. For example, farmers with only catastrophic coverage are not eligible for replant provisions for many crops. Similarly, farmers with GRP or GRIP coverage do not have replant provisions.

Farmer Options with Early Season Frost Damage

If a farmer's insured crop with replant coverage is severely damaged by an early season frost (or hail, wind, floods, or other natural events), the farmer has several options.

- Leave the damaged crop as it is and collect an indemnity if the harvested yield is less than the yield guarantee.
- Replant the same crop and receive an indemnity for all or some of the actual replant costs.
- Plant a different crop after release by the crop insurance company and receive an indemnity for the first crop, plus possibly continue insurance coverage on the second crop.
- Abandon the acres, or plant a cover crop.

Examples below help clarify issues for each these options, as each has different consequences for crop insurance coverage. Remember, contact your crop insurance agent if you have frost damage. Your agent can assess whether a loss adjustment is needed and then you can work with your agent to fully understand your insurance options and the consequences of your choices.

Example Frost Damage

Suppose a 200 acre unit of corn for grain has an APH yield guarantee of 100 bu/ac x 200 ac = 20,000 bu with a \$3.50/bu price election. All acres were planted before May 31, but a frost reduces the stand to less than 10,000 plants/ac on 80 acres of the unit.

Leaving the Crop until Harvest

The farmer can leave the crop until harvest and collect an indemnity then if the harvested yield is less than the unit's yield guarantee. In this case, suppose the 120 acres of undamaged corn yields 130 bu/ac while the frost damaged corn yields 30 bu/ac. The harvested yield is 120 ac x 130 bu/ac = 15,600 bu, plus 80 ac x 30 bu/ac = 2,400 bu, so that the unit's harvested yield is 15,600 + 2,400 = 18,000 bu, which is 2,000 bu below the yield guarantee, thus triggering an indemnity payment of 2,000 bu x \$3.50/bu = \$7,000.

Replanting to Corn

The farmer can replant the 80 acres damaged by frost to corn and keep the 100 bu/ac yield guarantee, even if the corn is planted after May 31, and receive an indemnity of \$2,240 (8 bu/ac x \$3.50/bu price election x 80 acres), or his actual cost of replanting, which ever is lower. Regular insurance coverage continues after replanting, so that the farmer will review in indemnity if the unit's harvested yield falls below the 20,000 bu. In this case, suppose the 120 acres of undamaged corn yields 130 bu/ac while the replanted corn yields 110 bu/ac. The harvested yield is 120 ac x 130 bu/ac = 15,600 bu, plus 80 ac x 110 bu/ac = 8,800 bu, so that the unit's harvested yield is 15,600 + 8,800 = 24,400 bu, which does not trigger an indemnity.

Note that replanted corn can be insured as corn for grain and then later used for silage, and the farmer will still receive an indemnity grain yield loss if an indemnity is due. If a farmer wants the option to use the replanted corn acres for silage, it will likely be better to continue to insure the replanted acres as corn for grain, since the yield guarantee will not be reduced. Then, late in the summer, the farmer can decide if using the replanted acres for silage would be better than waiting to harvest it as grain. The most important point to remember is that you must communicate with your crop insurance agent before chopping the corn. See "Drought and Alternative Uses of Insured Crops: Can I Chop My Insured Corn for Silage?" listed below which explains more about alternative uses of insured crops.

Replant to a Different Crop

The farmer can replant the 80 acres damaged by frost to a different crop such as soybeans. Before replanting, be sure to contact your crop insurance agent, as the company must release the corn acres. An insurance adjustor will then determine your yield loss for your frost damaged corn. Also, late planting rules apply, so that the yield guarantee may be reduced for the second crop (for more information see "Late and Prevented Planting Coverage and Replant Provisions for Wisconsin Farmers" listed below).

Insurance coverage becomes more complex depending on whether the second crop is insured. If the second crop is insured, the farmer receives 35% of any indemnity immediately due for the loss on the first crop, and at harvest, receives the larger of the remaining 65% of the indemnity due for the first crop and any indemnity due for the second crop. If the second crop is uninsured, the farmer gets 100% of any indemnity immediately due for the first crop. The farmer

is refunded 65% of the premium paid if only the 35% indemnity is received, but pays both premiums if 100% of the indemnity is received for the first crop. Also, rules apply for how the replanted acreage affects the unit's yield history. For additional information, see "Delayed and Prevented Planting Provisions" listed below.

Abandon the Acres

The frost damaged acres can be abandoned, which from the perspective of the crop insurance policy, is defined as prevented planting. The farmer receives the prevented planting indemnity, which is 60% of the original yield guarantee (more if higher prevented planting coverage was purchased). Several rules apply to abandoned crop land, so contact your crop insurance agent before using such acreage any purpose, or you may forfeit part or all of any indemnities you receive. No second crop can be planted on the abandoned acres, including crops for use as forage, nor can the land be grazed until a specific date, though a cover crop can be planted.

Conclusion

Wisconsin farmers suffering extensive frost damage to their crop this spring have several options available. This bulletin provides a quick overview of these options and is not meant to be exhaustive or have all the intricacies completely explained and defined. The most important advice for farmers suffering extensive frost damage is to communicate with a well-trained crop insurance agent to fully understand your options and the consequences of your decisions.

Early-Season Weeds in Corn

Chris Boerboom, Dave Stoltenberg, and Melinda Markham; Ext. Weed Scientist, Weed Scientist, and MS Graduate Research Assistant, respectively

Postemergence herbicide programs in corn should make growers and agronomists think hard about the question of "When does weed competition start to affect corn yield potential?" A few bushels lost to weed competition can easily result in a \$10/a or \$15/a loss or more. Certainly, this is enough money to be concerned about. Of course, the answer to the question varies depending on the weed species, their density, and their size. Based on years of field trials, our rule of thumb is that weeds need to be controlled before they exceed 4 inches in height or by the time corn is about the V3 (3-collar) stage to prevent significant yield loss.

It is interesting that there is a debate on what factor is primarily responsible for corn's yield loss from this early-season competition. Is it competition for water, nutrients, or light? Competition for water as a primary factor certainly seems reasonable in dry springs or on coarse soil, but competition for water seems less important on medium soils in seasons with average rainfall in Wisconsin. Competition for nutrients most likely would relate to nitrogen. Do 4-inch tall weeds remove a significant amount of nitrogen to affect corn growth? We (Laboski and Boerboom) are in the second year of trials to answer this question. The third option is competition for light. Early in the season, it seems unlikely

that corn is truly in competition for light because the corn is typically taller than most weeds.

However, another mechanism might be affecting corn growth and competition with weeds. Plants can detect if other plants are growing nearby because the spectrum of light changes. Light reflecting off plants has more far-red light and less red light, so the ratio of red to far-red (R:FR) light decreases. One hypothesis is that corn detects the presence of weeds when the light spectrum changes and then corn growth shifts to more shoot growth at expense of root growth. Over time this would limit corn's yield potential if true.

We (Stoltenberg and Markham) field tested this idea during the past two summers by measuring corn growth and yield when grown with "normal" light conditions (weed-free corn) and low R:FR light (simulated weed competition). Weed-free corn was grown at 22,000 plants/a for the normal light treatment (Figure 1). For the low R:FR light treatment, corn was grown at 44,000 plants/a which simulated the light spectrum associated with weed competition,(Figure 2). Plots were irrigated and fertilized so that these factors would not limit corn growth. When corn plants started to shade each other at V6-7 in the low R:FR (high density) treatment, one-half of the corn stand was removed so both treatments had the same plant density and spacing for the rest of the season.



Figure 1. Corn grown at 22,000 plants/a without weeds.



Figure 2. Corn grown at 44,000 plants/a to simulate the light conditions of weed competition.

The amount of sunlight, soil moisture, and soil nitrogen were similar between the normal and low R:FR light treatments through the V6-7 growth stage. However, the higher density of corn shifted the light spectrum such that the R:FR ratio was about 50% lower than the normal light treatment by V6-7. In other words, the extra corn plants changed the light spectrum to simulate weed competition.

Did the corn's growth differ because of the shifted light spectrum? For 18 characteristics that included early-season leaf, shoot, and root growth, corn did not differ between the normal or low R:FR light conditions in 2005 (only a few of these results are shown in Table 1). In 2006, corn plants in the low R:FR conditions (the simulated weed competition treatment) were taller, had longer leaves, and had less tillers than corn plants in normal light conditions. The root-to-shoot ratio did not differ between the light quality treatments in either year, which means the corn did not shift its growth to the shoot at the expense of root growth. Hand-harvested corn grain yield was also similar between these treatments in each year.

Table 1. Effect of normal (control) and low R:FR light spectrums on early- and late-season corn growth.

	2005		2006	
	Control	Low R:FR	Control	Low R:FR
Early-Season				
Extended plant height (cm)	77.0	76.4	86.5	95.1*
Stalk length (cm)	19.5	19.1	22.9	26.7*
Longest leaf (cm)	59.6	57.2	57.5	60.6*
Tiller weight (g)	--a	--	0.12	0.014*
Shoot weight (g)	11.0	9.3	2.9	3.2
Root:shoot ratio (g/g)a	0.20	0.19	0.51	0.47
Late-Season				
Grain yield (bu/a)	--	255	243	250

Some of the previous research to determine the effects of light spectrum (R:FR) on corn growth has been conducted under controlled conditions such as in growth chambers. However, the results from these Wisconsin field experiments suggest that the effect of early-season light quality had little effect on early corn growth and no effect on corn grain yield.

Is light quality a critical factor affecting corn growth and a significant component of early-season weed's interaction with corn? Perhaps not. A simple answer would be nice to explain and predict weed competition. However, the interactions between the weeds and the corn are probably more complex and may be driven by a mixture of water, nutrient, and light factors.

Labeled Stages for Postemergence Herbicides in Corn

Chris Boerboom, Extension Weed Scientist

In regards to postemergence herbicides in corn, I think three simple rules capture most of what needs to be said.

Three rules for postemergence herbicide applications in corn

1. Spray early to minimize the potential for yield loss from early-season weed competition.
2. Spray at the correct growth stage to reduce the risk of injuring the corn (see table below).
3. Do not spray under windy conditions when drift may damage neighboring crops or properties.

More information about current research related to early-season weed competition can be found in the article “Early-Season Weeds in Corn”, which is printed in this issue.

In the chart below, “V” refers to “V-stage”, which describes the number of leaf collars on a corn plant. The leaf collar is region where the leaf blade joins the leaf sheath, which wraps around the stalk. In Figure 1 below, this corn plant has 3 leaf collars (and 3 fully emerged leaves) and is called a V3 corn plant.

Herbicide	Corn stage
Accent	0-20" or V6; to 36" or V10 with drop nozzles
Accent Gold WDG	0-12" or V5
Acetochlor (Harness, etc.)	0-11"
Aim	0-V14
Atrazine	0-12"
Basagran	no restriction
Basis	0-V2
Beacon	4-20" or V6; to tasseling with drop nozzles
Bicep Lite II	0-5"
Magnum	
Buctril	4 leaf to before tasseling
Callisto	0-30" or V8
Camix	0-30" or V8
Celebrity Plus	4-24" or V6
Define	0-V5
Dicamba (Clarity, etc.)	0-8" or 5 leaf; to 36" with drop nozzles
Dimethenamid (Outlook, etc.)	0-12"
Distinct	4-24"; 24-36" with drop nozzles
Glyphosate (Roundup, etc.)	0-30" or V8
G-Max Lite	0-12"
Hornet WDG	0-20" or V6; 20-36" with drop nozzles if harvested for grain
Impact	emergence to 45 days before harvest
Liberty	0-24" or V7; 24-36" with drop nozzles
Lightning	0-20" or V6
Lumax	0-12"
Marksman	0-8" or 5 leaf
Metolachor (Dual II Magnum, etc)	0-40"
NorthStar	4-20" or V2 -V6; to 36" with drop nozzles
Option	V1-V6; to V7 with drop nozzles

Pendimethalin (Prowl, etc.)	0-30" or V8
Permit	0-36"
Priority	0-V8
Resolve	0-12" or V5
Resource	V2-V10
Shotgun	0-8"; to 12" with drop nozzles
Status	4-36" or V2 to V10
Steadfast	0-20" or V6
Steadfast ATZ	0-12"
Stinger	0-24"
Stout	0-16" or V5
Yukon	0-36"
2,4-D	0-8"; to before tasseling with drop nozzles

Figure 1. V3 corn plant.



Hill Mustard, an invasive mustard on the move in Southwestern Wisconsin

Mark J Renz and Jerry D Doll, UW Agronomy

A new invasive mustard called Hill mustard has recently been observed spreading throughout the southern part of the state. Attached to the end of this WCM issue is a factsheet that discusses this species and provides characteristics and pictures to help with identification. Also, the factsheet is online at the following link.

[Hill Mustard Fact Sheet MR.pdf](#)

Key traits to help differentiate it from other mustards are its robust yellow flowers (should be flowering right now) and “warty bumps” on the stems.

If you think you have an infestation of Hill mustard, please contact us as we will be mapping its presence throughout the state this June.

Bean Leaf Beetles are Active, Scout Emerging Soybeans

Eileen Cullen, Extension Entomologist, UW-Madison Entomology Department

Bean leaf beetles have begun to emerge in the region. Bean leaf beetles overwinter as adults beneath leaf litter. In early spring, adults feed on cultivated (alfalfa) and wild (e.g. showy tick trefoil) legumes. As soybean seedlings emerge, beetles move into soybean fields to continue feeding and lay eggs.

Marlin Rice, Iowa State University Field Crop Extension Entomologist reported in the Iowa ICM newsletter overwintered bean leaf beetle mortality estimates from 88-92% in northern Iowa, to about 60% in southern Iowa <http://www.ipm.iastate.edu/ipm/icm/2007/4-30/blbpop.html>.

In Wisconsin, winter mortality rates were calculated by the WI DATCP Pest Survey using two bean leaf beetle winter survival predictive models; the University of Minnesota model and the Iowa State University model. The models were run for 12 Wisconsin localities including Arlington, Hancock, Spring Green, Beloit, La Crosse, Milwaukee, Boscobel, Green Bay, Madison, Eau Claire, Wausau and Rhinelander. Winter mortality estimates ranged from 36-60% using the UMN model, and 60-100% using the ISU model (Wisconsin Pest Bulletin 52(5) May 11, 2007 <http://pestbulletin.wi.gov/>).

Once soybeans begin to emerge in an area, bean leaf beetles will quickly leave alfalfa fields and other alternate hosts and concentrate on soybean. Fields planted earliest in an area are most at risk for high populations of the beetle. Concentrate initial scouting in these early-planted fields.

Bean leaf beetles feed on young, new tissue and can cause noticeable defoliation on seedlings. Fortunately, soybean plants are quite resilient in terms of the amount of defoliation that is tolerated: up to 40 per cent leaf area defoliation in the vegetative stages. Therefore, feeding by overwintered and first-generation beetles on soybean leaves seldom results in economic yield losses because the seedlings often recover. Monitor bean leaf beetle populations and defoliation levels, and make sure the cotyledons and growing point are still intact and developing well. Adults of the first generation of bean leaf beetles will show up in the summer after the current batch of beetles lays its eggs and the insects develop through larval and pupal stages. (Bean leaf beetle larval development on soybean roots is not of economic concern).

Bean leaf beetles tend to drop quickly to the ground from seedling soybeans when disturbed. Approach plants carefully and look on the soil around seedlings for beetles that may have dropped off the plant. Count these beetles in your sample number as well as those found on the plant. Examining plants by hand is the easiest method for seedling soybeans.

Remember to scout in several areas of a given field to obtain a representative assessment of bean leaf beetle density for the field. A few high counts are offset when several areas of a field are not infested, lowering the average number of

beetles per plant. There's no need to treat an entire field if the field average of bean leaf beetles is lower than published thresholds.

University of Nebraska recommendations suggest a density of 16 adults per foot of row in the early seedling stage before economic injury from physical feeding will occur. By the V2 stage, 39 beetles per row foot are required before economic injury will occur. Examine 5 feet of row in each of five locations throughout the field. Divide the total number of beetles found by 25 to estimate the number per foot of row.

Alternatively, you can calculate the average number of beetles/plant from the five sampled areas in the field. ISU entomologist Marlin Rice has developed a table of dynamic early-season bean leaf beetle economic thresholds in soybean that incorporate crop value and treatment cost. Between VC and V2 growth stages, thresholds range between 2.0 and 10.7 beetles/plant depending on crop growth stage, crop value and insecticide treatment cost. Consult table 3-5 on p. 115 of UWEX Publication A3646 Pest Management in Wisconsin Field Crops to match your scouting information with numbers in the ISU table. Beetles/plant may be multiplied by 7.6 to obtain beetles per foot of row. More information on bean leaf beetle and insecticides registered for their control can also be found in UWEX Publication A3646, See Table 3-71, p. 121.

<http://learningstore.uwex.edu/Pest-Management-in-Wisconsin-Field-Crops2007-P155C31.aspx>

Bean leaf beetles are capable of transmitting a soybean virus called bean pod mottle virus (BPMV). While BPMV transmission can occur at any stage, early infection in the VC to V2 stage poses the greatest risk of yield loss. Field history of virus problems is an important indicator of whether BPMV may present a problem due to bean leaf beetle feeding.

Researchers at Iowa State University have constructed a flowchart to help growers with insect/virus management decisions. To view the chart in the article titled "Revisiting an integrated approach to bean leaf beetle and bean pod mottle virus management" please visit the ISU Integrated Crop Management newsletter, March 26, 2007 issue at <http://www.ipm.iastate.edu/ipm/icm/2007/3-26/beanleafbeetle.html>



Bean leaf beetle, tan.



Flowers have bright yellow petals, and are very fragrant and are borne on dense racemes.

Fruits are ovate, irregularly warty, 0.25 to 0.4 inches long, contain 2 to 4 seeds, and are borne on stalks about 0.5 inch long.

Taproots on older plants are at least 1 inch in diameter and appear in clusters of multiple thick roots. The central part of the root is often partially rotted away

Seedlings have long to oval cotyledons up to 1 inch long. The first true leaves are round to ovate and entire. Subsequent leaves on seedling plants are arranged in a rosette, are slightly toothed, become very long and have a rough feel and prominent veins.



Similar species: Hill mustard resembles yellow rocket but is easily distinguished by its leaf shape, stem texture, height and fruits. Leaves of yellow rocket do not have pointed lobes and are hairless unlike hill mustard which has toothed and hairy leaves. Yellow rocket stems never have the warty bumps found on hill mustard. Additionally, yellow rocket tends to be shorter and flower before hill mustard. The fruits of the two species are also quite distinct with yellow rocket forming a narrow pod with many very small seeds while hill mustard has tear-shaped pods with few seeds.

Biology: Hill Mustard is described as having either a biennial or perennial life cycle, but observations in Wisconsin suggest most plants behave as perennials. This plant is considered an aggressive invader in Central Europe (Steinlein et al., 1996). Researchers in this region believe its successfulness is due to its ability to establish rapidly and displace desired native species (Dietz et al., 1996). Adult plants can survive for many years, but populations appear to spread from seed as young seedlings are observed the following year along the leading edge of the infestation near parent plants (Dietz, 2002).

Control: Few methods on managing this plant have been tested. Mechanical methods are effective at preventing seed production if plants are mowed before seeds are produced. As soon as yellow flowers are seen, plants must be cut to prevent seed production. Additional mowing should be done if plants resprout and flower later in the summer. We do not know if repeated mowing will kill established plants but mowing will prevent the introduction of additional propagules to enhance spread of this species.

Tillage can dislodge the roots of hill mustard from the soil. No information is available as to how effective tillage alone is at managing this plant, but observations indicate that additional management methods will be required to effectively control this species. Establishment of

desired vegetation after tillage is essential as hill mustard plants maintain a large seed bank from which plants can establish. It is expected that desirable vegetation that is appropriate for the area will compete with hill mustard and reduce its dominance.

Herbicides are currently being evaluated on hill mustard populations within Wisconsin. Preliminary results suggest that this plant is sensitive to glyphosate, 2,4-D and metsulfuron, but more information about long-term control is required. Due to the large seedbank any management practices should include the establishment of desirable plants that will allow for selective management of this plant for several years.

References

Dietz, H. 2002. Plant invasion patches – reconstruction pattern and process by means of herbchronology. *Biological Invasion* 4: 211-222.

Dietz, H., T. Steinlein, P., Winterhalter, and I. Ullmann. 1996. Role of allelopathy as a possible factor associated with the rising dominance of *Bunias orientalis* L. (Brassicaceae) in some native plant assemblages. *J. Chem. Ecology*. 22: 1797-1811.

Steinlein, T., Dietz, H., and I Ullmann. 1996. Growth patterns of the alien perennial *Bunias orientalis* L. (Brassicaceae) underlying its rising dominance in some native plant assemblages. *Vegatio* 125: 73-82