



Weed Management in Row Crops

Application to Corn Production

By Mark VanGessel

Overview

This module focuses on managing weeds after both corn and weeds have emerged, but these concepts will generally apply to other grain crops. Please bear in mind: weed control involves complex factors, and many biological processes come into play. Our ability to predict the outcome of weed/crop interactions will improve as researchers continue to study the interaction of weeds and their environments. With this module we introduce people to some basic concepts of postemergence weed management.

The worksheets (and related discussion) in Activity #1 are optional. You may elect to do one or both activities.

Concept	Activity	Handouts
Not all weeds reduce yields equally. Knowing the principles of weed competition—how different weeds affect yield loss—helps us understand whether to manage weeds—and if so, when and how.	Activity #1: Sampling for Yield Loss Estimates	A. <i>Estimated Yield Loss Worksheet</i> (and accompanying instructions)
To determine how specific weeds affect our crops, we can measure weed density and calculate the total threshold for the weed species in our field.		B. <i>Competitive Index Factor Chart</i>
Several types of weed control are effective. Understanding the factors that influence their effectiveness helps us choose between cultural, mechanical, and chemical control.		C. <i>Weed Control Rating by Species</i> (and accompanying instructions)
Many herbicides are on the market and their effectiveness depends on the situation. If herbicides are called for, it's important to choose the right ones. <i>Always consult your state's pesticide recommendations. Read and follow the label.</i>	Activity #2: Determining the Most Effective Postemergence Options	D. <i>Relative Effectiveness Table</i> E. <i>Plantback Restriction Table</i> F. <i>Height Restriction, Rainfast Intervals, and Modes of Action Table</i> G. <i>Pre-Mix / Equivalent Products</i> H. <i>Tank-Mix Partners Table</i> I. <i>Comments for Postemergence Herbicides</i>
<i>Resources</i> Penn State Field Crop IPM (under Economic Thresholds) http://www.rec.udel.edu/weed_sci/Corn_weed_book/cornweed.pdf	<i>Related Topics</i> Module 3: Principles of Scientific Sampling Module 4: What is a Threshold? Module 9: Weed Identification in Row Crops Module 13: Equipment Calibration	

Here's what you'll do:

Beforehand:

- ◆ remind the host farmer not to treat the weeds before the class.

Today, on site:

- ◆ learn how to calculate the potential for yield loss due to weeds;
- ◆ learn factors that contribute to yield loss by weeds;
- ◆ observe and discuss factors that will influence weed management choices for this season on this site.

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Weed Management in Row Crops

ACTIVITY #1: Sampling for Yield Loss Estimates

Setting	Time Required	Materials	Handouts
Early summer, in somebody's cornfield; corn at 3- to 4-collared stage. Weeds should have emerged but farmer shouldn't have treated them yet.	1 hour	Clipboards Pencils Calculators	Optional: A. Competitive Index Factor Chart B. Estimated Yield Loss Worksheet (with example sheet and accompanying instructions)

Q:	Pose a series of questions:	A:
<p><i>Mini-lecture (an analogy):</i></p> <p>Just as we know that there's an upper seeding rate for corn beyond which we lose rather than make money there is a point at which the time and money spent getting rid of weeds is no longer cost effective. We call this point our threshold. A threshold is a conservative estimate that predicts whether or not we will sustain economic losses from a pest in this case, weeds.</p> <p>We'll discuss postemergence weeds in corn. (These concepts will generally apply to other grain crops.) Please bear in mind: weed control involves complex factors, and many issues come into play. We're often dealing with many weed species at a time. This is</p>		<p>very much a work-in-progress, and is intended to introduce concepts. With time we hope to refine and improve our ability to predict yield loss from weeds.</p> <p>Many issues associated with weed thresholds are not fully understood. For example, when weeds are allowed to produce seed, aren't we creating worse problems for next year? Maybe and maybe not. For instance, seed production in weeds emerging with corn is dramatically greater than in weeds emerging after corn.</p> <p>Although our host may have done something about weeds before emergence, we're here to take a look and understand what does or doesn't need to be done, postemergence.</p>
<p>What is this cornfield being used for? What kind of farm is it on? Do these uses and locations affect how we approach weed management?</p>	<p>Examples: a dairy farmer who spreads manure that's full of weed seeds will look at weed management one way. A vegetable grower who has few herbicides available for vegetables may plant corn to clean up a field, and will look at weed management another way.</p> <p>Are there herbicide options available for next year's rotation that will control the weeds present now? This is a major consideration for the level of weed control you strive to achieve.</p>	
<p>The bottom line is, let's manage weeds before they reduce our yield. Or, if predicted losses won't exceed management costs we may not need to manage them!</p>		
<p>What do plants need to grow?</p>	<p>Plants need water, nutrients, sunlight, and carbon dioxide.</p>	
<p>What happens when many plants compete for these resources?</p>	<p>Competition for resources keeps crops from growing to their maximum potential. Availability of moisture and nutrients decreases, and shaded crops may not get enough light.</p>	
<p>Do all weeds reduce yields equally?</p>	<p>No. Some species are much more competitive than others.</p> <p>Weeds emerging with the crop are more competitive than weeds emerging after the corn. Weeds emerging 4 to 6 weeks after corn emergence (under droughty conditions, 3 to 5 weeks) have little to no impact on yield.</p>	

Q:	<i>Continue the discussion</i>	A:
What characteristics make some weed species more competitive than other?	<ul style="list-style-type: none"> ◆ germinate under wide range of environmental conditions ◆ have rapid early growth ◆ grow tall (or wide) and intercept sunlight... large leaves may shade out other plants ◆ drought and/or water-stress tolerant 	
Does it matter if we're working with either no-till or conventional tillage?	It appears that percent yield loss remains fairly constant regardless of the tillage system.	
Weed control is best done when weeds are small, but we can't always get to the weeds on time. Will timing of control have an impact on yield loss?	Yes. But the length of time it takes for weeds to reduce yield is dependent on the density of the weeds. The higher the weed density, the earlier competition will adversely effect the crop. By the time the corn plant has three collars (<i>be sure people know what this means</i>) ear shoot development is beginning. Heavy weed densities now may affect yield by interfering with reproductive development.	
Do weed densities matter if corn is grown for silage instead of grain?	Probably not. We don't have a lot of data on this, but it appears that percent loss of grain will be very similar to loss of corn silage.	
What other factors can contribute to yield loss or gain, assuming the weed density stays the same?	<ul style="list-style-type: none"> ◆ The time the plant emerges—whatever comes up first usually has the advantage. ◆ Fertility—generally weeds in good soils don't reduce yields as much as weeds in poor soils do (assuming other factors remain the same). ◆ Soil moisture—irrigation or frequent rainfall reduces competition for moisture. Situations that reduce moisture stress will result in lower yield loss from weeds. ◆ Soil type—corn in deep fine-textured soils withstands weed pressure better than corn in shallow, coarse-textured soils. ◆ Hybrid selection—some corn hybrids withstand weed competition better than others. Certain hybrids are very competitive and can suppress weed growth. Generally, hybrids that are tall with wide, horizontally positioned leaves are best at suppressing weed growth. ◆ Use of soil-applied herbicides may not have killed the weeds, but they still reduce weed vigor... making the weeds less competitive. 	
Probably you have been talking mostly about annuals. What makes perennials so competitive?	As a general rule, perennial weeds develop from underground storage organs (the root system) that allows the plants to grow vigorously early in the year.	
<i>Mention a couple more issues people need to consider about thresholds:</i>	<ul style="list-style-type: none"> ◆ <i>for anyone who also grows vegetables, you know that ease of harvest is important will weeds get in the way?</i> ◆ <i>for those who grow other row crops, the amount of foreign matter in grain is a consideration although a properly adjusted combine should eliminate most of that.</i> 	

Q:	Scouting for Weeds	A:
Under what situations might NO threshold exist?	<ul style="list-style-type: none"> ◆ If you're using corn to clean up a weed problem in the field for rotational crops; ◆ Presence of noxious weeds—some states require that you prevent weeds on the state's noxious weed list from seeding; ◆ Presence of contaminating or poisonous weeds—such as nightshade in vegetables; ◆ Perennials may spread rapidly when left unchecked—there's usually no threshold for perennials. 	
<p><i>The rest of this activity is optional.</i></p> <p><i>Divide the group into three teams. Emphasize that the principles we work on will apply to many situations.</i></p> <p><i>Tell them that they'll be doing a weed count and ask</i></p>		
How can we be sure that our sample is unbiased?	Find random starting points in the field... stay away from headlands and field margins... don't focus on the heavy spots.	
How do we determine the number of samples to take, and in how many locations?	<p><i>Actually, the number of locations per acre hasn't been determined yet. But unless this is the first time in a field, most people have some indication of the weed pressure and how uniform it may be. (Ask the host farmer to tell people something about the weed history of this field.) Part of knowing how many samples to take is based on experience with a field.</i></p> <p>While gaining experience with scouting for weeds, start with one sample every 5 or 10 acres.</p> <p>The more uniform the weed pressure, the fewer samples required.</p> <p>Sample size should be 100 square feet. Smaller sample sizes aren't representative.</p> <p>For 30-inch rows, a 40-foot-long swath between 2 rows will provide a 100-square-foot area.</p>	
Should we randomly sample the entire field? Or split it into smaller units?	If the farmer is willing to treat part of the field separately or spray borders differently than the rest of the field, scout these smaller units separately. Otherwise, scout the field as one unit.	
<p><i>Hand out the Competitive Index Factor Chart and the Estimated Yield Loss Worksheet (with accompanying example and instructions.) Then head into the field and go at it.</i></p> <p><i>(This isn't an exercise in scouting—to keep it timely, you may need to limit where participants sample.)</i></p> <p><i>Come back to the following questions and discussion:</i></p>		
Based on what we've learned, observed, and discussed—are the weeds in this field plentiful enough to justify controlling them?	<i>Discuss weed density in this field, then the options for management: the things that were (or could have been) done; things that still can be done.</i>	

Q:	Discuss methods of postemergence weed control	A:
<p>What is cultural control?</p> <p><i>After reviewing these procedures...</i></p> <p>How has our host farmer used these cultural controls?</p>	<p>Good farming practices that promote a healthy, vigorous crop canopy are all part of cultural control. They include:</p> <ul style="list-style-type: none"> ◆ seedbed preparation ◆ planting procedures ◆ seed source ◆ tillage implements that move rootstocks to the soil surface, where they dry and die 	<ul style="list-style-type: none"> ◆ choosing seed variety traits ◆ crop rotation ◆ stale seedbeds ◆ fall herbicide applications for perennials ◆ cover crops
<p>What is mechanical weed control? How has our host farmer used it?</p>	<p>Primary tillage and cultivation remain valuable methods of weed control. Rotary hoes or harrows are most effective before weed emergence.</p>	
<p>What factors influence the effectiveness of mechanical weed control?</p> <p>Which of these may have been a factor for our host?</p>	<ul style="list-style-type: none"> ◆ weeds in the row versus between the row ◆ size of weeds ◆ equipment: some (harrows) are effective only on emerging plants; worn shields and sweeps are less effective than new ones ◆ soil moisture at cultivation—the drier the soil, the better the results ◆ rain or irrigation within 24 hours encourages rerooting ◆ experience of operator ◆ larger weeds are controlled by aggressive cultivation: high speed; sweeps set close to crop rows; pitch of sweeps set to move lots of soil 	
<p>What is chemical control?</p>	<p>Spraying herbicides for postemergence weed control.</p>	
<p>What factors do you need to consider in choosing an herbicide?</p> <p><i>We'll look more closely at these factors in Activity #2.</i></p> <p>Always consult the herbicide label to be sure it is labeled for your state. Read and follow the label.</p>	<ul style="list-style-type: none"> ◆ which herbicide(s) is most effective for controlling these weeds? ◆ what's the average size of weeds? ◆ will a given herbicide choice limit crop rotations? ◆ what soil insecticide was used? <p>Some soil organophosphate (OP) insecticides can increase the potential and severity of injury from some herbicides. These ALS-inhibiting herbicides include Accent, Basis Gold, Hornet, Scorpion III, Beacon, Exceed, Permit, and others. An IMI (Clearfield) hybrid allows a greater choice of options if an OP insecticide was used.</p> <ul style="list-style-type: none"> ◆ what corn hybrid was planted? Will it allow use of Roundup Ultra, Liberty, or Lightning herbicides? ◆ is the height of the corn within the range specified for a given herbicide? ◆ how many days before harvest? Before tasselling? 	
<p>What factors influence the effectiveness of chemical control?</p>	<ul style="list-style-type: none"> ◆ actively growing weeds at time of herbicide application ◆ weeds under stress are less susceptible to herbicides ◆ sprayer should be properly calibrated and set for optimal coverage ◆ quality surfactant or crop oil concentrate used (if either is recommended) ◆ herbicide resistant weeds. Species with heavy seed production are more likely to develop resistant populations 	
<p>How can we deal with perennial weeds?</p>	<ul style="list-style-type: none"> ◆ till soil with an implement that will move rootstocks to the soil surface where they will dry and die. ◆ apply fall herbicides ◆ select the most efficacious herbicide after weeds and crop have emerged. 	

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Weed Management in Row Crops

ACTIVITY #2: Determining the Most Effective Postemergence Options

Setting	Time Required	Materials	Handouts
Early summer, in somebody's cornfield	1/2 hour	Clipboards, pencils	C. Weed Control Rating by Species (and accompanying instructions) D. Relative Effectiveness Table E. Plantback Restriction Table F. Height Restriction, Rainfast Intervals, and Modes of Action Table G. Pre-Mix / Equivalent Products H. Tank-Mix Partners Table I. Comments for Postemergence Herbicides

Q:	Pose a series of questions:	A:
<p>Although this module focuses on postemergence weed management in corn, you may follow these steps when making weed control decisions for other crops, either before or at planting. Not all herbicide options are listed here.</p>		
<p>(If you did the yield loss activity in a different field or on a different day, or skipped Activity #1, this section will bring you up to speed.)</p>	<p>Corn fields that are weed-free for the first four to six weeks after planting (under extreme droughty conditions, three to five weeks) will often yield the same as fields that are weed-free the entire season. Nor is it important to control all weeds in a field to get the maximum yield. Use either a residual soil-applied herbicide or timely, effective postemergence weed control.</p> <p>Broadleaf weed populations of 10 weeds per 10 square yards (that's 40 feet of a 30 inch row) generally cause significant loss. Weed populations of 1 weed per 10 square yards will have no impact on yield. It's not always easy to predict the effect that weed populations will have between those populations.</p>	
<p>What are the factors that influence our decision to treat a field?</p>	<p>What weeds are present in the field... crop vigor... weather conditions... herbicide cost... whether the weeds be controlled with a cultivator (or not).</p>	
<p>How do we determine which weeds to evaluate for control when selecting soil-applied herbicides?</p>	<p>Focus on weeds that required postemergence control last year in the same field, or weeds that produced seed last year.</p>	
<p>Hand out the <i>Weed Control Rating by Species</i> (with instruction sheet) and the <i>Relative Effectiveness Table</i></p>		
<p>Then ask: What weeds are in this field?</p>	<p>Using the <i>Weed Control Rating by Species</i> handout, list weed species that may reduce yield, quality, or crop quality in left-hand column.</p>	

Q:	Continue your analysis		A:
What herbicides are most effective for these weeds?	<i>Refer to the Relative Effectiveness Table to list the herbicides that rate as excellent, good to excellent, good, and fair to good for each species.</i>		
<p><i>Hand out the</i></p> <ul style="list-style-type: none"> ◆ <i>Plantback Restriction Table</i> ◆ <i>Height Restriction (and Rainfast Intervals) Table.</i> <p><i>Will one herbicide provide effective control of all weeds, or do you need more than one? Answers will vary</i></p>			
What crop will you plant in this field next year?	<i>Refer to the Plantback Restriction Table to eliminate any herbicides with plant-back restrictions for your expected crop.</i>		
If considering postemergence herbicides: how tall is your corn?	<i>Referring to the Height Restriction (Rainfast Intervals, MOA) Table, eliminate herbicides that aren't right for the height of your crop.</i>		
Was an herbicide-tolerant hybrid planted?	Roundup Ready, Liberty Link, and Clearfield hybrids offer additional options for weed management.		
Was an organophosphate insecticide used at planting?	OP insecticides can limit options for postemergence herbicides due to potential crop injury.		
<p><i>Hand out the</i></p> <ul style="list-style-type: none"> ◆ <i>Pre-Mix / Equivalent Products Table, the Tank-Mix Partners Table, and Comments for Postemergence Herbicides.</i> 			
<p><i>Now critique your Weed Control Rating by Species chart.</i></p> <p>What is the herbicide with the highest rating for all the species on your list?</p> <p>Does this herbicide provide at least GOOD control of all species present?</p> <ul style="list-style-type: none"> ◆ If not, will partial control of some species be adequate? <p><i>(For postemergence herbicides) If not, what mix of herbicides will work together?</i></p> <ul style="list-style-type: none"> ◆ Refer to the <i>Tank Mix Partners Table</i> and the <i>Pre-Mix / Equivalent Products Table</i>. ◆ Select the combination with the highest overall rating. <p><i>For the herbicides you have selected, review the Comments for Postemergence Herbicides.</i></p>			
What should we check herbicide labels for?	<ul style="list-style-type: none"> ◆ how (and how not) to apply ◆ feeding restrictions for forage or silage ◆ specific comments about performance ◆ issues related to environmental concerns ◆ ensure the herbicide is labeled for use in the state (or county) you will be applying it. 		
If more than one herbicide will perform well, what should we consider?	<p>Determine costs:</p> <ul style="list-style-type: none"> ◆ product's price ◆ number of spray applications needed 		
How can you avoid herbicide resistance?	<p>Rotate herbicides with different modes of action.</p> <p>Use mechanical and cultural controls wherever possible.</p> <p>Review http://www.plantprotection.org/HRAC/ for in-depth discussion on resistance management.</p>		

Q:	<i>Continue your analysis</i>	A:
Is crop safety an issue in herbicide selection?		Crop injury is an important consideration and all herbicides have the potential to injure the crop. But following label directions and precautions dramatically lessens the likelihood of crop injury. Crop injury can be avoided in most instances.
What can contribute to crop injury?		<p>Our herbicide rate was too high. (Excessive rates can be due to either adding too much herbicide or improper sprayer calibration.)</p> <p>We sprayed the crop when it was too large or too small.</p> <p>We used the wrong adjuvants—or excessive amounts of the right ones.</p> <p>Cool, over-cast weather with plenty of soil moisture for several days running increased the susceptibility of corn to herbicides. (Injury is even more likely if the herbicide was applied under such conditions and then the weather became sunny and hot.)</p> <p>Some herbicides (ALS-inhibiting herbicides) should not be used if an organophosphate insecticide was used at planting. These herbicides include Accent, Beacon, Exceed, Basis, Basis Gold, Scorpion III, or herbicides containing these products. Soil-applied organophosphate insecticides include Counter, Dyfonate, Lorsban, and Thimet.</p>
Does crop injury reduce yield?		It depends on a number of factors, but generally, the earlier injury occurs in the crop development, the less impact it will have on yield.
<i>Herbicides are useful in most weed management programs. They should be used to supplement, not supplant, other methods or tools.</i>		

A. Estimated Yield Loss Worksheet

Worksheet for Activity 1

Table 1: Calculate Total Competitive Load

A: Weeds Species	B: Count/Location			C: Average Count	D: Competitive Index Factor (see chart)	E: Competitive Load Value	
	1	2	3				
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					X	=	
					Total Competitive Load (TCL)* =		%

**Total competitive load value is equal to Percent Yield Loss*

Table 2: Calculate Net Gain or Loss of Treatment

1. Expected Yield Bushel / acre =		5. Expected Revenue Loss Expected Yield Loss (4) x Sales Price/bu. =	
2. Total Competitive Load (TCL) (from Table 1) =		6. Expected Treatment Cost** Herbicide/acre + Application cost = (or substitute Cultivation cost)	
3. Move decimal of TCL (2) two places to left =		7. Net Gain or Loss of Treatment Expected Revenue Loss (5) - Treatment Cost (6) =	
4. Expected Yield Loss / acre Yield (bu.) (1) x TCL (3) =			

Assume weeds and corn emerge at approximately the same time.

***Treatment costs can range from \$5.00 to \$20.00/A for herbicide (and necessary adjuvants) not including application costs. Assume \$6-8.00/A for application costs. Assume \$7.00/A for cultivation. (Local costs may vary.)*

EXAMPLE **A. Estimated Yield Loss Worksheet**
Worksheet for Activity 1

Table 1: Calculate Total Competitive Load

A: Weeds Species	B: Count/Location			C: Average Count	D: Competitive Index Factor (see chart)		E: Competitive Load Value	
	1	2	3					
Common ragweed	13	26	21	20 (low moisture)	X	0.5	=	10.0
Fall panicum	10	50	30	30 (low moisture)	X	0.125	=	3.75
					X		=	
				OR...	X		=	
Common ragweed	13	26	21	20 (high moisture)	X	0.15	=	3.0
Fall panicum	10	50	30	30 (high moisture)	X	0.06	=	1.8
					X		=	
					X		=	
					Total Competitive Load (TCL)* =			low 13.75 % high 4.8 %

*Total competitive load value is equal to Percent Yield Loss

Table 2: Calculate Net Gain or Loss of Treatment

1. Expected Yield Bushel / acre =	125 bu/A	5. Expected Revenue Loss Expected Yield Loss (4) x Sales Price/bu.	
2. Total Competitive Load (TCL) (from Table 1) =	low m. 13.75 high m. 4.8	17.188 bu/A x \$2.00 /bu =	low m. \$ 34.375 high m. \$ 12.00
3. Move decimal of TCL (2) two places to left =	low m. 0.1375 high m. 0.048	6. Expected Treatment Cost** Herbicide/acre + Application cost (or substitute Cultivation cost/acre)	20 + 6 = = \$ 26 / A
4. Expected Yield Loss / acre Yield (bu.) (1) x TCL (3)	125 x 0.1375 = low m. 17.188 bu 125 x 0.048 = high m. 6 bu	7. Net Gain or Loss of Treatment Expected Revenue Loss (5) - Treatment Cost (6)	\$ 34.375 - \$26.00 = \$8.375/A \$12.00 - \$26.00 = -\$14.00/A

Assume weeds and corn emerge at approximately the same time.

**Treatment costs can range from \$5.00 to \$20.00/A for herbicide (and necessary adjuvants) not including application costs. Assume \$6-8.00/A for application costs. Assume \$7.00/A for cultivation. (Local costs may vary.)

Instructions for *Estimated Yield Loss Worksheet*, Activity 1

Accompanying your Estimated Yield Loss Worksheet is the Competitive Index Factor Chart. Refer to it in filling out your worksheet.

<p>1.</p> <p>Count the number of weeds, by species, in 40 feet of corn row (from row to row) for corn planted in 30 inch rows. (Adjust for row width if necessary.) Do this in three different locations in your field. <i>Remember to eliminate bias.</i> (Avoid field margins, headlands, and bad spots; “randomize” your sample.)</p>	<p>2.</p> <p>Enter your counts in <i>Estimated Yield Loss Worksheet: Table 1: Calculate Total Competitive Load</i>. Write the names of weeds in Column A and your count for each location (1, 2, and 3) in Column B. Then calculate the average number for each species in Column C.</p>
<p>3.</p> <p>Refer to the <i>Competitive Index Factor Chart</i> and enter the correct value for each weed species in Column D.</p> <p><i>Remember that soil type can make a big difference in how competitive weeds are. Notice that the chart lists two different factors for coarse-textured/shallow vs. fine-textured/deep soils. Choose the factor that best describes your soil.</i></p>	<p>4.</p> <p>Multiply Column C by Column D—and put the result in Column E. Now you’ve got the “Competitive Load Value”—the amount of competition your crop is up against from each weed species on your list.</p>
<p>5.</p> <p>Add all the figures in Column E. This is the Total Competitive Load (TCL)—which also happens to be your anticipated percent yield loss from the weeds in that field.</p>	<p>6.</p> <p>Now take a look at <i>Table 2: Calculate Net Gain or Loss of Treatment</i>. Just...</p> <p>(1) plug in your host s anticipated yield (2) pull down your figure for TCL (3) convert to the decimal (4) multiply to get the losses anticipated from such a competitive loss, then</p>
<p>7.</p> <p>... calculate Expected Revenue Loss (5) by multiplying the number of bushels per acre that could be lost if no weed control is imposed times the expected selling price of your crop.</p>	<p>8.</p> <p>Fill in the Expected Treatment Cost (6)</p> <p>Cost of weed control must be less than the expected revenue loss (5) to justify a weed control treatment.</p> <p>Subtract (6) from (5) for your net gain or loss (7).</p>

B. Competitive Index Factor Chart

Handout for Activity 1

Use with the *Estimated Yield Loss Worksheet*.

These competitive factors are based on the moisture-holding capacities of soils

The Competitive Index Factor is a number that represents the relative competitiveness of different weeds. The greater the number, the more competitive the weed.

Weed	Competitive Indexes		Weed	Competitive Indexes	
	low-moisture	moderate to high-moisture		low-moisture	moderate to high-moisture
Barnyardgrass	0.125	0.06	Jimsonweed	0.8	0.3
Black nightshade	0.25	0.1	Johnsongrass	0.25	0.125
Burcucumber	0.5	0.25	Morningglory species	0.5	0.25
Common cocklebur	1.25	0.6	Pigweed species	0.5	0.15
Common lambsquarters	0.5	0.15	Prickly sida	0.125	0.05
Common ragweed	0.5	0.15	Shattercane	0.25	0.125
Crabgrass species	0.1	0.05	Smartweed	0.5	0.25
Fall panicum	0.125	0.06	Spurred anoda	0.5	0.25
Giant foxtail	0.125	0.06	Velvetleaf	0.8	0.25
Giant ragweed	1.25	0.6			

If you have weeds that aren't on the chart, consider using the factor for weeds that are similar in size and growth characteristics.

for your further interest:

Weed densities required to cause 10% yield loss in corn*

Weed	Maryland	Illinois	Weed	Maryland	Illinois
Number per 40 feet of row					
Annual grasses	80	80	Morningglory	20	40
Common cocklebur	8	16	Pigweed	20	60
Common lambsquarters	20	60	Smartweed	20	32
Jimsonweed	12	32	Velvetleaf	12	40

*Data based on information from Maryland Cooperative Extension values and Illinois Cooperative Extension values

What factors make crops in Maryland less weed tolerant than crops in Illinois?

- ◆ Soils in Illinois are generally heavier than those in Maryland. They hold moisture better and thus the crops grown on them can tolerate higher populations of weeds.

EXAMPLE

C. Weed Control Rating by Species

Worksheet for Activity 2

1. Species	2. Degree of Control				3. Plantback Considerations Rotation to pumpkins	4. Crop Height
	Excellent	Good to Excellent	Good	Fair to Good		
Common ragweed 20 plants / 100ft ² 2" tall	2,4-D	Atrazine		Basis Gold		corn is 8 inches tall
		Banvel / Clarity				
		Beacon				
		Exceed				
		Marksman				
		Permit				
Fall panicum 30 plants / 100ft ² 3" tall			Accent			
			Basis Gold			
Option 1:	Step 1: Atrazine, Basis Gold, Beacon, Exceed, and Marksman eliminated due to rotational restrictions for planting					
	Step 2: Accent is needed for fall panicum control, so 2,4-D is eliminated because it can reduce the effectiveness of Accent for control of annual grasses.					
	Step 3: Permit is eliminated since both Accent and Permit are ALS-inhibiting herbicides and this increases the risk of developing herbicide resistant weed populations.					
	Step 4: No organo-phosphate insecticide was used and no other factors limit use of Accent plus Banvel.					
Option 2:	<i>Given that:</i> 1) 2,4-D is very inexpensive (\$3/A) and Accent is very expensive (\$ 18/A); 2) the majority of yield loss due to weeds is from common ragweed not fall panicum; 3) there are effective herbicides for fall panicum control in pumpkins – the decision may be to spray only the common ragweed and cultivate for fall panicum control.					

Instructions for *Weed Control Rating by Species*, Activity 2

<p>1.</p> <p>Column 1:</p> <p>Identify the weeds that may reduce crop yield or quality.</p> <p>List the ones you're most concerned with at the top.</p>	<p>2.</p> <p>Column 2 (follow subheadings)</p> <p>Using the <i>Relative Effectiveness Table</i>, determine which herbicides will control the weeds you've got.</p> <ul style="list-style-type: none"> ◆ Will you need more than one herbicide? ◆ Can these herbicides be mixed? ◆ Is a pre-mix available?
<p>3.</p> <p>Column 3:</p> <p>Review your crop rotation options and any herbicide plantback restrictions (see <i>Plantback Restriction Table</i>) and chose compatible herbicide options—or consider revising the rotation.</p>	<p>4.</p> <p>Column 4:</p> <p>Using the <i>Height Restrictions, Rainfast Intervals, and Modes of Action Table</i>, note recommended corn size for postemergence treatments</p>
<p>5.</p> <p>Review commentary on your herbicides of choice in Comments for Postemergence Herbicides.</p> <p>Cross out any herbicides you can't use after your review.</p>	<p>6.</p> <p>If there are still several that will do the job, determine the cost by considering</p> <ul style="list-style-type: none"> ◆ Product price ◆ Number of spray applications needed ◆ Time frame limitations and your ability to get the work done on time

Consider this program from a resistance standpoint.

- ◆ Are you using herbicides with multiple modes of action?
- ◆ Can you rely on herbicides with a single mode of action?
- ◆ Are you using cultivation?
- ◆ What herbicides did you use last year? How do they affect your choices this year?

Keep good records and know where they are!

Refer to the *Height Restrictions, Rainfast Intervals, and Modes of Action Table* and evaluate herbicide programs for risk of herbicide resistant weed development. You may wish to:

- ◆ Use a second effective herbicide when relying on herbicides with a single site of action.
- ◆ Or rotate herbicides with various modes of action. (This could be a whole module in itself.)
- ◆ For more in-depth discussion of herbicide resistance management see <http://www.plantprotection.org/HRAC/>

Always be sure to know your state s recommendations, consult herbicide product labels, and follow label instructions. Note recommendations for adjuvants.

D. Relative Effectiveness Table

Handout for Activity 2

Postemergence corn herbicides for certain grass and grass-like weed species

Legend is based on adequate moisture, good growing conditions, and proper herbicide application

E: excellent (> 90% control)	F: fair (60-80% control)
G-E: good — excellent	P-F: poor - fair
G: good (80-90% control)	P: poor (20-60% control)
F-G: fair - good	N: none (< 20% control)

Single active ingredient products	Barnyardgrass	Bermudagrass	Crabgrass	Fall panicum	Foxtails	Goosegrass	Johnsongrass (seedling)	Johnsongrass (rhizome)	Quackgrass	Sandbur	Shattercane	Yellow nutsedge
Accent	G-E	N	P-F	G	G	P	E	G-E	G-E	G	E	P
Atrazine	F	N	P-F	P	F	G	P	N	F-G	-	P	P-F
Beacon	P	N	P	F	F-G	P	E	G	G	-	E	P
Liberty ^a	F-G	N	F	F-G	F-G	P	F-G	N	F	F-G	F-G	P
Permit	N	N	N	N	N	N	N	N	N	N	N	E
Roundup Ultra ^b	E	G	E	G-E	E	E	E	G	G-E	E	G	P-F
Premixes												
Basis Gold	G-E	N	P-F	G	G	P	E	G-E	G-E	G	E	P
Exceed	P	N	P	P	P-F	N	P-F	N	P-F	-	P-F	P
Marksman	N	N	P	N	P	F	N	N	F	-	N	P

a = requires use of Liberty-Link hybrids

b = requires use of Roundup Ready hybrids

Not recommended for postemergence grass or yellow nutsedge control: Banvell/Clarity, 2,4-D, or Resource.

Postemergence corn herbicides for certain broadleaf weed species

Single active ingredient products	Eastern black nightshade	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	TR-Lambsquarters ^c	Morningglory (annual spp.)	Pigweed	TR-Pigweed ^c	Giant ragweed	Common ragweed	Smartweed	Spurred anoda	Prickly sida or teaweed	Velvetleaf
Accent	N	F-G	P	F	P	P	F	G-E	G-E	P	P	F-G	-	P	P
Atrazine	G-E	F-G	G-E	E	E	N	G-E	E	N	G	G-E	E	-	G	F-G
Banvel/Clarity	E	F	E	E	E	E	E	E	E	G-E	G-E	E	-	G	G
Beacon	P-F	G	F-G	F-G	F-G	F-G	F	G-E	G-E	G	G-E	F-G	-	F	F-G
2,4-D	F	P	G-E	E	E	E	E	E	E	E	E	F-G	-	G	F-G
Liberty ^a	G	G	G-E	G-E	F-G	F-G	G-E	G	G	G	G-E	F	-	F-G	G
Permit	P	P	G-E	G	P	P	F	G-E	G-E	F-G	G-E	F-G	-	N	G
Resource	F-G	F-G	P	P	P	P	P	F	F	P	P	P	-	N	E
Roundup Ultra ^b	F-G	E	E	E	F-G	F-G	G	E	E	G	F-G	F-G	F-G	F	G
Premixes															
Basis Gold	G	F-G	F-G	F-G	F-G	P	F	G	G	F-G	F-G	G	-	F	G
Exceed	G	G	G	G	P-F	P-F	P-F	G-E	G-E	G-E	G-E	G-E	-	P	F-G
Marksman	E	G	E	E	E	E	G-E	E	E	G-E	G-E	E	-	G	G

a = requires use of Liberty-Link hybrids

b = requires use of Roundup Ready hybrids

c = resistant to triazine

E. Plantback Restriction Table

Handout for Activity 2

Crop Rotation Planting Restrictions Months After Herbicide Application Until Planting New Crop ¹ — This Table Is Not Comprehensive For All Corn Herbicides Or Rotational Crops

Herbicide	Alfalfa	Barley, winter	Cabbage	Corn, field	Corn, sweet	Potato, white	Pumpkin	Rye, winter	Soybean	Wheat, winter
Accent	12	4	10 ²	NR	10	10 ²	10 ²	4	0.5	4
Atrazine	SY	SY	SY	NR	NR	SY	SY	12	SY	SY
Banvel	AH	1 ³	AH	NR	AH	AH	AH	1 ³	1 ⁴	1 ³
Basis Gold	18	10	18	NR	10	18	18	18	10	10
Beacon	8	3	18	0.5d	8	18	18	3	8	3
Celebrity Plus	12	4	10 ⁵	NR	10 ⁵	10 ⁵	10 ⁵	4	1	4
Clarity	3	AH	AH	NR	AH	AH	AH	1 ³	1 ⁴	AH
Distinct	4	4	4	0.25	4	4	4	4	4	4
Exceed	18	3	18 ⁵	1 ⁵	3	10	18	3	18 ⁵	3
Liberty	4	2.5	4	NR	4	4	4	2.5	NR	2.5
Liberty ATZ	SY	SY	SY	NR	NR	SY	SY	12	SY	SY
Lightning	9.5	9.5	40B	8.5 ⁵	18	26	40B	4	9	4
Marksman	SY	10	SY	NR	NR	SY	SY	10	SY	10
NorthStar	8	3	18	0.5	8	8	18	3	8	3
Permit	9	2	15	1	3	9	9	2	9	2
Resource	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Roundup Ultra	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Scorpion III	10.5	4	26B	NR	10.5	18	26B	4	10.5	4
Spirit	18	3	10	1 ⁶	8	10	18	3	10	3
Stinger	10.5	NR	10.5	NR	10.5	18	18	NR	10.5	NR
2,4-D	3	3	3	NR	NR	3	3	3	.25-1 ⁷	3

¹ AH = after harvest

B = bioassay of soil recommended before planting

d = days

NR = no restrictions

NY = next year

SY = second year following application

² 18 Months with a soil pH \geq 6.5

³ 20 Days per pint

⁴ 30 Days per pint

⁵ Read the label for additional restrictions due to special state restrictions, varieties, rate, rainfall, soil, pH, application rate, etc.

⁶ Corn hybrids, which are classified as tolerant (IT) or resistant (IR) to imidazolinone herbicides (Clearfield), may be planted anytime

⁷ See current 2,4-D label

F. Height Restrictions, Rainfast Intervals, and Modes of Action Table

Handout for Activity 2

For postemergence herbicide application. Always check the herbicide label to be sure it is labeled for use in your state (county); read and follow label instruction..

Column B:

- ◆ *Broadcast* refers to an over-the-top application
- ◆ *Directed* refers to use of special spray equipment to direct the spray and prevent it from coming in contact with the whorl of the corn
- ◆ When corn height and collar number are both listed, base your decision on whichever feature is attained first.

Column C: The rainfast interval is number of hours needed between the time of herbicide application and rainfall or irrigation to ensure sufficient absorption in the plant.

Column D: When making herbicide decisions, alternate between herbicides having different modes of action.

A. Herbicides	B. Maximum corn size	C. Rainfast interval (hr)	D. Mode of action
<i>Accent</i>	broadcast: 6 collars or 24" directed: 10 collars or 36"	4	Amino acid inhibitor at ALS enzyme
<i>Atrazine</i>	12" tall	2	Photosynthetic inhibitor (PS-II)
<i>Banvel / Clarity</i>	more than 1/2 pt/A: broadcast: 5 lvs or 8" directed: 36" tall 1/2 pt/A or less: 36" tall	4	Plant growth regulator
<i>Beacon</i>	broadcast: min 4" tall max- 20" tall or 6 collar directed: pre-tassel	4	Amino acid inhibitor at ALS enzyme
<i>2,4-D Amine</i>	broadcast: 8" tall directed: pre-tassel	6-8	Plant growth regulator
<i>2,4-D Ester</i>	broadcast: 8" tall directed: pre-tassel	2-3	Plant growth regulator
<i>Liberty</i>	broadcast: 24" tall or 7 collars max directed: 20" to 36" tall	4	Amino acid inhibitor at GS enzyme
<i>Permit</i>	broadcast: 48" tall directed: when necessary	4	Amino acid inhibitor at ALS enzyme
<i>Resource</i>	broadcast: 2- to 10-collar stage directed: when necessary; when corn leaves interfere with spray	1	Cell membrane disruptor
<i>Roundup Ultra</i>	up to 30" or 8 collars max	1-6	Amino acid inhibitor at EPSP enzyme
Premixes			
<i>Basis Gold</i>	5 collars or 12" tall	4	Amino acid inhibitor at ALS enzyme Photosynthetic inhibitor (PS-II)
<i>Exceed</i>	broadcast: min- 4" tall max- 20" tall or 6 collar directed: 20" to 30" tall	4	Amino acid inhibitor at ALS enzyme
<i>Marksman</i>	broadcast: 5-lf stage or 8" tall	4	Photosynthetic inhibitor (PS-II) Plant growth regulator

G. Pre-Mix / Equivalent Products Table

Handout for Activity 2

<i>Trade name</i>	<i>Common name</i>	<i>Formulation</i>	<i>If you apply</i>	<i>Equivalent tank mix of:</i>
Basis Gold		89.5DF	14 oz	
Accent	nicosulfuron	1.34%		0.25 oz Accent 75 DF
Matrix	rimsulfuron	1.34%		0.75 oz Matrix 25 DF
Atrazine	atrazine	86.8%		13.5 oz Atrazine 90 DF
Exceed		57WG	1 oz	
Peak	prosulfuron	28.5%		0.5 oz Peak 57 WG
Beacon	primisulfuron	28.5%		0.38 oz Beacon 75 DG
Marksman		3.2L	1 qt	
Banvel	dicamba	1.1 lb		8.8 fl oz Banvel 4 S
Atrazine	atrazine	2.1 lb		0.5 qt Atrazine 4 L

Key to abbreviations:

DF: dry flowable

DG: dry granular

L: liquid

S: solution

WG: wettable granular

WDG water dispersible granular

H. Tank-Mix Partners Table

Handout for Activity 2

■ = approved tank-mixes

Often the variety of weeds in a given field is great enough to consider tank-mixing two (or more) herbicides to broaden the spectrum of control. Always consult the product label for each herbicide included in the tank-mixture for specific details, because the tank-mixture may be approved on the label of one of the tank-mix partners but not on both. Unless specifically prohibited on product labels, other tank-mix combinations may be appropriate for use. See

individual labels for specific mixtures that may be prohibited and for specific application rate and timing information.

Comparable residual activity is given for comparison purposes only. These are based on herbicide half-life which is the length of time it takes for half of the herbicide to break down. Residual activity is not the same as herbicide carryover.

Residual activity:

N= none or negligible

S= short (less than 2 wks)

M= moderate (less than one month)

L= long (one to two months)

VL= very long (greater than 2 months)

Single active ingredient products	Accent	Atrazine	Banvel / Clarity	Beacon	2,4-D	Liberty	Permit	Resource	Roundup Ultra	Basis Gold	Exceed	Marksman	Residual Activity
Accent	■	■	■	■		■	■	■		■	■	■	M
Atrazine	■		■	■	■	■	■	■	■	■	■	■	L-VL
Banvel / Clarity	■	■		■		■	■	■	■	■	■	■	S
Beacon	■	■	■		■	■	■	■			■	■	M
2,4-D		■		■	■	■	■	■			■		S
Liberty	■	■	■	■	■		■	■		■		■	N
Permit	■	■	■	■	■	■		■				■	S
Resource	■	■	■	■	■	■	■		■		■	■	N
Roundup Ultra		■	■					■					N
<i>Premixes</i>													
Basis Gold	■	■	■			■							
Exceed	■	■	■	■	■			■				■	M
Marksman	■	■	■	■		■	■	■			■		

When tank-mixing, read and follow the product labels for important information on herbicide use.

I. Comments for Postemergence Herbicides

Handout for Activity 2, p.1

Herbicides arranged alphabetically by trade name with rate and remarks concerning their use.

These guidelines are not a substitute for pesticide labeling. Know your states recommendations and read and follow pesticide labels.

Herbicide trade name	Rate product /A	Remarks
Accent 75DF ** Premixes Basis Gold 89.46 WDG ** Celebrity Plus 76.8 WDG **	0.66 oz	Consult label when applying to corn that is under stress; treated with Counter insecticide; treated PRE or POST with other organophosphate insecticides; treated with Basagran; or when using a corn hybrid resistant to MDMV or MCDV if johnsongrass is present. Tank-mixing with certain broadleaf herbicides other than atrazine may result in a reduction of annual grass control and an increase in crop injury. A higher degree of johnsongrass control may be achieved with split applications, but do not exceed 1.33 ounces per acre in 1 year. Do not graze or feed forage or grain from treated areas to livestock within 30 days after application.
Atrazine 4L ** Atrazine 90DF ** many trade names Premixes Laddok S-12 5L ** Liberty ATZ 4.3SC ** Marksman 3.2L ** Ready Master ATZ 4FL Shotgun 3.25L	1.0 - 2.0 qt 1.1 - 2.2 lb	<i>Restricted Use Pesticide.</i> Use in single broadcast spray before weeds exceed 1.5 inch in height. Do not include oil in atrazine sprays when corn is under stress from prolonged cold, wet weather, poor fertility, or other factors, or when corn is wet and succulent from recent rainfall as crop injury may occur. Do not use oil in sprays when treating inbred lines or other breeding stock. Adding other pesticides, fertilizers, or other material to the oil-water emulsions may cause compatibility problems or crop injury. Follow instructions on the container for proper mixing and maintaining the emulsion in the spray tank. If no atrazine was applied prior to crop emergence, use a maximum rate of 2.0 pounds of active ingredient of atrazine per acre. If a preemergence application was made in the same calendar year, the combined preemergence and postemergence applications may not exceed 2.5 pounds of active ingredient of atrazine per acre.
Banvel 4S / Clarity 4S Premixes Distinct 70WDG ** Marksman 3.2L ** NorthStar 47.4 WDG **	0.5 - 1.0 pt	Best performance occurs when weeds are small. Drop nozzles may be used to increase coverage if the corn leaves cover the weeds. Observe precautions to avoid drift to adjacent crops.

E. Comments for Postemergence Herbicides

Handout for Activity 2, p.2

These guidelines are not a substitute for pesticide labeling. Know your states recommendations and read and follow pesticide labels.

Herbicide Trade name	Rate product IA	Remarks
Basis Gold 89.5DF **	14 oz	<p><i>Restricted Use Pesticide.</i></p> <p>Apply to 1- to 3-inch tall grasses and 2- to 4-inch tall broadleaf weeds.</p> <p>Do not tank-mix with Bladex, Basagran, Laddok, or organophosphate insecticides (i.e. Lorsban, malathion, parathion) due to injury.</p> <p>Do not tank-mix with 2,4-D as grass control may be reduced.</p> <p>Do not apply with Banvel or Clarity if corn is under stress.</p> <p>Do not apply Basis Gold to conventional or IT corn hybrids previously treated with Counter 15G or 20CR. Applications of Basis Gold to conventional or IT corn hybrids previously treated with other insecticides may also result in crop damage. There are no restrictions with regard to insecticides applied when an IR corn hybrid is planted.</p>
Beacon 75DG ** Premixes Exceed 57WG ** NorthStar 47.4WDG ** Spirit 57WG **	0.38 - 0.76 oz	<p>Consult county Extension office or seed corn dealer for list of corn hybrids susceptible to Beacon applications.</p> <p>Do not apply to corn that is under stress, treated with Counter insecticide, treated or in tank-mixes with other pesticides, unless recommended on the label.</p> <p>Do not apply an organophosphate insecticide 10 days before or after Beacon application. Do not apply to hybrids susceptible to MDMV or MCDV if johnsongrass is present in field.</p> <p>Tank mixing with other broadleaf herbicides may result in a reduction of grass control and increase in crop injury.</p> <p>A higher degree of johnsongrass control may be achieved with split (0.38 ounce + 0.38 ounce) applications, but do not exceed 0.76 ounce per acre in 1 year.</p>
2,4-D 4L Many trade names Premix Shotgun 3.25L	0.5 - 1.0 pt	<p>Apply from the time that the corn emerges until layby.</p> <p>Do not cultivate for 10 days, or corn may break off.</p> <p>Small weeds are easier to kill; use higher rate for larger weeds.</p> <p>This won t control grasses.</p>
Exceed 57WG **	1.0 oz	<p>Do not apply to corn under severe environmental stress..</p> <p>Do not apply to corn treated with Counter 15G (any application) or Counter 20CR applied in-furrow.</p> <p>If an IR corn hybrid is planted, the above restrictions do not apply.</p> <p>Exceed contains more prosulfuron than Spirit, and as a result has more restrictive rotational guidelines.</p>

E. Comments for Postemergence Herbicides

Handout for Activity 2, p.3

These guidelines are not a substitute for pesticide labeling. Know your states recommendations and read and follow pesticide labels.

Herbicide Trade name	Rate product IA	Remarks
Liberty 1.67SL ** Premix Liberty ATZ 4.3SC **	1.5 - 1.75 pt	Requires use of Liberty-Link corn hybrids. Good coverage is required for acceptable control. Adjust application rates for individual weed species and weed size as directed by the label. A repeat application of Liberty or repeat applications with appropriate residual herbicides will be needed to control weeds that have not emerged at the time of application. Liberty is a postemergence herbicide with no residual soil activity and may be applied as the only herbicide in the program, or alone following preemergence herbicides, or mixed with other postemergence herbicides listed on the label. Ammonium sulfate has improved broadleaf weed control by Liberty. Can be tank-mixed with approved postemergence herbicides except Sencor or Basis.
Permit 75WG **	0.6 - 1.3 oz	Do not apply to corn under severe environmental stress.
Resource 0.86EC **	4.0 - 6.0 oz	Apply as a broadcast over-the-top postemergence spray to 5- to 6-leaf velvetleaf and to corn that is in the 2- to 10-leaf stage. As a directed spray using drop nozzles, Resource may be applied at 8.0 ounces per acre. Resource has activity against several other weeds when they are in the 2- to 3-leaf stage including lambsquarters, common ragweed, and smooth pigweed.
Roundup 4L ** Roundup Ultra 4L ** Premix Ready Master ATZ 4FL	1.0 qt 1.0 qt	Requires the use of Roundup Ready corn hybrids. Sequential applications of 1 quart per acre followed by 1 quart per acre can be made, with applications at least 10 days apart. A full rate preemergence herbicide program followed by one application of Roundup Ultra may provide better weed control under heavy weed pressure than one timely application of Roundup Ultra.

www.nysaes.cornell.edu/ipmnet/sare.mod/index.html



Module Feedback

Weed Identification in Row Crops

Adapt these questions to the needs of your class.

Tell us a little about yourself:

<p><i>I m a</i></p> <ul style="list-style-type: none"> ◆ Farmer _____ ◆ Crop advisor _____ ◆ Industry rep _____ ◆ Extension educator _____ ◆ Other _____ 	<p><i>My commodity area is:</i></p> <ul style="list-style-type: none"> ◆ Dairy and field crops _____ ◆ Vegetables _____ ◆ Fruits and berries _____ ◆ Greenhouse and nursery stock _____ ◆ Other _____
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Adapt as needed for your situation.

Let us know what you think:

<p>What part of the workshop was most interesting for you?</p>
<p>What part of the workshop was most valuable to you?</p>
<p>What two new ideas would you like to try on your farm or in your business?</p>
<p>Do you feel you understand IPM—and how to use it—better now?</p>
<p>What other information should be included in this module?</p>
<p>What other topics would you like us to cover in future modules?</p>

Teachers, please fill out an evaluation as well. Photocopy and send all informative evaluations to:

NE-IPM Modules, NYS IPM Program, Box 28 Kennedy Hall, Cornell University, Ithaca NY 14853