PERENNIAL WEEDS – MY OLD FRIENDS

Jerry Doll [1/]

Introduction

Perennial weeds in grain and forage crops used to be a major challenge faced by many of our producers. We know this is true because the older literature and extension bulletins highlighted the difficulty of controlling weeds like Canada thistle, quackgrass and field bindweed and many of us do not need publications to tell us this: we have lived in the era when perennial weeds were a real management challenge. Life has changed dramatically in the past 28 years and in this presentation I will cover the changes I've seen in perennial weed management. For each species presented, I will mention unique biological features, the research we have done and give the principal findings and the most effective management system. The species covered include:

Field horsetail	Yellow nutsedge
Quackgrass	Wirestem muhly
Common dandelion	Canada thistle
Hemp dogbane	Common milkweed
Wild four o'clock	Leafy spurge
Multiflora rose	Comfrey

Field Horsetail

This non-seed bearing plant is one of our oldest plants in an evolutionary sense. It is most common in poorly drained sites but is surprisingly common along roadsides and in railroad beds. Plants produce spores on the reproductive stems but in agricultural crops, the vegetative form (plants appear like a horsetail or small pine trees) predominates. Horsetail is a poor competitor except in no-till systems. With tillage to prepare a seedbed and a single row cultivation or vigorous competition from narrow row crops, horsetail seldom reduces crop yields. Where tillage is not practical, we found that a combination of primisulfuron (Beacon) at 0.75 oz/a and 2,4-D amine at 0.5 pt/a that resulted in the highest foliar burn on horsetail (75% one month after application) of all treatments tested. Beacon alone only gave 33% control and 2,4-D alone had little effect (13% control) one month later. Thus, it appears that 2,4-D has a synergistic effect with Beacon on horsetail. The level of control with Beacon plus dicamba was 50%, which was also better than that of Beacon alone (33%). Thus, it appears to take more than just Beacon to achieve a significant level of horsetail suppression. Glyphosate has essentially no effect horsetail so even in Roundup Ready crops, this is not an option. The literature indicates that MCPA is better than 2,4-D so if horsetail appears in small grains, this may be a consideration. The bottom line: horsetail is still a challenge, especially in no-till systems.

[1/] Professor, Department of Agronomy, Univ. of Wisconsin-Madison.

Yellow Nutsedge

This is one of my really old friends. In fact, I worked with his very close cousin, purple nutsedge south of the border (Colombia, South America) before coming to Wisconsin. We have reigned in yellow nutsedge while purple nutsedge still wears a crown that reads, "the world's worst weed." My first long term research projects and those of my early graduate students related to yellow nutsedge. We documented that it is allelopathic and that high densities of uncontrolled nutsedge can reduce corn and soybean yields by more than 50%. The name of the game for nutsedge suppression is tuber prevention. When not controlled, we found up to 30,000,000 tubers per acre! Thankfully tubers have a relatively short half life (unlike true seeds, most tubers either sprout or die the year after they are produced) and with only two seasons of excellent control we achieved a great reduction in tuber populations.

We found no advantage to crop or herbicide rotation to reduce the tuber population; generally the best results occurred when a single row cultivation followed the use of an effective preplant incorporated or postemergence herbicide. The most active herbicide for yellow nutsedge control is halosulfuron (Permit). As with horsetail, glyphosate is relatively weak on this nutsedge. Basagran (bentazon), Classic (chlorimuron), acetochlor, metolachlor, difenamid and alachlor are also effective yellow nutsedge herbicides.

Quackgrass

This plant is much less common in cropped land today as well it should be. After 40 years of atrazine and 30 years of glyphosate use, it is surprising that we have any quackgrass left! The reason we do is primarily because quackgrass is very well adapted to forage crops and it is still found on many livestock farms. Its seriousness as a weed in these systems depends on the species of livestock, harvest system (mechanical or grazing), and the perception of the producer.

Quackgrass is vulnerable to tillage. A single year of summer fallow with repeated soil disturbance (this is how the term "quack digger" can to be used) can be as effective as glyphosate. Quackgrass is also controlled by other weeds. In a long-term study that included a non-weeded treatment for both quackgrass and annual weeds, heavy annual weed pressure for three or more years eliminated quackgrass! It's not a profitable farming system but points out the adaptability of quackgrass to survive when we give it a chance by removing competition from other weeds or tillage, as is the case in forages and pastures.

As mentioned, effective quackgrass herbicides have been available for many years. The discovery of the accase herbicides (sethoxydim, quizalofop, etc.) gave us a great in-crop management tool for soybean and alfalfa. The "fops" are more effective than the "dims) on quackgrass and in general, neither is as effective as glyphosate. And with the advent of glyphosate resistant crops, the use of other herbicides for quackgrass control on grain farms is nil. Clethodim and sethoxydim are still our best alternatives for quackgrass suppression in forage legumes.

Wirestem Muhly

Wirestem muhly is another weed native to our region. In fact, the driftless area of Illinois, Iowa and Wisconsin is where it first appeared as a weed. Its rhizomes are considerably shorter than those of quackgrass but it is a prolific seed producer. We studied the growth of wirestem alone, in soybean and in corn when the weed started either from rhizomes or from seed at both Arlington and Lancaster for two years. Competition from corn and soybeans significantly reduced wirestem muhly stem numbers and plant biomass. Soybeans reduced stem numbers 82 to 99% and corn reduced them 71 to 96% compared to the crop-free environment. Wirestem muhly biomass was reduced 78 to 97% in soybeans and 72 to 95% in corn compared to the crop-free treatment. Interestingly, in the absence of crop competition, the biomass of wirestem plants originating from seed exceeded those starting from rhizomes! Thus, we must pay attention to wirestem seedlings to ensure reinfestation does not occur following the destruction of the rhizomes.

Previously producers assumed high rates of atrazine would control wirestem because quackgrass was controlled with 3 to 4 lb ai atrazine (legal rates years ago). Wirestem is essentially immune to atrazine at almost any rate. Our first effective herbicides for wirestem muhly control in growing crops came with the arrival of the accase inhibitors (the dims and the fops) for postemergence use in soybeans. All are equally effective and are nearly equivalent to using glyphosate in Roundup Ready soybeans. In corn, foramsulfuron (Option) and nicosulfuron (Accent) alone or tank mixed with primisulfuron (Beacon) or premixed with rimsulfuron (Steadfast) suppresses wirestem muhly effectively if applied when the tallest wirestem plants are no taller than 8 inches. This is tricky because most perennials emerge over many days so plant height is variable. Wirestem is also controlled in corn by glyphosate or glufosinate (Liberty) in their respective biotech hybrids (RR or Liberty Link). A single row cultivation 10 to 14 days after herbicide application improves wirestem control with most herbicides.

Common Dandelion

I have spent many hours working on dandelions. It is probably my favorite weed, so much so that I often do not see it as a weed but rather as an old friend. Here are the primary take home messages I've learned.

In forages, common dandelion:

- has little impact on forage digestibility
- is 4 to 5% lower in protein than alfalfa at the first cutting
- is equal to alfalfa in protein content in subsequent harvest
- can add a day of drying time if the forage is handled as dry hay
- seeds germinate anytime the soil is warm and moist and they receive light
- seedlings survive winter once they have produced only 3 or 4 leaves
- is expensive to control but pre-greenup applications of hexazinone (Velpar) or metribuzin (Sencor) are effective
- will be economically controlled with fall applications of glyphosate once Roundup Ready alfalfa is available

In no-till grain production systems, common dandelion:

- is increasing in abundance in long-term no-till systems
- can cause far greater yield losses than you would expect
- is effectively controlled with fall herbicide applications based on sulfonylurea herbicide combinations that include tribenuron (Express)
- can be adequately suppressed in the spring by 2,4-D if applied when air temperatures are 60F or greater and dandelions are in the early to mid bloom stage
- control is synergized by diflufenzopyr applied with dicamba and other herbicides
- is surprisingly sensitive to glufosinate (Liberty), a contact herbicide

Dandelions are becoming more abundant in no-till systems on grain farms. The fall burndown system offers new and effective control alternatives. More assessment of the weed changes in long-term no-till systems and further fall burndown research is needed.

Hemp Dogbane

This perennial is native to North America and the fibers extracted from soaked stems were used by native Americans for clothing and rope, thus the name "hemp" dogbane. Interestingly, plants often flower in cropped land but rarely form seeds while plants in fence rows and roadsides often produce seed.

It is surprising that hemp dogbane became problematic in grain fields because it is very sensitive to 2,4-D which could have reduced its abundance when corn or wheat was in the rotation. Many producers do not like the risk of crop injury associated with 2,4-D in corn and for those who used this herbicide in fields with dogbane, my suspicion is that the application was too early to be effective. An even more active and safer herbicide choice in conventional corn is the relatively new alternative of fluroxypyr (Starane) which can also be used in winter wheat. We have no herbicides to control dogbane in conventional soybeans.

Hemp dogbane is the weed that started me down the road to the "three-step system for perennial broadleaf control in glyphosate resistant crops." The steps are as follows:

1. Use a no-till system; this allows the weed to develop quickly and keeps the root system in tact
2. Consider applying a half rate of a soil residual herbicide with the burndown herbicide; this will control most annual weeds for 20 to 30 days and removes the risk that these would reduce crop yield while waiting to treat the perennial weed
3. Apply 0.75 lb ae/acre of glyphosate when hemp dogbane is starting to flower or is 24 inches tall, whichever occurs first. This is later than we normally apply glyphosate in glyphosate resistant crops but earlier applications are often less effective.

We have tested higher rates of glyphosate and repeated applications: neither is necessary if the above steps are followed. My observation is that in the BG days (before glyphosate), most producers targeted their perennial broadleaf weed problems in the corn phase of the rotation. Now the soybean crop is the point of perennial weed attack and I am in full agreement with this strategy because soybeans offer an earlier and more complete canopy cover which is the critical "next step" to ensure maximum kill and little if any root regeneration of the weed.

Common Milkweed

This native milky-sapped perennial has very deep roots and can also generate new plants via seed germination. It is rarely a weed of concern in cropped land where it actually serves as food for the monarch butterfly. We have had questions on controlling milkweed in pastures because the sap is potentially harmful to livestock if consumed. We used the system described for hemp dogbane in two years of research in RR soybeans and achieved excellent milkweed control. The same would be expected in RR corn. In conventional corn hybrids, halosulfuron (Permit and Yukon) and dicamba plus diflufenzopyr (Distinct) offer the best milkweed suppression.

Wild Four O'clock

This plant is also native to North America and is found mostly in sites with shallow, loose soils including roadsides. In no-till fields, the taproots of four o'clock may be 3 inches or more in diameter. Plants produce abundant seeds and these germinate readily. I used to associate this weed with no-till systems but it certainly survives a chisel plowing. Repeated mowing of alfalfa does not eliminate established wild four o'clock plants but should prevent seed production.

There are no control options for this weed in conventional soybeans but in non-biotech corn hybrids, dicamba suppresses wild four o'clock for several weeks. If the field is cultivated after the herbicide is applied (10 to 14 days later), control is improved and little if any yield loss is expected. The best solution for wild four o'clock infestations is to use the glyphosate system described for hemp dogbane.

Leafy Spurge

Leafy spurge is a long-standing legally declared noxious weed in Wisconsin. It was of little concern to most people until about 15 years ago when it began appearing in new locations. It's spread in non-disturbed sites continues, with prairies, roadsides and other right-of-way sites being the most common habitat for leafy spurge.

Control options in Wisconsin are few. The most active herbicide is picloram (Tordon) which is not widely used here due to its persistence, leachability and cost. My research at Ft. McCoy on leafy spurge has focused on how often imazapic (Plateau) is needed over a long time interval. We find that a single early fall application suppresses leafy spurge for 2 to 4 years. Control is often lost if the site is burned as is done in prairies. Several insects

aid in suppressing leafy spurge and my current on this weed involves the use of insects, Plateau and mowing as single strategies and in all combinations. More time is needed to determine how these tools can best be integrated into a management program.

Multiflora Rose

I grew up with this weed in Southern Illinois as my Dad, like many other conservation-minded farmers, did what was recommended: plant multiflora rose for wildlife benefits. Now we seek ways to fix our mistake! And the task is feasible biologically but a challenge physically given the terrain where the wildlife we wanted to foster has move multiflora rose seeds which are now large plants that often form impenetrable thickets.

Several foliarly applied herbicides control multiflora rose, including metsulfuron (Ally, Escort and Cimarron), 2,4-D plus triclopyr (Crossbow) and glyphosate. All are reasonably priced and land owners are gaining back terrain from this invader. We find great interest in learning how to control this plant. Attendance at field days far exceeds expectations. Part of this if driven by the approval in several counties in southwest Wisconsin to use EQIP funds from the NRCS to control multiflora rose. Approved plans must have a long-term view and a monitoring method so will yield valuable information for others to learn from.

Mother Nature is also entering the picture regarding multiflora rose. The rose rosette disease was confirmed in Wisconsin several years ago but did not become abundant until 2004. The level and scope of infection in Richland and Crawford counties were indeed impressive. Time will tell if this "free agent" will result in dead plants but it can only help.

Canada Thistle

This is also a favorite plant of mine as we've spent a lot of time together! In the late 1970s, we found that the white-flowered biotype (less than 1% of the Canada thistles in the state) are more sensitive to bentazon (Basagran) than the much more common purple-flowered biotypes. Both biotypes were similar in sensitivity to dicamba and glyphosate. Clopyralid (Stinger and Transline) arrived and we had a new and very effective tool to tackle Canada thistle in crops, pastures and roadsides. We learned that the plant responds to this molecule differently as habitats differ. In cropped land, a single application can result if suppression for 3 or more years. In roadsides, a higher rate is needed and the length of suppression is perhaps 2 to 3 years. In pastures, lower rates are needed to reach economical realms and this meant we needed to apply clopyralid (or this product followed by dicamba) for consecutive years to reach low infestation levels.

I and others had observed for years that Canada thistle is often "sick" with a natural disease, *Pseudomonas syringae* pv. *tagetis* (PST) that turns many leaves on some stems creamy white. This only happens when Canada thistle is on non-disturbed sites such as roadsides, pastures and CRP fields. In the mid 1980s, we tested a freeze-dried version of PST as a possible biocontrol agent. It failed to infect in Wisconsin and several other states where it was tested and the commercial effort to have a biocontrol for Canada thistle ended.

But Mother nature kept showing us the disease and this lead to a research project my last graduate student explored: trying to use infected Canada thistle plants as the source of PST to biologically control (or at least infect) healthy Canada thistles. We were able to achieve or increase the level of infection but could not reach the levels needed to expect a reduction in thistle severity.

We learned that rainfall is a key factor is inducing the infection and that was driven home in 2004 when the levels of infection reached impressive levels with no input from anyone. If similar levels of infection occur in subsequent years, Canada thistle densities may decline. Several locations that had infected thistles in previous years were found to be nearly thistle free in 2004. So perhaps nature will do what the Noxious Weed Law has not.

Comfrey

I have saved the most interesting perennial weed for the last. It is interesting because we planted it in our gardens (for medicinal uses) and fields (as a forage), because it has little ability to spread on its own, because it is not affected by most herbicides, and because I said I might not retire until I found a way to control it! Initially it appeared that I would not retire for a while, if ever. But the "3-step" method proved effective even with comfrey. Here's some of what you need to know about comfrey:

- it flowers abundantly but rarely produces seed
- the root is:
  - the source of reinfestation and spread (if we move them)
  - a deep, branched taproot, usually with a brownish surface but may also be black
  - able to produce new plants from segments as small as 0.25 inch in length

- new plants emerge early and continue appearing throughout the summer
- plowing, especially mold board plowing, ensures prolonged emergence
- plants are very shade tolerant

Comfrey is not controlled by 2,4-D, paraquat, dicamba alone, clopyralid (Stinger), sulfonylureas and imidazolinones used in corn. Dicamba plus diflufenzopyr (Distinct) applied in split applications in corn and some of the sulfonylureas used in soybeans suppress comfrey but without a doubt, glyphosate is the most active herbicide for this plant. Plant a RR crop in a no-till system and apply 0.75 lb ae/acre when comfrey begins to flower or when it is 24 inches tall; this will reduce the infestation significantly in a single year. Consecutive-year use of this system will approach eradication.

The seldom used practice of preharvest applications of glyphosate approached eradication with a single treatment in both corn and soybeans. This would be the best approach in fields with comfrey that have been tilled as the preharvest application would kill plants that emerged after the in-crop herbicide application.

Summary

There you have it. Twenty-eight years of Wisconsin experiences with perennial weeds boiled down to seven pages of "take home messages!" The rest of the story on these friends has been told over the years at this event. Check past proceedings for more information on almost all of these weeds.

Are there challenges left? Of course. Weeds that need further attention on cropped land include curly dock, white cockle and giant chickweed. In pastures, edges of wood lots and other areas, woody species like buckthorn, prickly ash and autumn and Russian olive. And we need to see what else Mother nature brings our way for this will certainly happen. With giant hogweed encroaching from the north, Turkish warty cabbage from the south and devil's claw from the west, weed scientists will not have to look far or hard to find plants that need their attention. So while I may soon be moving on, "my old friends" will remain and new ones may join them. Hope you enjoy being with them as much as I have.