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PROBLEM PERENNIAL WEEDS IN ROW CROPS[1]

Mother Nature seems to never sleep. If we use the same crop production system for many years, she responds with a change in the weed spectrum. And if we change from one tillage system to another, again the weed complex changes. Here are some of the weeds on the increase in Wisconsin cropping systems and suggested management strategies to deal with them.

Wirestem Muhly (*Muhlenbergia frondosa*)

Wirestem muhly weed is native to North America. It has generally remained on the fringe of agricultural systems, with rather limited appearances as a significant weed problem. The Muhlenbergia genus contains more than 50 species in the United States but wirestem muhly is the only one of agricultural significance. A 1960 article labeled wirestem muhly as "a new cornfield weed menace" (Scott and Slife, 1960) and alerted producers in the upper Midwest of the potential problem. Little changed for the next 20 years, but since the mid 1980s wirestem muhly has invaded new areas and has increased in frequency and density where it already existed. The increased abundance of wirestem muhly is due to several factors, including the adoption of reduced tillage systems, excellent control of other weed species, loss of diversity in crop rotations (especially less forages), and the production and spread of wirestem muhly seeds.

Wirestem muhly can be easily confused with quackgrass because both are perennial grasses with rhizomes. However, as the following table illustrates, there are significant differences between them.

Table 1. Comparison of the key characteristics of quackgrass and wirestem muhly.

Characteristic	**Quackgrass**	**Wirestem muhly**
grass type	cool season, C3	warm season, C4
auricles	present	none
membranous ligule	very short	easily seen
leaves	relatively few	numerous, narrow
tillers	relatively few	numerous
rhizomes	long, slender, smooth	thick, short, scaly

The top-heavy appearance of wirestem muhly plants is due to branches formed in the upper nodes and to the fact that these internodes are shorter than the lower ones. The stems are erect early but often become decumbent and can form roots at the nodes. The inflorescence is a

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panicle and plants produce numerous axillary inflorescences, many of which are enclosed in the leaf sheaths. The main stem and all tillers form seed heads giving plants a tremendous seed production potential.

Wirestem muhly is easy to control in both conventional and glyphosate resistant soybean. All of the systemic selective graminicide products (Assure, Fusion, Poast Plus and Select) in conventional varieties and glyphosate in glyphosate resistant varieties give excellent control if applied when wirestem is 6 to 10 inches tall and actively growing. In corn, the best alternatives for wirestem muhly infestations are Accent or Accent plus Beacon in conventional hybrids, Liberty in Liberty Link hybrids, Lightning in ClearField hybrids and glyphosate in glyphosate resistant hybrids. Timing is very important with conventional and ClearField hybrids: treat wirestem when it is 4 to 8 inches tall. With Liberty Link and glyphosate resistant hybrids, when treat wirestem is 6 to 10 inches tall. In all cases, best results are obtained if a second application or a cultivation is done 10 to 14 days after the first application.

However, long-term wirestem control may not be as great as expected. It appears that not all buds on wirestem muhly rhizomes are affected by herbicides so that some plants regenerate from rhizomes. Wirestem also has a much higher potential to reinfest fields via seed germination than quackgrass. Thus careful planning and monitoring is necessary each year to contain wirestem muhly.

Wild Four O'clock (*Myrabilis nyctaginea*)

This taprooted perennial is native to the USA. It has spread from its home in the southwest along rail and highway corridors and now stretches from Texas to Maryland. We first received reports of it in no-till fields, but in recent years it is just as common in chisel plowed and other reduced tillage systems. Plants thrive in shallow, gravelly soils (thus its frequency along rail and highway systems) but are probably able to grow and compete in many soil types. When plants grow undisturbed, roots can be 2.5 to 3 inches in diameter at the crown. Wild four o'clock is a prolific seed producer. Seeds begin germinating in early May and seedlings appear well into the growing season. Emergence from buds on roots occurs over an extended period as well. Little additional information on the biology of wild four o'clock is known.

Plants are easily identified. Weed books describe the roots as fleshy but they seem to be somewhat woody under Wisconsin conditions. Plants grow 2 to more than 3 feet tall and have erect, branched stems with conspicuous nodes that are particularly evident after leaf drop. Stems are often 4-sided but are not as square as those of plants in the mint family. Leaves are opposite, simple, heart-shaped (resemble a lilac leaf), 1 to 3 inches long, usually with a pointed tip. Leaves have a short petiole and are widely separated on the stem. The inflorescence is an umbel of terminal clusters, each cluster with 1 to 5 flowers. Individual flowers are perfect, have no petals and are bell-shaped with pink to reddish purple sepals (calyx). Seeds are oblong, grayish-brown to yellow, warty or wrinkled with 5 ribs that are about 3/16 of an inch long. The large, tough taproot; the opposite lilac-like leaves; branched, squarish stems; and the pink to

reddish flowers that open in the late afternoon and close in the late morning easily distinguish wild four-o'clock from other plants.

Wild four o'clock is difficult to control in conventional hybrids and varieties. In conventional corn hybrids, products with dicamba should be considered and in conventional soybean varieties, Classic gives some suppression. In both crops, glyphosate resistant varieties offer the best control. Where possible, use a no-till system and apply a low rate of a soil-active herbicide along with the burndown treatment (or apply a preplant treatment if no burndown product is needed). This will keep most annual weeds in check until the wild four o'clock begins to flower. At this point, apply 0.75 lb ae/acre of glyphosate. Like wirestem muhly, wild four o'clock also propagates by seed so plan future cropping, tillage and herbicide programs accordingly.

This three-step program works very well for most perennial broadleaf weeds in glyphosate resistant crops:

1. Use a no-till system
2. Apply a low rate of a soil-active herbicide to control annual weeds before or soon after planting
3. Apply 0.75 lb ae/acre of glyphosate when the perennial species begins to flower or when it is 24 inches tall, whichever occurs first.

This system is based on two years of on-farm trials for each of these weeds: Canada thistle, hemp dogbane, common milkweed and wild four o'clock. We have not seen a need to use higher rates of glyphosate (with the possible exception of common milkweed) nor to make a second glyphosate application when these practices are followed.

Hemp dogbane (*Apocynum cannabinum*)

This is another weed native to North America. It has an extensive vertical and horizontal rhizome system and managing hemp dogbane is complicated by its extended period of emergence. Hemp dogbane is capable of reproducing by seed but nearly all plants in cultivated field arise from vegetative buds in the crown region and on the horizontal lateral roots. All plant parts have sticky, milky sap and this is why dogbane may be confused with common milkweed while in the vegetative stage.

Hemp dogbane has an extensive, branched root system with vegetative buds irregularly placed on the lateral roots. The buds can give rise to shoots but most remain dormant. Vertical roots may penetrate 8 feet or more but do not have buds. Hemp dogbane stems are reddish and smooth and grow 3 to 5 feet tall. They are woody near the base and, unlike common milkweed, dogbane stems branch near the top, giving them a "bushy" look. The leaves are smooth, opposite, ovate to lanceolate, and have a very short petiole. They are generally smaller, lighter green in color and more pointed than the leaves of common milkweed. Hemp

dogbane leaves are bright green during the growing season and turn a yellowish-brown to orangish-yellow in the fall.
From late June to August, hemp dogbane produces clusters of small, greenish-white, bell-shaped flowers at the end of each branch. Each flower may produce two slender, slightly curved, pencil-like pods 3 to 4 inches long. Pods have up to 200 reddish-brown seeds, each with a tuft of silk on one end, similar to milkweed seeds. However, common milkweed seeds are much wider and flatter than hemp dogbane's spike-shaped seeds.

Hemp dogbane control in conventional corn is feasible with timely applications of 2,4-D alone or in combination with Beacon or Clarity followed by cultivation. There are no postemergence herbicides in soybeans that affect the root system of hemp dogbane in conventional varieties. The best program for fields with hemp dogbane is to plant glyphosate resistant soybean and follow the three-step program described in the wild four o'clock section above.

Comfrey (*Symphytum officinale*)

Comfrey is native to Russia and was introduced into the USA from Europe as a medicinal herb. It has also been used as a forage crop. Medicinal and herbal tea uses have come into disfavor as the plant contains alkaloids that can cause serious health problems if consumed in excess or over long periods. Once established, comfrey is very difficult to eradicate. Our infestations are most often the result of a garden being converted into a field. The shift from moldboard plows and disks to chisel plows and tined secondary tillage tools has undoubtedly spread comfrey roots from their original sites.

Plants are 2 to 4 feet tall and have many large, dark green, hairy leaves that arise from the crown and feel somewhat sticky. Leaves are up to 8 inches long, have no petioles and flow into the stem giving the stem a winged appearance. Comfrey flowers are bell-like, blue, pinkish or white and are borne in one-sided clusters on curved stalks, as is typical of plants in the Borage family. A pair of wing-like leaves is present at the base of each flower stalk. Plants seldom produce viable seed but have many thick, branched, brownish to black taproots that can reach 9 feet deep. Plants propagate readily from root fragments. Little is known about the biology of comfrey under field conditions.

Comfrey control is extremely difficult. Grower experiences that we hear of are consistently ones of great frustration and no one seems to have gained ground on this weed, much less eradicated it. So the 99% of our producers who do not have comfrey should count their blessings and learn to identify it! Be especially cautions of renting new ground that includes the "old homestead" where comfrey may have been in the garden. Inspect these sites carefully and if comfrey is present, consider not farming the infested area. Plant it to a permanent grass cover and either leave it undisturbed or treat it with dicamba two or three times a year.

We conducted an on-farm research trial in Sauk Co. with comfrey in 2001. Persistent and heavy rains in May prevented timely tillage and planting. The site was moldboard plowed in late May when comfrey was approximately 2 feet tall and a glyphosate resistant corn hybrid

was planted on May 28. The late and aggressive tillage operations delayed comfrey emergence considerably and gave corn a chance to gain a substantial height advantage over comfrey. We applied a range of postemergence herbicides on July 6. Corn was in the V-6 stage and 24 inches tall while comfrey was only 2 to 11 inches tall and it was apparent that more comfrey would emerge later.

Glyphosate and NorthStar gave 70% control of the treated plants 30 days after application, Clarity and Distinct gave 85% control and the tank mix of glyphosate and Distinct gave 95% control. Permit and Lightning gave 75% control. Stinger and Callisto gave poor comfrey control. Comfrey continued emerging in all plots so that no treatment reduced the overall level of infestation. However, in early September, treatments with dicamba averaged 15% comfrey pressure and the glyphosate and dicamba combinations averaged 14%. This is in contrast to 45% comfrey pressure for glyphosate alone and it suggests that dicamba provided soil activity on comfrey during the growing season. Additional work is needed to verify this and to determine the best tillage and herbicide treatments for comfrey.

White Cockle (*Lychinis alba*)

White cockle is native to Europe. It is most common in our older hay fields but in the last 10 years or so has become increasingly common in no-till cash grain cropping systems. The life cycle is described as a biennial or short-lived perennial in the Weeds of the North Central States book. In our cash grain no-till systems, it seems to behave as a winter annual in that it is seldom seen in corn but can be a serious problem before and after planting soybeans the next season. Thus it appears to germinate late season in corn and grow rapidly the next year in soybean.

White cockle is easily identified by its opposite, softly hairy grey-green leaves that have no petioles and by its imperfect flowers with five snow white notched petals. Plants produce either male or female flowers but not both. New plants are formed only by seeds.

Because dicamba and atrazine control white cockle very well, we rarely hear are asked how to control it in corn. In contrast, we have very few effective alternatives for white cockle in soybean. We know of no herbicide label that claims white cockle control in soybean, including glyphosate. It is common knowledge that 2,4-D is weak on nearly all plants in the Pink family (chickweeds and cockle). Those who have used 2,4-D with glyphosate as a burndown treatment before planting soybeans usually fail to control white cockle, even if 0.75 lb ae/a of glyphosate was applied. This rate applied in glyphosate resistant soybeans when the cockle is flowering and the soybean are planted in narrow rows can give sufficient suppression but complete kill appears to be difficult. Research is needed to study the best herbicide program, timing and rate to control white cockle in soybean.

Common Dandelion (*Taraxacum officinale*)

This weed also is finding ways to adapt to our cash cropping systems and, as with white cockle, the challenge is greatest in the soybean phase of the rotation. Fall treatments based on 2,4-D

or dicamba seem to offer the best control but timing is a challenge. If every fall were as the one just completed, we would have ample opportunity to apply an effective treatment after corn harvest. But the reality is that the application window can be very short and also we do not have much experience with herbicide alternatives to control dandelion after corn harvest. In general, growth regulator products probably offer the best hope. Recently, tank mixes of sulfonylurea herbicides and 2,4-D have been promoted as fall treatments to suppress dandelions and appear to offer promise.

Spring burndown treatments that include 2,4-D alone seldom give satisfactory dandelion control because we are limited on the rate that can be applied ahead of soybean and results are improved only slightly with the addition of glyphosate. The used of a sulfonylurea herbicide as part of the burndown program may prove to give satisfactory dandelion suppression. These are the best options in no-till soybean systems and if a glyphosate resistant soybean variety is then planted, the subsequent application of glyphosate followed by soybean canopy closure often gives adequate dandelion suppression.

Dandelion control in corn is much easier, even in no-till systems. Dicamba, clopyralid (Stinger and a component of Hornet) and Distinct are very effective on dandelion. Of these options, Distinct seems to provide the best dandelion control. Liberty is very effective on dandelion and this would be the only treatment needed if Liberty Link hybrids are no-till planted after a burndown herbicide is applied.

Common Pokeweed (*Phytolacca americana*)

Pokeweed is native to North America and has become more important in no-till systems, especially in Illinois and Kentucky. Plants are easy to identify as they have large, smooth, hollow, pinkish colored, branched stems; large alternate leaves with long petioles; and a very large taproot. Flowers have no petals and are formed on elongated stalks. Fruits are a fleshy berry with a rich crimson juice. Birds and other animals spread the seeds. Plants are considered poisonous and the root is the most toxic part. In no-till systems, escaping plants compete vigorously with crops (especially relatively short-statured ones like soybeans) and the ripe fruit lower grain quality by staining the grain during harvest.

Pokeweed requires more time after germination to be able to regenerate vegetatively than some other perennials. Kalnay and Czapar (2001) found that some plants could regenerate from the crown if cut 6 weeks after emergence but it took 10 weeks before all plants were able to regrow after clipping below the cotyledons. Thus we have a wide window of opportunity to prevent newly germinated seedlings from becoming true perennials with vegetative reproduction capabilities.

To date, pokeweed is rare in Wisconsin. When plants are seen in production fields, take all measures necessary to kill the taproot and prevent seed production and movement. Determine the source of the infestation (fence rows, edge of woods, waste areas) and try to eliminate established plants. Perhaps moldboard plowing should be considered if infestations

occur in fields. Glyphosate and dicamba have good to excellent activity on pokeweed and will be more effective on younger plants with relatively small taproots.

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