1. MANAGEMENT STRATEGIES FOR PROBLEM WEEDS

Problem perennial and biennial weeds are challenging to control because they typically have extensive root systems that can propagate new shoots. Although difficult to eradicate it is possible to minimize the impact perennial weeds have by eliminating top growth and providing competition from desired vegetation to exhaust the root system. An integrated approach that uses tillage, cover crops and effective herbicides has proven to be the most effective way to reduce populations of problem weeds. This chapter provides a summary of over three decades of public research that has investigated management strategies for some of the most challenging weed species.

Crop Rotation

A number of long term studies have demonstrated that the density of perennial weeds increases under monoculture cropping system compared to cropping rotations consisting of three or more crops.

Cover Crops

The inclusion of cover crops such as rye, red clover, buckwheat and oilseed radish or overwintering crops like winter wheat or forages in the cropping system will suppress perennial weed growth and reduce seed production of annual and perennial weeds. Fast growing crops or crops exhibiting allelopathic properties will also suppress weed growth. It is best to kill off a lush cover crop prior to winter so that the above ground biomass can decompose prior to planting in the spring.

Tillage Systems

The type of tillage implement used and the depth at which the ground is tilled has been shown to influence the density of perennial and biennial weeds. No-till systems are more likely to increase perennial weed populations due to a lack of underground root disruption. Deep tillage (greater than 15 cm) with a moldboard plough has been shown to decrease populations of Canada thistle and perennial sow-thistle. The choice of tillage system used on any particular field should be based primarily on the soil type and slope of the land so as to minimize erosion. Its benefits to weed control should only be taken advantage of when it has the sustainability of the top soil as the priority.

Herbicide Selection

In general, the use of postemergence herbicides results in more successful top growth control of perennial and biennial weeds compared to preemergence herbicides. The strategy with in-crop postemergence herbicides is to kill off top growth so that the perennial plant must use its root reserves to generate new top growth. Every opportunity should be made to apply a systemic herbicide (e.g., glyphosate) in the fall months. The combination of shorter day lengths and cooler temperatures triggers many perennial weeds to begin allocating carbohydrates to the roots for over-wintering, which allows for translocation of a systemic herbicide down to the roots resulting in density reductions the next spring. Below are the most successful herbicide strategies for corn, soybean and cereal production on 16 different species based on University of Guelph comparative research trials conducted over more than 20 years. Always refer to each product's label for specific details about the weed species which are controlled. Refer to the precautionary statements provided for each product in the appropriate crop chapter in this guide as well as the product label.

Alfalfa, Volunteer (Retired Stand)

BEST STRATEGY

Autumn is the best time to terminate an old stand of alfalfa so that a suitable seedbed exists in the spring and volunteer plants are minimized. A moldboard plough is the most effective tillage implement. If in a minimum or no-till cropping system, glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) tank-mixed with either 2,4-D Ester 700 at 1.3 L/ha (520 mL/acre) or ENGENIA at 1 L/ha (400 mL/acre) or XTENDIMAX/ FEXAPAN at 1.7 L/ha (680 mL/acre) provides the most effective chemical control (>95%). If trying to terminate an old stand of glyphosate tolerant alfalfa, these tank-mixes will be equally effective. Growing degree day accumulation after applying these herbicide tank-mixes appears to significantly affect the level of control. Alfalfa has a base growing temperature of 5°C and when air temperatures following herbicide application rarely exceed 5°C, alfalfa growth is stagnant and control is typically unacceptable. Conversely, if air temperatures following herbicide applications are often above 5°C, alfalfa kill is greatly improved.

Corn – Conventional

In comparative trials postemergence applications of dicamba (e.g., ENGENIA) at 1L/ha (0.4 L/acre) dicamba/atrazine (e.g., MARKSMAN) at 3.75 L/ha (1.5 L/acre) and DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) have provided suppression of volunteer alfalfa. When either dicamba, dicamba/atrazine or DISTINCT is tank-mixed with ACCENT, OPTION or STEADFAST, control of volunteer alfalfa is improved.

Expectation for control: 70%–75%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, glyphosate can be tank-mixed with either dicamba (e.g., ENGENIA) or dicamba/atrazine products (e.g., MARKSMAN).

Expectation for control: 70%–80%

Soybeans – Conventional

If fall herbicide applications have not been made in reduced tilled soybeans, then the tank-mix of glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) + 2,4-D Ester 700 at 800 mL/ha (320 mL/acre) applied 7 days preplant provides the best control of alfalfa.

Expectation for control: 75%–85%

Once soybeans have emerged, volunteer alfalfa is virtually impossible to control. REFLEX or BLAZER will burn the leaf tissue of volunteer alfalfa but the plants will grow out of the injury in 2–3 weeks. Volunteer alfalfa is tolerant to all other postemergence soybean herbicides.

Expectation for control: 40%–50%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, control of volunteer alfalfa is listed on the ROUNDUP WEATHERMAX (540 g/L) label when applied at a rate of 4.67 L/ha (1.87 L/acre).

Expectation for control: 70%–80%

In Roundup Ready 2 Xtend soybean varieties, control of volunteer alfalfa is listed on the RU Xtend label when applied at 2 L/acre. Expectation for control: 80%–90%.

Cereals

In limited comparative trial work, cereal herbicides containing 2,4-D Ester 700, dichlorprop/2,4-D (e.g., ESTAPROP XT, TURBOPROP), LONTREL XC + 2,4D and the PIXXARO co-pack have provided the best suppression of volunteer alfalfa.

Expectation for control: 70%–80%

Bindweed, Field

Corn – Conventional

In limited comparative trials, postemergence applications of dicamba (e.g., ENGENIA) at 1 L/ha (0.4 L/acre) or DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) have provided the most consistent control of emerged field bindweed.

Expectation for control: 75%–85%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, sequential applications of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre) applied at the 2–3 leaf stage of corn and then again at the 7–8 leaf stage of corn to emerged field bindweed provided the most consistent level of control. Alternatively, a single application of glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) provided comparable control to the sequential applications.

Expectation for control: 75%–85%

In glufosinate tolerant ("Liberty Link") corn, suppression of top growth can be achieved when LIBERTY 200 SN is applied twice, to emerged field bindweed. The first application typically being at the 3 leaf stage of corn and at a rate of 2.5 L/ha (1 L/acre) followed by a second application at the 7–8 leaf stage of corn at a rate of 2 L/ha (0.8 L/acre). Alternatively, tank-mix LIBERTY 200 SN with dicamba /atrazine (e.g., MARKSMAN) and apply once to emerged field bindweed between the 2–6 leaf stage of corn.

Soybeans – Conventional

Postemergence applications of BLAZER at 1.67 L/ha (0.67 L/acre) or BASAGRAN FORTE at 2.25 L/ha (0.9 L/acre) can burn back the foliage of field bindweed when applied during periods of high heat, high humidity and adequate soil moisture. However, field bindweed will grow back.

Expectation for control: 40%–50%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, sequential applications of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre) applied at the 1st trifoliate stage of soybean and then again at the 4th trifoliate stage of soybean to emerged field bindweed provided the most consistent level of control. Alternatively, a single application of glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) provided comparable control to the sequential applications.

Expectation for control: 75%–85%

Cereals

The challenge with field bindweed control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. In winter wheat some farmers have had success in applying bromoxynil/MCPA in the fall to suppress field bindweed growth the following spring. The single most important management practice that a grower can implement to reduce field bindweed is with either a pre-harvest glyphosate (540 g/L) application at 1.67 L/ha (0.67 L/acre) or with an application of glyphosate (540 g/L) at 2.5 L/ha (1 L/acre) after cereal harvest, typically in mid to late September, after field bindweed has re-grown. Following cereal harvest, some farmers have had better success when tank-mixing 2,4-D Ester 700 at 0.67 L/acre with glyphosate (540 g/L) at 1 L/acre than using high rates of glyphosate. Both application timings will decrease the level of field bindweed to manage in the following spring. A pre-harvest application is preferred if field bindweed is at a population density that is problematic for harvesting.

Black Medick

Refer to management strategies for ALFALFA, as they apply equally to Black medick.

Bur Cucumber

Corn – Conventional

Sequential applications provide the most consistent level of control. Either CONVERGE XT or PRIMEXTRA II MAGNUM should be applied preemergence followed by a postemergence application of bromoxynil (e.g., PARDNER + AATREX 480) or CALLISTO + AATREX 480. Bromoxynil + AATREX 480 is best applied when bur cucumber is at the 4–6 leaf stage of growth.

Expectation for control: 85%–90%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, the most consistent bur cucumber control has been achieved when glyphosate (540 g/L) is applied twice to emerged bur cucumber, with the first application occurring at the 2–3 leaf stage of corn and the second at the 7–8 leaf stage of corn. Bur cucumber at the 4–6 leaf stage requires a glyphosate (540 g/L) rate of 3.33 L/ha (1.34 L/acre) to provide adequate control.

Expectation for control: 85%–90%

Soybeans – Conventional

Sequential applications provide the most consistent level of control. In comparative trials the best control of bur cucumber was achieved when SENCOR 75DF was applied preemergence at 1.5 kg/ha (0.6 kg/acre) followed by an application of either CLASSIC/CHAPERONE at 35 g/ha (14 g/acre) with a non-ionic surfactant at 0.2% v/v or PINNACLE SG at 12 g/ha (4.8 g/acre) with a non-ionic surfactant at 0.1% v/v to bur cucumber at the 4–6 leaf stage of growth.

Expectation for control: 75%–80%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, sequential applications of glyphosate (540 g/L) applied at the 1st trifoliate stage of soybean and then again at the 4th trifoliate stage of soybean provided the most consistent level of control. Bur cucumber at the 4–6 leaf stage requires a glyphosate (540 g/L) rate of 3.33 L/ha (1.34 L/acre) to provide adequate control.

Expectation for control: 85%–90%

Cereals

Typically not found in winter cereals as the crop produces enough ground cover to inhibit the germination of this summer annual weed. Cereal herbicides have not been evaluated. However in field corn, the active ingredient bromoxynil has shown to have reasonable activity on bur cucumber, therefore cereal herbicides that contain bromoxynil (e.g., BUCTRIL M, INFINITY) should provide some control of this species in cereals.

Canada Fleabane – Glyphosate Resistant

Corn

Control of glyphosate resistant Canada fleabane has been most consistent with postemergence herbicide applications but good control can be achieved with preemergence herbicides. Of the preemergence herbicides, ACURON, INTEGRITY, MARKSMAN, CALLISTO + AATREX 480 and ENGENIA, FEXAPAN or XTENDIMAX are all good options. Postemergence applications of MARKSMAN, ENGENIA , PARDNER + AATREX 480 and DISTINCT are also effective on glyphosate resistant Canada fleabane. Aggressive primary tillage prior to planting to small fleabane rosettes can also be very effective.

Soybean

Glyphosate resistant Canada fleabane is most difficult to control in soybean because few options exist to control it once the soybean crop has emerged. Therefore, it must be controlled prior to planting. When research trials were initially done, the pre-plant tank-mix of glyphosate + ERAGON LQ + MERGE was the most effective option. However, as that treatment was evaluated over several seasons and locations, about one third of the time, glyphosate + ERAGON LQ + MERGE failed to provide commercially acceptable control of glyphosate resistant Canada fleabane. To address this inconsistency, different tank-mix options were evaluated and the addition of SENCOR 75 DF (metribuzin) at 538 g/ha (215 g/acre) to glyphosate + ERAGON LQ + MERGE improved control of glyphosate resistant Canada fleabane. This improved control has also been observed when other herbicides containing metribuzin are used (e.g., BIFECTA, BOUNDARY LQD, CANOPY PRO, CONQUEST LQ, STRIM MTZ, TRIACTOR etc.). The pre-plant herbicide BLACKHAWK has proven to be ineffective when applied alone but control exceeds 90% when tank-mixed with BIFECTA.

Soybeans – Herbicide Tolerant

In glyphosate and dicamba tolerant ("Roundup Ready 2 Xtend") soybean, the highest labelled rate of ENGENIA, FEXAPAN or XTENDIMAX provide good control of emerged Canada fleabane provided the weed is <15 cm tall at time of application. Tank-mixing these dicamba products with Eragon LQ, in the preplant burndown, would provide two modes of action that control Canada fleabane and is the most effective way to mitigate the selection of herbicide resistant biotypes.

Cereals

INFINITY, PIXXARO and LONTREL XC are the most effective at controlling Canada fleabane in winter wheat, spring wheat and spring barley.

Post Cereal Harvest

Once the cereal crop is harvested, a greater amount of sunlight will hit the soil surface and will either stimulate new weed germination, or growth of Canada fleabane that was suppressed by the cereal canopy. To minimize Canada fleabane seed being produced and returned to the soil, an aggressive cover crop (e.g., oats, rye, cover, oilseed radish) should be planted. Alternatively, fall tillage should be done no later than 4–6 weeks after harvest or before weed seed reaches maturity. In research conducted by the University of Guelph (Guelph campus), fall tillage followed by planting cereal rye at 56 kg/ha (50 lbs/acre) has been very effective at lowering populations of glyphosate resistant Canada fleabane and has improved the control achieved with spring applied herbicides.

Canada Thistle

Corn – Conventional

In comparative trials postemergence applications of DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) has provided excellent control of Canada thistle. Other herbicides like dicamba (e.g., ENGENIA) or dicamba/atrazine (e.g., MARKSMAN) also have good activity on Canada thistle. CALLISTO + AATREX 480 will provide suppression. LONTREL XC applied at 0.25 L/ha (0.1 L/acre) provides season long control of Canada thistle.

Expectation for control (with DISTINCT): 90% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, target actively growing Canada thistle at the rosette stage and no larger than 50 cm in height with an application of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre). It is not advisable to tank-mix DISTINCT + glyphosate because of increased risk of crop injury.

Expectation for control: 90% top growth control

Soybeans – Conventional

Consistent control of Canada thistle is difficult to obtain in non-GMO (conventional) soybeans. In comparative trials CLEANSWEEP, BLAZER, PURSUIT or REFLEX + TURBOCHARGE were all capable of providing acceptable levels of top growth control when low populations of Canada thistle were present. However, all 4 products are inconsistent in their ability to deliver acceptable control with the most consistent product being CLEANSWEEP.

Expectation for control: 55%–90% top growth control

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, target actively growing Canada thistle at the rosette stage and no larger than 50 cm in height with an application of glyphosate (540 g/L) at 1.67L/ha (0.67 L/acre).

Expectation for control: 90% top growth control

Cereals

The challenge with Canada thistle control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. If emerged prior to the flag leaf stage of cereals, LONTREL XC dichlorprop/2,4-D, TROPHY and MCPA Ester have provided the best top growth control. The single most important management practice that a grower can implement to reduce Canada thistle is with an application of glyphosate (540 g/L) at 2.5 L/ha (1 L/acre) after cereal harvest, typically in mid to late September, after Canada thistle has re-grown to 20–25 cm. This application timing will decrease the level of Canada thistle to manage in the following spring. A pre-harvest application is preferred if Canada thistle is at a population density that is problematic for harvesting.

Chamomile, Scentless

IMPORTANT CONSIDERATION: Scentless chamomile is extremely difficult to control once in its second year of growth. Successful management of this species relies on removing newly germinated plants. Since this species germinates and emerges in both the fall and spring, effective management must be initiated during both those emergence periods. Trying to control fall germinated scentless chamomile with selective herbicides in the spring often results in poor performance. Established plants are best controlled in the fall with either glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) or tillage with a moldboard plough.

Corn

Ontario research has demonstrated that (540 g/L) at 3.33 L/ha (1.34 L/acre) is the most effective herbicide at controlling top growth of scentless chamomile in glyphosate tolerant corn. A split application is more effective than a single application. In conventional corn, no herbicide evaluated provided over 50% control.

Soybeans – Conventional

In Ontario trial work, glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) provided the best control of scentless chamomile when applied prior to planting. Certified Crop Advisors in the Niagara region have had success with the higher rate of glyphosate also, but two applications are required to provide season long control as one application tends to result in re-growth. Classic can also provide decent activity on scentless chamomile but has been inconsistent

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) provides the best control of scentless chamomile

Cereals

In winter wheat a "two application" system works best whereby the first herbicide is applied in the fall to emerged winter wheat and the second application is made in the spring during the tillering to first node stage of winter wheat. In comparative trials, REFINE SG, REFINE M or BOOST M and bromoxynil/MCPA have all provided good control of scentless chamomile, provided it is no bigger than the 6 leaf stage of growth. Therefore, one strategy to achieve optimum control of fall germinated scentless chamomile would be to apply bromoxynil/MCPA in the fall and then REFINE SG in the spring if spring germinated seedlings are present.

Clover, Red

IMPORTANT: A lush stand of red clover, either as a cover or forage crop must be controlled in the fall if the intention is to plant a field crop in the spring. If one waits until the spring to control a stand of red clover, the level of control will not be as good and it will take that thick biomass at least 3–4 weeks to decompose enough to make a suitable seedbed. A fall moldboard plough is the only type of tillage that effectively buries a red clover stand. For minimum till cropping systems, a fall application of glyphosate (540 g/L) at 2.5 L/ha (1 L/acre) + either dicamba (e.g., ENGENIA) at 0.5 L/ha (0.2 L/acre) or DISTINCT at 285 g/ha (115 g/acre) is the most effective way to remove a red clover stand.

Corn – Conventional

If glyphosate + dicamba was not applied in the fall, then it should be applied in the spring 2 weeks prior to corn planting.

If red clover plants have escaped tillage treatments, such volunteer plants can be controlled with postemergence applications of either dicamba (e.g., ENGENIA) at 0.5 L/ha (0.2 L/acre), or DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre). When these broadleaf herbicides are tank-mixed with either ACCENT, OPTION or STEADFAST, control of volunteer red clover is improved. CALLISTO + AATREX 480 when applied postemergence can also provide good control of volunteer red clover.

Expectation for control: 95%

Corn – Herbicide Tolerant

If glyphosate + dicamba was not applied in the fall, then it should be applied in the spring 2 weeks prior to corn planting.

In glyphosate tolerant ("Roundup Ready") corn, glyphosate could be used at a lower use rate and tank-mixed with either dicamba or dicamba/atrazine products.

Expectation for control: 95%

Soybeans – Conventional

In reduced tilled soybeans without any fall control of red clover, glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) provides the best level of control.

Expectation for control: 85%

Once soybeans have emerged, red clover is virtually impossible to control. REFLEX or BLAZER will burn the leaf tissue of red clover, but the plants will grow out of the injury in 2–3 weeks. Red clover is tolerant to all other postemergence soybean herbicides.

Expectation for control: 40%–50%

Soybeans – Herbicide Tolerant

In reduced tilled soybeans without any fall control of red clover, glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) provides the best level of control in Roundup Ready soybeans. In "Roundup Ready 2 Xtend" soybean, ROUNDUP XTEND or ENGENIA, FEXAPAN or XTENDIMAX + glyphosate will control emerged red clover.

Expectation for control: 85%

If red clover escapes the preplant treatment above and is present in emerged glyphosate tolerant ("Roundup Ready") soybeans, glyphosate (540 g/L) at 2.5 L/ha (1 L/acre) should provide adequate control.

Expectation for control: 80%–85%

Cereals

The under-seeding of red clover in cereals has numerous benefits and is desired. Therefore, if controlling weeds in a winter wheat crop under-seeded to red clover, herbicides which minimize clover injury should be used. Bromoxynil/MCPA, MCPA sodium and MCPA/MCPB products are all registered for use on winter wheat under-seeded to red clover.

Dandelion

Corn – Conventional

A tank-mix of OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre) + DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) has provided the best control of dandelion in comparative trials. DISTINCT applied alone provides less visual control than when tank-mixed with OPTION.

Expectation for control: 75%–85%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, glyphosate (540 g/L) applied at 3.33 L/ha (1.34 L/acre) provides suppression of dandelion. The practice of tank-mixing a herbicide like dicamba, dicamba/atrazine or CALLISTO + AATREX 480 with glyphosate has not improved the level of dandelion control in limited comparative trials.

Expectation for control: 65%–70%

Soybeans – Conventional or Herbicide Tolerant

GUARDIAN MAX (a co-pack of POLARIS MAX + CLASSIC) applied preplant has provided the best control of dandelion in comparative trials.

Cereals

Comparative trials have shown that INFINITY and dichlorprop/2,4-D products have provided the best control of larger dandelions. However, results can be inconsistent especially under dryer soil conditions (visual control range of 50%–95%). Smaller dandelions can be suppressed with REFINE M and 2,4-D (visual control range of 40%–75%). The optimal time to control dandelions is post cereal harvest with glyphosate (540 g/L) applied typically in mid-September to early October at a rate of 3.33 L/ha (1.34 L/acre) if dandelions are 15 cm in diameter or less or at a rate of 5 L/ha (2 L/acre) if dandelions are larger than 15 cm in diameter.

Horsetail, Field

Corn – Conventional

Either OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre), ACCENT at 33 g/ha (13 g/acre) + non-ionic surfactant at 0.2% v/v or BROADSTRIKE RC have activity on field horsetail but effectiveness varies greatly by population.

Expectation for control: 40%–70%

The most effective herbicide treatment for field horsetail in recent University of Guelph research has been the combination of BROADSTIKE RC at 62.5 g/ha (25 g/acre) + MCPA Amine (500 g/L) at 1 L/ha (0.4 L/acre). However, this treatment MUST be applied before the 4 leaf stage of corn to minimize crop injury and yield loss. When this combination has been applied to corn past the 4 leaf stage, significant crop injury occurs and has resulted in yield losses as great as 1.9 MT/ha (30 bu/acre), which was more than any yield loss associated with field horsetail competition.

Expectation for control: 80%

Corn – Herbicide Tolerant

Field horsetail is fairly tolerant to glyphosate. In glyphosate tolerant ("Roundup Ready") corn the combination of glyphosate + BROADSTIKE RC at 62.5 g/ha (25 g/acre) + MCPA Amine (500 g/L) at 1 L/ha (0.4 L/acre). However, this treatment MUST be applied before the 4 leaf stage of corn to minimize crop injury and yield loss. When this combination has been applied to corn past the 4 leaf stage, significant crop injury occurs and has resulted in yield losses as great as 1.9 MT/ha (30 bu/acre), which was more than any yield loss associated with field horsetail competition.

Expectation for control: 80%

Soybeans – Conventional or Herbicide Tolerant

Glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre) + BROADSTRIKE RC at 87.5 g/ha (35 g/acre) applied preplant to soybeans has provided the best control of field horsetail. However, susceptibility of field horsetail to this treatment varies significantly by population.

Expectation for control: 45%–99%

Cereals

Comparative trials have shown that any cereal herbicide that contains the active ingredient MCPA will provide very effective top growth control of field horsetail.

Horse Nettle

Corn – Conventional

Postemergence applications of STEADFAST + non-ionic surfactant at 0.2% v/v tank-mixed with either DISTINCT, dicamba (e.g., ENGENIA), dicamba/atrazine (e.g., MARKSMAN) or PEAK has provided the best control in comparative trials.

Expectation for control: 75%–95% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, two 1.67 L/ha (0.67 L/acre) applications of glyphosate (540 g/L), the first at the 2–3 leaf stage of corn and the second at the 7–8 leaf stage of corn provide the most consistent level of control. A single application of glyphosate (540 g/L) applied at a rate of 3.33 L/ha (1.34 L/acre) also provides control but not as consistent as the two application strategy.

Expectation for control: 90%–95%

Soybeans – Conventional

FIRSTRATE at 20.8 g/ha (8.5 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 2.5% v/v and REFLEX applied postemergence are the only herbicides to provide suppression of horse nettle in non-GMO (conventional) soybeans.

Expectation for control: 70%–85% top growth control

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, two 1.67 L/ha (0.67 L/acre) applications of glyphosate (540 g/L), the first at the 1st trifoliate stage of soybean and the second at the 3rd trifoliate stage of soybean provide the most consistent level of control. A single application of glyphosate (540 g/L) at a rate of 3.33 L/ha (1.34 L/acre) also provides control but not as consistent as the two application strategy.

Expectation for control: 90%–95%

Cereals

There has been no public research done on horse nettle susceptibility to cereal herbicides. However, limited field experience would suggest that dichlorprop/2,4-D products (e.g., ESTAPROP XT, TURBOPROP, DICHLORPROP D) have some activity on horse nettle. The single most important management practice that a grower can implement to reduce horse nettle is with either a pre-harvest glyphosate (540 g/L) application at 1.67 L/ha (0.67 L/acre) or with an application of glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) after cereal harvest, typically in mid to late September, after horse nettle has re-grown. Both application timings will decrease the level of horse nettle to manage in the following spring. A pre-harvest application is preferred if horse nettle is at a population density that is problematic for harvesting.

Medick, Black

Refer to management strategies for ALFALFA, as they apply equally to Black medick.

Nutsedge, Yellow (Nut Grass)

Corn – Conventional

Preplant incorporated (PPI) applications of either DUAL II MAGNUM or KOMODO at 1.75 L/ha (0.7 L/acre) or FRONTIER MAX at 963 mL/ha (390 mL/acre) will suppress nutsedge growth. If either product is not applied PPI, nutsedge control will be reduced. A postemergence application of PERMIT at 70–90 g/ha (28–38 g/acre) + non-ionic surfactant at 0.25% v/v) provides the best control of yellow nutsedge.

Expectation for control: 60%–80%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, nutsedge control with glyphosate is greatly affected by rate. A single application of glyphosate (540 g/L) applied at a rate of 3.33 L/ha (1.34 L/acre) will provide around 80% visual control of nutsedge whereas the 1.67 L/ha (0.67 L/acre) rate will typically provide less than 60% visual control A tank-mix of PERMIT at 47–90 g/ha (19–38 g/acre) + glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre) non-ionic surfactant at 0.25% v/v) provides the best control of yellow nutsedge.

Expectation for control: 70%–80%

Soybeans – Conventional

CLASSIC/CHAPERONE at 36 g/ha (14 g/acre) + non-ionic surfactant at 0.2% v/v applied postemergence has provided the best control of nutsedge in comparative trials. In fields with tremendous nutsedge pressure, some producers have opted to preplant incorporate either DUAL II MAGNUM, KOMODO or FRONTIER MAX at their highest labelled rate and then apply CLASSIC/CHAPERONE postemergence in soybeans.

Expectation for control (with CLASSIC/CHAPERONE): 90%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, GUARDIAN MAX (a co-pack of POLARIS MAX + CLASSIC) applied postemergence to nutsedge has continually provided the best visual control.

A single application of glyphosate (540 g/L) applied at 3.33 L/ha (1.34 L/acre) will also provide control of nutsedge but consistently at 10%–20% less than GUARDIAN MAX.

Expectation for control: 95%

Cereals

Typically not a huge problem in winter cereals since cereal growth will provide a level of competition that keeps nutsedge suppressed during the season. The majority of cereal herbicides provide little activity on nutsedge.

Sow-Thistle, Perennial

Corn – Conventional

In comparative trials postemergence applications of dicamba/atrazine (e.g., MARKSMAN) at 2.5 L/ha (1 L/acre), dicamba (e.g., ENGENIA) at 1 L/ha (0.4 L/acre) or DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) and PEAK at 13.3 g/ha (5.3 g/acre) + non-ionic surfactant at 0.2% v/v. have all provided good control of perennial sow-thistle. LONTREL XC applied at 0.25L/ha (0.1 L/acre) provides season long control of perennial sow-thistle

Expectation for control 80%–90% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, glyphosate (540 g/L) applied postemergence at 3.33 L/ha (1.34 L/acre) will provide good top growth control of perennial sow-thistle. It is not uncommon for perennial sow-thistle to re-grow after an application of glyphosate, therefore requiring follow-up applications. Tank-mixing glyphosate with dicamba/atrazine, dicamba, PEAK or LONTREL XC can deter perennial sow-thistle re-growth.

Expectation for control 85%–95% top growth control

Soybeans – Conventional

In comparative trials all postemergence soybean herbicides can periodically provide some level of perennial sow-thistle control however none do consistently. CLEANSWEEP, BLAZER at 2.5 L/ha (1 L/acre), BASAGRAN FORTE at 2.25 L/ha (0.9 L/acre) and CLASSIC + non-ionic surfactant at 0.2% v/v provide top growth control, but typically sow-thistle will re-grow and be present at harvest. Pre-harvest glyphosate applications will have more impact on reducing perennial sow-thistle populations than any in-crop herbicide.

Expectation for control: 50%–70% top growth control

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, glyphosate (540 g/L) applied postemergence at 3.33 L/ha (1.34 L/acre) will provide good top growth control of perennial sow-thistle. It is not uncommon for perennial sow-thistle to re-grow after an application of glyphosate, therefore requiring follow-up applications.

In "Roundup Ready 2 Xtend" soybean, ENGENIA, FEXAPAN or XTENDIMAX + glyphosate or ROUNDUP XTEND will provide good top growth control of perennial sow-thistle and can also suppress the emergence of new vegetative shoots.

Expectation for control 85%–95% top growth control

Cereals

The challenge with perennial sow-thistle control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. If emerged during the tillering to nodal stage of cereals, dichlorprop/2,4-D, TROPHY, PIXXARO and MCPA Ester have provided good top growth control. The single most important management practice that a grower can implement to reduce perennial sow-thistle is to use an application of glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) after cereal harvest, typically in mid to late September, after perennial sow-thistle has re-grown. This application timing will decrease the level of thistles to manage in the following spring. A pre-harvest application is preferred if perennial sow-thistle is at a population density that is problematic for harvesting.

Quackgrass

Corn – Conventional

Either OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre), STEADFAST + non-ionic surfactant at 0.2% v/v or ACCENT at 33 g/ha (13 g/acre) + non-ionic surfactant at 0.2% v/v applied postemergence to quackgrass will provide excellent control.

Expectation for control 90%–95% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, target actively growing quackgrass that is 10–20 cm in height with an application of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre).

Expectation for control: 90%–95%

Soybeans – Conventional

If quackgrass has emerged before planting, a preplant burndown with glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) should be made.

For quackgrass that has emerged in the soybean crop, postemergence applications of ASSURE II at 0.75 L/ha (0.3 L/acre) + SURE MIX at 0.5% v/v, VENTURE at 2 L/ha (0.8 L/acre) or POAST ULTRA at 1.1 L/ha (0.45 L/acre) + MERGE at 2 L/ha (0.8 L/acre) will provide suppression/control of quackgrass. ASSURE II has been the most consistent of the three in limited comparative trials.

Expectation for control 70%–85%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, target actively growing quackgrass that is 10–20 cm in height with an application of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre).

Expectation for control: 90%–95%

Cereals

There are no products available in cereals that will control quackgrass. The single most important management practice that a grower can implement to reduce quackgrass is to use either a pre-harvest glyphosate (540 g/L) application at 3.33 Lha (1.34 L/acre) or an application of glyphosate after cereal harvest, typically in mid to late September, after quackgrass has re-grown. Both application timings will decrease the level of quackgrass to manage in the following spring. A pre-harvest application is preferred if quackgrass is at a population density that is problematic for harvesting.

Vetch, Tufted

Corn – Conventional

LONTREL XC is the most effective at providing season long top growth control of tufted vetch. In comparative trials either dicamba (i.e. ENGENIA) at 0.1 L/ha (0.4 L/acre), DISTINCT at 285 g/ha (115 g/acre) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) or CALLISTO at 210 mL/ha (85 mL/acre) + AATREX 480 at 580 mL/ha (235 mL/acre) + non-ionic surfactant at 0.2% v/v have all provided good top growth control of tufted vetch.

Expectation for control: 80%–90%

Corn – Herbicide Tolerant

The maximum rate of glyphosate listed for use in glyphosate tolerant ("Roundup Ready") corn has only provided 70% visual control of vetch in University of Guelph dose response trials. Tank-mixes of either CALLISTO + AATREX, dicamba/atrazine (e.g., MARKSMAN), dicamba (e.g., ENGENIA) or LONTREL XC with glyphosate have provided the best level of vetch control in comparative trials.

Expectation for control: 85%–95%

Soybeans – Conventional

It is extremely difficult to control a perennial legume weed in an annual legume crop. Of all the herbicide programs tested over the past 10 years, a "two-pass" strategy of applying DUAL II MAGNUM + SENCOR, BOUNDARY LQD or STRIM MTZ preemergence followed by REFLEX postemergence has provided the best suppression of vetch. If vetch has emerged prior to planting, University of Guelph research has shown that the addition of 2,4-D Ester 700 at 320 mL/acre (800 mL/ha) tank-mixed with glyphosate and applied 7 days prior to planting can provide good early season control of vetch.

Expectation for control: 50%–70%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, the rate listed on the ROUNDUP WEATHERMAX (540 g/L) label of 4.67 L/ha (1.87 L/acre) for the control of volunteer alfalfa offers the best potential for vetch suppression/control. If vetch has emerged prior to planting, University of Guelph research has shown that the addition of 2,4-D Ester 700 at 800 mL/ha (320 mL/acre) tank-mixed with glyphosate and applied 7 days prior to planting can provide good early season control of vetch.

Expectation for control: 70%–80%

In "Roundup Ready 2 Xtend" soybean the high rate of Engenia/Xtendimax or RU Xtend will provide good control.

Expectation for control: 80%

Cereals

The challenge with vetch control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. If emerged during the tillering to nodal stage of cereals, PIXXARO, TROPHY, 2,4-D Ester, MCPA Ester and dichlorprop/2,4-D have all provided some level of top growth control. Post harvest herbicide applications made before the first frost (vetch is sensitive to cold air temperatures and is one of the first species to die off in the fall) are advantageous in decreasing the level of vetch to manage in the following spring. In limited comparative trial work, glyphosate (540 g/L) at 3.33 L/ha (1.34 L/acre) tank-mixed with either DISTINCT at 285 g/ha (115 g/acre) or dicamba (e.g. ENGENIA) at 1 L/ha (0.4 L/acre) significantly reduced the amount of vetch that emerged the following spring and into the summer.

Waterhemp – Glyphosate Resistant

Corn

Control of glyphosate resistant waterhemp is best achieved with a two-pass herbicide program where one of ACURON, LUMAX EZ, INTEGRITY, CONVERGE XT or CALLISTO + AATREX is applied preemergence. If a second flush of waterhemp emerges after the crop has emerged, then one of CALLISTO + AATREX, MARKSMAN, ENGENIA, FEXAPAN or XTENDIMAX, SHEILDEX + AATREX, ARMEZON + AATREX or 2,4-D can be applied. It is advisable not to apply the same active ingredient postemergence if it was also applied preemergence as this can result in carryover issues for next year's crop (e.g. applying ACURON preemergence followed by CALLISTO + AATREX postemergence results in the active ingredient "mesotrione" being applied twice).

Soybeans

Control of glyphosate resistant waterhemp is best achieved with a two-pass herbicide program where one of FIERCE, AUTHORITY SUPREME, BOUNDARY LQD, STRIM MTZ or TRIACTOR is applied preemergence. If a second flush of waterhemp emerges once the crop has emerged, then one of REFLEX or BLAZER can be applied.

If growing "Roundup Ready 2 Xtend" soybean varieties, a preemergence herbicide is still critical. There is more flexibility in postemergence options as ENGENIA, FEXAPAN or XTENDIMAX provide good control of emerged waterhemp, provided waterhemp is 10 cm tall or less. If growing E3 (Enlist) soybean varieties, then Enlist Duo or Enlist 1 will provide good postemergence control of waterhemp provided the plants are not taller than 10 cm at application.

Cereals

In limited University of Guelph research trials, PIXXARO, INFINITY and 2,4-D ESTER have provided over 90% visual control of waterhemp.

Wire-Stemmed Muhly

Corn – Conventional

OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre) provides the best control.

Expectation for control 80%–95%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, target actively growing wire-stemmed muhly that is 10–20 cm in height with an application of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre).

Expectation for control: 80%–95%

Soybeans – Conventional

If wire-stemmed muhly has emerged before planting, a preplant burndown with glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre) should be made. For wire-stemmed muhly that has emerged in the soybean crop, VENTURE at 2 L/ha (0.8 L/acre) will provide the best suppression/control of wire-stemmed muhly.

Expectation for control: 75%–95%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, target actively growing wire-stemmed muhly that is 10–20 cm in height with an application of glyphosate (540 g/L) at 1.67 L/ha (0.67 L/acre).

Expectation for control: 80%–95%

Cereals

There are no products available in cereals that will control wire-stemmed muhly. The single most important management practice that a grower can implement to reduce this weed is to use either a pre-harvest glyphosate (540 g/L) application at 3.33 L/ha (1.34 L/acre) or an application of glyphosate after cereal harvest, typically in mid to late September, after wire-stemmed muhly has re-grown. Both application timings will decrease the level of wire-stemmed muhly to manage in the following spring. A pre-harvest application is preferred if wire-stemmed muhly is at a population density that is problematic for harvesting.