



PRAIRIE & GRASSLANDS EDITION

SPRING 2016

TechLine

INNOVATIVE RESEARCH, SUCCESS
STORIES, AND TIPS FOR INVASIVE
PLANT MANAGERS

INVASIVE PLANT NEWS

2015 PHOTO CONTEST WINNER

Cynoglossum officinale in
flower, by Stacy Davis
(Montana State University).
See inside cover for details
about the 2016 photo
contest.

IN THIS ISSUE:

Impact of Canada Thistle

Cover on Plant Community
Structure in Early Stage Prairie
Restoration

Practical Tips for Managing Canada Thistle

Proper Application Timing
to Maximize Control of Key
Invasive Plants

Essential Online Resources
To Kick Off Your Field Season

ABOUT TECHLINE

TechLine Invasive Plant News aims to provide an objective communication tool for on-the-ground natural resource managers who face common management challenges so they may share the successes of their programs and learn from one another.

Print newsletters are published twice per year and delivered free of charge. This and past issues can be downloaded from www.techlinenews.com.

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Learn more: www.techlinenews.com

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Gearing Up for Spring

When the harsh months of winter have passed and the first spring flowers appear, it is time to gear up for the field season! Updating management plans, hiring and training summer crews, inspecting equipment, and ordering supplies are only part of the tasks that need to be done before managing invasive plants. One of the best ways to accomplish your objectives is to review and implement some of the new research, application techniques, inventory methods and training tools that are available to invasive plant managers.

The goal of TechLine Invasive Plant News is to provide you with new resources and ideas to help you get ready for the field season. In this issue you will find information on the impact of Canada thistle cover on desirable native forbs (wildflowers), calibrating and maintaining herbicide equipment, training tips and tools for new employees, education series on herbicides and much more.

Thank you for your dedication and support of invasive plant management. Your continued perseverance and talents are making a difference in protecting and restoring desirable plant communities!



-- Celestine Duncan, Editor

Sweepstakes Winnings Help New Mexico Weed Coordinator Expand Reach, Save Time and Money



CONGRATULATIONS TO REBECCA HEALY FOR WINNING TECHLINE'S \$200 SWEEPSTAKES. Rebecca is the Noxious Weed Coordinator for the Chaves Soil and Water Conservation District (SWCD) in Roswell, and Hagerman/Dexter SWCD in Hagerman and Dexter, New Mexico. TechLine's \$200 prize will help Healy address equipment limitations for one of their largest annual projects, Russian Knapweed control on the Hagerman Canal.

READ MORE about Healy's program and how she chose to spend her winnings > <http://techlinenews.com/sweepstakes>

2016 PHOTO CONTEST

Send us your best shots of **INVASIVE PLANTS and invasive plant MANAGEMENT IN ACTION** for TechLine's 2nd annual photo contest and a chance to win a \$200 prize.

WHEN TO ENTER: August 15 to October 14, 2016

WHAT TO ENTER: Your original photographs of invasive plants or invasive plant management in action.

WHY TO ENTER: You'll win a prize! The winner of each category will receive a gift card to Forestry Suppliers or REI (\$200 value).

STAY TUNED FOR DETAILS <http://techlinenews.com/photo-contest>

Subscribe at <http://techlinenews.com/subscribe/> to receive contest updates.



Vastlan™ Specialty Herbicide Replaces Garlon® 3A

Vastlan™ is a herbicide developed by Dow AgroSciences for the control of woody plant species and annual and perennial broadleaf weeds on industrial vegetation management, aquatic, Conservation Reserve Program (CRP), range and permanent grass pastures sites and grasses grown for hay. Vastlan herbicide is formulated as a soluble liquid (SL) and contains 4 pounds acid equivalent per gallon (lbs ae/ gallon) of triclopyr choline. The choline formulation of triclopyr reduced the signal from "Danger" on Garlon® 3A to "Warning". This reduced toxicity and higher concentration sets Vastlan herbicide apart from its predecessor Garlon 3A. Grass tolerance and weed control spectrum of Vastlan herbicide is the same as Garlon 3A. Vastlan will be commercially available in the spring of 2016.

APPLICATION RATE CONVERSION FOR GARLON® 3A TO VASTLAN™ SPECIALTY HERBICIDE

Garlon 3A has 3 lb acid equivalent per gallon (ae/gallon) and Vastlan has 4 lb ae/gallon.

GARLON® 3A (3 lb ae/gal)		VASTLAN™ (4 lb ae/gal)
2 pints/Acre	=	1.5 pints/Acre
3 pints/Acre	=	2.25 pints/Acre
4 pints/Acre	=	3 pints/Acre
6 pints/Acre	=	4.5 pints/Acre
8 pints/Acre (4 quarts)	=	6 pints/Acre (3 quarts)

Milestone® Specialty Herbicide Label Updates

The label for Milestone® specialty herbicide has been updated to include an expanded site listing for use, a new section for spot treatment on small areas, changes to the section on seeding grasses and forbs, and addition of a section on a supplemental label for the control/suppression of medusahead and other winter annual grasses.

Download a copy of the new label here: http://bit.ly/techline_labels

®™ Trademark of The Dow Chemical Company ("DOW") or an affiliated company of Dow. Always read and follow the label directions.

SELECTING, MAINTAINING & CALIBRATING EQUIPMENT

TIPS FOR SELECTING, MAINTAINING, AND CALIBRATING BACKPACK SPRAYERS

Learn key features to consider before purchasing a backpack sprayer, maintenance guidelines, and TechLine reader-reviews of backpack sprayer equipment.

<http://bit.ly/sprayerselection>

SELECTING ATV OR UTV HERBICIDE SPRAYER PLATFORMS FOR WILDLAND AND NATURAL AREA MANAGEMENT

We asked 10 public and private invasive plant management professionals which ATV and UTV herbicide application platforms they recommend and why.

Learn about the equipment they endorse based on experience.

<http://bit.ly/atvutvplatform>

CALIBRATION GUIDELINES FOR SMALL (BACKPACK) AND LARGE VOLUME (ATV-, TRUCK-MOUNTED BOOM AND BOOMLESS) HERBICIDE SPRAYERS

How do I make the most of my herbicide spot treatments? How much herbicide do I put in my tank? The answers to these questions plus step-by-step procedures for calibrating your large and small volume sprayers are included in this article.

<http://bit.ly/techlinecalibration>

MOBILE APPS AIDING IN HERBICIDE APPLICATION

Explore smart phone apps that calculate tank mixes and log application records.

<http://bit.ly/applicationapps>



MARY HALSTVEDT

IMPACT OF CANADA THISTLE COVER ON PLANT COMMUNITY STRUCTURE IN EARLY STAGE PRAIRIE RESTORATION



MARY HALSTVEDT

By Byron B. Sleugh, Mary B. Halstvedt, Roger L. Becker, and Paul Bockenstedt

LAND MANAGERS' ABILITY TO RECONSTRUCT OR RESTORE PRAIRIES HAS ADVANCED GREATLY THE LAST TEN YEARS. Although much has been learned, restoring mixed wildflower (forb)-grass prairie landscapes is often compromised by the presence of invasive plants such as Canada thistle (*Cirsium arvense* L.).

A field study was conducted near Renville, Minnesota to determine if there was a threshold of Canada thistle cover that would impact desirable plant community structure. Objectives of the study were to: 1) measure the effect of Canada thistle cover on seeded species in a two-year old prairie restoration; and 2) determine the threshold of Canada thistle cover that would impact the desirable plant community.

Study Site

The study site encompassed 74 acres of former cropland that was converted to permanent prairie habitat as part of a Ducks Unlimited acquisition. The area was cultivated and seeded with 10 native prairie grasses and 31 native forbs in May 2011 (Figure 1). Seedling rate averaged about 6 pounds (lbs) of pure live seed per acre (PLS/A) for all grasses combined, and 1.5 lbs of PLS/A for all forbs combined. Five days following seeding, the site was treated with glyphosate herbicide to remove undesirable plants prior to

RESEARCH PARTNERS
PAUL BOCKENSTEDT,
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MANAGER, STANTEC INC.
(LEFT) AND DR. ROGER
BECKER, UNIVERSITY OF
MINNESOTA (RIGHT).

EDITORS NOTE:

The following was summarized from information presented at the North Central Weed Science Society of America meeting, December 7 through 10, 2015 in Indianapolis, Indiana.

Continued on page 4...



NEW ARTICLES ON HERBICIDE SPRAYER NOZZLES

NOZZLES: SMALL IN SIZE —BIG IN IMPORTANCE.

Spray nozzles are an important part of your herbicide application program. There are many different types of nozzles available from manufacturers, and each nozzle can perform differently. Review some guidelines for selecting the proper spray nozzles and operating them effectively.

<http://bit.ly/nozzletips>

PROFESSIONAL INSIGHTS ON SPRAYER NOZZLE SELECTION, MAINTENANCE, AND OPERATION

We asked 13 invasive plant management professionals to provide insight and tips on nozzle selection and maintenance based on their field experience. See what the professionals suggest for type and size of nozzles for backpack and ATV/UTV or truck-mounted sprayers, supplemental equipment, and best practices for calibrating, maintaining, and replacing nozzles.

<http://bit.ly/nozzlereview>

UNDERSTANDING PERFORMANCE OF YOUR ATV-MOUNTED BOOMLESS SPRAY NOZZLES

A summary of field studies by Robert Woolf and others at Kansas State University to evaluate the effectiveness of spray nozzles on all-terrain vehicles (ATVs).

<http://bit.ly/boomless>



ROGER BECKER



MARY HALSTVEDT

FIGURE 1. STUDY SITE NEAR RENVILLE, MINNESOTA AT PLANTING IN MAY 2011 (LEFT) AND ONE YEAR FOLLOWING PLANTING (RIGHT).



MARY HALSTVEDT

FIGURE 2. RESTORED PRAIRIE TWO YEARS AFTER PLANTING SHOWING CANADA THISTLE INVASION.

...Continued from page 3

emergence of desirable seeded species.

Desirable seeded species successfully established one year following planting; however, within two years Canada thistle began to invade the restored prairie (Figure 2). There was concern that Canada thistle could out-compete desirable species in the restoration, which precipitated the field study.

Materials and Methods

Canada thistle in the study area was mapped and the acreage and perimeter of infestations recorded with a hand-held GPS unit. Mapping was conducted annually in mid-summer from 2013 through 2015.

The plant community was characterized by measuring percent cover of individual species

along permanent transects established within Canada thistle infestations. Cover data were collected in 25, 0.25 meter squared (m^2) quadrats per transect. Quadrats were measured annually in mid-summer from 2013 through 2015. A total of 925 quadrats were measured during the three-year study. Individual species were grouped into botanical categories including: native grasses, non-native grasses, native forbs, Canada thistle, and other non-native forbs. The percent bare ground and litter was also recorded. The study area was mowed once in September 2013 after transects were established.

Data from all quadrats were pooled to develop mean percent cover by botanical category in each year of the study. In addition, data from quadrats were sorted and grouped by Canada thistle cover classes, and a mean



UNDERSTANDING HERBICIDES

With spring just around the corner, now is the time to improve your skills and expand your understanding of the science behind selecting, applying, and assessing the effects of herbicides.

Explore these and more articles with technical and practical information about using herbicides at: <http://techlinenews.com/herbicides>

HERBICIDE EDUCATION SERIES

- [Effective Herbicide Use Starts With the Label](#)
- [Introduction to Herbicide Formulations](#)
- [Factors Affecting Herbicide Performance](#)
- [Surfactants and Adjuvants](#)

TOLERANCE OF NON-TARGET SPECIES TO HERBICIDE

- [Native Forb and Shrub Tolerance to Milestone® Herbicide](#)
- [Tolerance of Warm and Cool Season Grasses to Milestone Herbicide](#)
- [Possible Effects of Herbicides to Honeybees](#)

PRODUCT INFORMATION

- [Answers to FAQs about Control of Saltcedar and Russian Olive with Garlon® 3A vs Garlon 4 Ultra](#)
- [Answers to FAQs about Milestone Herbicide Labels, MSDS, and Additional Information](#)

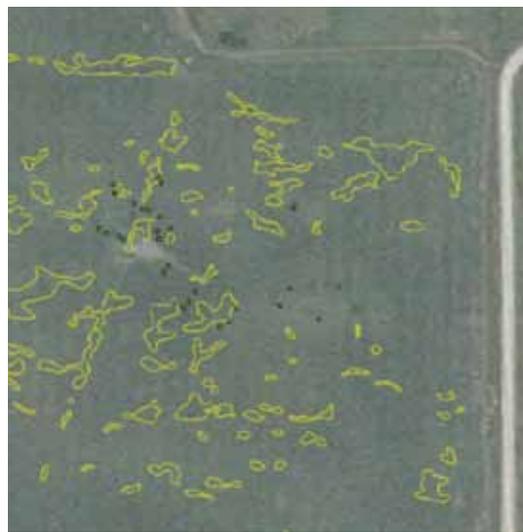


FIGURE 3. LOCATION AND SIZE OF CANADA THISTLE POPULATIONS ON THE RESTORED PRAIRIE STUDY SITE IN 2013 (LEFT) AND 2014 (RIGHT).

was calculated to measure the interaction of Canada thistle cover on each botanical category. A Oneway Analysis of Variance (ANOVA) test was performed to compare native forb percentage across five categories of Canada thistle growth. Comparison of means was conducted with a Student's t-test. In addition, correlation coefficients were estimated by the REML (Restricted Maximum Likelihood) method.

Results and Discussion

Canada thistle populations expanded from less than one acre in 2013 to greater than three acres in 2014. Individual patches of Canada thistle were dynamic over the three-year study, with small low-density patches disappearing and others coalescing into larger, better defined populations during the three year study (Figure 3).

Data collected from sample quadrats in 2013, two growing seasons following seeding, showed native grass and forb cover was about 54 and 31 percent respectively (Table 1). Dominant native grasses included big bluestem (*Andropogon gerardii*) and switchgrass (*Panicum virgatum*). Common native forbs included: Canada milk vetch (*Astragalus Canadensis*), common ox-eye (*Heliopsis helianthoides*), golden alexander (*Zizia aurea*) and yellow coneflower (*Ratibida pinnata*). The remaining 15 percent cover was predominately Canada thistle (9%), other non-native forbs (4%) and bare ground or litter.

Bare ground and litter cover increased from 0.5 percent in 2013 to more than 21 percent in 2014 (Table 1). Native forb cover declined from about 31 percent to 14 percent

during this same time period. Native grass cover also declined slightly between 2013 and 2014. However, cover of Canada wildrye (*Elymus Canadensis*), slender wheatgrass (*Elytrigia trachycaulum*), and Virginia wildrye (*Elymus virginicus*) was significantly reduced. The increase in bare ground is attributed to mowing in September 2013, which had a negative impact on desirable forb and grass cover.

Vegetative data collected from sample quadrats were grouped into five Canada thistle cover classes: no Canada thistle, less than 10 percent, 11 to 19 percent, 20 to 30 percent, and greater than 30 percent Canada thistle. The percent cover of each botanical group was compared within the five cover classes. Results showed that as Canada thistle cover increased, the percent cover of native forbs and some grasses declined (Figure 4). The greatest impact to native forbs occurred at Canada thistle cover of 20 percent or greater (Figures 4 and 5).

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TABLE 1. CHANGE IN PERCENT COVER BY BOTANICAL GROUPING FROM 2013 THROUGH 2015 ON THE STUDY SITE (ALL SAMPLE QUADRATS COMBINED IN EACH YEAR).

Category	Change in % Cover		
	2013	2014	2015
non-native grasses	0.3	1.1	-
native grasses	54.3	49.1	48
Canada thistle	9.5	9.2	7.5
other non-native forbs	4	4	8.2
native forbs	30.5	14.3	17.5
bare ground/litter	0.5	21.7	18

PROPER APPLICATION TIMING MAXIMIZES INVASIVE PLANT CONTROL

**SPRING AND EARLY SUMMER
CAN BE EXCELLENT TIMES
TO CONTROL ACTIVELY
GROWING INVASIVE PLANTS
WITH HERBICIDES.** Applying
herbicides to the target plant
at the optimum growth stage is
important to maximize control.

The following guidelines
provide information on the best
application timing and rate to
control key invasive plants.

CANADA THISTLE (*Cirsium arvense*)

Late spring and early summer
applications of Milestone® spe-
cialty herbicide on Canada thistle
should be made after all plants
have emerged and basal leaves
are expanded. It is better to wait
until some of the plants are at
the bud growth stage to be sure
that all plants are emerged before
applying Milestone at 5 to 7 fluid
ounces per acre (fl oz/A). Use
the 7 fl oz/A rate at later growth
stages. <http://bit.ly/canadathistle>

BIENNIAL THISTLES:

BULL (*Cirsium vulgare*), **MUSK**
(*Carduus nutans*), **PLUMELESS**
(*Carduus acanthoides*)

Milestone at 3 to 5 fl oz/A can
be applied in spring and early
summer from rosette to early
flower growth stage. Use the 5
fluid ounce rate at the late bolt to
early flower growth stage.

<http://bit.ly/biennialthistle>

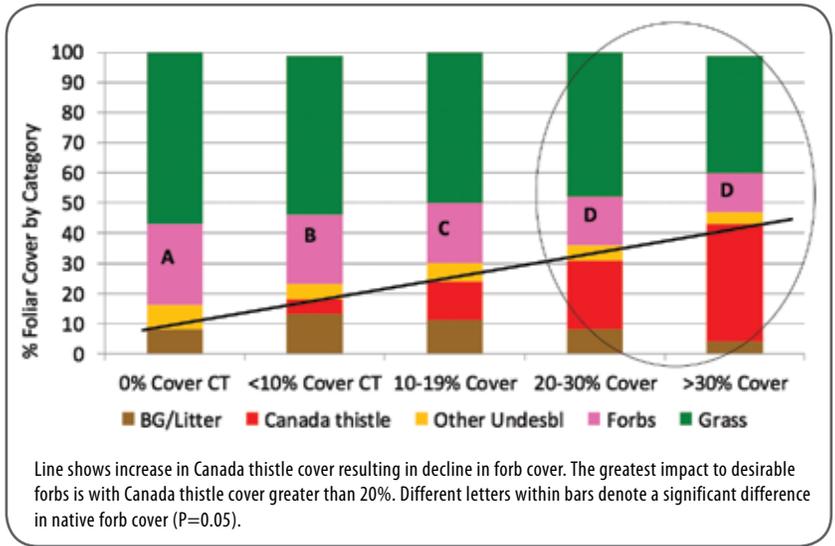
SPOTTED and DIFFUSE KNAPWEED

(*Centaurea stoebe* and *C. diffusa*)

Milestone at 5 to 7 fl oz/A may
be applied any time during the
growing season when plants are
actively growing. Applications
made during the late bud to
bloom stage will not stop seed
production the year of treatment.

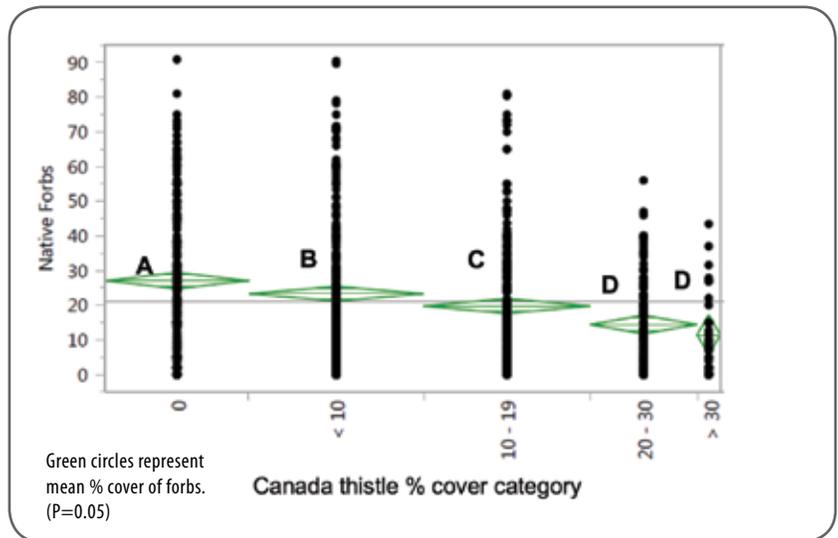
<http://bit.ly/spottedknawweed>

FIGURE 4.
COMPARISON OF
PERCENT COVER OF
EACH FOLIAR CATEGORY
AND BARE GROUND/
LITTER AT DIFFERENT
LEVELS OF CANADA
THISTLE COVER (DATA
POOLED ACROSS
YEARS).



Line shows increase in Canada thistle cover resulting in decline in forb cover. The greatest impact to desirable forbs is with Canada thistle cover greater than 20%. Different letters within bars denote a significant difference in native forb cover (P=0.05).

FIGURE 5.
PERCENT COVER OF
NATIVE DESIRABLE
FORBS PRESENT AT
DIFFERENT LEVELS
OF CANADA THISTLE
COVER (DATA POOLED
ACROSS YEARS).



Green circles represent
mean % cover of forbs.
(P=0.05)

...Continued from page 5

Management Implications

Results from this study have important implications for land managers restoring native prairie. Managers must recognize that Canada thistle populations in grasslands and prairies can be dynamic. Infestations should be monitored and management efforts implemented on areas with Canada thistle cover greater than 20 percent.

A control and containment strategy is recommended, which includes mapping and documenting noxious weed infestations and determining the best management option for a target plant.

CONSIDERATIONS INCLUDE:

- Focus management efforts on areas where invasive plants are having the most impact on plant community.
- Utilize current information to understand the benefit and risk of an herbicide treatment to desirable forbs or grasses, and tolerance of desirable plants to the herbicide selected.
- Choose an appropriate herbicide rate and application timing to create a mosaic of greater forb diversity.
- Timing, frequency, and height of mowing may impact desirable prairie vegetation.
- Mowing to reduce competition from weedy species is not recommended on restored prairies after the first growing season.

PRACTICAL TIPS FOR MANAGING CANADA THISTLE

by Dennis Pederson,
Habitat Forever specialist

MOWING OR FIRE ALONE WILL NOT CONTROL CANADA THISTLE.

For optimum Canada thistle control, use fire and/or mowing in conjunction with herbicides. Spring fire and spring mowing reduce vegetative cover, which allows for better herbicide coverage on thistle. Fire and mowing also add an additional stress to Canada thistle. It is important to delay herbicide application until all Canada thistle has emerged and plants are at rosette to late bolting growth stage following fire or mowing.

CONTROL THE ROOT SYSTEM. About 95 percent of thistle biomass is underground, so the root system has to be killed to effectively control Canada thistle.

USE THE MOST EFFECTIVE HERBICIDES AT LABELED RATES.

Milestone® specialty herbicide at 5 to 7 fluid ounces per acre (fl oz/ac) or Transline® specialty herbicide at 10 to 12 fl oz/ac translocate into the root system giving the best control. Of the two products, Milestone is more effective on Canada thistle. However, Transline is an option for use in areas where there is desirable woody vegetation because it is more selective. Milestone and Transline can be applied in either spring or fall; however, Milestone is more effective than Transline when applied in the fall.

SPRING/EARLY SUMMER HERBICIDE APPLICATIONS SHOULD BE MADE WHEN THISTLE IS FULLY EMERGED, AND WHEN THE LARGEST PLANTS ARE AT EARLY BUD GROWTH STAGE. Mowing or fire prior to application will allow for more consistent Canada thistle growth, but be sure plants are completely emerged and at rosette to bolt growth stage prior to herbicide application.

FALL APPLIED HERBICIDES. Thistle can tolerate temperatures as low as 25°F so applications can be made from September until early- to mid-October as long as green growth remains on thistle.

USE BROADCAST HERBICIDE APPLICATIONS. Thistle patches that are completely defined and well documented can be treated with spot spraying. To ensure the greatest chance for thorough and complete application, the whole field should be treated if good inventory data is not completed.

CONTROL INFESTATIONS ON EDGES OF PRAIRIE AND NATURAL AREAS. If field edges, ditch banks, wetland edges and fence lines are not treated along with the main grassland body, thistle colonies will maintain a foothold in those locations and reestablish quickly.

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ESSENTIAL ONLINE
RESOURCES FOR INVASIVE
PLANT MANAGERS

Proper timing, continued...

RUSSIAN KNAPWEED

(Acroptilon repens)

Applications of Milestone® specialty herbicide at 5 to 7 fl oz/A should be delayed until Russian knapweed has bolted and is in the early bud to flower growth stage; applications can be made through the fall. It is important to remember that herbicide efficacy symptoms do not always show on Russian knapweed the season the treatment is made.

<http://bit.ly/russianknapweed>

LEAFY SPURGE

(Euphorbia esula)

The optimum time to treat leafy spurge with most herbicides is at the true flower growth stage, which is after the yellow bract is formed (late spring to early summer). Apply Tordon® 22K specialty herbicide alone at 1 to 2 quarts of product per acre (qt/A) at true flower. When applying Tordon 22K at rates less than 1 qt/A add 2,4-D at 1 qt/A (1 lb ae/A). The addition of OverDrive herbicide at 4 oz/A may improve leafy spurge control by up to 20%. For suppression of leafy spurge on sensitive sites apply a tank mix of 7 fl oz/A Milestone plus 1 qt/A 2,4-D plus 4 oz/A of OverDrive.

<http://bit.ly/leafyspurge>

EXPLORE MORE CONTROL RECOMMENDATIONS AT

<http://techlinenews.com>

KNOTWEEDS

<http://bit.ly/knotweeds>

WOODY PLANTS

<http://bit.ly/woodyplantcontrol>

HAWKWEEDS

<http://bit.ly/hawkweeds>

COMMON TEASEL

<http://bit.ly/teasel2014>

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ESSENTIAL ONLINE RESOURCES
 FOR INVASIVE PLANT
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TRAINING OPPORTUNITIES & RESOURCES

**TURN AROUND,
 LOOK AROUND**

A presentation to use for spring training programs for private, commercial, and government herbicide applicators and staff. The downloadable PDF includes over 40 slides highlighting important guidelines applicators should follow before, during and after herbicide application.
bit.ly/turnaroundlookaround

**FIND MORE RESOURCES
 FOR YOUR INVASIVE PLANT
 MANAGER'S TOOLBOX**

techlinenews.com/resources/

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PRAIRIE AND GRASSLAND MANAGEMENT is a new guide that provides a suite of resources to natural resource managers so they can better understand how and when to integrate herbicides into prairie and grassland management programs. The guide includes information on herbicide use rates, herbicide selectivity on desirable forbs and grasses, seeding options and guidelines, invasive woody and herbaceous plant control, and other useful tips. Available online at: techlinenews.com/prairieguide



INVASIVE PLANT MANAGEMENT GUIDE
 This guide provides information on selective herbicides as one tool for invasive plant management on rangeland, pastures, and natural areas. Information on herbicide use rates, herbicide selectivity on non-target plants, sprayer calibration, seeding guidelines, environmental considerations, and other useful tips are provided in this document. techlinenews.com/management-guide/



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