

## ADOPT Final Report-Project #20160487

### Project Identification

1. **Project Title:** Integrated Approaches to Control Leafy Spurge in Perennial Pasture
2. **Project Number:** #20160487
3. **Producer Group Sponsoring the Project:** Saskatchewan Forage Council (SFC)
4. **Project Location(s):**
  - RM of Manitou Lake, co-operator: Artland Co-op Pasture
  - RM of Battle River, co-operator: Town of Battleford
  - RM of Marquis, co-operators: Joel and Jerry Taylor
5. **Project start and end dates:** May 2017 to February 2019
6. **Project contact person and contact details:**

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### Objectives and Rationale

#### **7. Project Objectives**

In Saskatchewan, *The Weed Control Act* lists leafy spurge as a noxious weed which must be prevented from expansion if the infestation is greater than 5 hectares (ha) or eradicated if the infestation is less than 5 hectares in size. Once established, leafy spurge is very difficult to eradicate and will take over forage stands reducing both forage quality and yield. Cattle do not graze leafy spurge by choice and may even develop mouth irritation if grazed. Leafy spurge has established itself on large areas of land in Saskatchewan.

The objective of this project was to use an integrated approach to control leafy spurge. On the sites with an existing leafy spurge beetle population the level of leafy spurge control (leafy spurge dying) is disappointing. There was evidence of leafy spurge beetle damage but only enough to weaken the leafy spurge stand. This project looked at late season herbicide application onto these leafy spurge plants weakened by the beetles. Herbicide was applied after the beetle larvae had gone dormant for the season. In the following season it was expected the leafy spurge beetles would be concentrated onto the remaining leafy spurge plants to make more effective control. As leafy spurge beetle populations increase over time, the excess beetles can be collected and moved to new leafy spurge patches. The efficacy of later season herbicide application on leafy spurge will be observed.

## 8. Project Rationale

Leafy spurge is a long-lived perennial that was introduced to Eastern North America as either an ornamental or crop seed contaminant in the early 1800's. It spread gradually from the east to the great plains where it became an aggressive invader. It reproduces primarily by re-sprouting from its extensive, persistent, creeping root system, but also by seed. Leafy spurge roots can extend 4.5 m laterally and about 9 m deep. Leafy spurge forms dense stands over time and a large plant can produce up to 130,000 seeds. All parts of the plant contain a milky sap that can have a range of negative effects on livestock, from skin irritation to rare toxic conditions. It can also cause skin irritation to humans.

Examples of these large areas of land include pastures around Mortlach, Manitou Sand Hills (near Marsden, Sask.) and south of the Town of Battleford. Control of leafy spurge in range or pasture land is very difficult. There are limited herbicide options, and these tend to be very expensive at approximately \$50-\$150.00 per acre. Normally the herbicide is applied early to mid-summer while the plant is actively growing and before the seeds are mature. Sheep and goat grazing are examples of cultural methods that have shown to be effective to reduce stand density of leafy spurge when grazed long term. There have been several biological control agents released to try to control spurge. The most successful have been four different leafy spurge flea beetles, *Aphthona* spp. However, the level of control by these biological agents has been disappointing in the northern ranges of the leafy spurge infestations.

Adult beetles emerge in late June or early July. They feed near the top of the leafy spurge shoots and along the leaf edges. After mating, the females lay their eggs in groups of 20 to 30, below the soil surface near the leafy spurge root. The eggs, which may number up to 300 in a season, hatch in about three weeks. The larvae bore through the soil until they encounter a small leafy spurge root, on which they feed. As the larvae grow, they feed on larger roots. After about two months, feeding stops. The larvae go dormant in the winter and resume feasting in the spring. They pupate in the soil and emerge as adults. It is the larvae that are primarily responsible for the control of the leafy spurge, with the destruction of the root system. Their feeding depletes the plants nutrient reserves. The plant is no longer able to flower, and it eventually withers and dies.

With the implementation of the new *Weed Control Act* in December 2010, producers are required to control larger populations and eradicate smaller populations of noxious weeds such as leafy spurge. Selective chemical control of leafy spurge in pastureland is very expensive. Tordon 22K is the one of the few herbicides currently registered for pasture that will kill spurge. To kill leafy spurge, you need a rate of 3.6L/ac herbicide applied in 20L/ac water. The active ingredient in Tordon 22K is Picloram which tends to persist in soils and will move in the soil so is a risk to contaminate ground water. To mitigate this risk, you are only allowed to spray 1.9L of Tordon 22 K herbicide in any one year. Thus, to get a "killing rate" of Tordon you apply a split rate of 1.9L/ac for two consecutive years. The cost of the split application is \$75.00/ac per year or \$150.00 /ac. Two newer herbicide options, Navius (Aminocyclopyrachlor and Metsulfuron Methyl) and Truvist (Aminocyclopyrachlor and Chlorsulfuron) have just entered the market. Navius has been registered in the fall of 2016 for pasture use. The cost of Navius is about \$55.00/ac. Other herbicides give top growth control only.

## Methodology and Results

### 9. Methodology

Leafy spurge patches are very variable in the three pastures. The patches were surveyed and swept for the presence of leafy spurge beetles. This took place in June and early July 2017 when the beetles had hatched and were active. Leafy spurge beetles were introduced to the Marquis site July 4<sup>th</sup>, 2017. There was a high mortality rate of the beetles collected and released at the Marquis site. Manitou Lake plots were 120' by 315', Battle River plots were 60' by 120', and Marquis plots were 30' by 90'.

Surveys for percent cover of leafy spurge, grasses, forbs, shrubs, and other invasive species of significant quantity were done August 8<sup>th</sup> at the Manitou Lake site, August 9<sup>th</sup> at the Marquis site, and August 17<sup>th</sup> at the Battle River site, in 2017. This occurred just ahead of the herbicide treatments. The percentages were visually estimated at 10 random points (quarter meter quadrats) along a 5 m transect within each plot. Observations were done independently by two people at each site and then compared.

Three herbicide treatments were applied on the leafy spurge patches damaged by leafy spurge beetles. Treatment #1 was 1.9 L/ac application of Tordon 22K. Treatment #2 was 68 g/ac of Navius herbicide. Treatment #3 was a lower cost option of Dicamba at a rate of 0.84 L/ac. (original low- cost herbicide was to be a mix of Dicamba/24-D mix. During application it was decided to use straight Dicamba due to concern of mixing formulations of 24-D with the Dicamba). Herbicide was applied in 25 L/ac of water. Equipment was an ATV sprayer with a boomless nozzle with a 30-foot spray width.

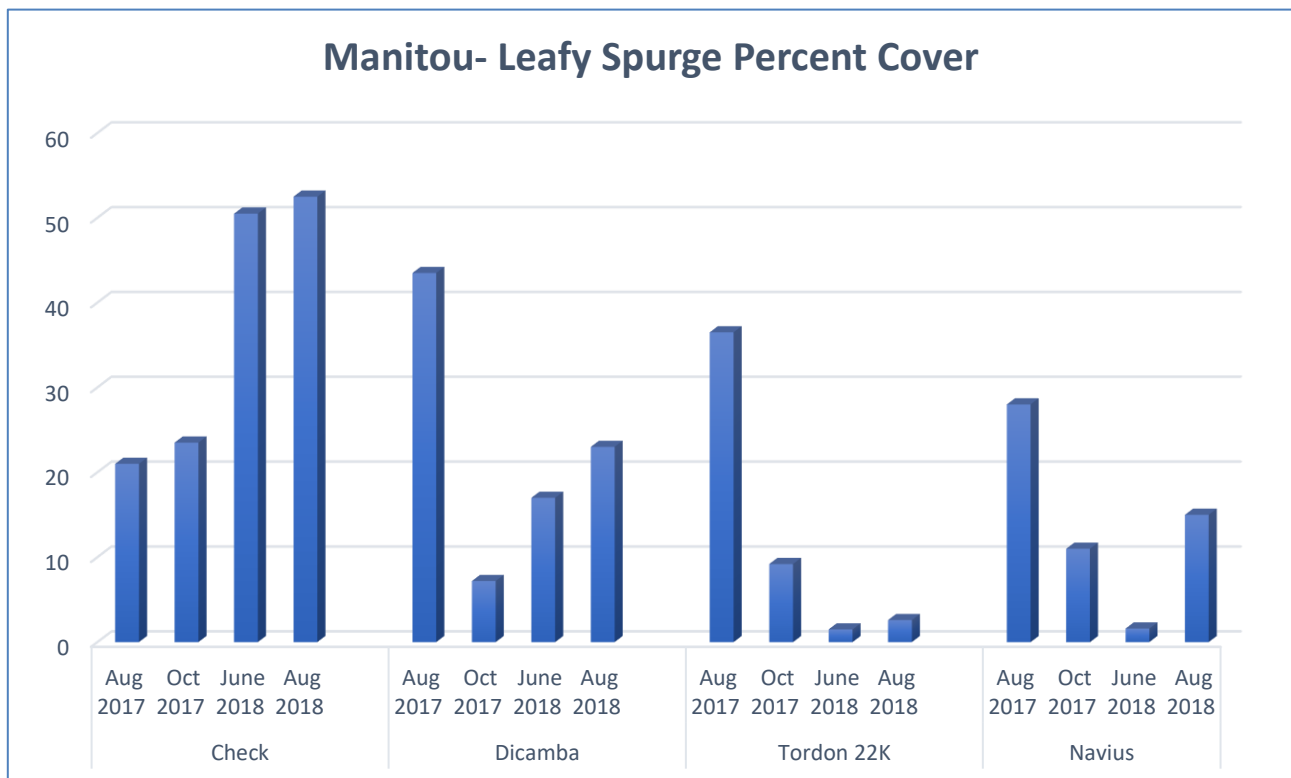
The untreated check served as a collection or concentration point area for the leafy spurge beetles. As the beetles hatched in year two, their food source (leafy spurge on treatments 1,2 & 3) had severely diminished. The intent was to sweep for leafy spurge beetles in 2018 and move them to patches where no beetles were present. Sweeping for leafy spurge beetles is very variable and dependent on the weather. The beetles are most active on warm, sunny days with little wind. Unfortunately, there were not ideal conditions when the plant counts were conducted (when sweeping was planned). As a result, beetles were not swept for during the 2018 plant measurements. The plots will be monitored in 2019 and future years to try to assess beetle presence.

Plant surveys and photos were done October 10<sup>th</sup> at Manitou Lake and Battle River sites and October 11<sup>th</sup> at the Marquis site in 2017. Plant surveys and photos were done again June 28<sup>th</sup> and August 9<sup>th</sup> of 2018 in Battle River and Manitou Lake, and June 27<sup>th</sup> and August 8<sup>th</sup> of 2018 in Marquis. Plant height and percent cover were done in every quadrat; however, leafy spurge photos were taken in quadrats 1 and 6 only.

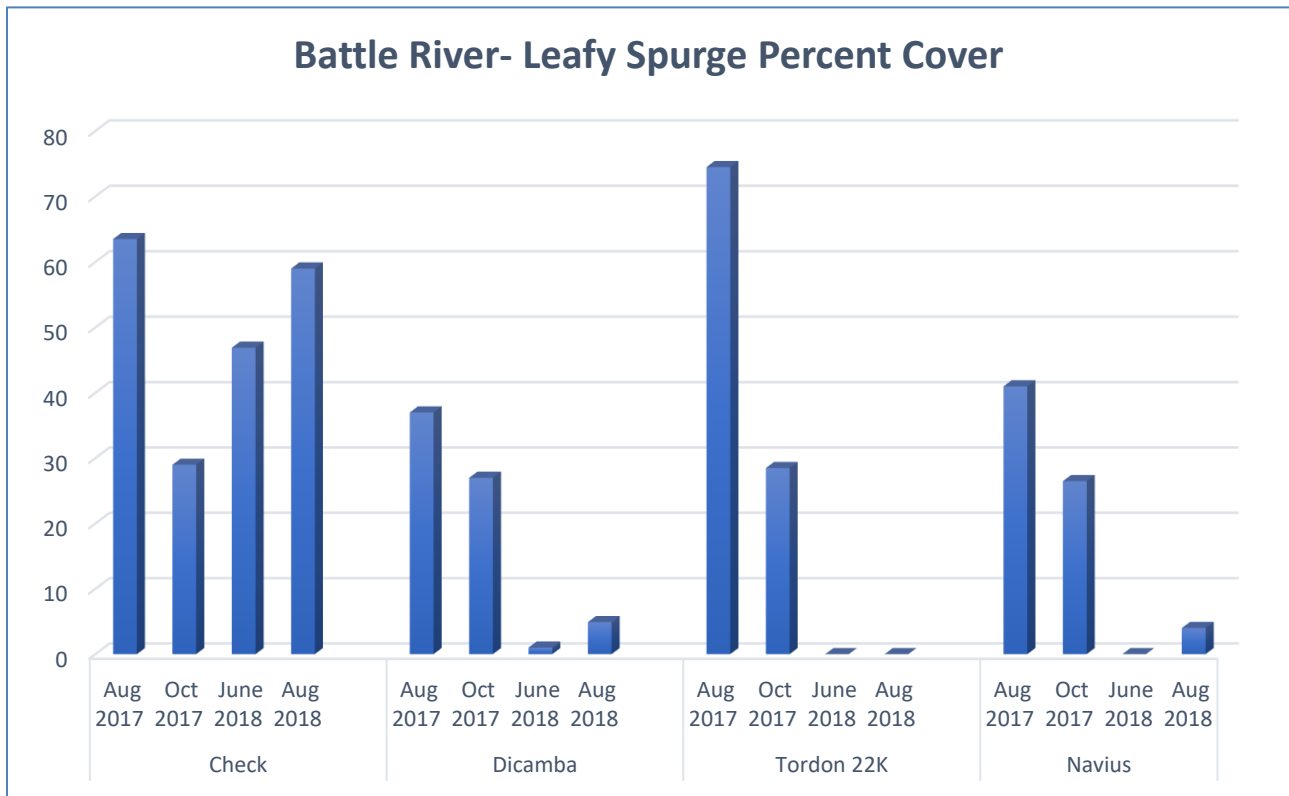
## 10. Results

Charts 1, 2 and 3 show the percent cover of leafy spurge for each of the herbicide treatments and check plots, just before herbicide was applied, in August of 2017, and at two, ten and twelve months after herbicide application.

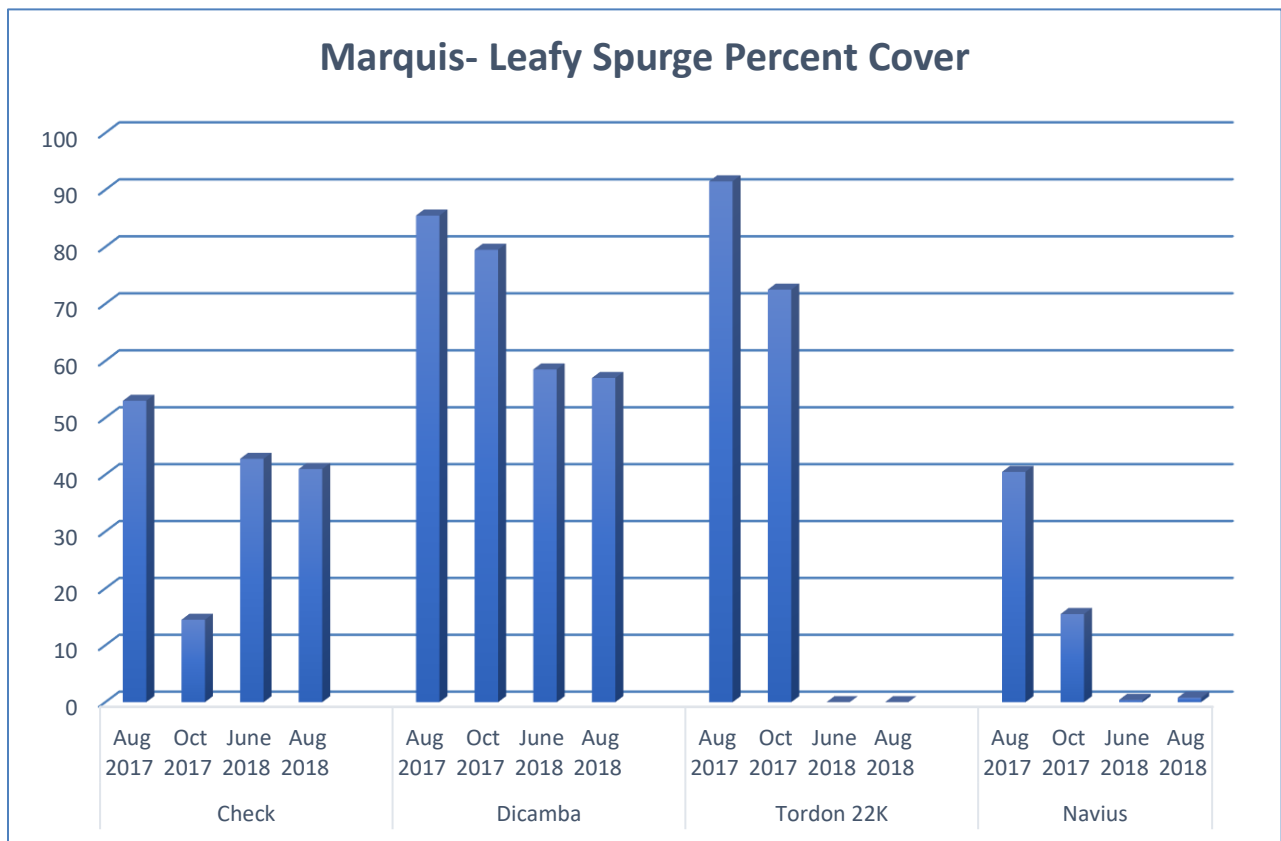
**Chart 1. ADOPT Integrated Management of Leafy Spurge- Manitou Lake Percent Cover**



**Chart 2. ADOPT Integrated Management of Leafy Spurge- Battle River Percent Cover**



**Chart 3. ADOPT Integrated Management of Leafy Spurge- Marquis Percent Cover**



There was a lot of variation in leafy spurge cover within and between plots at all three sites. In addition, quadrats were randomly placed and as a result were not in exactly the same spot for each set of observations. Large variability between some quadrats within treatments are not apparent in chart averages.

At the Manitou site all three chemical treatments showed a reduction in the percent cover of leafy spurge. The level of leafy spurge control in the Tordon and Navius treatments appears to be higher than the Dicamba treatment. In the Dicamba treatment leafy spurge populations gradually increased over time from fall 2017 through the 2018 plant counts. The Tordon 22K and Navius treatments showed continued decline in leafy spurge cover through the third observations with a slight re-emergence in the fourth observation. The Navius showed an increase in spurge coverage in the August 2018 observations, but the numbers are skewed with one of the ten sites having 100% spurge coverage. If you remove this outlier, the average coverage of spurge drops to 5%.

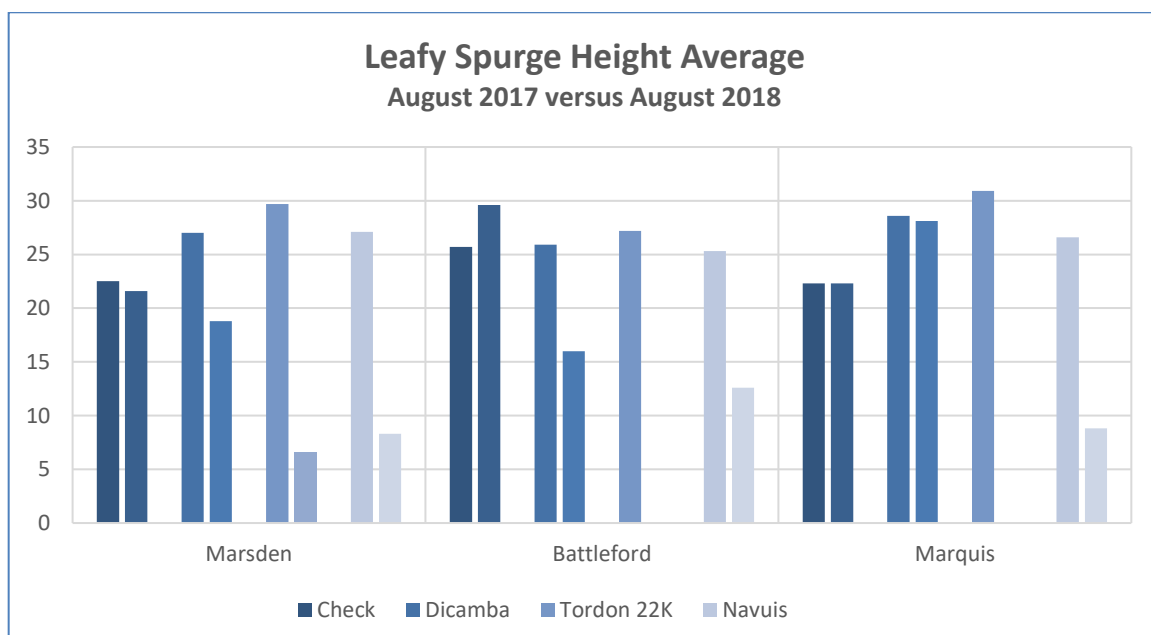
The Battle River site showed similar results for the Dicamba and Navius treatments. The average cover of leafy spurge was similar, however the Dicamba shows some leafy spurge in all plots observed, while in the Navius plots, half the observations had no leafy spurge at all. In the 2018 plant counts there was good control of spurge in all three treatments. Of the three sites, Dicamba performed best at the Battle River site. The Battle River site is predominantly smooth brome while the Marquis and Manitou sites are native prairie. After the herbicide treatments, the brome grass may have competed with leafy spurge better than native species.

At the Marquis site all three treatments showed reductions in the percent cover of leafy spurge with Tordon 22K and Navius achieving almost 100% control.

Percent change in leafy spurge cover over the three sites was: Dicamba 52% decrease, Navius 78% decrease (88% if adjustment is made for outlier quadrat), and Tordon 22K 98% decrease. The check was variable with the Manitou site showing a large increase in spurge and the Battle River and Marquis sites showing a slight decline.

Leafy spurge populations in the check plots were lower in October 2017 at all 3 sites. There is natural senescence in the fall that may have contributed to the lower counts on the check plots. Although beetle sweeps were not done in 2018, dispersion of beetles from treated plots to the check plots may account for less leafy spurge at the Battle River sites in 2018. At the Manitou site there is ample leafy spurge outside of the plot areas for the beetles to disperse to, reducing the chance of them becoming concentrated on the check plots.

Percent coverage of grasses, forbs, shrubs and other noxious weeds were taken at the same time as the leafy spurge readings. As leafy spurge cover went down, grass coverage went up. All the herbicides were also active on the forbs and they disappeared from the stands. Forbs had not recovered by the August 2018 readings.



The tallest spurge plant in each quadrat was recoded as the spurge height and then those heights were averaged across the ten plots to get the Leafy Spurge Height Average. Plant height remained relatively constant in the check plots, somewhat diminished in the Dicamba treatment and greatly reduced in the Tordon 22K and Navius treatments. The herbicide treatments have residual effects and the most effective herbicide treatments had the shortest spurge plants.

The following extension activities were completed to communicate results and raise awareness of this demonstration:

- September 27, 2017 field day at Marquis site. There were 45 people in attendance including weed inspectors, custom sprayers and RM representatives.
- Field day pictures were displayed on the Sask Forage Council Twitter account and Facebook page.
- October 17, 2017 field day at Battle River site. There were 30 people in attendance including weed inspectors, RM and industry representatives.
- Field day pictures were displayed on the North Sask River Basin Facebook page.
- Battle River field day was covered by CTV's Farmgate and interviews recorded, see following link: <https://saskatoon.ctvnews.ca/video?clipId=1236403>
- July 11, 2018 field day at Marquis site. There were 18 in attendance.
- Video footage was done by Sask Cattleman's Association at the 2018 field day. Sounds quality was a problem and editing is currently taking place. Once complete the footage will be available through the Sask Forage Council and the Sask Cattleman's Association websites.
- Final results of the project will appear on Saskatchewan Forage Council and Saskatchewan Cattleman's Association website and social media.

Posters were made for each field day and mailed to rural PO boxes in area RMs as well as sent to RM councils. Posters were also shared with the Government of Saskatchewan Stay Connected and Facebook page.



Livestock and Forages


## Integrated Approach to Leafy Spurge Management

When: October 17, 2017 Time: 1:00 p.m.—4:30 p.m.  
Where: Meeting Room A/B, Alex Dillabough Centre, 421-28th Street, Battleford, Saskatchewan (Next to Battleford's Parks and Recreation office)

1:00 Registration and welcome	2:15 Weed Control Surveying, Mapping and Programs
1:15 Integrated approach—ADOPT project Rachel Turnquist, Ministry of Agriculture	Annette Smith, AEGP Technician, North Sask. River Basin Council
1:45 Beetles and Bugs: Biological Controls John Hauer, Ministry of Agriculture	2:45 Coffee
	3:15 Field Tour—ADOPT site
	4:30 Field tour wrap up


To Register contact the North Battleford Agricultural Office 306-446-7964

No cost to attend. Registration Deadline: October 12, 2017


## INTEGRATED APPROACH TO LEAFY SPURGE MANAGEMENT 2.0

Craik Legion Hall, Craik SK  
Wednesday July 11, 2018 – 10:00 a.m. – 4:00 p.m.



10:00 – Registration and welcome	Eligible for CE Credits for Pesticide Application Recertification
10:15 – ADOPT Project Update Rachel Turnquist, Ministry of Agriculture	
10:30 – CAP Programming Folly Bough, Wascana Upper Qu'Appelle Watersheds Association	
11:15 – New Leafy Spurge Research Jonathan Bennett, University of Saskatchewan	
12:00 – Lunch	
1:00 – Invasive Plant Biocontrol and Targeted Grazing BMP Sarah Sommerfeld, Ministry of Agriculture	
1:30 – About SARM Plant Health Officers Joanne Kwasnicki, SARM Division 2	
Field Tour – ADOPT site	
4:00 – Field tour wrap up	

Registration: \$10 (Lunch Included). Registration deadline: July 4, 2018.  
For more information or to register, contact the Agriculture Knowledge Centre: 1-866-457-2377





**Livestock and Forages**

### **Integrated Approach to Leafy Spurge Management**

When: September 27, 2017  
Where: Legion Hall, Craik

Time: 10:00 a.m.—4:00 p.m.  
Cost: \$10 (Lunch Included)

10:00 Registration and welcome	12:00 Lunch
10:30 Integrated approach—ADOPT project <i>Rachel Turnquist, Ministry of Agriculture</i>	1:00 What it takes to multi species graze? <i>A producer experience</i>
11:00 SARM programming <i>Folly Baugh, Wascana Upper Qu'Appelle Watersheds Association</i>	1:30 Beetles and bugs <i>John Hauer, Ministry of Agriculture</i>
11:15 A day in the life of a Weed Inspector <i>Renny Grilz, Meewasin Valley Authority</i>	Field Tour—ADOPT site
	4:00 Field tour wrap up

Eligible for CE credits for Pesticide Application Recertification

TO REGISTER CONTACT THE AGRICULTURE KNOWLEDGE CENTRE @ 1-866-457-2377  
Registration Deadline: September 20, 2017







## 11. Conclusions and Recommendations

The conventional time for spraying leafy spurge is in June or July before seed set. This study showed that delaying the time of spraying does not decrease the efficacy of Tordon 22K or of Navius. Both these treatments showed high rates of control of spurge. Delaying the time of spraying allowed the beetles to complete their life cycle before their host plant was killed, allowing for better beetle survivability.

Both the range herbicides that are registered for leafy spurge control, Navius and Tordon 22K provided very good control i.e. 88% and 98% reduction of spurge respectively. Dicamba is not registered for control (suppression only) and as might be expected there was only a 52% reduction in leafy spurge counts. In addition, the leafy spurge populations were recovering quicker on the Dicamba plots.

Control plots at Battle River and Marquis showed similar leafy spurge counts August 2017 and August 2018 with a slight decrease that may be from increased beetle impact as they concentrated on to the remaining patches of spurge. The Manitou site showed a marked increase in leafy spurge on the check plot. This site had the highest infestation of spurge and as there is ample spurge for the beetles, they were unlikely to concentrate on the check plots without being moved there.

The cost of herbicide application is approximately \$75.00/ac for 1.9L/ac Tordon 22K (generally need 3.6 L/ac rate to control spurge), \$55.00/ac for the Navius and \$30.00/ac for the Dicamba. Application costs would be an additional \$15.00 to \$30.00/ac depending on plot size (how scattered the leafy spurge patches are) type of terrain, and how much and how difficult it is to haul water to site.

Dicamba costs 45 – 60% less than Navius and Tordon 22K but control is close to half that of the other treatments. Generally, it takes two broadcast treatments of Tordon 22K to get a control rate so it was unexpected that it had better control than Navius after only one herbicide application. This may in part be explained by the wet conditions and excellent growing conditions in 2017 resulting in good uptake of herbicide by the leafy spurge. Likely another year of study would be needed to fully evaluate the cost/control comparison between Tordon 22K and Navius.

Later application of herbicides, once the leafy spurge beetles became dormant, did not reduce the efficacy of the treatments in this study. It must be noted, however, that this is just a single year of observations. An integrated approach to managing leafy spurge will give the best results and managing timing of herbicide applications can allow for better beetle survival.

## **Supporting Information**

### **12. Acknowledgements**

Tordon 22K herbicide was supplied by DOW AgroSciences Canada (now Corteva Agriscience).

Navius herbicide was supplied by Bayer Crop Science Canada.

Lands Branch of Sask Ministry of Agriculture supplied the ATV, sprayer, trailer, and Dicamba herbicide.

In-kind support was provided by Saskatchewan Ministry of Agriculture Regional Forage Specialists setting up the sites, applying the treatments and taking observations.

In-kind support of video footage provided by Saskatchewan Cattleman's Association.

The Ministry's support for the project was acknowledged on field day posters.

### **13. Appendices**

#### **Appendix A- Spreadsheets**

##### **Abstract**

#### **14. Abstract/Summary**

The ADOPT program provided funding to look at late season herbicide application onto leafy spurge plants weakened by leafy spurge beetles. Plots were set up at three sites; Marquis, Battle River and Manitou.

Surveys for percent cover of leafy spurge, grasses, forbs, shrubs, and other invasive species of significant quantity were done August 2017 at all three sites just ahead of the herbicide treatments. The percentages were visually estimated at 10 random points (quarter meter quadrats) along a 5 m transect within each plot. Herbicide was applied after the beetle larvae had gone dormant for the season in August of 2017. The three herbicide treatments were Tordon 22K, Navius, and Dicamba. Plant surveys, for height and percent cover were done again October 2017, June 2018 and August of 2018.

The Tordon 22K and Navius treatments showed control of 98 and 88 percent respectively, while Dicamba had 52% control. There was large variability in leafy spurge cover within each treatment plot at each site and as such the difference between Tordon 22K and Navius control may not be significant. The Dicamba is less expensive than the other two treatments but is registered for suppression only and resulted in less control and higher leafy spurge counts.

Leafy spurge populations on the check plots at Marquis and Battle River may have been the result of increased leafy spurge beetle pressure or may show the of variability of the plots i.e. transect and quadrats hitting slightly different vegetation mix. The Manitou check plots continued to increase in spurge counts. This site has large infestations of leafy spurge and the beetles had large areas in which to disperse outside of the control plots.

Two field days were held in 2017 with indoor presentations and visits to the plot sites. There were 75 in attendance. One field day was held in 2018 with 18 participants with the same format of presentations and plot visits.











2017 Field Day- Marquis



Marsden June 2018- check



Marquis 2018- Navius



Marsden 2018- Tordon 22K