Pink Section **Perennial and Noxious Weed Control** Page

Control of leafy spurge in environmetally sensitive areas. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Leafy spurge control in environmentally sensitive areas such as around trees, near water, and in areas with very sandy soil has been especially difficult. Most auxinic herbicides that control this weed such as picloram and aminocyclopyrachlor can severely injure broadleaf trees and shrubs and have long soil residuals which allow them to move through the soil profile into groundwater. Leafy spurge biological control agents such as *Aphthona* spp. flea beetles have not controlled leafy spurge in these sensitive sites either. 2,4-D can be used in many ecological sensitive areas, but will only control leafy spurge top-growth and must be reapplied annually to prevent spread of the weed. The purpose of this research was to evaluate herbicide mixtures for leafy spurge control in sensitive sites. The herbicides evaluated are labeled for use near trees and open water, but generally will not control leafy spurge when applied alone.

The first study evaluated aminopyralid applied with 2,4-D and/or dicamba plus diflufenzopyr for leafy spurge control. The experiment was established on the Albert Ekre Grassland Perserve near Walcott, ND on June 23, 2014. Leafy spurge was in the true flower growth stage and 7 to 28 inches tall. All treatments in these studies were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. Experimental plots were 10 by 30 feet and replicated four times in a randomized complete block design. Leafy spurge control was evaluated visually using percent stand reduction compared to the untreated control.

Aminopyralid applied alone at 1.75 or 2.5 oz/A provided 40% or less leafy spurge control (Table 1) one year after treatment. However, when aminopyralid was applied with dicamba plus diflufenzopyr, control increased to 87% 12 months after treatment (MAT) which was similar to control from the long-residual herbicides picloram and aminocyclopyrachlor. Leafy spurge control was 73% 12 MAT when aminopyralid at 1.7 oz/A was applied with 2,4-D at 14 oz/A. Leafy spurge control with dicamba plus diflufenzopyr at 2 + 0.8 oz/A was only 21% 12 MAT, but control increased to 62% when 2,4-D at 14 oz/A was added to the treatment. Aminopyralid plus 2,4-D plus dicamba plus diflufenzopyr provided 97% leafy spurge control 12 MAT. Although expensive, this treatment could be used to control small leafy spurge infestations near trees or water and prevent further spread of the weed. *Aphthona* spp. flea beetles became established at the site and leafy spurge control from herbicides alone could not be further evaluated.

The second and third experiments evaluated leafy spurge control with quinclorac applied alone or with 2,4-D or dicamba plus diflufenzopyr. The second study was established at the Albert Ekre Grassland Preserve and treatments were applied on June 23 or September 8, 2014. Leafy spurge was in the true flower growth stage in June and had fall regrowth and was 22 to 26 inches tall in September. Leafy spurge control with quinclorac applied alone in June at 6 or 12 oz/A provided 67 and 88% leafy spurge control, respectively, 15 MAT. Quinclorac applied with dicamba plus diflufenzopyr or 2,4-D provided similar leafy spurge control to quinclorac applied alone. In contrast to the first study, the addition of 2,4-D to dicamba plus diflufenzopyr did not result in acceptable long-term leafy spurge control.

Quinclorac applied in the fall at 6 and 12 oz/A provided only 42 and 70% leafy spurge control 12

MAT (Table 2). Control increased to 68% when quinclorac at 6 oz/A was applied with dicamba plus diflufenzopyr. No other fall-applied treatment provided satisfactory season-long leafy spurge control.

The third experiment was established on the Sheyenne National Grassland near Anselm, ND and treatments were applied on June 3 or September 8, 2014. Leafy spurge was in the true flower growth stage in June and had 6 inch vegetative regrowth on the main stems in September. Quinclorac applied at 6 or 12 oz/A in June provided an average of 89% leafy spurge control 12 MAT (June 5, 2015) and compared to 83% 12 MAT when applied in the fall (September 8, 2015) (Table 3). Leafy spurge control was similar when quinclorac was applied alone or with 2,4-D.

In summary, aminopyralid applied with 2,4-D and/or dicamba plus diflufenzopyr and quinclorac applied alone provided similar leafy spurge control to picloram or aminocyclopyrachlor treatments and can be used near trees, open water, and in areas with shallow groundwater. These treatments will allow land managers to manage leafy spurge in areas long-term auxinic herbicides cannot be applied without compromising long-term control and are superior to 2,4-D the only other herbicide available for use in these areas.

Table 1. Leafy spurge control with aminopyralid mixed with various herbicides applied in June 2014 near Walcott, ND.

		Evaluation date		
		2014		2015
Treatment[a]	Rate	23 July	4 Sept	4 June
	—— oz/A ——	% injury	— % control —	
Aminopyralid[b]	1.75	30	21	11
Aminopyralid	2.5	40	36	40
Aminopyralid + 2,4-D[c]	1.7 + 14	94	90	73
Aminopyralid + dicamba + diflufenzopyr[d]	1.75 + 2 + 0.8	84	86	87
Aminopyralid + dicamba + diflufenzopyr	2.5 + 2 + 0.8	83	86	87
Aminopyralid + 2,4-D + dicamba + diflufenzopyr	1.7 + 14 + 2 + 0.8	95	95	97
Dicamba + diflufenzopyr	2 + 0.8	23	30	21
2,4-D	14	84	74	62
2,4-D + dicamba + diflufenzopyr	14 + 2 + 0.8	81	95	91
Picloram[e]	8	91	99	99
Picloram + dicamba + diflufenzopyr	8 + 2 + 0.8	96	98	99
Aminocyclopyrachlor + chlorsulfuron[f]	1.9 + 0.75	86	97	99
LSD (0.05)		19	8	27

[a]All treatments appliled with 0.25% NIS Activator 90 by Loveland Products, 3005 Rocky Mountain Ave., Loveland, CO 80538.
Commercial formulations - [b]Milestone, [c]Forefront, [e]Tordon 22k by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
[d]Commercial formulation - Overdrive by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.
[f]Commercial formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.

Table 2. Quinclorac applied in June or September 2014 alone or with various herbicide mixtures for leafy spurge control near Walcott, ND.

		Evaluation date		
		2014	2015	
Treatment[a]	Rate	4 Sept	4 June	26 Aug
	—— oz/A ——	—— % control ——		
Spring application (June 23, 2014)				
Quinclorac[b]	6	98	90	67
Quinclorac	12	99	98	88
Quinclorac + dicamba + diflufenzopyr	6 + 3 + 1.2	98	96	78
Quinclorac + 2,4-D	6 + 16	96	80	60
Dicamba + diflufenzopyr[c]	3 + 1.2	68	54	32
Dicamba + diflufenzopyr + 2,4-D	3 + 1.2 + 16	84	64	38
2,4-D	16	68	42	16
Fall application (Sept. 8, 2014)				
Quinclorac	6		78	42
Quinclorac	12		98	70
Quinclorac + dicamba + diflufenzopyr	6 + 3 + 1.2		99	68
Quinclorac + 2,4-D	6 + 16		52	28
Dicamba + diflufenzopyr	3 + 1.2		75	36
Dicamba + diflufenzopyr + 2,4-D	3 + 1.2 + 16		83	39
2,4-D	16		23	9
LSD (0.05)		13	33	31

[a]All treatments were applied with 1 qt/A of Upland MSO by West Central Inc., 2700 Trott Ave SW, P.O. Box 897, Willmar, MN 56201.
Commercial formulation - [b]Facet L, [c]Overdrive by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.

Table 3. Quinclorac applied alone or with 2,4-D in June or September for leafy spurge control on the Sheyenne National Grasslands near Anselm, ND.

		Evaluation date			
		2014		2015	
Treatment[a]	Rate	5 Aug	8 Sept	5 June	26 Aug
	— oz/A —	— % control —			
Spring application (June 23, 2014)					
Quinclorac[b]	6	71	82	88	44
Quinclorac	12	94	97	90	71
Quinclorac + 2,4-D	6 +16	83	86	76	58
Quinclorac + 2,4-D	12 + 16	93	91	84	82
2,4-D	16	32	50	20	18
Fall application (Sept 8, 2014)					
Quinclorac	6			95	77
Quinclorac	12			97	88
Quinclorac + 2,4-D	6 + 16			92	63
Quinclorac + 2,4-D	12 + 16			91	75
2,4-D	16			56	42
LSD (0.05)		23	20	19	33

[a]All treatments applied with 1 qt/A of Upland MSO by West Central Inc., 2700 Trott Ave SW, P.O. Box 897, Willmar, MN 56201.
[b]Commercial formulation - Facet L by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.

Evaluation of quinclorac applied in the spring or fall for optimum leafy spurge control. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). The use of quinclorac to control leafy spurge was largely developed in the 1990s but the herbicide was little used until a full grazing label was obtained in 2010. While control of leafy spurge with quinclorac has been well documented, initial publications indicated optimum leafy spurge control was obtained when quinclorac was applied in the spring compared to fall applications. Observations made since 2010 have indicated quinclorac applied in the fall will provide leafy spurge control similar to spring applications. The purpose of this research was to evaluate quinclorac applied in the spring or fall for leafy spurge control.

The experiment was established at two locations in North Dakota. The first site was located on the Sheyenne National Grassland (SNG) near Anselm, while the second location was on the Albert Ekre Grassland Perserve near Walcott. Both locations were within grazed pastures with a dense stand of leafy spurge. Treatments were applied on June 3, or September 8, 2014 at the SNG and June 23 or September 8, 2014 at the Walcott location. Leafy spurge was in the true-flower growth stage and 6 to 24 inches tall in June and was in the fall regrowth stage with with 4 to 6 inch long branches growing from the main stem in September when treatments were applied. Quinclorac applied at 6, 9, or 12 oz/A was compared to aminocyclopyrachlor plus chlorsulfuron at the Walcott location and 2,4-D on the SNG where aminocyclopyrachlor use is prohibited. Herbicides were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. All quinclorac treatments were applied with a methylated seed oil at 1 qt/A. Experimental plots were 10 by 30 feet and replicated four times in a randomized complete block design. Leafy spurge control was evaluated visually using percent stand reduction compared to the untreated control.

In general, quinclorac tended to provides slightly better leafy spurge control at the Walcott location than at the SNG and as a spring compared to fall applied treatment (Tables 1 and 2). For instance, leafy spurge control 3 months after treatment (MAT) averaged across all quinclorac application rates was 88 and 97% at the SNG and Walcott locations, respectively and 82 and 95% 12 MAT (June 2015), respectively. Quinclorac applied in September 2014 provided excellent control when evaluated in June 2015 (96% average) but control dropped rapidly at both locations. Leafy spurge control averaged over all quinclorac application rates was 82 and 62% when applied in June or September and evaluated 12 MAT at the SNG. The decrease was even more dramatic at the Walcott location as leafy spurge control averaged 95 and 71% when spring and fall applied treatments were compared 12 MAT.

Leafy spurge control tended to increase as the quinclorac application rate increased with 9 oz/A the most likely cost-effective application rate considering both long-term control and chemical cost (approximately $5 per oz ai) (Tables 1 and 2). Quinclorac applied at 9 to 12 oz/A provided similar control to aminocyclopyrachlor plus chlorsulfuron (Table 2) but is more expensive ($45 to $60/A for quinclorac compared to $11/A for aminocyclopyrachlor). However, quinclorac can be used in areas with high ground water, near trees, or in other environmental sensitive areas which makes the treatment most cost-effective from an environmental standpoint. In summary, this research confirmed previous findings that quinclorac provides better long-term leafy spurge when applied in June compared to September.

Table 1. Leafy spurge control with quinclorac applied in June or September on the Sheyenne National Grasslands near Anselm, ND.

		Evaluation date			
		2014		2015	
Treatment	Rate	25 Aug	8 Sept	5 June	26 Aug
	— oz/A —	— % control —			
June application					
Quinclorac[a] + MSO[b]	6 + 1 qt	81	78	86	68
Quinclorac + MSO	9 + 1 qt	89	86	81	55
Quinclorac + MSO	12 + 1 qt	95	84	79	87
2,4-D	16	40	35	30	10
September application					
Quinclorac + MSO	6 + 1 qt			87	49
Quinclorac + MSO	9 + 1 qt			98	68
Quinclorac + MSO	12 + 1 qt			98	71
2,4-D	16			24	8
LSD (0.05)		36	11	12	27

[a]Commercial formulation - Facet L by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.
[b]Upland MSO by West Central Inc., 2700 Trott Ave. SW, P.O. Box 897, Willmar, MN 56201.

Table 2. Leafy spurge control with quinclorac applied in June or September at the Albert Ekre research station near Walcott, ND.

		Evaluation date		
		2014	2015	
Treatment	Rate	4 Sept	4 June	26 Aug
	— oz/A —	——— % control ———		
June application				
Quinclorac[a] + MSO[b]	6 + 1 qt	96	92	78
Quinclorac + MSO	9 + 1 qt	96	94	91
Quinclorac + MSO	12 + 1 qt	99	95	93
Aminocyclopyrachlor + chlorsulfuron[c]	1.4 + 0.6	97	97	98
September application				
Quinclorac + MSO	6 + 1 qt		97	56
Quinclorac + MSO	9 + 1 qt		99	68
Quinclorac + MSO	12 + 1 qt		99	89
Aminocyclopyrachlor + chlorsulfuron	1.4 + 0.6		99	93
LSD (0.05)		NS	4	22

[a]Commercial formulation - Facet L by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.
[b]Upland MSO by West Central Inc., 2700 Trott Ave. SW, P.O. Box 897, Willmar, MN 56201.
[c]Commercial formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.

Aminocyclopyrachlor mixtures applied in the spring or fall for absinth wormwood control. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (AMCP) has been used to control absinth wormwood in non-grazed or hayed areas. Often combinations of herbicides have provided better long-term control of invasive species than a single herbicide used alone. The purpose of this research was to evaluate AMCP applied in the spring or fall with other herbicides for long-term absinth wormwood control.

The first study was established within a pasture near Spiritwood, ND which was fenced to prevent grazing during the study. Herbicides were applied on June 3, 2013 when absinth wormwood was 4 to 16 inches tall and in the rosette growth stage. Fall treatments were applied on September 13, 2013 to plants that had 12 to 18 inches of regrowth after being mowed in August. The second study was established near the Pipestem Dam on land managed by the Army Corp of Engineers on September 16, 2014. The absinth wormwood had been mowed in August and had vigorous regrowth 12 to 18 inches tall at application.

Herbicides were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. Experimental plots were 10 by 30 feet and treatments were replicated four times in a randomized complete block design. Absinth wormwood control was evaluated visually using percent stand reduction compared to the untreated control.

Absinth wormwood control was 90% or more the season after treatment regardless of AMCP application rate or whether applied with metsulfuron, chlorsulfuron, or 2,4-D in a grazed pasture near Spiritwood (Table 1). Aminopyralid applied at 1.75 oz/A provided near 100% control one year after treatment. In the second study, absinth wormwood control averaged 79 and 95% when AMCP was applied at 1.1 or 1.8 oz/A, respectively, with metsulfuron or chlorsulfuron (Table 2). Control averaged 95% 12 months after treatment (MAT) when AMCP was applied with 2,4-D regardless of the AMCP application rate. Aminopyralid provided 99% control 12 MAT.

In summary, AMCP applied with 2,4-D provided more consistent absinth wormwood control than when applied with metsulfuron or chlorsulfuron, when the application rate was less than 1.8 oz/A. Control was similar regardless of herbicide mixture or application date when AMCP was applied at 1.8 oz/A. Aminopyralid applied at 1.75 oz/A provided near 100% control regardless of application timing or location.

Table 1. Efficacy of aminocyclopyrachlor applied with various other herbicides on absinth wormwood applied in spring or fall at Spiritwood, ND.

		Evaluation date		
		2013	2014	
Treatment/date[a]	Rate	1 Aug	21 May	11 Sept
	— oz/A —	——— % control ———		
Spring (June 3, 2013)				
AMCP + metsulfuron[b]	1.1 + 0.2	94	94	95
AMCP + metsulfuron	1.8 + 0.3	98	98	95
AMCP + chlorsulfuron[c]	1 + 0.4	94	96	96
AMCP + chlorsulfuron	1.8 + 0.7	98	98	90
AMCP + 2,4-D[d]	1 + 7.6	95	97	96
AMCP + 2,4-D	1.7 + 12.7	98	99	98
Aminopyralid[e]	1.75	99	99	99
Fall (Sept 13, 2013)				
AMCP + metsulfuron	1.1 + 0.2		93	94
AMCP + metsulfuron	1.8 + 0.3		97	95
AMCP + chlorsulfuron	1 + 0.4		93	90
AMCP + chlorsulfuron	1.8 + 0.7		98	95
AMCP + 2,4-D	1 + 7.6		95	95
AMCP + 2,4-D	1.7 + 12.7		98	95
Aminopyralid[e]	1.75		99	98
LSD (0.05)		NS	5	NS

[a]Surfactant at 0.25% applied with all treatments - Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
Formulations -[b]Rejuvra, [c]Persective, [d]Kindra by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[e]Commercial formulation - Milestone by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

Table 2. Efficacy of aminocyclopyrachlor applied with other herbicides in September 2014 on absinth wormwood near Jamestown, ND.

Treatment[a]	Rate	Evaluation date	
		8 July 15	2 Sept 15
	—— oz/A ——	— % control —	
AMCP + metsulfuron[b]	1.1 + 0.18	89	81
AMCP + metsulfuron	1.8 + 0.24	97	95
AMCP + chlorsulfuron[c]	1 + 0.38	88	78
AMCP + chlorsulfuron	1.8 + 0.7	95	96
AMCP + 2,4-D[d]	1 + 7.62	92	92
AMCP + 2,4-D	1.7 + 12.7	98	97
Aminopyralid[e]	1.5	99	99
Untreated check	...	0	0
LSD (0.05)		8	10

[a]Surfactant at 0.25% applied with all treatments - NIS Dyne-Amic by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
Formulations - [b]Rejuvra [c]Perspective, [d]Kindra, by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[e]Commercial formulation - Milestone by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

Control of yellow toadflax with herbicide mixtures. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Yellow toadflax (*Linaria vulgaris* P. Mill.) is a perennial forb that was introduced to North America as an ornamental because the flower resembles horticultural snapdragons. Yellow toadflax can decrease the value of invaded rangeland by displacing forage plants and reducing native forb diversity, and is considered mildly poisonous to cattle. Previous research at North Dakota State University found that yellow toadflax is best controlled with aminocyclopyrachlor (AMCP) applied early in the growing season or with picloram applied with dicamba plus diflufenzopyr from June through September. The purpose of this research was to further evaluate yellow toadflax control with herbicide mixtures applied in mid-summer or in the fall.

Two experiments were established on land managed by the Army Corp of Engineers at Pipestem Dam near Jamestown, ND. The first experiment evaluated yellow toadflax control with AMCP applied with chlorsulfuron, 2,4-D, or metsulfuron while the second experiment compared aminopyralid or picloram applied with chlorsulfuron. The mid-summer treatments were applied on July 9, 2014 when yellow toadflax was in the vegetative to early bud growth stage and 6 to 20 inches tall. The fall applications were made on September 16, 2014 when the weed was 14 to 18 inches tall and in the flowering to seed-set growth stage. Experimental plots were 10 by 30 feet and replicated three times in a randomized complete block design. Yellow toadflax control was evaluated visually using percent stand reduction compared to the untreated control.

In general, AMCP provided better yellow toadflax control when applied at 1.8 compared to 1 oz/A which averaged 73 and 52% 12 months after treatment (12 MAT), respectively, for both July and September application dates (Table 1). Control was similar whether AMCP at comparable rates was applied with chlorsulfuron, 2,4-D, or metsulfuron regardless of application date. AMCP plus chlorsulfuron plus dicamba plus diflufenzopyr provided slightly better weed control than AMCP plus chlorsulfuron applied alone. Picloram plus dicamba plus diflufenzopyr tended to provide the best long-term yellow toadflax control which averaged 97 and 93% 12 MAT when applied in July or September, respectively.

Yellow toadflax control increased from an average of 46% 12 MAT when picloram was applied alone at 8 oz/A to 85% with picloram applied with chlorsulfuron averaged over application dates (Table 2). Yellow toadflax control with AMCP plus chlorsulfuron averaged 87 and 94% 12 MAT in July and September, respectively. Yellow toadflax control was superior to that observed in the first study even though the treatments were applied on the same dates and the experiments were located side by side. This inconsistency in yellow toadflax control with identical treatments has been observed in several experiments and by land managers attempting to control the weed in a variety of locations. The reasons for the inconsistency are unclear but could be related to differences in yellow toadflax biotypes which came from multiple introductions of the plant, or variation in grass density between the two experiments. The site where aminopyralid was evaluated tended to have denser smooth brome (*Bromus inermis* Leyss.) and reed canarygrass (*Phalaris arundinacea* L.) cover than the AMCP site.

In summary, picloram applied with chlorsulfuron or dicamba plus diflufenzopyr tended to provide better yellow toadflax control than any AMCP combination treatment. Control was inconsistent between experiments despite identical treatments applied on the same day at the same location.

Table 1. Yellow toadflax control with aminocyclopyrachlor applied with other herbicides in July or September near Jamestown, ND.

		Evaluation date		
		2014	2015	
Treatment[a]	Rate	16 Sept	8 July	2 Sept
	oz/A	% control		
Summer application (July 9, 2014)				
AMCP + chlorsulfuron[b]	1 + 0.4	52	48	49
AMCP + chlorsulfuron	1.8 + 0.7	57	55	58
AMCP + 2,4-D[c]	1 + 7.6	55	42	51
AMCP + 2,4-D	1.8 + 12.7	75	84	82
AMCP + metsulfuron[d]	1.1 + 0.18	79	62	74
AMCP + metsulfuron	1.8 + 0.24	77	85	81
Picloram[e] + dicamba + diflufenzopyr[f]	16 + 4 + 1.6	99	97	97
AMCP + chlorsulfuron+ dicamba + diflufenzopyr	1 + 0.4 + 4 + 1.6	96	93	88
Fall application (Sept 16, 2014)				
AMCP + chlorsulfuron	1 + 0.4		52	42
AMCP + chlorsulfuron	1.8 + 0.7		84	81
AMCP + 2,4-D	1 + 7.6		57	45
AMCP + 2,4-D	1.8 + 12.7		80	72
AMCP + metsulfuron	1.1 + 0.18		68	70
AMCP + metsulfuron	1.8 + 0.24		72	58
Picloram + dicamba + diflufenzopyr	16 + 4 + 1.6		97	93
AMCP + chlorsulfuron+ dicamba + diflufenzopyr	1 + 0.4 + 4 + 1.6		92	79
LSD (0.05)		16	21	27

[a]All treatments applied at 0.25% with NIS Dyne-Amic by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
Formulations - [b]Perspective, [c]Kindra, [d]Rejuvra by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[e]Commercial formulation - Tordon 22k by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
[f]Commercial formulation - Overdrive by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.

Table 2. Yellow toadflax control with herbicide mixtures applied in July or September near Jamestown, ND.

		Evaluation date		
		2014	2015	
Treatment[a]	Rate	16 Sept	8 July	2 Sept.
	—— oz/A ——	—— % control ——		
Summer application (July 9, 2014)				
Picloram[b]	8	85	50	33
Chlorsulfuron[c]	0.75	52	25	18
Picloram + chlorsulfuron	8 + 0.75	95	90	69
Aminopyralid[d] + chlorsulfuron	1.75 + 0.75	55	28	20
Picloram + dicamba + diflufenzopyr[e]	8 + 2 + 0.8	99	83	82
Aminocyclopyrachlor + chlorsulfuron[f]	1.87 + 0.76	79	87	72
Fall application (Sept 16, 2014)				
Picloram	8		50	42
Chlorsulfuron	0.75		80	40
Picloram + chlorsulfuron	8 + 0.75		95	87
Aminopyralid + chlorsulfuron	1.75 + 0.75		95	55
Picloram + dicamba + diflufenzopyr	8 + 2 + 0.8		89	78
Aminocyclopyrachlor + chlorsulfuron	1.87 + 0.76		96	94
LSD (0.05)		14	15	16

[a]All treatments appliled with 0.25% NIS Activator 90 by Loveland Products, 3005 Rocky Mountain Ave., Loveland, CO 80538.
Commercial formulations - [b]Tordon 22K, [d]Milestone by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
Commercial formulation - [d]Telar, [f]Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[e]Commercial formulation - Overdrive by BASF Corporation, 26 Davis Drive, Research Triangle Park, NC 27709.

Yellow toadflax control with aminocyclopyrachlor, Fredonia. Greg Endres and Sheldon Gerhardt. A field study was conducted in an active pasture near Fredonia (Logan County), ND to examine long-term control of yellow toadflax with aminocyclopyrachlor (AMCP). Experimental design was a randomized complete block with three replications. Treatments were applied September 24, 2010 to flowering yellow toadflax with a CO_2-pressurized backpack sprayer delivering 12 gal/A at 30 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 30-ft plots.

Yellow toadflax control visually evaluated 2 years after treatment (YAT) was good to excellent (84 to 96%) with Tordon, Tordon plus Overdrive, and the high rate of AMCP alone or plus Telar (Perspective) (Table). The high rate of AMCP alone or plus Telar continued to provide excellent control (94 to 97%) 3 YAT and good to excellent control (87 to 91%) 4 YAT. Suppression of yellow toadflax was still observed 5 YAT with the high rate of AMCP alone or plus Telar (data not recorded).

Table.

Herbicide		Yellow toadflax control			
Treatment[1]	Product rate	28-Sep-11	11-Sep-12	22-Aug-13	26-Sep-14
	oz wt/A	%			
untreated check	x	0	0	0	0
Plateau	12 fl oz	47	20	44	36
Tordon	64 fl oz	88	89	77	68
Tordon + Overdrive	32 fl oz + 6	93	84	81	68
Milestone	7 fl oz	20	8	0	0
AMCP + Telar	1.88 + 0.5	76	77	62	45
AMCP + Telar	5 + 1.33	94	92	94	87
AMCP	5	96	94	97	91
Telar	1.33	61	53	41	28
CV (%)		12.3	21.6	29.8	29.3
LSD (0.05)		14	22	28	24

[1]Treatments were applied on September 24, 2010. All treatments except Plateau and Tordon included NIS (Preference; Winfield) at 0.5% v/v.

Leafy spurge control with aminocyclopyrachlor, Carrington. Greg Endres and Joel Lemer. A field study was conducted in a riparian area near Carrington (western Foster County), ND to examine long-term control of leafy spurge with aminocyclopyrachlor (AMCP). Experimental design was a randomized complete block with three replications. Treatments were applied June 15, 2012 to flowering leafy spurge with a CO_2-pressurized backpack sprayer delivering 17 gal/A at 35 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 30-ft plots.

Leafy spurge visually evaluated 3 months after treatment (September 19, 2012) was suppressed (64 to 79%) with AMCP + chlorsulfuron (Perspective) or 2,4-D, while Tordon + Overdrive provided good control (Table). About one year after treatment (YAT) on July 3, 2013, leafy spurge control was 81 to 90% with Perspective and 85% with Tordon + Overdrive. However, 2 and 3 YAT, Perspective at the high rate and Tordon + Overdrive provided only 65 to 75% control of leafy spurge, while other treatments provided poor control (34 to 57%).

Table.

Herbicide		Leafy spurge control			
Treatment[1]	Product rate	19-Sep-12	3-Jul-13	3-Jul-14	2-Jul-15
	fl oz/A		%		
untreated check	x	0	0	0	0
Perspective	2.5 oz wt	64	81	57	51
Perspective	4.5 oz wt	79	90	73	65
AMCP + 2,4-D	1 + 7.6	65	56	37	47
AMCP + 2,4-D	2 + 15.2	64	59	47	55
Tordon + 2,4-D	16 + 32	72	41	34	46
Tordon + Overdrive	16 + 4 oz wt	88	85	71	75
Plateau + Sharpen	6 + 2	78	52	37	37
CV (%)		14.4	24.2	38.7	38.9
LSD (0.05)		16	24	30	32

[1]All treatments included NIS (Preference; Winfield) at 0.25% v/v.

Leafy Spurge control with aminocyclopyrachlor, DeLamere. Greg Endres and Melissa Blawat. A field study was conducted in a pasture near DeLamere (Sargent County), ND to examine control of leafy spurge with aminocyclopyrachlor (AMCP) and Yukon (dicamba&halosulfuron). Experimental design was a randomized complete block with three replications. Treatments were applied July 7, 2014 to flowering or seed-production stage leafy spurge, or September 22, 2014 to flowering or earlier-growth stage (12- to 24-inch tall) leafy spurge with a CO_2-pressurized backpack sprayer delivering 17 gal/A (summer application) or 12 gal/A (fall application) at 35 psi through 8001 flat fan nozzles to the center 6.7 ft of 10- by 30-ft plots.

Leafy spurge visually evaluated on August 20, 2015 generally was suppressed (60 to 80%) with summer-applied AMCP plus chlorsulfuron (Perspective R&P), and Tordon plus Distinct or 2,4-D (Table 1). Leafy spurge was not controlled with fall-applied Yukon or Permit treatments (Table 2).

Table 1. Leafy spurge control with summer-applied herbicides.

Herbicide		Leafy spurge control
Treatment[1]	Product rate	20-Aug-15
	fl oz/A	%
Perspective R&P	2.5 oz wt	70
Perspective R&P	4.5 oz wt	80
AMCP + 2,4-D	1 + 7.6	33
AMCP + 2,4-D	2 + 15.2	47
Tordon + 2,4-D	16 + 32	60
Tordon + Distinct	16 + 4 oz wt	77
Plateau + Sharpen	6 + 2	52
CV (%)		32
LSD (0.05)		NS

[1]Treatments applied on July 7, 2014. 2,4-D=DMA salt at 3.8 lb ai/gal. Adjuvants applied at 0.25% v/v: AMCP treatments included Phase; Tordon and Plateau + Sharpen treatments included Preference.

Table 2. Leafy spurge control with fall-applied herbicides.

Herbicide		Leafy spurge control
Treatment[1]	Product rate	20-Aug-15
	oz wt/A	%
Yukon	8	0
Permit + 2,4-D amine	0.5 + 12 fl oz	10
Yukon + 2,4-D amine	8 + 16 fl oz	13
CV (%)		239
LSD (0.05)		NS

[1]Treatments applied on September 22, 2014 and included Preference at 1% v/v and AMS at 17 lb/100 gal. Yukon=dicamba-Na&halosulfuron-CH3 (Gowan); Permit=haloslfuron-methyl (Gowan); 2,4-D=4 lb ai/gal.