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

Comparison of aminocyclopyarachlor applied with chlorsulfuron or 2,4-D for invasive weed control. Rodney G. Lym (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (AMCP) has generally been applied with chlorsulfuron for control of a variety of invasive weeds. AMCP plus chlorsulfuron is marketed as a dispersible granule (DG) formulation which may be more difficult to adapt to direct injection application often used in roadside weed control compared to soluble liquid (SL) formulations. The purpose of this research was to compare AMCP applied with chlorsulfuron as a DG or with 2,4-D as a SL formulation for long-term control of three invasive weed species.

Studies were established for leafy spurge, Canada thistle, or spotted knapweed control near Walcott, ND in an ungrazed area of pasture, on the campus of North Dakota State University, or near Hawley, MN, respectively. Treatments 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 at all locations. The leafy spurge study was established on June 6, 2011 when the plants were in the true-flower growth stage and 12 to 24 inches tall. Spotted knapweed was treated when in the rosette stage on June 9, 2011. The Canada thistle experiment was established on July 18, 2011 when the plants were 4 to 6 inches tall and beginning to bolt. A herbicide treatment considered the current standard for control of each weed species was included in each trial. Weed control was evaluated visually using percent stand reduction compared to the untreated control.

Long-term leafy spurge control was better when AMCP was applied as a liquid formulation with 2,4-D compared to application with chlorsulfuron as a DG or the standard treatment of picloram plus imazapic, plus 2,4-D (Table 1). For instance, leafy spurge control averaged 82% with AMCP plus 2,4-D applied at 1 + 7.6 oz /A, respectively, 14 months after treatment (MAT) (August 12, 2012) compared to only 41% with AMCP plus chlorsulfuron at 1 + 0.4 oz/A, respectively. Control increased to 90% 14 MAT with the liquid formulation, but only averaged 62% with AMCP applied in the DG treatment or the standard picloram plus imazapic plus 2,4-D.
In contrast to the leafy spurge study, spotted knapweed control from AMCP was excellent whether applied with chlorsulfuron or 2,4-D and averaged 98% 14 MAT which was the same control observed with the standard treatment of aminopyralid at 1.25 oz/A (Table 2). Similarly, Canada thistle control was excellent regardless of treatment or formulation and averaged 100% 13 MAT (Table 3). AMCP applied with chlorsulfuron suppressed annual foxtail species (*Setaria* spp.) nearly 90% averaged over application rate, compared to 66% when AMCP was applied with 2,4-D as an SL. All treatments provided excellent control of common ragweed (*Ambrosia artemisiifolia* L.) except AMCP + 2,4-D. As reported in previous studies, AMCP will suppress some annual grass species. The increased control when AMCP was applied as a DG compared to a SL was likely due to the chlorsulfuron in the DG mixture which is known to control many annual grass species. AMCP plus chlorsulfuron and aminopyralid provided nearly 100% ragweed control 11 MAT, compared to no control when AMCP was applied with 2,4-D.

In summary, leafy spurge control was better when AMCP was applied with 2,4-D compared to AMCP applied with chlorsulfuron, but control of Canada thistle and spotted knapweed was similar regardless of formulation. Suppression of annual grass species is likely when AMCP is used to control various invasive weed species.

Table 1. Evaluation of aminocyclopyrachlor applied with chlorsulfuron or 2,4-D for leafy spurge control, near Walcott, ND.

		Evaluation date		
		2011	2012	
Treatment	Rate	4 Aug	24 May	28 Aug
	oz/A	% control		
Aminocyclopyrachlor + chlorsulfuron[a] + NIS[b]	1 + 0.4 + 0.25%	89	55	41
Aminocyclopyrachlor + chlorsulfuron + NIS	1.8 + 0.7 + 0.25%	95	73	64
Aminocyclopyrachlor + 2,4-D[c] + NIS	1 + 7.6 + 0.25%	98	89	82
Aminocyclopyrachlor + 2,4-D + NIS	2 + 15.2 + 0.25%	99	95	90
Picloram + imazapic + 2,4-D + MSO	4 + 1 + 16 + 1 qt	99	76	61
Untreated	• • •	0	0	0
LSD (0.05)		6	22	28

[a]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[c]Soluble liquid formulation, by E.I. duPont de Nemours and Company.

Table 2. Evaluation of aminocyclopyrachlor applied with chlorsulfuron or 2,4-D for spotted knapweed control near Hawley, MN.

		Evaluation date		
		2011	2012	
Treatment	Rate	2 Aug	24 May	17 Aug
	oz/A	% control		
Aminocyclpyrachlor + chlorsulfuron[a] + NIS[b]	1 + 0.4 + 0.25%	92	96	96
Aminocyclpyrachlor + chlorsulfuron + NIS	1.8 + 0.7 + 0.25%	100	100	100
Aminocyclpyrachlor + 2,4-D[c] + NIS	1 + 7.6 + 0.25%	96	97	98
Aminocyclpyrachlor + 2,4-D + NIS	2 + 15.2 + 0.25%	100	100	100
Aminopyralid[d] + NIS	1.25 + 0.25%	100	98	98
Untreated	• • •	0	0	0
LSD (0.05)		3	5	3

[a]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[c]Soluble liquid formulation, by E.I. duPont de Nemours and Company.
[d]Commercial formulation - Milestone by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

Table 3. Evaluation of aminocyclopyrachlor applied with chlorsulfuron or 2,4-D for Canada thistle control, Fargo, ND.

		Evaluation date					
		13 Sept 2011			12 June 12		16 Aug 12
Treatment	Rate	Canada thistle	Rag-weed	Foxtail spp.	Canada thistle	Rag-weed	Canada thistle
	oz/A	% control					
Aminocyclpyrachlor + chlorsulfuron[a]+ NIS[b]	0.987 + 0.394 + 0.25%	100	100	82	99	99	100
Aminocyclpyrachlor + chlorsulfuron+ NIS	1.777 + 0.709 + 0.25%	100	100	94	100	99	100
Aminocyclpyrachlor + 2,4-D[c] + NIS	1 + 7.6 + 0.25%	100	100	55	100	0	100
Aminocyclpyrachlor + 2,4-D + NIS	2 + 15.2 + 0.25%	100	100	76	100	0	100
Aminopyralid[d] + NIS	1.25 + 0.25%	100	99	0	100	97	100
Untreated	• • •	0	0	0	38	20	0
LSD (0.05)		1	1	16	28	24	1

[a]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[c]Soluble liquid formulation, by E.I. duPont de Nemours and Company.
[d]Commercial formulation - Milestone by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

Leafy spurge and Canada thistle control with aminocyclopyrachlor applied with various herbicides. Rodney G. Lym (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (AMCP) provides good to excellent control of many invasive weeds and is generally applied with either metsulfuron or chlorsulfuron. These herbicide combinations may also be applied with other compounds to broaden the spectrum of weed control, or with insecticides to control pests with a single application. The purpose of this research was to evaluate the effect of AMCP plus chlorsulfuron or metsulfuron applied with other herbicides, malathion, or with nitrogen as a carrier for leafy spurge or Canada thistle control.

The leafy spurge experiment was established near Walcott, ND in an ungrazed area of pasture with a dense stand of leafy spurge. Treatments were applied June 24, 2011 when leafy spurge was in the true-flower growth stage 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. The Canada thistle experiment was established on unused cropland on the campus of North Dakota State University in Fargo. Treatments were applied as previously described on June 30, 2011 when Canada thistle was in the rosette to starting to bolt growth stage and 4 to 6 inches tall. Leafy spurge and Canada thistle control was evaluated visually using percent stand reduction compared to the untreated control.

Initial leafy spurge control was excellent regardless of treatment but most treatments resulted in smooth bromegrass injury (Table 1). The highest injury occurred (> 60%) when AMCP was applied with triclopyr plus fluroxypyr or AMCP plus metsulfuron was applied in a nitrogen carrier. Leafy spurge control averaged near 100% 11 and 14 months after treatment (MAT) with all treatments except AMCP plus metsulfuron applied alone. Grass injury was not observed the year after treatment (data not shown). Canada thistle control averaged 99% 14 MAT regardless of treatment (Table 2). All treatments provided excellent control of annual foxtail species. No chemical incompatibility was observed with any treatment in either experiment.

AMCP applied with chlorsulfuron or metsulfuron has provided excellent leafy spurge and Canada thistle control in previous studies. Control was excellent in this study as well with nearly all herbicide mixtures except when AMCP was applied with metsulfuron on leafy spurge. In general, application of AMCP with other herbicides or with malathion should not affect leafy spurge or Canada thistle control.

Table 1. Aminocyclopyrachlor applied with various herbicides for leafy spurge control near Walcott, ND.

Treatment	Rate	Evaluation date: 4 August 11 Leafy spurge control	4 August 11 Smooth brome injury	24 May 12 Leafy spurge control	28 Aug 12 Leafy spurge control
	oz/A	%			
Aminocyclpyrachlor + chlorsulfuron[a] + NIS[b]	2 + 0.8 + 0.25%	100	15	99	96
Aminocyclpyrachlor + chlorsulfuron + 2,4-D + NIS	2 + 0.8 + 15.2 + 0.25%	96	20	97	92
Aminocyclpyrachlor + chlorsulfuron + picloram + NIS	2 + 0.8 + 8 + 0.25%	99	48	100	99
Aminocyclpyrachlor + chlorsulfuron + aminopyralid[c] + NIS	2 + 0.8 + 1.75 + 0.25%	100	24	99	97
Aminocyclpyrachlor + triclopyr + fluroxypyr[d] + NIS	2 + 0.8 + 12 + 4 + 0.25%	100	68	99	96
Aminocyclpyrachlor + metsulfuron + NIS	2 + 0.3 + 0.25%	99	10	88	82
Aminocyclpyrachlor + metsulfuron + 2,4-D + dicamba[e] + NIS	2 + 0.3 + 11.5 + 4.01 + 0.25%	100	20	96	90
Aminocyclpyrachlor + metsulfuron + picloram + 2,4-D[f] + NIS	2 + 0.3 + 2.1 + 8.1 + 0.25%	98	21	97	96
Aminocyclpyrachlor + metsulfuron + NIS in nitrogen carrier[g]	2 + 0.3 + 0.25%	100	63	97	96
Aminocyclpyrachlor + metsulfuron + malathion + NIS	2 + 0.3 + 16 + 0.25%	98	14	96	94
Untreated	• • •	0	0	20[h]	0
LSD (0.05)		3	19	11	9

[a]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
Commercial formulatons - [c]Milestone, [d]Pastureguard, [f]Grazon P+D by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
[e]Commercial formulation - Weedmaster by Nufarm Inc., 150 Harvester Drive, Burr Ridge, IL 60527.
[g]Nitrogen fertilizer 28-0-0.
[h]Biological control agents (*Aphthona* spp.) reduced leafy spurge stand.

Table 2. Aminocyclopyrachlor applied with various herbicides for Canada thistle control Fargo, ND.

Treatment[a]	Rate	Evaluation date/species: 16 August 11 Canada thistle	16 August 11 Foxtail spp.	13 Sep 11 Canada thistle	1 June 12 Canada thistle	16 Aug 12 Canada thistle
	oz/A	% control				
Aminocyclpyrachlor + chlorsulfuron[a] + NIS[b]	2 + 0.8 + 0.25%	99	98	100	100	99
Aminocyclpyrachlor + chlorsulfuron + 2,4-D + NIS	2 + 0.8 + 15.2 + 0.25%	89	97	100	100	99
Aminocyclpyrachlor + chlorsulfuron + picloram + NIS	2 + 0.8 + 8 + 0.25%	100	96	100	100	99
Aminocyclpyrachlor + chlorsulfuron + aminopyralid[c] + NIS	2 + 0.8 + 1.75 + 0.25%	100	100	100	100	99
Aminocyclpyrachlor + triclopyr + fluroxypyr[d] + NIS	2 + 0.8 + 12 + 4 + 0.25%	98	99	100	99	99
Aminocyclpyrachlor + metsulfuron + NIS	2 + 0.3 + 0.25%	99	100	100	99	99
Aminocyclpyrachlor + metsulfuron + 2,4-D + dicamba[e] + NIS	2 + 0.3 + 11.5 + 4.01 + 0.25%	98	86	100	99	98
Aminocyclpyrachlor + metsulfuron + picloram + 2,4-D[f] + NIS	2 + 0.3 + 2.1 + 8.1 + 0.25%	99	98	100	100	99
Aminocyclpyrachlor + metsulfuron + NIS in nitrogen carrier[g]	2 + 0.3 + 0.25 %	99	91	100	100	99
Aminocyclpyrachlor + metsulfuron + malathion + NIS	2 + 0.3 + 16 + 0.25 %	98	99	100	100	100
Untreated	• • •	0	0	0	0	0
LSD (0.05)		3	5	1	1	4

[a]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
Commercial formulatons - [c]Milestone, [d]Pastureguard, [f]Grazon P+D by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
[e]Commercial formulation - Weedmaster by Nufarm Inc., 150 Harvester Drive, Burr Ridge, IL 60527.
[g]Nitrogen fertilizer 28-0-0.
Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
Commercial formulations - [b]Milestone, [c]PasturGard, [e]Grazon P+D by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.
[d]Commercial formulation - Weedmaster by Nufarm Inc., 150 Harvester Drive, Burr Ridge, IL 60527.
[f]Nitrogen fertilizer 28-0-0.

Comparison of aminocyclopyarachlor applied with chlorsulfuron or 2,4-D for plumeless thistle and houndstongue control. Rodney G. Lym (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (AMCP) has generally been applied with chlorsulfuron for control of many invasive weeds. However, previous research at North Dakota State University (NDSU) has shown that long-term control of leafy spurge is improved when AMCP is applied with 2,4-D compared to application with chlorsulfuron but control of Canada thistle and yellow toadflax was similar regardless of AMCP treatment. The purpose of this research was to evaluate control of the invasive biennial species plumeless thistle (*Carduus acanthoides* L.) and houndstongue (*Cynoglossum officinale* L.) with AMCP applied alone or with chlorsulfuron or other herbicides.

The plumeless thistle study was established on May 26, 2011 on unused pasture near the NDSU campus. The plants were in the rosette to bolt growth stage and 6 to 14 inches tall. The plots were 10 by 30 ft and replicated four times. The houndstongue experiment was established on private pasture near McLeod, ND on June 16, 2011. The houndstongue plants were either in the rosette stage (first yr) or starting to flower (second yr) and 4 to 42 inches tall. The plots were 9 by 9 ft in the first two reps and 8 by 9 feet in reps three and four. Treatments were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. Weed control was evaluated visually using percent stand reduction compared to the untreated control.

AMCP applied with either chlorsulfuron or 2,4-D provided rapid and complete control of plumeless thistle regardless of application rate (Table 1). Control averaged 100% the year of treatment and nearly 100% 13 MAT which was similar to the current standard treatment of aminopyralid alone at 1.25 oz/A. Houndstongue control with AMCP alone averaged 89 and 83% 3 and 12 months after treatment (MAT), respectively (Table 2). However, there was a trend for houndstongue control to decline as AMCP application rate increased. Control averaged 100% 12 MAT when AMCP was applied with chlorsulfuron and 94% when applied with 2,4-D, which was similar to metsulfuron plus chlorsulfuron applied at 0.3 plus 0.1 oz/A, a current standard for houndstongue control.

In summary, AMCP applied with chlorsulfuron or 2,4-D provided excellent plumeless thistle and houndstongue control. AMCP applied alone provided satisfactory houndstongue control, but might be best used in combination with an ALS herbicide for consistent control of this weed.

Table 1. Efficacy of aminocyclopyrachlor applied with chlorsulfuron or 2,4-D for plumeless thistle control at Fargo, ND.

Treatment	Rate	Evaluation date	
		20 July 11	25 June 12
	oz/A	% control	
Aminocyclpyrachlor + chlorsulfuron[a]+ NIS[b]	0.6 + 0.24 + 0.25%	100	99
Aminocyclpyrachlor + chlorsulfuron + NIS	1 + 0.4 + 0.25%	100	100
Aminocyclpyrachlor + 2,4-D[c] + NIS	0.6 + 4.75 + 0.25%	100	100
Aminocyclpyrachlor + 2,4-D + NIS	1 + 7.6 + 0.25%	100	100
Aminopyralid[d] + NIS	1.25 + 0.25%	100	100
Untreated	• • •	0	0
LSD (0.05)		1	0.6

[a]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[c]Soluble liquid formulation - E.I. duPont de Nemours and Company.
[d]Commercial formulation - Milestone by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268.

Table 2. Efficacy of aminocyclopyrachlor herbicide for houndstongue control near McLeod, ND.

Treatment	Rate	Evaluation date			
		2011			2012
		19 July	17 Aug	8 Sept	18 May
	oz/A	% control			
Aminocyclpyrachlor + NIS[a]	1 + 0.25%	68	75	90	90
Aminocyclpyrachlor + NIS	2 + 0.25%	83	88	97	87
Aminocyclpyrachlor + NIS	3 + 0.25%	79	80	80	73
Aminocyclpyrachlor + chlorsulfuron[b] + NIS	1.8 + 0.7 + 0.25%	98	100	100	100
Aminocyclpyrachlor + 2,4-D[c] + NIS	2 + 15 + 0.25%	93	80	95	94
Metsulfuron + chlorsulfuron[d] + NIS	0.3 + 0.1 + 0.25%	85	88	100	100
Untreated	• • •	0	0	0	0
LSD (0.05)		23	34	14	18

[a]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[b]Dispersible granule formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[c]Soluble liquid formulation - E.I. duPont de Nemours and Company.
[d]Commercial formulation - Cimarron Plus, by E.I. duPont de Nemours and Company.

Effect of aminocyclopyarachlor applied with chlorsulfuron or 2,4-D on broadleaf and grass production in non-cropland. Rodney G. Lym (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminocyclopyrachlor (AMCP) has generally been applied with chlorsulfuron for control of a variety of invasive weeds. AMCP plus chlorsulfuron is marketed as a dispersible granule (DG) formulation but could also become available mixed with 2,4-D as a soluble liquid (SL) formulation . The purpose of this research was to compare AMCP applied with chlorsulfuron as a DG or with 2,4-D as a LS formulation on long-term broadleaf and grass production in non-cropland.

The experiment was established on June 9, 2011 in an ungrazed non-cropped area in north Fargo. The area had previously been heavily infested with leafy spurge, but the *Aphthona* spp. biological control agents had reduced the weed to a minor component of the vegetation. Treatments 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. The area contained a wide variety of broadleaf species, but the major grass species present was Kentucky bluegrass. AMCP efficacy was visually evaluated on native and weedy species that were commonly present in all plots using percent stand or height reduction compared to the untreated control. Biomass was harvested in mid-September of 2011 and 2012 by clipping three 0.25-m^2 quadrats per plot and separated into broadleaf or grass species content. Harvested plant material was dried at 120 F for at least 72 hr and weighed to estimate yield.

AMCP provided an average of 81 and 94% leafy spurge control applied with chlorsulfuron or 2,4-D, respectively, 3 months after treatment (MAT) in August 2011 (Table1). Control declined to an average of 51% 23 MAT when AMCP was applied with chlorsulfuron, but averaged 72% when applied with 2,4-D. Previous research at North Dakota State University has shown that long-term leafy spurge control is better when AMCP is applied with 2,4-D, compared to application with chlorsulfuron. Canada thistle control averaged 98% 3 MAT regardless of AMCP application rate or formulation, but declined rapidly to less than 50% by 23 MAT. Buckbrush or western snowberry (*Symphoricarpos occidentalis* Hook.) height was initially reduced when treated with AMCP, but gradually recovered with no injury observed by 23 MAT on this native species. However, Canada goldenrod (*Solidago canadensis* L.) was nearly eliminated and had not returned by the end of the study. Wild licorice (*Glycyrrhiza lepidota* Pursh) was tolerant of all AMCP treatments.

AMCP applied with chlorsulfuron or 2,4-D reduced grass production the year of treatment (2011) even though no grass injury had been observed (Tables 1 and 2). Grass biomass averaged 1760 and 1250 lb/A when AMCP was applied with chlorsulfuron or 2,4-D, respectively, compared to 2235 lb/A in the untreated control. Grass production was similar regardless of treatment in 2012 but was much less than in 2011, likely due to drought conditions that occurred in 2012. Broadleaf plant production following AMCP application averaged 270 lb/A in 2011 compared to 1940 lb/A in the untreated control. Similar to the reduced grass production in 2012, broadleaf biomass in the untreated control only averaged 790 lb/A, but was still more than the average biomass in treated plots which again averaged 270 lb/A.

In summary, AMCP reduced many of the broadleaf species in this study, including leafy spurge, Canada thistle, Canada goldenrod. Buckbrush growth was reduced the year of treatment, but the species recovered by the year after treatment and wild licorice was very tolerant. Grass production was also reduced the year of treatment but not the following growing season. AMCP should maintain long-term control of many broadleaf species but may temporarily reduce grass production.

Table 1. Control of various wildland grass, weed, and native species with aminocyclopyrachlor applied either with chlorsulfuron or 2,4-D near Fargo, ND.

		Evaluation date/plant species											
		3 August 11						30 July 12					
Treatment	Rate	Grass	Leafy spurge	Canada thistle	Buck brush	Wild licorice	Golden rod	Grass	Leafy spurge	Canada thistle	Buck brush	Wild licorice	Golden rod
	oz/A	% control											
AMCP + chlorsulfuron[a] + NIS[b]	1 + 0.4 + 0.25%	0	80	100	29	3	74	0	37	27	0	0	93
AMCP + chlorsulfuron + NIS	1.8 + 0.7 + 0.25%	0	82	98	33	0	89	0	64	69	4	0	95
AMCP + 2,4-D[c] + NIS	1 + 7.6 + 0.25%	0	93	95	18	0	85	0	64	62	0	0	92
AMCP + 2,4-D + NIS	2 + 15.2 + 0.25%	0	98	99	13	5	93	0	82	10	5	0	92
Untreated	• • •	0	0	0	0	0	0	0	0	0	0	0	0
LSD (0.05)		NS	16	2	NS	NS	20	NS	32	4	15	NS	9

[a]Dispersible granular formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[c]Soluble liquid formulation, by E.I. duPont de Nemours and Company.

Table 2. Effect of aminocyclopyrachlor applied either with chlorsulfuron or 2,4-D on grass and broadleaf species near Fargo, ND.

		Harvest date			
		15 Sept 11		20 Sept 12	
Treatment	Rate	Grass	Broadleaf	Grass	Broadleaf
	oz/A	lb/A			
AMCP + chlorsulfuron[a] + NIS[b]	1 + 0.4 + 0.25%	1810	240	1275	350
AMCP + chlorsulfuron + NIS	1.8 + 0.7 + 0.2%	1710	295	1365	250
AMCP + 2,4-D[c] + NIS	1 + 7.6 + 0.25%	1415	285	970	170
AMCP + 2,4-D + NIS	2 + 15.2 + 0.25%	1085	265	1000	310
Untreated	● ● ●	2234	1940	990	790
LSD (0.05)		665	625	NS	260

[a]Dispersible granular formulation - Perspective by E.I. duPont de Nemours and Company, 1007 Market Street, Wilmington, DE 19898.
[b]Surfactant Induce by Helena Chemical Co., 225 Schilling Blvd, Collierville, TN 38017.
[c]Soluble liquid formulation, by E.I. duPont de Nemours and Company.

Aminopyralid applied alone or in combination with clopyralid for Canada thistle control.
Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58108-6050). Aminopyralid is generally applied at 1.25 to 1.75 oz ai/A for Canada thistle control in North Dakota. Prior to the release of aminopyralid, clopyralid was commonly used to control Canada thistle, especially in cropland. The purpose of this research was to evaluate aminopyralid applied alone or at reduced rates with clopyralid for long-term Canada thistle control.

The study was established along a drainage ditch that had become heavily infested with Canada thistle on the North Dakota State University Agricultural Experiment Station in Fargo. The treatments were applied June 30 or September 24, 2009. June treatments were applied to Canada thistle in the bolted to early bud growth stage and 30 to 48 inches tall while plants were post-flower with woody stems and 36 to 48 inches tall when herbicides were applied in the fall.

Herbicides 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 with replications established length wise along the ditch. Canada thistle control was evaluated visually using percent stand reduction compared to the untreated control.

Canada thistle control was similar with all treatments except clopyralid alone when applied in June or September of the previous year (Table). For instance, aminopyralid at 1.25 to 1.75 oz/A alone provided an average of 97% Canada thistle control when applied in June or September, 12 to 15 MAT (months after treatment) (August 2010). In general, aminopyralid applied at 0.5 to 1 oz/A with clopyralid provided similar Canada thistle control to aminopyralid applied alone at higher rates regardless of application timing. Clopyralid alone did not provide satisfactory Canada thistle control.

All treatments that contained 1 oz/A or more of aminopyralid applied alone or with clopyralid provided approximately 90% Canada thistle control the second season after application except aminopyralid at 1.25 oz /A applied in June, which declined to 43% (Table). Canada thistle control improved to 91% when aminopyralid at 1.25 oz/A was applied with clopyralid at 5.7 oz/A in June 2009. However, this treatment would be priced at $56/A and would not be cost-effective compared to aminopyralid alone at 1.75 oz/A at $19/A.

In summary, the combination of aminopyralid plus clopyralid at reduced rates generally provided similar Canada thistle control to aminopyralid alone at 1.75 oz/A the maximum labeled use rate. Aminopyralid at 1.25 oz/A applied in the fall provided the most cost-effective long-term Canada thistle control (89%) for $14/A.

Table. Aminopyralid plus clopyralid for Canada thistle control applied on June 30 or September 24, 2009 at Fargo, ND.

		Evaluation date				
		2009	2010		2011	
Treatment[a]	Rate	28 Aug	14 June[b]	20 Aug	29 June	Cost[c]
	— oz/A —	— % control —				$/A
June application						
Aminopyralid[d]	1.25	99	99	92	43	14
Aminopyralid	1.75	99	100	99	92	19
Clopyralid[e]	6	88	96	92	75	44
Aminopyralid + clopyralid	0.5 + 2.3	92	93	86	62	17
Aminopyralid + clopyralid	0.75 + 3.45	99	99	98	76	25
Aminopyralid + clopyralid	1 + 4.6	98	100	99	93	44
Aminopyralid + clopyralid	1.25 + 5.7	98	100	99	91	56
September application						
Aminopyralid	1.25		98	98	89	14
Aminopyralid	1.75		100	98	99	19
Clopyralid	6		64	47	40	44
Aminopyralid + clopyralid	0.5 + 2.3		88	71	61	17
Aminopyralid + clopyralid	0.75 + 3.45		98	91	77	25
Aminopyralid + clopyralid	1 + 4.6		100	94	91	44
Aminopyralid + clopyralid	1.25 + 5.7		98	98	86	56
Untreated		0	0	0	0	
LSD (0.05)		4	9	17	29	

[a]All treatments applied with NIS Activator 90 at 0.25%. Activator 90 from United Agri Products, 7251 W. 4th St. Greeley, CO 80634.
[b]Only two replications could be evaluated in June 2010 because the other two had been mowed.
[c]Based on Milestone and Transline at $350/gal each and does not include surfactant or application costs.
[d]Commercial formulation - Milestone and [e]Transline, from Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.