

A Strategic Overview of
Rights-of-Way
Weed Management
Within
the North Central States

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Summary

On March 20th, 2003 the above group of individuals, with an average of 5 to 7 years of experience in controlling weeds on rights of way, met with the facilitator at Decatur, Illinois to discuss weed problems and the herbicides and techniques commonly used to control them. Most of the participants contract with the DeAngelo Brothers Inc business to control weeds on state, county, township and industrial rights of way in an area including Illinois, Indiana, Missouri, Wisconsin, and Iowa.

Critical Herbicide Uses: The principal need expressed by participants was for the continued registration of the herbicides 2,4-D, glyphosate, and diuron. These herbicides were deemed critical due to their flexible and economic application in a broad range of rights of way applications. Participants also expressed concern about resistant weeds and indicated that rotating herbicides on an annual basis was their principal means of combating its development. Participants also indicated the following issues were concerns they wished were addressed by research, education, and regulatory action.

Research: Participants felt that they needed to know more about the effect of long term human exposure to the herbicides they use. They would encourage the EPA to investigate, or cause to have investigated, the impact of various right of way products or combination of products, on all aspects of the health of applicators. They felt that as a group, they were exposed to these herbicides for longer periods, and at higher doses, than most pesticide applicators, and wished to know of possible effects on their health.

Education: Participants felt that the public needs to be educated regarding the need for herbicides and pesticide use in general and specifically the need for rights of way applicator tanks to be filled from local resources. As a very mobile business, most rights of way spray trucks must fill from public sites or accessible surface water resources. Backing a truck up to a stream or lake has the appearance of being highly suspect, though in reality, quite innocuous activity. A program educating the public about the role and purpose of rights of way applicators would eliminate a great deal of the negative image they currently have.

Regulatory: Participants indicated a need for nation-wide licensing of applicators with reciprocity among states. As a mobile business many rights of way applicators work in several states. To maintain a license in each state for which applications are to be made requires multiple licensing and multiple testing. Development of a uniform standard for testing and licensing would facilitate compliance with existing statutes and enhance enforcement where necessary.

Background:

Weed and brush control on rights of way contributes significantly to the safety, security, and aesthetic quality of our nations roadways, railways, and industrial sites. In the absence of control weeds obscure traffic at road crossings and provide cover to the large animals along roadways which are a hazard to traffic. Weed control also reduces the large amounts of biomass from dead weeds and grass that are a fire and smoke hazard to rail and road traffic. In addition, ditches and medians provide an opportune environment for invasive weeds, insects and diseases that are a threat to adjacent crops or other desirable plants. In fact, weed control along roads and rails can be considered a primary deterrent to the movement of invasive species.

Table 1. Miles of primary and secondary roadway and estimated acres of Rights of Way by state for the North Central Region.

State	Miles of primary and secondary roads	Acres of Rights of way (assuming 16 feet r-o-w either side)
IL	102,000	394,138
IN	74,000	285,943
IA	108,000	417,322
MN	118,000	455,963
MO	109,000	421,186
MI	92,000	355,497
OH	83,000	320,720
ND	85,000	328,448
NE	88,000	340,040
KS	124,000	479,148
SD	81,000	312,992
WI	96,000	370,953
NC Region totals	1160000	4,482,351

There are currently over 3 million miles of primary and secondary rural roads within the United States. Of this total about 500,000 miles of roads are found in the 12 states of the North Central Region outside of urban areas. To this can be added approximately 50,000 miles of rail lines within the region. Assuming an average of 16 feet of right-of-way on either side of roads and rails we can estimate the total amount of right of way to be approximately 2.1 million acres for this region.

Weeds of Concern:

The weeds listed below are those of primary concern to rights of way applicators. However, this list is not meant to be all-inclusive. There are many other weeds which can be found in road, rail, or industrial rights of way, but are less often confronted and less of a problem for control. Many grass plants, which may be considered weeds in field crops, are generally ignored in roadsides or rail rights of way. The only grass which is found on the list is Johnsongrass, as it is a noxious weed.

Annual broadleaf weeds

Horseweed (marestail) (*Conyza canadensis*)(previously *Erigeron canadensis*)

Kochia (*Kochia scoparia*)

Teasel (*Dipsacus sativus*)

Giant Ragweed (*Ambrosia trifida*)
Common Ragweed (*Ambrosia artemisiifolia*)
Pigweeds/waterhemp (*Amaranthus retroflexus*, *A. hybridus*, *A. powellii*, *A. tuberculatus*, *A. rudis*)
Lambsquarters (*Chenopodium album*)
Chicory (*Cichorium intybus*)

Perennial broadleaf weeds

Canada thistle (*Cirsium arvense*)
Musk thistle (*Carduus nutans*)
Bull thistle (*Cirsium vulgare*)
Sumac (*Rhus sp*)
Poison ivy (*Rhus radicans*)
Wild carrot (*Daucus carota*)
Wild parsnips (*Pastinaca sativa*)
Water hemlock (*Cicuta douglasii*)

Perennial and annual grasses

Johnsongrass (*Sorghum halepense*)

Woody Species

Multiflora rose (*Rosa multiflora*)
Osage orange (*Maclura pomifera*)
Brambles (*Rubus spp*)
Black locust (*Robinia pseudoacacia*)
Honeysuckle (*Lonicera japonica*)

There are a number of new invading weeds which are already a problem in many parts of the Midwest. The exact extent to which these weeds may become a problem is unknown but they have been recognized as significant problems in some local areas. These include garlic mustard (*Alliaria petiolata*), purple loosestrife (*Lythrum salicaria*), and kudzu (*Pueraria lobata*).

Non-chemical control

- Mowing is commonly used on state and county maintained roadsides, and many industrial areas.
- Cutting or mechanical removal is done where practical or necessary for control of larger woody species.
- Planting of cover crop/desirable species is regularly used after the installation of new roadways. However, once an established area becomes infested with weeds or has eroded extensively the expense and practicality of reseeding may be prohibitive.
- Burning is a control method of last resort. It is not widely used due to threat of fire to adjacent areas and the hazard for existing traffic created by smoke.

Chemical Control

Broadleaf weeds

- Broadleaf weeds often are controlled best with foliar applications.
- Deep-rooted perennials can usually be controlled best when they are at the early bud or bloom stage. Perennials often need multiple treatments spaced several days apart for best control.
- Some herbicides can move through the air and damage nearby desirable trees, shrubs, and broadleaf plants. This can be a serious problem where rights of way are adjacent to homes, orchards, or sensitive field crops.
- Some of the herbicides are mobile in the soil and can damage desirable broadleaves if applied to the soil near their roots. This can also be serious where there are desirable trees or crops nearby.

Woody plants

- Most of the herbicides used to control woody plants are applied to the foliage.
- Foliar treatments usually are applied in the spring as soon as the leaves of brush or trees have fully expanded.
- Many herbicides also may be applied as basal-bark treatments if the woody plants have stems smaller than 5 inches in diameter
- Cut-surface (frilled) treatments can be used if the plants are larger. Basal-bark treatments usually are applied in fuel oil. Application may be made throughout the year, even during the dormant season. Cut-surface treatments also may be made throughout the year, but herbicides should be applied to the cut surface within 2 to 3 hours of cutting.
- The use of cut stump treatments is typical for control of many woody species in rights of way.

Weedy grass control

- Except for Johnsongrass and in areas where total vegetation control is desired few grasses are targeted for control. Weedy grasses can be controlled selectively with Assure II (quizalofop), Glyphosate (many), Select (clethodim), or Vantage (sethoxydim)
- Although glyphosate is nonselective and kills broadleaves as well as grasses, the use of low rates will often injure broadleaf weeds without seriously damaging grasses.

Resistant Weeds

The possibility of resistant weeds moving from rights of way into farm fields or causing persistent problems for those treating non-crop areas has not gone unnoticed. Right of way applicators rotate herbicide products with different modes of action on an annual basis to forestall resistance. Tank mixes of two herbicides with different modes of action is common but not always done. A number of factors, including high rates of herbicide for total vegetation control (TVC), few modes of action from which to choose, and weeds which have a high propensity for resistance, make weed resistance a serious concern.

Chemical Weed Control

Chemical weed control is widely used on rights of way to prevent weed growth or to remove existing vegetation. The advantages of herbicide use are primarily in the ease with which control may be effected on a wide range of weed species with minimal amounts of labor. When properly used herbicides can selectively favor short stature grasses or legumes which are aesthetically pleasing and provide a competitive disadvantage to weeds.

Herbicides for Residual weed control

ALS (amino acid synthesis inhibitors)

Group has high potential for weed resistance

Imazapyr (Arsenal 2AS)

May be foliar- or soil-applied

Typical uses: primarily used on railroads

Has the potential for off target movement

Level of control = Fair to good

ALS+PSI

Imazapyr + diuron (Topsite 2.5G)

Typical uses: not widely used

Level of control: Fair to good

Sulfometuron (Oust 75DF)

Primarily soil-applied

Typical uses: roadsides and rail roads and industrial sights

Level of control: Fair to good

Photosynthetic inhibitors (PSI)

Group has high potential for weed resistance

Bromacil (Hyvar X 80W and Hyvar XL 2L)

For spray application

Hyvar XL is combustible

Cannot be used around wells or surface water

Typical uses: minimally used for rights of way

Level of control: fair on annuals, none on perennials

Diuron (Karmex 80DF, Krovar 80DF (1:1 bromacil + diuron)

Soil-applied

Should not be used around wells or surface water

Typical uses: sub stations, guard roads, bare ground, railroads

Level of control: excellent when used properly

Must keep tank agitated to prevent settling

Hexazinone (Velpar 2L or 75SP)

Foliar or soil applied.

Should not be used around wells or if surface water is present

Typical uses: minimal use for rights of way except for guard rails

Level of control: Fair to good

Prometon (Pramitol 25E, 5PS)

25E may be foliar- or soil applied

5PS formulated for soil application only

Typical uses: not widely used because of past reputation of off-target movement and injury

Level of control: Fair

Tebuthiuron (Spike 80DF or 20P)

80DF soil-applied for broadleaf weed and brush

20P may be used for brush control in pastures

Typical uses: bare ground, rail roads, and industrial sites

Level of control: fair to good

Herbicides for short-term (nonresidual) control

PS I inhibitor

Paraquat (Gramoxone MaxRUP 3S)

Low potential for weed resistance

Contact herbicide

Use a crop-oil concentrate or nonionic surfactant

Typical uses: very little used, not persistent

Level of control: fair on immature annuals only

EPSP inhibitors (amino acid synthesis inhibition)

Low to moderate potential for weed resistance

Glufosinate (Finale)

Low potential for weed resistance

Controls annual grass and broadleaf weeds

Primarily a contact herbicide that can be used in noncrop areas
Maximum spray coverage is imperative for adequate control
Typical uses: minimally used for rights of way
Level of control: fair on some annuals, weak on perennials
Glyphosate (Roundup Pro, Touchdown, Accord, etc.)
Translocated (systemic) herbicides
Slow to act
Low to moderate potential for weed resistance
Typical uses: widely used for weed control and seed head suppression
Level of control: good to excellent for short term weed control on most weeds

Plant-growth regulators (PGR)

Group has very low probability of weed resistance
Primarily foliar applied
Typical uses: used with glyphosate. Used to selectively control broadleaf weeds in grasses

2,4 D (Many trade names)

Many formulations: acid, amine, salt, or ester
Often mixed to broaden control spectrum and reduce cost
Typical uses: tank farms, some roadsides
Level of control: fair to good
Use not permitted at certain times of the year
Dicamba (Banvel 4S, Clarity 4L, Sterling 4S, or Vanquish 4S (dicamba);
Dicamba + diflufenzopyr (Distinct 70WG) (**+auxin transport inhibitor**)
Dicamba + 2,4-D (Brash or Weedmaster (1:3)
Typical uses: Vanquish used for roadsides
Level of control: fair to good

Triclopyr (Garlon 4E, Garlon 3A, or Remedy and Crossbow (2:1 triclopyr + 2,4-D))
Typical uses: roadside, rail roads, stump treatments with basal oil
Level of control: fair to good

Picloram (Tordon K 2S and Tordon 101 (picloram + 2,4-D) Pathway (picloram+2,4-D))
Formulated as amines for foliar application
Typical uses: roadsides, widely used
Level of control: fair to good
Applications are subject to drift and movement through soil

Dichlorprop +2,4-D (DPD Ester Brush Killer and Super Brush Killer 4E
Dichlorprop + 2,4-D + dicamba (Brushmaster 2E)
Typical uses: minimally used for rights of way
Level of control: fair

Clopyralid (Stinger or Transline)

Primarily for Canada thistle control
Typical uses: roadsides, not much used due to cost
Level of control: good on Canada thistle, poor on most other

Other modes of action

Acetolactate-synthase inhibition (ALS)

Group has high potential for weed resistance, especially in some weeds
Imazapyr
(Arsenal 2AS) Used for foliar or soil application
(Stalker 2S or RTU) Basal-bark or cut-surface application to control brush
Typical uses: brush control
Level of control: good

Metsulfuron (Escort 60DF)

Foliar or soil application
Typical uses: widely used, roadsides, brush, railroad, used as tank mix
Level of control: good

Chlorsulfuron (Telar 75DG)

Foliar or soil application

Typical uses: moderate use, roadsides, especially for wild carrot and chicory
 Level of control: good though spectrum narrow
 Bromoxynil (many trade names: Buctril, Moxy, Bromox, Broclean, etc.) **PS II inhibitor**
 Moderate potential for weed resistance
 Contact activity against broadleaf weeds, may suppress perennials
 Toxic to fish-- observe proper precautions around water
 Cannot be applied with backpack or handheld equipment
 May require surfactant in cool, dry conditions
 Typical uses: minimally used for rights of way
 Level of control: poor to fair

Fosamine (Krenite S 4S) (**enzyme inhibitor, not assigned MOA**)
 Unknown potential for weed resistance
 For total control or side trimming of brush, depending upon amount sprayed
 When applied within 2 months of autumn color susceptible plants fail to re-leaf the following spring
 Typical uses: minimal use, used on roadsides and public access
 Level of control: fair to poor (limited spectrum)

Applicator Exposure

The predominant method of herbicide application to rights of way is via truck mounted sprayers. During applications, about 70 percent of applicators are separated from the sprays or spray drift by the enclosed truck cab and air conditioning. However, about 30 percent of sprays require the applicator to manually apply herbicides via hoses attached to the truck mounted sprayer unit. During the predominant part of the spray season, April through October, right of way applicators may load and fill applicators, spray, or clean sprayer equipment a total of 40 to 45 hours per week.

Application Timing

	Ja	Fe	M	Ap	M	Jn	Jy	Au	Se	Oc	Nv	Dc
Foliar Spray				x	x	x	x	x	x	x		
Soil applied			x	x	x	x	x	x	x	x	x	
Basal/cut bark	x	x	x	x	x	x	x	x	x	x	x	x

Table 2. Spray applications for residual (long-term) weed control

* Herbicide	Rate of formulation per acre	Formulations	Annuals	Some perennials	"Hard to control"
Arsenal	2AS		2 to 4 pt	1 to 6 pt	4 to 6 pt
Hyvar X	80W		3 to 6 lb	7 to 15 lb	7 to 15 lb
Hyvar X-L	2L		1.5 to 3 gal	3 to 6 gal	6 to 12 gal
Karmex, Direx	80DF		5 to 15 lb	5 to 15 lb	5 to 15 lb
Krovar	80DF		4 to 6 lb	7 to 18 lb	19 to 30 lb
Oust	75WDG*		3 to 5 oz	6 to 8 oz	8 to 12
Pramitol 25E	2S		4 to 6 gal	7.5 to 10 gal	10 gal
Spike	80DF		5 to 7.5 lb	2.5 to 5 lb	3.75 to 7.5 lb
Velpar	75SP		2.5 to 6.5 lb	6 to 10 lb	
VelparL	2L		1 to 2.5 gal	3 to 6 gal	

Table 3. Herbicides for broadleaf weed control

Herbicide	Rate of formulation per acre	
	Annuals and "easy to control" perennials	"Hard to control" perennials
2,4-D	1 to 2 qt	2 to 4 qt
Brushmaster (2,4-D + 2,4-DP + dicamba)	2 to 4 qt	4 to 8 qt
Bromoxynil (many)	1 to 2 pt	1 to 2 pt
Crossbow (triclopyr + 2,4-D)	1 to 2 qt	2qt
Dicamba (many)	0.5 to 1 qt	1 to 4 qt
Distinct (dicamba + diflufenzopyr)	4 to 6 oz	4 to 6 oz
Escort (metsulfuron)	0.33 to 0.5 oz	0.5 to 2 oz
Finale IS (glufosinate)	2 to 4 qt	4 to 6 qt
Garlon 3A (triclopyr)	2 to 3 qt	3 to 6 qt
Garlon 4/Remedy (triclopyr)	1 to 2 qt	2 to 4 qt
Glyphosate (many)	0.5 to 3 qt	3 to 5 qt
Gramoxone Max (paraquat)	1.5 to 3 pt	1.5 to 3 pt
Oust (sulfometuron)	3 to 5 oz	6 to 12 oz
Stinger, Transline (clopyralid)	0.33 to 0.5 pt	0.67 to 1.33 pt
Super Brush Killer (2,4-D + 2,4-DP + dicamba)	1 to 2 qt	2 to 4 qt
Telar DF (chlorsulfuron)	0.25 to 1 oz	1 to 3 oz
Tordon 101 Mixture (picloram + 2,4-D)	2 to 3 qt	1 to 2 gal
Tordon K (picloram)	0.5 to 2 qt	2qt
Weedmaster, Brash (2,4-D + dicamba)	0.5 to 4 pt	4 to 6 pt

Table 4. Herbicides for woody plant control

Arsenal 2AS (imazapyr)	Foliar or cut-surface	2 to 3 qt/A
Brushmaster (2,4-D + 2,4-DP +	Foliar	1 to 2 gal/100 gal water
Crossbow (triclopyr + 2,4-D)	Foliar	4 to 6 qt/A
	Basal-bark	1 to 4 gal/100 gal fuel oil
Dicamba (many)	Foliar	2 to 4 qt/A
Distinct (dicamba + diflufenzopyr)	Foliar	4 to 6 oz/A
Garlon 3A (triclopyr)	Foliar or cut-surface	2 to 3 gal/A
Garlon 4 /Remedy (triclopyr)	Foliar or basal-bark	4 to 8 qt/A
Glyphosate (many trade names)	Foliar or cut-surface	2 to 5 qt/A
	Spot treatment	1 to 2% solution
Krenite S (4 lb/gal)	Basal-bark	1 to 5 gal /1 00 gal water
	Foliar	1.5 to 6 gal/A
Pathway (picloram + 2,4-D)	Cut-surface	Wet cambium thoroughly
SBK (2,4-D + 2,4-DP + dicamba)	Foliar	0.5 to 1 gal/100 gal water
	Basal-bark or cut-surface	1 gal/25 gal diesel fuel
Stalker (2 lb/gal imazapyr)	Basal-bark or cut-surface	8 to 12 oz/gal; wet cambium thoroughly
Stalker RTU (3% imazapyr)	Basal-bark or cut-surface	Wet cambium thoroughly
Tordon 101 Mixture (picloram +	Foliar or cut-surface	1 to 4 gal/A
	Foliar or soil	1 to 2 qt/A
Tordon K (picloram)	Foliar	4 to 6 qt/100 gal spray
Patron 170 (2,4-D + diclorprop)	Basal-bark or cut-surface	3 to 4 gal/100 gal spray
2,4-D ester	Foliar or basal-bark	2 to 4 qt/A

Table 5. Herbicide for weed grass control

Herbicide	of formulation per acre	
	Rate	
	Annuals	Perennials
Assure II (quizalofop)	5 to 10 fl oz	8 to 12 fl oz
Glyphosates (many)	0.38 to 2 qt	1 to 5 qt
Select (clethodim)	6 to 10 fl oz	8 to 16 fl oz
Vantage (sethoxydim)	2.25 to 2.5 pt	3.0 to 3.75 pt

Glyphosate rates based on 3 lb a.e./gal formulation.