Recommendations for Roundup Ready[1] Alfalfa Weed Management and Stand Removal in New Mexico

Guide A-337

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Introduction

Effective weed management in alfalfa is critical not only for the production of high-quality, weed-free forage but also for enhancing stand establishment and persistence by eliminating weed competition. The development of Roundup Ready alfalfa (RRA) provides a significant option for effective weed control with no measurable damage to the alfalfa (Table 1). Glyphosate, the active ingredient in many commercially available herbicides such as Roundup, is the world's most widely used herbicide due to its cost-effective, broad-spectrum weed control and environmental safety (it readily breaks down in the soil leaving no residues). Roundup can be used on RRA at any growth stage (including establishment) for effective weed management with minimal restrictions on harvesting as hay or grazing (5 days) or crop rotations (30 days prior to planting the next crop).

Monsanto, the company that developed the Roundup Ready technology, requires RRA hay producers to sign their Technology Use Agreement and follow the requirements in their Technology Use Guide (https://www.genuity.com/stewardship/Documents/2011_TUG.pdf). Those requirements include (a) planting RRA in wildlife food plots is forbidden; (b) all RRA field locations must be identified with GPS coordinates; (c) forage from RRA fields must be harvested before 10% bloom, labeled to prevent comingling with non-RRA forage if it is to be exported out of the US, and not sold in countries where the importation of genetically modified crops is prohibited (labeling requirements do not apply to forage to be used in the US); and (d) RRA hay fields are not to be harvested for seed (RRA seed production is only by contract with Forage Genetics International and Monsanto [http://www.monsanto.com/ourcommitments/Pages/seed-patent-protection.aspx]).

Table 1. Effectiveness of Selected Post-Emergence Herbicides for Weed Control in Seedling (late summer seeded) and Established Roundup Ready Alfalfa[a]

	Herbicide				
Weed	**Glyphosate**	**Buctril**	**Butyrac**	**Pursuit**	**Raptor**
	Weed Control Rating				
Common lambsquarters	9	9	9	8	8+
Curly dock	9	N	6	8	8
Common chickweed	9+	6	6	8+	8+
Shepherds purse	9	9	9	8+	9
	Alfalfa Tolerance Rating				
	0	2+	1+	1	1

Weed Control Rating	**Alfalfa Tolerance Rating**
10 = 95–100%	0 = No injury
9 = 85–95%	1 = Rarely significant
8 = 75–85%	2 = Damage evident
7 = 65–75%	3 = Significant injury
6 = 55–65%	
5 = 45–55%	

N = No control

[a]Source: Dillehay and Curran (2006).

Availability and Selection of Roundup Ready Alfalfa Varieties in New Mexico

Similar to conventional varieties, the RRA varieties vary in their performance and levels of pest resistance and are available in a broad range of fall dormancy categories. Table 2 lists the varietal characteristics and relative performances of RRA varieties tested from

[1]Roundup and Roundup Ready are registered trademarks of Monsanto Technology LLC. Roundup Ready alfalfa varieties are proprietary to Forage Genetics International.

[2]Respectively, Forage Agronomist, Agricultural Science Center at Tucumcari; Extension Agronomist, Agricultural Science Center at Clovis; and Extension Weed Specialist, Department of Extension Plant Sciences, New Mexico State University.

Table 2. Characteristics and Relative Performance of Roundup Ready Alfalfa Varieties Tested in New Mexico from 2006 to 2010

			Pest Resistance[a]									Annual Relative Performance[b]				
Variety	**Proprietor**	**FD[c]**	**BW**	**FW**	**AN**	**PRR**	**SAA**	**PA**	**BAA**	**SN**	**SRKN**	**2006**	**2007**	**2008**	**2009**	**2010**
DKA41-18RR	Monsanto	4	HR	HR	HR	HR	n/r	R	n/r	R	n/r	91	94	88	n/t	n/t
6R100	Eureka Seeds and others	6	R	HR	HR	HR	HR	R	HR	R	HR	n/t	96	105	88	97
R65BD277	Forage Genetics International	6	n/r	n/r	R	HR	n/r	n/r	n/r	HR	n/r	n/t	105	102	96	101
R65BD278	Forage Genetics International	6	n/r	n/r	HR	HR	n/r	n/r	n/r	HR	n/r	n/t	104	105	96	103
R65BD279	Forage Genetics International	6	n/r	n/r	HR	HR	n/r	n/r	n/r	HR	n/r	n/t	100	98	96	98
R65BD280	Forage Genetics International	6	n/r	n/r	HR	HR	n/r	n/r	n/r	HR	n/r	n/t	108	103	107	103
WL550RR	W-L Research	8	R	HR	HR	HR	R	HR	HR	R	n/r	n/t	97	97	82	93

[a]BW = bacterial wilt, FW = Fusarium wilt, AN = Anthracnose, PRR = Phytophthora root rot, SAA = spotted alfalfa aphid, PA = pea aphid, BAA = blue alfalfa aphid, SN = stem nematode, SRKN = rootknot nematode; S = susceptible, LR = low resistance, MR = moderate resistance, R = resistant, HR = high resistance; n/r indicates either that the variety was not rated for that characteristic or no rating was available.

[b]Annual relative performance is yield as a percent of the test average for that year; n/t indicates that the variety was not tested that year.

[c]FD = Fall dormancy

2006 to 2010 in New Mexico. More varieties have been released since 2010 (http://www.alfalfa.org/) that have not been tested in New Mexico. Consequently, nothing is known about their performance in the state. See Circular 654, *Selecting Alfalfa Varieties for New Mexico* (http://aces.nmsu.edu/pubs/_circulars/CR654.pdf), for alfalfa variety selection guidelines, as well as The New Mexico Alfalfa Variety Test Reports (http://aces.nmsu.edu/pubs/variety_trials/welcome.html#alfalfa) for the performance of alfalfa varieties tested in New Mexico in recent years. Producers should order seed well in advance (late winter) for late summer planting in New Mexico (recommended) to ensure the availability of seed for the variety of their choice; a considerable amount of spring planting is done in other alfalfa-producing regions, which may affect seed availability at certain times of the year.

Herbicide Use During Establishment of Roundup Ready Alfalfa in New Mexico

Up to about 10% of the seeds in a bag of RRA might not have the Roundup Ready trait. Consequently, an initial Roundup application is needed at the 3rd to 5th leaf stage (Figure 1) to remove non-RRA plants because allowing them to become established before applying Roundup can create larger gaps in the stand that could be filled by weeds. Alfalfa seeding rates do not need to be increased to account for removal of non-RRA plants if the recommended seeding rate of 20 lb/ac is used. This initial application also will control any weeds that are already present while they are still small and easier to control.

Herbicide Use in Established Roundup Ready Alfalfa in New Mexico

Once RRA is established, it is important to not rely only on Roundup or other glyphosate products for weed management. Using herbicides with different modes of action against the target weeds, either in rotations and/or in mixtures, will help prevent the development of herbicide-resistant weeds. It also allows growers to use glyphosate occasionally as needed to clean up what was missed or as a rotational herbicide (following label guidelines for maximum annual application rates of Roundup). Optimum application timing to maximize weed control by any herbicide should always be followed.

Monsanto's Technology Use Guide encourages producers to report consistent lack of weed control by Roundup or other glyphosate-containing herbicides to a company representative, retailer, or county Cooperative Extension Service agriculture agent to reduce the likelihood of developing herbicide-resistant weed populations. Guide A-325, *Managing Weeds in Alfalfa* (http://aces.nmsu.edu/pubs/_a/A-325.pdf), lists herbicides that are labeled for use on alfalfa in New Mexico. Table 3 in this publication shows the labeled herbicides by mode of action group.

Removing Stands of Roundup Ready Alfalfa in New Mexico

When the time comes to renovate RRA fields, the choice of herbicides for stand removal is currently limited (Table 4). Since none of the currently available options are 100% effective in eradicating alfalfa stands, deep tillage, such as moldboard plowing, is often necessary to completely eradicate the alfalfa. Deep tillage is also helpful in breaking up any soil effects due to alfalfa's perennial crop culture (e.g., compaction, traffic patterns, dry zones). Research at NMSU's Agricultural Science Center at Tucumcari indicates that tillage alone can be more effective than herbicide application alone and is as effective as herbicide application plus tillage for conventional alfalfa stand removal. Tillage should be as effective for RRA stand removal as it is for removing conventional alfalfa. For information about when to renovate alfalfa, see Circular 644, *Assessing Alfalfa Stands After Winter Injury, Freeze Damage, or Any Time Renovation Is Considered in New Mexico* (http://aces.nmsu.edu/pubs/_circulars/CR644.pdf).

Final Thoughts for Management

Producers should keep in mind that the availability of RRA varieties only provides an additional herbicide tool for hard-to-control weeds and cannot replace proper agronomic practices regarding variety selection, establishment, fertility, irrigation, insect control, and harvest management for reducing weed pressure. These management aspects will be the same for RRA varieties as for conventional

Figure 1. **Alfalfa seedlings with the third leaf ready to expand (top) and with five leaves fully expanded (below). Photos courtesy of Dan Undersander, Wisconsin Cooperative Extension Service (www.uwex.edu/ces/forage).**

Table 3. Mode of Action Groups for Herbicides Labeled for Alfalfa in New Mexico[a]

Mode of Action Group		Herbicides
1	ACCase grasskillers	Clethodim, Poast, Poast Plus, Select 2E, Select Max
2	ALS/AHAS inhibitors	Pursuit, Raptor, Sandea
3	Microtubule assembly inhibitors	Balan DF, Prowl H_2O, Treflan 4EC, Treflan 4L, Treflan HFP, Treflan TR-10, Kerb 50W
4	Synthetic auxins	Butoxone 200, Butoxone 7500, Butyrac 200, MCPA amine 4
5	Photosynthetic inhibitors – triazines	Lexone 75DF, Sencor 4F, Sencor 75DF, Sinbar, Velpar
6	Photosynthetic inhibitors – nitriles/benzothiadiazoles	Buctril, Buctril 4EC
7	Photosynthetic inhibitors – ureas/amides	Karmex DF
8	Lipid synthesis inhibitors	Eptam 7E
9	EPSP synthase inhibitors	Roundup and other glyphosate products
12	Carotenoid biosynthesis inhibitors	Solicam DF
14	PPO inhibitors	Chateau, ET Herbicide
22	Photosystem I inhibitors	Gramoxone Extra
27	Unknown	K-PAM HL, Metam CLR 42%, Scythe

[a]Adapted from Weed Science Society of America, *Weeds Resistance Education and Action Program* (http://wssa.net/Weeds/Resistance/WREAP.pdf). New herbicides do not necessarily have a unique mode of action and may fall within the groups listed in the charts. Herbicides that have the same mode of action may not control the same weed spectrum. Other trade names with the same active ingredient may be available on the market.

Table 4. Roundup Ready Alfalfa Stand Removal Prior to No-Till Corn[a]

Herbicide(s)[b]	Rate	Alfalfa Control Rating
2,4-D LV4	1 pint/ac	7+
dicamba	1 pint/ac	8
2,4-D LV4 + dicamba	1 + 1 pint/ac	9
2,4-D LV4 + dicamba	1 + 0.5 pint/ac	8+
2,4-D LV4 + dicamba	0.5 + 1 pint/ac	8
2,4-D LV4 + dicamba	0.5 + 0.5 pint/ac	8
Clopyralid (Stinger)	8 oz/ac	9

Alfalfa Control Rating
10 = 95–100%
9 = 85–95%
8 = 75–85%
7 = 65–75%
6 = 55–65%
5 = 45–55%

[a]Source: Dillehay and Curran (2006).

[b]Herbicide should be applied to alfalfa with at least 10 inches of spring growth or after 6 inches of alfalfa regrowth.

varieties, and alfalfa's competitive nature, coupled with proper management, can significantly reduce encroachment by weeds and reduce herbicide costs, even when using Roundup.

Additionally, the availability of RRA seed does not justify prematurely replacing alfalfa stands. As long as a stand of conventional alfalfa remains productive, there is no reason to renovate. In fact, as more varieties of RRA are released and information is collected about their performance in New Mexico and published in The New Mexico Alfalfa Variety Test Reports (http://aces.nmsu.edu/pubs/variety_trials/welcome.html#alfalfa), producers will have more options when stand replacement does become necessary. Consequently, the wait should be worth it.

Finally, Roundup Ready alfalfa is a genetically modified crop, and some conventional and organic alfalfa growers fear that it will inevitably contaminate their alfalfa through gene flow (the movement of pollen from plant to plant or inadvertent seed mixing), thereby negatively affecting their products and possibly leading to legal action. Good stewardship should be used by everyone involved—those wanting to use RRA as well as those not wanting it to affect their operation—so that the two can be grown in nearby fields.

Key components of coexistence include talking across the fence, understanding your neighbors' goals, and coming to an agreement on what is best for all parties involved. These and other guidelines are presented in Guide A-336, *Managing Roundup Ready and Conventional or Organic Alfalfa Hay in Nearby Fields in New Mexico* (http://aces.nmsu.edu/pubs/_a/A336.pdf).

For more information about managing alfalfa or any other forage, visit the resources page of NMSU's forage website (http://forages.nmsu.edu/resources.html) or your county Cooperative Extension Service office.

Reference

Dillehay, B.L., and W.S. Curran. 2006 *Guidelines for weed management in Roundup Ready alfalfa* [Agronomy Facts 65]. University Park, PA: Penn State University Extension. Available at http://cropsoil.psu.edu/extension/facts/agronomy-facts-65

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Notes

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November 2012 **Las Cruces, NM**