

ROUNDUP READY ALFALFA FOR STAND ESTABLISHMENT AND SPECIAL WEED ISSUES

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ABSTRACT

Roundup Ready technology has been successfully incorporated into alfalfa and was commercially released in the fall of 2005. It was anticipated that Roundup Ready alfalfa, as a weed control system, would have significant merit for alfalfa producers. Weed control using glyphosate would improve for many annual weeds; however, glyphosate alone may not always be suited to control the entire weed complex during stand establishment or in later years. There are known tolerant weed species to glyphosate that occur in alfalfa and demonstrated occurrences of weed shifts when glyphosate was the only herbicide used. If and when these situations arise, tank mixing other herbicides with glyphosate maybe needed if crop injury and weed control are not compromised. In addition, there are no effective weed control programs for some of the most difficult-to-control perennial weeds. Yellow nutsedge, quackgrass, bermudagrass, bindweed, Johnsongrass and perennial pepperweed control could also be improved using glyphosate. Dodder, a parasitic plant, has long been a significant problem in alfalfa hay and seed production having very few effective control options. Selective post emergent control of dodder in alfalfa would be a tremendous advantage. Controlling these tough weeds could easily extend alfalfa stand life and productivity for several years.

Key Words: Stand establishment, Perennial weeds, Yellow Nutsedge, Dodder, Quackgrass, glyphosate.

INTRODUCTION

During the phase-in period of Roundup Ready (RR) alfalfa, little consideration was given to tank mixing other herbicides into the management system. Only a couple herbicide combinations were identified in initial field-trials. Roundup Ready alfalfa is being rapidly adopted and situations will arise that require the knowledge to combine other herbicides. This information is not only useful in the first year of an alfalfa stand but equally important in subsequent years to avoid glyphosate (Roundup) tolerant weed shifts and managing against herbicide resistant weeds. An experiment was conducted on a seedling stand of RR alfalfa to study the effects of tank mixing herbicides and surfactants to measure any negative impacts to the seedling plants.

Initial testing and trials of RR alfalfa did not have perennial weeds to evaluate, therefore we can only speculate on performance and procedure. Now with many commercial fields

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being planted, opportunities are presenting themselves where some of the more problematic perennial weeds are present. Studies were conducted on new plantings of RR alfalfa where yellow nutsedge was an emerging problem. Other fields were identified where dodder was a known problem and they were monitored during the season to evaluate the results of glyphosate applications.

Evaluating Herbicide Combinations

A field experiment was set up in February 2005 in a newly-planted field of RR alfalfa. Roundup herbicide was applied alone and in tank mix combinations with other herbicides used for weed control in seedling alfalfa. The herbicides used in the study were Roundup, Pursuit, Raptor, Butyrac and Buctril.

Each herbicide was applied alone and in a tank-mix combination with Roundup at the 3-4 trifoliolate leaf stage of the alfalfa. The Roundup-only treatments were made at three timings, the 2, 4 and 8 trifoliolate leaf stage. Evaluations were made for crop injury, weed control and yield. The results showed a moderate amount of early crop injury with Pursuit, Buctril, and 2, 4-DB, all of which resumed to normal growth within 30 days. The Roundup treatments showed no crop damage and the combinations of Roundup and other herbicides gave no more injury than the herbicides by themselves.

Overall weed control was excellent with Roundup and Roundup combinations. Other herbicides were slower in controlling weeds but the plots were relatively clean of weeds at harvest time. Alfalfa yields were taken for the first harvest on May 11, 2006. Yields ranged from a low of 2.0 tons/A in the untreated check (with weeds removed) to a high of 2.4 tons/A for Roundup at two applications (Table 1).

Dodder

Dodder (*Cuscuta* sp.) is a parasitic plant, commonly infesting broadleaf crops. Some of the more important crop hosts include alfalfa, tomato, melon, onion, safflower, sugarbeet, and carrot. Dodder germinates from seed without a root and sends a single stem out of the soil that twists in a counter-clockwise rotation until it finds a suitable host. Once attached to a host, dodder's original connection to the soil dies and dries up. At that point, dodder is completely dependent on the host plant for life support. Once attached to the host plant, dodder extracts nutrients weakening the host plant and sometimes secondary diseases such as Phytophthora root rot invades the alfalfa causing it to die. Dodder reduces alfalfa plant growth which lowers yields and also makes it difficult to dry the alfalfa in the windrow. In alfalfa seed production, the presence of dodder creates seed cleaning problems and un-certifiable seed.

In greenhouse experiments conducted by (T. Lanini, UC Davis 2005) dodder (*Cuscuta pentagona*) was allowed to attach to RR alfalfa, and treated with glyphosate when dodder stems were 6 to 8 inches in length (Miranda 2003). Glyphosate rates were 0.75 or 1.5 lbs ai/A. Neither treatment totally controlled the dodder and dodder growth resumed within a week after treatments. Increasing the single glyphosate rate to 3.0 lbs ai/A or sequential treatments of 1.5 lbs ai/A made at two week intervals resulted in 99% control, but some dodder always survived. The surviving dodder was not observed to resume normal growth during the course of the experiment.

In another a field study, RR alfalfa was seeded in late April, 2006. Dodder (*C. pentagona*) was allowed to attach to RR alfalfa grown in greenhouses, and these alfalfa plants with dodder attached were placed in the field to ensure good dodder cover in each plot. Glyphosate treatments were made when dodder attached to the young alfalfa plants and dodder stems reached 4 to 8" in length. Roundup was applied on June 16, 2006 and a subsequent treatment on July 2, 2006 on selected plots (Table 2).

Dodder control with glyphosate treatments in RR alfalfa was very good to excellent through the July rating. The Pursuit treatment stunted the dodder, but dodder growth resumed within a few weeks. Alfalfa was harvested on August 10, 2006. By August 28th, dodder was completely controlled in all the glyphosate plots except those that received a single application at the low rate (0.75 lbs ai/A).

Field observations were made in commercial RR alfalfa fields near Tracy California during the summer of 2006. Large dodder patches (3-5 feet in diameter) were present after the first cutting and were treated with 44 oz of Roundup Weather Max resulting in 90% control. A sequential treatment using 22 oz of Roundup was applied following the second cutting. This resulted in 100% dodder control for the next three cuttings.

It is evident that Roundup controls dodder in RR alfalfa, but higher rates and sequential treatments will be needed to achieve long term success. If dodder is treated soon after initial attachment, a single application of glyphosate at 1.5 lbs ai/A maybe sufficient, but if dodder is well attached, two or possibly more applications will be needed to achieve complete control.

Yellow Nutsedge

Yellow nutsedge is arguably the state's number one perennial weed problem in field and vegetable crops. In alfalfa, it impacts longevity by competing for soil moisture and nutrients; it reduces yield and lowers forage quality. Curing alfalfa with large amounts of nutsedge is difficult and usually results in a longer drying period before baling. Nutsedge is an increasing problem in alfalfa because there are few effective control methods and at best only suppression of nutsedge is achieved with herbicide treatments. Summer irrigated crops promote nutsedge development. One reason perennial weeds in perennial crops are more problematic than in annual crops is cultivations are not used.. Cereal grains which dry the soil and corn which shades most weeds play a major role in limiting nutsedge spread. With declining economics in cereal grains as a rotation crop, nutsedge is on the rise and has become more problematic in vegetables and alfalfa. Once nutsedge invades an alfalfa stand, only a few herbicides are available for use and at best usually only provide short term suppression. Nutsedge plants have underground root systems that produce nutlets that are a food source for long-term continued development of new plants. The use of Roundup in RR alfalfa offers a new tool for the grower.

It is well documented that Roundup can be effective on nutsedge when rates and sequential applications are made at regular intervals. A long-term study was established in the spring of 2006 to better understand rates and the number of applications needed to manage yellow nutsedge in an alfalfa field. Roundup treatments were applied at various rates and different application dates during the summer of 2006. Evaluations were made following each harvest to determine the percent nutsedge control (Table 3).

Roundup Weather Max treatments showed excellent alfalfa tolerance. All treatments of Roundup with multiple applications gave excellent (97-98%) yellow nutsedge control. A

single application of Roundup Weather Max 1.5 lb ai/A after the second cutting gave 96% control but the single treatment after first cutting showed the poorest results of 85%. It is difficult to predict long-term strategies for nutsedge control after only one year's experience. However, it is clear that multiple applications are necessary during the growing season and will likely be needed in subsequent years, especially as alfalfa stands thin and become less competitive.

Quackgrass

Quackgrass is a problematic weed in the intermountain areas of California and other states. It is extremely aggressive with an extensive rhizominous root system. It is not adequately controlled with any of the herbicides applied to conventional alfalfa. It is especially a problem in older alfalfa stands and some fields are taken out of production as a result of severe quackgrass infestations. Initial observations with RR alfalfa are extremely encouraging. The tillage used to prepare an alfalfa seedbed cuts the quackgrass roots into smaller segments. An application of Roundup to quackgrass emerging in a seedling alfalfa field has provided effective control. How many applications will be needed for complete control is not known at this time but initial results are impressive.

SUMMARY

Roundup Ready alfalfa for annual and perennial weed control has great potential showing promising results. Having the flexibility of applying an herbicide without limitations to alfalfa size and having a wide range of rate options allows for a timely and more effective weed control program, especially in the case with larger weeds or perennial weeds that require higher rates for control. It is also possible to combine other alfalfa herbicides with Roundup without crop injury problems or compatibility issues, so implementing good weed management systems that produce weed-free hay seems achievable. Combining herbicides will also be important in managing weed shifts and protecting against the development of Roundup-resistant weeds. It will take time to understand and fine-tune the weed control programs but unquestionably the tools are available to take alfalfa weed control to the next level.

Without question, the RR alfalfa system has heightened interest and is gaining in popularity. However, one of the greatest concerns facing rapid adoption of this new technology is the overuse or potential misuse of Roundup which will lead to weed resistance and weed shifts. The low cost and flexibility of Roundup with no potential threat to crop injury, plant back issues or listed as a problem in groundwater protection zones; may lead growers to become complacent and totally reliant on glyphosate alone. Having a well informed weed control plan in place and a strategy for using glyphosate prudently will protect this valuable technology and the ability to control most of alfalfa weeds but especially the important perennial weeds.

Table 1 – Alfalfa Tolerance, Yields and Quality in Roundup Ready Alfalfa

Treatment ²	Rate Lb ai/A	App ³ Timing	% - Alfalfa Injury ⁵			Alfalfa Yield ¹ & Quality		
			2/18	3/1	5/8	Yield Ton/A	% ADF	% TDN
Untreated Ck	-	-	0	0	0	2.0d	25.2	57.1
Roundup ⁴	1.0	A+C	0	2	0	2.3ab	26.1	56.5
Roundup	2.0	A+C	0	0	0	2.4a	26.2	56.4
Roundup	1.0	B	0	3	0	2.3ab	25.0	57.3
Roundup	2.0	B	0	3	0	2.4a	-	-
Pursuit + Butyrac	0.094 + 1.0	B	0	0	0	2.1bcd	-	-
Raptor + Butyrac	0.047 + 1.0	B	0	1	0	2.1bcd	-	-
Pursuit + Buctril	0.094 + 0.375	B	0	0	0	2.1bcd	-	-
Raptor + Buctril	0.047 + 0.375	B	0	3	0	2.0cd	-	-
Roundup + Pursuit	1.0 + 0.094	B	0	7	0	2.1bcd	-	-
Roundup + Raptor	1.0 + 0.047	B	0	3	0	2.1bcd	-	-
Roundup + Butyrac	1.0 + 1.0	B	0	30	0	2.2abc	-	-
Roundup + Buctril	1.0 + 0.375	B	2	10	0	2.3ab	-	-
Roundup + Pursuit + Butyrac	1.0 + 0.094 + 1.0	B	8	12	0	2.2abc	-	-
Roundup + Pursuit + Buctril	1.0 + 0.094 + 0.375	B	5	18	0	2.4a	-	-
Pursuit + Raptor	0.032 + 0.032	B	0	2	0	2.2abc	-	-

¹ – 1st cutting; 5/8/06, 90% D.M.

² – No Foam A (NIS) added to all tank mix combinations at 0.25% V/V

³ – Application timing; (A) applied on 2/6/06, (B) applied on 2/13/06

⁴ – Roundup formulation used in this trial was Roundup Weather Max 5.5SL

⁵ – 0 = No crop injury, 100 = Crop dead

Table 2. UC Davis Alfalfa Trial

Dodder control (%) in RR alfalfa.

Treatment lb ai/a	Dodder control (%)			
	6/26	7/2	7/18	8/28
Untreated	0	0	0	11
Glyphosate 0.75	84	92	90	78
Glyphosate 1.5	83	94	100	100
Glyp 0.75 fb.0.75@2wks	86	81	100	100
Glyp 1.50 fb.1.50@2wks	86	95	100	100
Glyp 0.75 fb.1.50@2wks	86	91	100	100
Pursuit 0.094	17	46	32	33
Glyp 1.50 + Pursuit 0.094	84	94	100	100
Glyp 1.50 + Raptor 0.047	86	89	100	100
LSD .05	8	11	5	20

Treatment Dates: June 16, 2006

2-week treatment: July 2, 2006

Table 3 – Yellow Nutsedge Control and Crop Tolerance in Roundup Ready Alfalfa

Treatment	Rate lb ai/A	Application ¹ Timing	% -Alfalfa Injury ²			% -Yellow Nutsedge Control ²			
			6/22	7/17	8/10	7/17	8/10	9/5	9/18
Roundup Weather Max	1.0	1 st ,2 nd ,3 rd	0	0	0	70c	98a	100a	98a
Roundup Weather Max	1.5	1 st	0	0	0	90a	84b	89c	85b
Roundup Weather Max	2.0 1.0	1 st 2 nd , 3 rd	0	0	0	95a	98a	99a	97a
Roundup Weather Max	1.5 1.0	1 st 2 nd ,3 rd	0	0	0	80b	97a	100a	98a
Roundup Weather Max + BB5 ³ Natural	1.5	1st	0	0	0	93a	88b	88c	87b
Roundup Weather Max	1.5	2 rd	0	0	0	-	96a	93b	96a
Untreated Check	-	-	0	0	0	0e	0d	0d	0c

¹ – Herbicide applied after cutting; 1st = 6/15/06, 2nd = 7/17/06 & 3rd = 8/10/06² – 0 = No weed control or crop injury, 100 = Complete weed control; crop dead³ – Added BB5 Natural buffering agent 0.22% V/V⁴ – Added Agridex COC 1.25% V/V