

# Tank mix of glufosinate and indaziflam for weed control in walnut and grape

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## Introduction

California is the largest producer of walnut and grape in the USA. Weed management in orchards and vineyards is greatly varied depending on the specific crop, producer, location, and availability of resources. Among various methods of weed control, herbicides are an important choice commonly used by California growers either as strip applications within the crop row or as broadcast applications to the orchard floor. Glufosinate (Rely 280) is a new formulation of Rely 200, a broad spectrum, non-selective, post-emergence herbicide used in annual and perennial crops grown in California. Indaziflam (Alion 200) is a new herbicide to be registered for pre-emergence weed control in perennial fruit, nut and vine crops. Indaziflam may be applied alone or in a tank mix with other herbicides. It is expected that when applied with a post-emergence herbicide such as glufosinate, the combination will provide control of existing weeds as well as extended residual weed control. There is little information available on weed control with a tank mixes of glufosinate and indaziflam in California orchards and vineyards.

## Objective

To evaluate tank mix combinations of glufosinate and indaziflam applied at various rates for control of broadleaf and grass weeds in orchards and vineyards in California.

## Materials and Methods

**Field Experiments:** Field experiments were conducted in an established walnut orchard and a vineyard in Yolo County, CA in 2010. At both sites, treatments included glufosinate (Rely 280) applied alone at 0.88, 1.03 or 1.47 lb/acre or glufosinate tank mixed with indaziflam (Alion 200) at 0.065 or 0.085 lb/acre. An untreated control and glyphosate (Roundup Weathermax) at 2 lb ae/acre alone or tank mixed with indaziflam at 0.065 lb ai/acre was included for comparison. Both the experiments were conducted in randomized complete block design with four replications. In the walnut trial, 8 x 30 ft plots were arranged between the tree rows (middles). Herbicides were applied on April 22, 2010 at the walnut site in a spray volume of 20 gallons per acre (gpa). In the vineyard trial, herbicides were applied in a spray volume of 30 gpa to 6 x 20 ft plots centered on the vine row on March 30, 2010.

**Data Collection:** Visual ratings of broadleaf and grass weeds (based on 0 to 100% scale) were taken several times during the crop season. In mid-summer, all weeds from a random 0.25 m<sup>2</sup> area in each plot were cut at the soil surface, placed in paper bags, dried for 72 h at 60 °C and total weed biomass was recorded.

**Statistical Analysis:** All data were subjected to analysis of variance (ANOVA) using the Proc GLM procedure of SAS (SAS Institute, NC). The weed density data were square root transformed for homogenous variance prior to analysis; however, data presented here are the means of actual values for comparison.

**Table 1.** Visual weed control evaluations in a glufosinate and indaziflam tank mix trial in a walnut orchard.

Treatment <sup>a</sup>	Rate lb ae or ai/acre	% Control <sup>b</sup>									Weed Biomass (g m <sup>-2</sup> )	
		May 10 (2.5 WAT)			June 2 (7.5 WAT)			July 27 (15.5)				
		Filaree	Bindweed	Hare barley	Mallow	Bindweed	Sowthistle	Lambsquarters	Bindweed	Bermuda grass		
1	Untreated	0 c	0 d	0 c	0 d	0 d	0 c	0 c	0 e	0 c	416 a	
2	Glufosinate	97 a	96 a	95 ab	70 ab	9 bc	69 ab	14 b	21 cd	73 ab	123 bc	
3	Glufosinate	96 a	95 ab	96 a	45 bc	5 cd	56 b	19 b	28 bcd	53 ab	193 b	
4	Glufosinate	91 ab	91 abc	78 ab	87 a	6 bcd	95 a	5 bc	23 cd	22 bc	136 bc	
5	Glufosinate + Indaziflam	0.88 + 0.065	89 ab	93 abc	89 ab	87 a	8 bc	96 a	73 a	8 de	37 bc	186 b
6	Glufosinate + Indaziflam	1.03 + 0.065	94 a	87 c	93 ab	91 a	25 b	94 a	59 a	39 abc	76 ab	217 b
7	Glufosinate + Indaziflam	0.88 + 0.085	80 b	88 bc	76 b	31 c	5 cd	87 ab	64 a	9 d	56 ab	168 bc
8	Glyphosate	2.0	89 ab	92 abc	89 ab	91 a	68 a	95 a	8 bc	61 a	57 ab	156 bc
9	Glyphosate + Indaziflam	2.0 + 0.065	91 ab	93 abc	88 ab	94 a	89 a	93 a	89 a	54 ab	98 a	43 c



Untreated at 7.5 WAT



Glufosinate at 1.03 + indaziflam at 0.065 lb ai/acre at 7.5 WAT

**Table 2.** Visual weed control evaluations in a glufosinate and indaziflam tank mix trial in a vineyard.

Treatment <sup>a</sup>	Rate lb ae or ai/acre	% Control <sup>b</sup>									Weed Biomass (g m <sup>-2</sup> )	
		April 15 (2 WAT)			June 2 (9 WAT)			August 17 (20 WAT)				
		Willowherb	Filaree	Burclover	Willowherb	Filaree	Hare barley	Willowherb	Sowthistle	Hare barley		
1	Untreated	0 c	0 b	0 b	0 d	0 d	0 c	0 d	0 c	0 c	76 a	
2	Glufosinate	73 a	93 a	97 a	79 ab	96 ab	27 bc	79 abc	98 a	75 b	20 b	
3	Glufosinate	79 a	97 a	97 a	93 a	89 bc	62 ab	85 ab	74 b	82 ab	7 b	
4	Glufosinate	78 a	93 a	96 a	91 a	96 ab	60 ab	92 a	99 a	99 a	20 b	
5	Glufosinate + Indaziflam	0.88 + 0.065	88 a	96 a	97 a	97 a	88 c	92 a	99 a	99 a	97 ab	2 b
6	Glufosinate + Indaziflam	1.03 + 0.065	47 ab	73 a	77 a	95 a	93 abc	57 ab	99 a	97 a	99 ab	21 b
7	Glufosinate + Indaziflam	0.88 + 0.085	62 a	92 a	91 a	77 ab	97 a	76 ab	96 a	98 a	97 ab	7 b
8	Glyphosate	2.0	5 c	81 a	94 a	31 c	93 abc	92 a	41 c	98 a	97 ab	25 b
9	Glyphosate + Indaziflam	2.0 + 0.065	8 bc	91 a	95 a	42 bc	94 abc	84 a	47 bc	99 a	99 ab	11 b



Untreated at 9 WAT



Glufosinate at 0.88 + indaziflam at 0.085 lb ai/acre at 9 WAT

<sup>a</sup>All treatments with glyphosate included ammonium sulfate at 10 lb/100 gallon spray solution; <sup>b</sup>WAT, weeks after treatment; Least square means within columns with no common letters are significantly different according to Fisher's Protected LSD test where  $P < 0.05$ .

## Results and Discussion

The present study investigated efficacy of tank mix of glufosinate and indaziflam for weed control in walnut and grape in California. The results suggested that all treatments controlled most broadleaf and grass weeds at 2.5 and 7 weeks after treatment (WAT) with some inconsistent results in control of panicle willowherb (*Epilobium ciliatum*). The application of glufosinate alone was slightly less effective for some weed species later in the season (> 14 WAT) compared to tank mixes with indaziflam. All treatments were effective for reducing weed biomass compared with untreated plots in both the experiments with some significant difference among tank mix treatments. The treatments were applied much later than recommended application timing; therefore it is likely that control of annual weeds would have been improved with an earlier application. Overall results indicated that indaziflam can be a good tank mix partner with glufosinate for control of weeds in orchards and vineyards. Weed control with glyphosate alone or in a tank mix with indaziflam was usually comparable with a tank mix of glufosinate plus indaziflam. However, because of increasing selection pressure of glyphosate resistant weeds in orchards and vineyards, it is predicted that alternative herbicides such as glufosinate alone or in a tank mix with other herbicide(s) will be used extensively for controlling glyphosate-resistant weeds in California.