Understanding winegrape weed management practices of a biologically integrated farming system in San Joaquin County, California

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ABSTRACT

Many inexpensive and highly effective herbicides used on vineyards such as simazine have been detected in California's groundwater. To reduce the risk of this contamination, a Biologically Integrated Farming Systems (BIFS) program in San Joaquin County, California, employed a weed management approach between 1996 and 1998. We used California's unique Pesticide Use Records (PUR) database to investigate whether BIFS growers reduced their use of pre-emergents and attempt to gain a better understanding of herbicide use patterns during and after BIFS program years based on economic, efficacy, and rainfall data. Results showed that simazine use decreased significantly in the first year of the program. The initial decrease in simazine use in the inaugural year may have been due to initial enthusiasm for a locally grower-driven program, low weed pressure, and a shift in weed management strategies.

1.OBJECTIVES

-Investigate whether BIFS growers reduced their use of pre-emergent herbicides
- Gain a better understanding of herbicide use patterns during and after program years based environmental, efficacy, and economic data

2. MATERIALS AND METHODS

2.1 Study site and participants

- 49 winegrape BIFS fields in San Joaquin County, California, representing approximately 3000 acres during program years (1996-98)
- 1,100 conventional fields representing roughly 75,000 acres

2.2 Data source

- Pesticide use reports (1993-2001) from California's Dept. of Pesticide Regulations
- Rainfall data (1992-2000) from California Irrigation Management Information System (CIMIS) for Lodi, California (station 42)
- Economic and pesticide price data from California Grape Advisory Team and FQPA Grape Partnership and Ohmart (1998)
- Pesticide efficacy data from University of Virginia (Pfeiffer et al., 2003)

Fig. 1. BIFS monitoring techniques include hand-held computers that efficiently transfer field data to the lab for analysis.

2.4 Analysis

We used STATISTICA© (1997, version 5.1) to perform t-tests on simazine and glyphosate use between and among groups from 1993-2001. A regression analysis was performed for rainfall and simazine use.

We formulated an index for the economic and efficacy data (hereafter "EE index"): C x E = EE. This EE index is the results of the dollar cost per acre of an herbicide multiplied by the efficacy of the active ingredient.

3. RESULTS

Table 1.Simazine use (lbs of active ingredient/ acre planted) by time period (pre-, during- and post-program).

	BIFS			Conventional		
	N	Mean ± SD		N	Mean ± SD	
Before program (1993-1995)	52	.693 ± .404	A	45	.975 ± .706	BC
During program (1996-1998)	58	1.1018 ± .884	B	60	.969 ± .660	BC
After program (1999-2001)	49	.810 ± .608	B	58	.959 ± .537	BC

Means followed by the same letters are not significantly different at _ =.05.

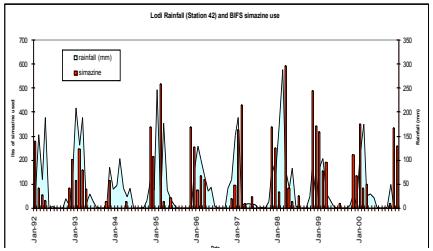


Fig. 2. Rainfall and simazine use on BIFS fields. BIFS correlation coefficient between rainfall and simazine use: pre-program (.13), during (.38), and post (.05). Conventional correlation coefficient between rainfall and simazine use: pre-program (.08), during (.19), and post (.09).

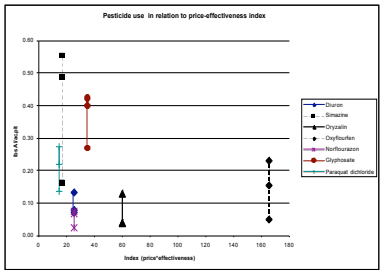
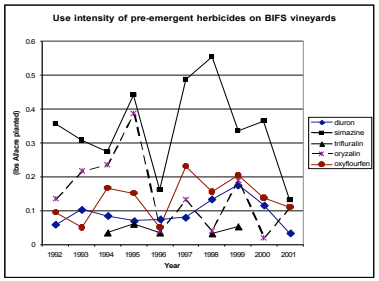


Fig. 3. Pesticide use on BIFS fields and price-efficacy index. Effectiveness data is only for annual grasses and pesticide use data is for BIFS programs year 1996-1998.



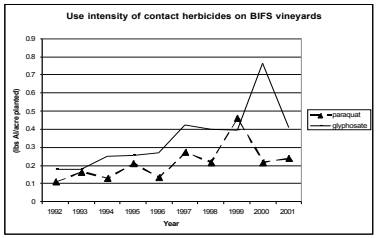


Fig. 4. Pounds of active ingredient per acre planted for pre-emergent and contact herbicides on BIFS fields.

4. CONCLUSIONS

-Winegrape BIFS fields lowered their use of pre-emergent herbicides in the first year of the program, most notably simazine. Increases in simazine use during 1997 and 98 could be attributed to higher weed pressure.

-The successes of the BIFS program may be attributed to amenable environmental and social conditions: low weed pressure as measured by low-normal rainfall, initial enthusiasm and group collaborations on the project, and shifts in management practices..

Table 2. BIFS and conventional acreage composition for pre-, during-, and post-program years. The total value is provided in acreage while field proportions are calculated in percentages for each field profile. Values in **bold** denote highest percentage for that particular year. SMZ: fields that used simazine and no glyphosate. GLY: fields that used glyphosate and no simazine. BSG: fields that used both simazine and glyphosate, NSG: fields that used neither simazine or glyphosate and NR: fields that had no reported use of herbicides. NSMZ: fields that did not use simazine (the sum of groups GLY, NSG, and NR).

		Pre-program			During-prog.			Post-prog.		
		1993	1994	1995	1996	1997	1998	1999	2000	2001
BIFS										
	SMZ	**27.9**	**36.7**	**36.1**	18.9	8.1	23.2	**28.3**	15.4	7.4
	GLY	22.0	14.6	22.7	**36.5**	23.2	21.7	23.7	30.0	27.9
	BSG	13.4	11.5	12.2	12.0	**33.3**	**36.9**	18.9	**34.9**	12.6
	NSG	9.1	2.3	13.1	1.6	22.8	3.0	18.1	0.0	20.8
	NR	27.6	34.9	15.9	31.0	12.7	15.2	11.0	19.7	**34.4**
	TOTAL acres	3008	3105	3082	3256	3172	2989	3272	3023	3024
	NSMZ	58.7	51.8	51.7	69.1	58.6	39.9	52.8	49.7	83.1
Conventional										
	SMZ	35.7	**48.1**	38.5	**35.2**	**47.4**	**54.1**	**51.2**	26.7	20.9
	GLY	0.9	12.1	16.4	15.2	13.3	12.9	9.8	11.3	12.7
	BSG	9.9	0.0	4.9	10.3	8.5	3.4	5.1	**36.7**	13.5
	NSG	15.2	2.5	0.0	8.9	5.7	3.2	8.1	8.1	8.2
	NR	**38.3**	37.4	**40.3**	30.5	25.0	26.3	25.8	17.2	**47.1**
	TOTAL acres	2906	2885	2934	2915	2916	2836	2916	2966	2966
	NSMZ	54.4	54.4	51.9	56.6	54.5	44.0	42.5	43.7	36.6

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