Evaluation of Least-Toxic Herbicides

Cheryl Wilen
UC Statewide IPM Program
Phil Boise
Urban Ag Ecology

The Problem

- Desire to reduce use of synthetic herbicides
  - environmental and human health
- Reduce labor time
  - including notification/reporting
- Regulations
  - Healthy Schools Act
  - Local codes

The Solutions

- Do nothing
- Use less synthetic herbicides
- Use more mechanical/physical controls
- Use alternative herbicides

Products

- Ingredients are GRAS or food quality
- Listed as Organic
- Caution label
- Possibility of better public acceptance

Methods

- Two sites
  - Santa Barbara City College
  - Cachuma Park
- Six alternative herbicides
- Compare to Roundup Pro and Untreated
- Four replications, RCB design

Applications

- CO_2 backpack sprayer, 114 gal/A
- One application at SBCC
- Two applications at Cachuma
- Label rates (high)

Materials

- Eco-Exempt[s,c] 5:1
- Matran 2[s,c] 7.5 gal/A (~14:1)
- Cimonex[c] 3:1 FB 1:1
- AllDown[s,c] RTU
- Burnout II[s,c] 2:1
- Weed Zap[c] 4 oz/gal (~32:1)
- Weed-A-Tak[s] 7:1
- Roundup Pro[s,c] 1.5% (~66:1)

Tworkoski, T. 2002. Herbicide effects of essential oils. Weed Science 50:425-431.

Laboratory and greenhouse experiments were conducted to determine the herbicidal effect of plant-derived oils and to identify the active ingredient in an oil with herbicide activity.

Twenty-five different oils were applied to detached leaves of dandelion in the laboratory.

Essential oils (1%, v/v) from red thyme, summer savory, cinnamon, and clove were the most phytotoxic and caused electrolyte leakage resulting in cell death.

Essential oil of cinnamon had high herbicidal activity, and eugenol (2-methoxy-4-[2-propenyl]phenol) **was determined to be this oil's major component** (84%, v/v). Dandelion leaf disk and whole-plant assays verified that eugenol was the active ingredient in the essential oil of cinnamon.

Eugenol/Clove Oil/Cinnamon Oil

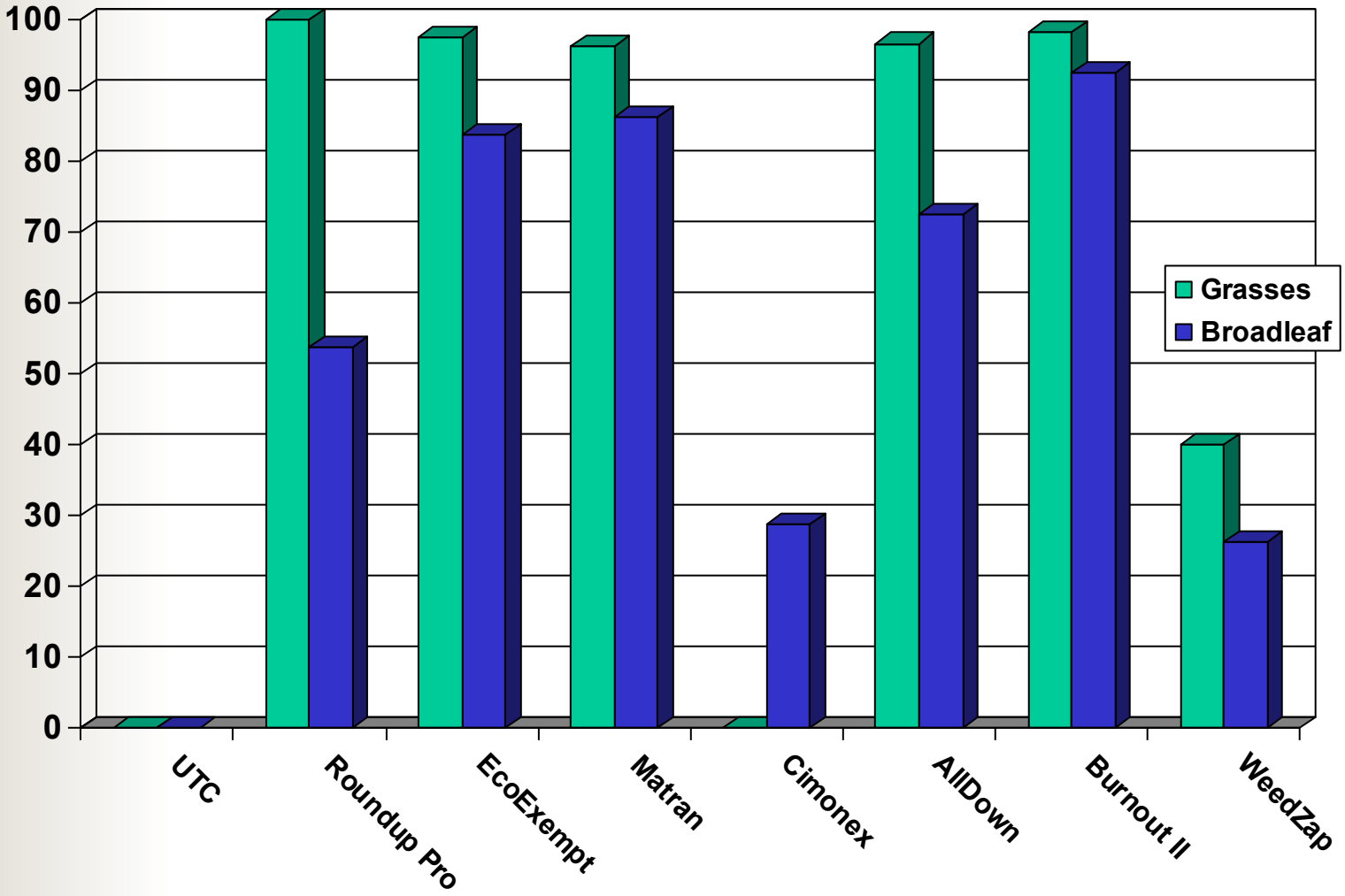
Mode of Action: cell membrane disruptor.

Vinegar

Mode of Action: Loss of membrane integrity
Leakage of cellular fluids

	Percent solution	Percent Eugenol in Conc.	Final Percent Eug
Eco-Exempt	16.70	21.4	3.57
Matran 2	6.70	46	3.08
Burnout II	33.00	12	3.96
Weed Zap	3.00	25	0.75

Percent Control
6DAT



Results (% control)

45DAT 1st app, 35DAT 2nd app




	UNTREATED	ROUNDUP	ECOEXEMPT	MATRAN
1X	0	98.5	30.0	13.8
2X	0	98.5	30.0	15.0




	CIMONEX	ALL DOWN	BURNOUT II	WEEDZAP
1X	6.3	28.8	36.3	5.0
2X	6.3	38.8	51.3	5.0

ALL DOWN
28.8
38.8

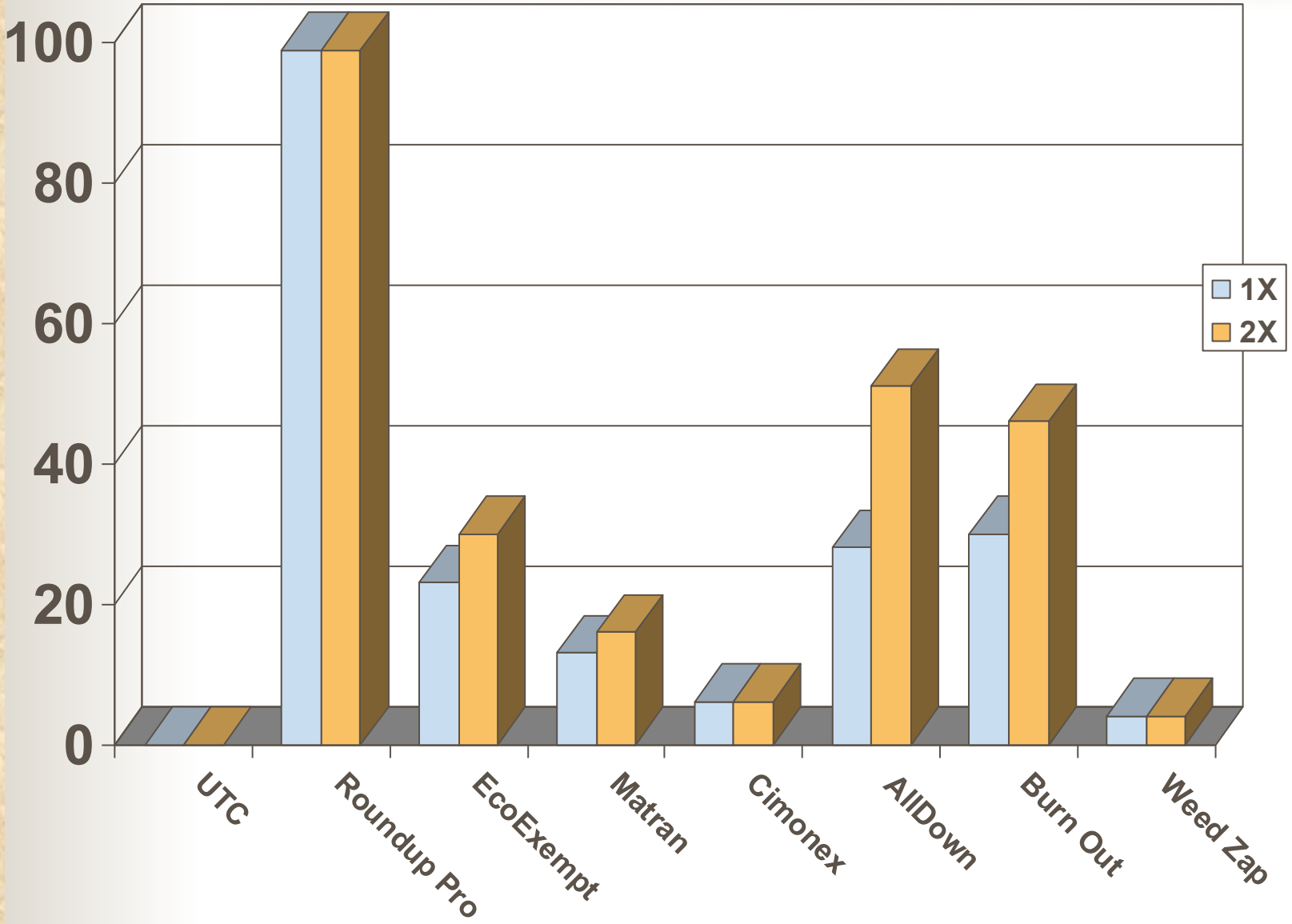
BURNOUT II

36.3

51.3

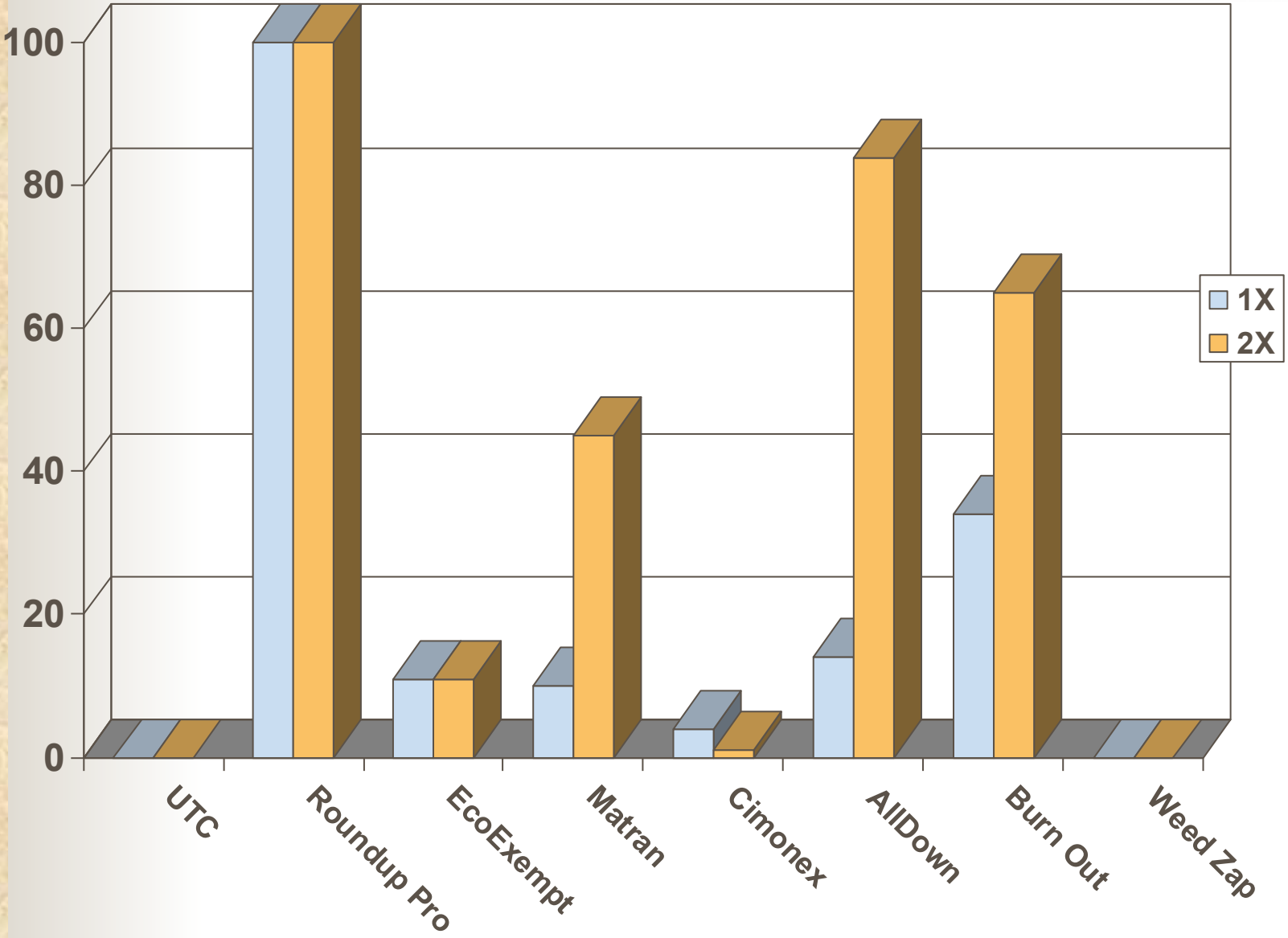
Percent Control

Grasses



Percent Control

Broadleaves



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Costs

	$/gal	gal/A	$/A
Roundup Pro	47.60	1.70	80.92
EcoExempt	97.00	19.00	1843.00
Matran	80.00	7.60	608.00
Cimonex	n/a	57.00	
AllDown	15.20	114.00	1732.80
Burnout II	32.00	38.00	1216.00
Weed Zap	n/a	14.25	
Reward	126.00	0.66	83.00

Conclusions

- Roundup Pro 1X is most effective for long-term and cost effective control in established areas
- Where Roundup Pro is not an option, AllDown and BurnOut provide good control with 2 applications but cost is ~30X higher than Roundup or 15X higher than Reward (material only)
- May be some convenience savings where exempt materials are used
- Should make comparisons versus similar contact herbicides rather than Roundup