

Organic Herbicides Performance in Field Trials

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In recent years, several organic herbicide products have appeared on the market. These include Weed Pharm (20% acetic acid), C-Cide (5% citric acid), GreenMatch (55% d-limonene), Matratec (50% clove oil), WeedZap (45% clove oil + 45% cinnamon oil), and GreenMatch EX (50% lemongrass oil), Final-San-O (22% ammoniated soap of fatty acids), Biolink (80% Caprylic-Capric acid), among others. These products are all contact-type herbicides and will damage any green vegetation they contact, though they are safe as directed sprays against woody stems and trunks. These herbicides kill weeds that have emerged, but have no residual activity on those emerging after application. Additionally, these herbicides can burn back the tops of perennial weeds, but perennial weeds recover quickly.

Organic herbicides only kill contacted tissue; thus, good coverage is essential. Initial greenhouse studies found that spray volumes of 70 gallons per acre (gpa) were superior to 35 gpa, regardless of the organic herbicide tested. In test comparing various spray volumes and product concentrations, we found that high concentrations at low spray volumes (20% concentration in 35 gallons per acre) were less effective than lower concentrations at high spray volumes (10% concentration in 70 gallons per acre). Applying these materials through a green sprayer (only living plants are treated), can reduce the amount of material and thus the application and material cost (<http://www.ntechindustries.com/weedseeker-home.html>).

Also, we observed that adjuvant addition improved organic herbicide performance. Among the organic adjuvants tested thus far, Natural wet, Nu Film P, Nu Film 17, and Silwet ECO spreader have performed the best. The Silwet ECO spreader is an organic silicone adjuvant which works very well on most broadleaf weeds, but tends to roll off of grass weeds. The Natural wet, Nu Film 17 and Nu Film P work well for both broadleaf and grass weeds. Although the recommended rates of these adjuvants is 0.25 % v/v, we have found that increasing the adjuvant concentration up to 1% v/v often leads to improved weed control, possibly due to better coverage.

Field testing has further confirmed greenhouse observations. These products are effective in controlling weeds when the weeds are small and the environmental conditions are optimum. In a large field study, we found that weeds in the cotyledon or first true leaf stage were much easier to control than older weeds (Tables 1 and 2). Broadleaf weeds were also found to be easier to control than grasses, possibly due to the location of the growing point (at or below the soil surface for grasses), or the orientation of the leaves (horizontal for most broadleaf weeds) (Tables 1 and 2).

Because organic herbicides lack residual activity, repeat applications will be needed to control new flushes of weeds or to further suppress perennial weeds. Perennial weeds were found to recover after a single treatment with an organic herbicide. However, treating a second time 15 to 21 days after the initial application resulted in almost complete top kill of the perennial (field bindweed or yellow nutsedge), and slowed recovery.

Temperature and sunlight have both been suggested as factors affecting organic herbicide efficacy. In several field studies, we have observed that organic herbicides work better when temperatures are above 75F. Weed Pharm (acetic acid) is the exception, working well at temperatures as low as 55F. Sunlight has also been suggested as an important factor for effective weed control. Anecdotal reports and our own observations indicate that control is better in full sunlight. However, in a greenhouse test using shade cloth to block 70% of the light, it was found that weed control with WeedZap improved in shaded conditions (Table 3). The greenhouse temperature was around 80F. It may be that under warm temperatures, sunlight is less of a factor, or that cool, shaded conditions, the products are less effective.

Organic herbicides are expensive at this time and may not be affordable for broadcast applications in cropping systems. However, for spot treatments, they may have a fit. Mulches are a common method used to control weeds in organic crop production systems. Mulches are generally effective for the first year or so after installation, but weed growth on or next to the mulch can reduce its value. In small field test, we found that wood chip mulches could be kept in good condition by periodic spot treatment of weeds with organic herbicides. Organic herbicides were able to kill the weeds growing on the mulch without disturbing the mulch.

Table 1. Broadleaf (pigweed and black nightshade) weed control (% control at 15 days after treatment), when treated 12, 19, or 26 days after emergence.

	-----Weed age-----		
	12 Days old	19 days old	26 days old
GreenMatch Ex 15%	89	11	0
GreenMatch 15%	83	96	17
Matran 15%	88	28	0
Acetic acid 20%	61	11	17
WeedZap 10%	100	33	38
Untreated	0	0	0

Table 2. Grass (Barnyardgrass and crabgrass) weed control (% control at 15 days after treatment), when treated 12, 19, or 26 days after emergence.

	-----Weed age-----		
	12 Days old	19 days old	26 days old
GreenMatch Ex 15%	25	19	8
GreenMatch 15%	42	42	0
Matran 15%	25	17	0
Acetic acid 20%	25	0	0
WeedZap 10%	0	11	0
Untreated	0	0	0

Table 3. Weed control with WeedZap (10% v/v) in relation to adjuvant, spray volume and light levels. Plants grown in the greenhouse in either open conditions or under shade cloth, which reduced light by 70%.

	Pigweed control (%)		Mustard control (%)	
	<u>Sun</u>	<u>Shade</u>	<u>Sun</u>	<u>Shade</u>
WeedZap + 0.1%v/v Eco Silwet (10 gpa)	31.7	93.3	26.7	35.0
WeedZap + 0.5%v/v Eco Silwet (10 gpa)	31.7	48.3	43.3	71.7
WeedZap + 0.5%v/v Natural Wet (70 gpa)	26.7	94.7	26.7	30.0
Untreated	0.0	0.0	0.0	0.0
LSD.05*	5.7		11.5	

* Values for comparing any two means. Pigweed and mustard were each analyzed separately.