

Fungicides for the

FUTURE

Biocompatible formulations containing bicarbonates offer an effective, environmentally safe alternative to current fungicides.

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Effect of Potassium Bicarbonate Formulations on Powdery Mildew Spores

Formulation	Total No. of Spores Collected Before Treatment	Total No. of Viable Spores After Treatment	Total % of Viable Spores
D	1,224	0	0
Armicarb	1,263	0	0
E	1,724	0	0
F	1,070	6	0.6
G	1,196	4	0.3
Water	2,249	730	32.5

Since the late 1940s, agricultural chemicals have served as the principle means of plant-disease control. The pesticide market today is quite large. Fungicide sales alone amount to \$500 million per year in the US and \$4 billion per year worldwide. Yet, due to increasing public concerns over the safety of pesticide use, the Environmental Protection Agency has begun limiting the number of pesticides registered for legal use.

Over the last 10 years, 35 percent of registered pesticides have been recalled, reviewed and withdrawn from the market. Just last year, the EPA canceled 1,215 pesticide registrations, and that trend is expected to continue as the ramifications of using these products become more readily apparent. As the need for safer pest-control methods increases, researchers have begun looking to biocompatible fungicides, which are those that exhibit low mammalian and environmental toxicities.

Two biocompatible candidates, bicarbonate salts and horticultural oils, have been shown to control activity against specific pathogenic fungi. At Cornell University, Ithaca, NY, we wanted to determine the effectiveness of both candidates, singly and in combination, in controlling powdery mildew on roses. This condition, which is caused by the fungus *Sphaerotheca pannosa* var. *rosae*, is the most widespread and destructive disease of roses in the world.

We chose four *Rosa* cultivars for the study: 'Kardinal', 'Osiana', 'Samantha' and 'Melody'. More than 1,000 plants were studied and all showed signs of powdery mildew. Several plants of each species were sprayed with one of the following treatments: potassium bicarbonate combined with the horticultural oil Sunspray UFO, sodium bicarbonate combined with Sunspray UFO, potassium bicarbonate alone, sodium bicarbonate alone, Sunspray UFO alone and ammonium bicarbonate. Control plants were treated only with water. Treatments were applied

Powdery Mildew Control and Phytotoxicity of Potassium Bicarbonate Formulations

Species	Formulation	Result
<i>Acer rubrum</i>	H	Good control, no phytotoxicity
<i>A. rubrum</i>	I	Excellent control, stunted leaves
<i>Centaurea montana</i>	J	Excellent control, no phytotoxicity
<i>Chrysanthemum</i> × <i>morifolium</i>	K	Excellent control, no phytotoxicity
<i>Euphorbia pulcherrima</i>	K	Good control, young-leaf distortion
<i>Heliopsis scabra</i>	J	Excellent control, no phytotoxicity
<i>Melissa officinalis</i>	J	Excellent control, no phytotoxicity
<i>Phlox</i>	J	Fair to good control, young-leaf distortion
<i>Pulmonaria</i>	J	Excellent control, possibility of wrinkling
<i>Quercus</i> spp.	I	Good control, leaf distortion
<i>Quercus</i> spp.	I (diluted formula)	Good control, no phytotoxicity
<i>Quercus</i> spp.	L	Good control, no phytotoxicity
<i>Rhododendron</i>	I	Excellent control, no phytotoxicity
<i>Verbena</i>	J	Good control, no phytotoxicity
<i>Zinnia</i>	K	Good control, no phytotoxicity

Selected Potassium Bicarbonate Powdery Mildew Ratings (Mean Percentage of Lesions per Plant)

Variety	Formulation	3 Sprays	4 Sprays	5 Sprays
<i>Rosa</i> 'Kardinal'	A	0.01	0.07	0.48
	B	0.09	0.00	0.02
	C	0.06	0.10	0.11
	Water	2.19	2.74	3.36
<i>R.</i> 'Osiana'	A	0.38	0.06	0.60
	B	0.22	0.02	0.23
	C	0.30	0.11	0.33
	Water	2.90	3.06	3.92
<i>R.</i> 'Samantha'	A	0.97	0.97	1.69
	B	0.40	0.28	0.61
	C	0.51	0.36	0.98
	Water	2.57	3.14	4.03
<i>R.</i> 'Melody'	A	0.83	0.46	0.74
	B	0.35	0.04	0.30
	C	0.32	0.40	0.59
	Water	4.07	4.53	4.45

Opposite: The untreated rose leaves (left) display symptoms of powdery mildew, but after treatment with potassium bicarbonate, the symptoms disappear (right).

