



Researching Organic Materials to Control Fruit Set of 'Honeycrisp™' Apples

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Introduction

In 2007 and 2008 laboratory, greenhouse and field trials were conducted to test 28 different organic material treatments as potential blossom thinners for the cultivar 'Honeycrisp.' Qualitative and quantitative evaluations were made for 1) the *in vitro* assays of pollen germination in 2007, 2) the *in vivo* evaluation of phyto-toxicity in 2007 and 2008, 3) the *in vivo* evaluation of the effect of the organic materials on pollen-pistil interactions in 2007 and 2008, 4) the field evaluation of phyto-toxicity in 2008, 5) the field evaluation of the effect of organic materials on flower fate for 1 out of 3 census in 2008, and 6) the field evaluation of the effect of organic materials on pollen-pistil interactions in 2008.

Materials and Methods

The laboratory trials (Myra et al., 2007) tested *in vitro* pollen germination using apple tree branches and collecting pollen from dehisced flowers. The greenhouse trials (Myra et al., 2007) studied *in vivo* phyto-toxicity of the organic materials on flowers and foliage. *In vivo* pollen germination and pollen tube growth were also evaluated in the greenhouse. In the field trial fruitset, and phyto-toxic effects on foliage and flower were documented as in past trials (Embree, 2005). From the field trial, pollen germination and pollen tube growth assays were conducted to evaluate the *in vivo* pollen germination and pollen tube growth. Both qualitative and quantitative effects were analyzed. Tables 1 and 2 show the organic materials used in the experiments.

Table 1. Test materials and codes for 2007.

Organic Material	Code
Lime sulphur + garlic	LS+Ga
Lime sulphur + fish oil	LS+FO
Water	Control
ATS (negative control)	ATS
Sea water + CaCl ₂	SW+CaCl ₂
Sea water from the Minas Basin	SWMB
CaCl ₂ + Acadian	CaCl ₂ +Ac
Sea water + Acadian	SW+Ac

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Table 2. Test materials and codes for 2008.

Organic Material	Code
Clove oil	CO
Instant coffee	IC
Mayonnaise	MA
CaCl ₂	CaCl ₂
Ammonium thiosulphate	ATS
Horticultural vinegar + garlic oil	HV+GO
Acadian	AC
CaCl ₂ + garlic oil	CaCl ₂ +GO
Sea water Minas Basin (150ml/L)	SWMB15
CaCl ₂ + Acadian	CaCl ₂ +AC
Citric acid	CA
Sea water Minas Basin (500ml/L)	SWMB50
Clove oil and corn starch	CO+CS
Latex	LA
Water	Control
Sea water Minas Basin (250ml/L)	SWMB25
Olive oil	OO
Cream of tartar	CoT
Caffeine pills	CP
CaCl ₂ + corn starch	CaCl ₂ +CS

Results and Discussion

Tables 3 and 4 show the ranking of 28 of the organic material treatments used in the laboratory, greenhouse and field trial experiments. The ranking for the effectiveness of the 28 is based on the sum of the average values for the presence of pollen germination in the *in vitro* assays; the pollen receptivity for old and new flowers in the *in vivo* phyto-toxicity assays, and by additionally including the average values of pollen adhesion, pollen germination and pollen tube growth in the style based on the *in vivo* pollination assays.

Table 3. Effects of potential organic pollenicides in 2007.

Organic Material	Rating <i>in vivo</i>	Rating <i>in vitro</i> and phyto-toxicity	Rating integrated	Rank
LS+Ga	-0.12	0.34	0.22	1
LS+FO	0.10	0.28	0.38	2
Control	0.19	0.58	0.77	3
ATS	-0.42	1.29	0.86	4
SW+CaCl ₂	-0.03	0.97	0.94	5
SWMB	0.33	0.82	1.15	6
CaCl ₂ +Ac	0.21	1.08	1.29	7
SW+Ac	0.31	1.02	1.32	8

Table 4. Effects of potential organic pollenicides in 2008.

Organic Material	Rating <i>in vivo</i>	Rating <i>in vitro</i> and phyto-toxicity	Rating integrated	Rank
CO	0.50	0.32	0.82	1
IC	1.35	0.10	1.44	2
MA	0.44	1.10	1.54	3
CaCl ₂	0.50	1.28	1.78	4
ATS	0.33	1.63	1.95	5
HV+GO	1.08	1.06	2.14	6
AC	1.38	1.01	2.39	7
CaCl ₂ +GO	1.08	1.61	2.68	8
SWMB15	1.32	1.40	2.72	9
CaCl ₂ +AC	1.25	1.60	2.85	10
CA	1.54	1.37	2.92	11
SWMB50	1.66	1.27	2.93	12
CO+CS	0.17	2.78	2.94	13
LA	1.29	1.68	2.97	14
Control	1.07	2.10	3.17	15
SWMB25	1.39	1.93	3.32	16
OO	1.38	2.17	3.54	17
CoT	1.25	2.37	3.62	18
CP	1.01	2.74	3.75	19
CaCl ₂ +CS	1.25	3.63	4.88	20

Conclusions

The effectiveness of the potential organic blossom thinning test materials were given an integrated rank calculated from accumulative results of *in vivo* and *in vitro* pollen germination and tube growth and phyto-toxicity. In most cases different materials were used in 2007 than in 2008 and the rankings therefore are not directly comparable. Additionally, the rankings do have a predictive value assignment that is based on healthy foliage and stigmatic receptivity. Since year to year verification was not possible, the results must only be valued as a preliminary screening trial for a wide range of potential organic thinning agents.

References

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