Valencia orange (*Citrus sinensis*)
Citrus canker (*Xanthomonas axonopodis* pv. *citri*)

P.D. Roberts, P.A Stansly, and R. Sytsma
University of Florida, IFAS
Southwest Florida REC
Immokalee, FL 34142

Evaluation of foliar applied products for management of citrus canker on Valencia orange trees, 2007.

The experimental site was at a commercial grove located on SR29N near Immokalee, FL. The trees were planted in 2002 and were 'Valencia' orange grafted to 'Swingle' citromelo rootstock. The tree spacing was 12 × 24 ft on a double row bed, 151 trees/A. Irrigation was via microjet. Plots contained 10 trees with at least two trees serving as buffers between each plot and two tree rows between each row of treatments. There were four replications per treatment arranged in a randomized complete block design. Foliar applications were applied with a Durand Wayland speed sprayer calibrated to deliver 125 GPA (gal per A) at 150 psi at 3 mph. Disease severity was assessed on a scale of 0 to 9 where 0 = no disease, 1 = 1-15%, 2 = 16-30%, 3 = 31-40%, 4 = 41-50%, 5 = 51-60%, 6 = 61-70%, 7 = 71-80%, 8 = 81-90% and 9 = 91-100% coverage of foliage affected. The number of 'hits' (H. Yonce, personal communication) were recorded as discrete hot spots of canker lesions in the tree canopy. At the final rating date, the number of fruit per tree exhibiting citrus canker lesions was recorded. Numbers from replication of each treatment were subjected to ANOVA and means tested by Tukey Multiple Range Test. Additionally, citrus leafminer damage was assessed of 14 Aug on 4 trees per treatment per replicate and three flushes per tree. The number of damaged (mined) and undamaged (without mines) leaves on each flush was noted. Only treatments including AdmirePro and/or horticulture mineral oil and the untreated check were assessed.

Average monthly high and low temperatures (°F) were 84 and 32 in Feb, 87 and 39 in Mar, 92 and 40 in Apr, 92 and 52 in May, 94 and 58 in Jun, 96 and 70 in Jul, 97 and 70 in Aug, 94 and 69 in Sep, 97 and 68 and in Oct. and 88 and 44 in Nov. Rainfall totals for Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, and Nov were 0, 0.20, 0.93, 0.79, 5.7, 2.6, 3.7, 4.7 and 3.4 in., 0.02 respectively.

Citrus canker symptoms were evident on trees and disease severity increased on foliage and fruit during the test, but canker was distributed across blocks in an east-west gradient with little or no canker evident on trees on the west side of the experiment. Despite this gradient, statistical differences were detected among treatments. The treatment containing only citrus oil had the highest canker ratings at every reading. This is consistent with other work showing increased bacterial disease severity on crops treated with oil. In general, most treatments containing copper were statistically separated from the untreated control. Actigard did not appear to confer any synergist disease suppression with Kocide 3000 and nor did Kasumin appear to be effective as a copper replacement strictly by comparison to a straight copper treatment. K-Phite plus Kocide 3000 was not statistically different from the control. Treatments mixed with copper that provided statistically reduced canker ratings compared to the control were Omega-Plus, Serenade Max, and citrus oil, although none were statistically more efficacious than Kocide 3000 alone. Curiously, Admire the insecticide alone performed as well as copper. This may be due to an SAR effect, control of citrus leafminer and its damage, or both. Leafminer pressure was fairly

intense and over half the leaves on untreated trees were damaged. Trees treated with Admire had most undamaged leaves with oil-treated trees intermediate (Fig. 1).

	Treatment/Rate (Date of application)[z]	28-29 Aug		7 Nov		
		DS[y]	Hits[x]	DS	Hits	Fruit[w]
1	UTC……	0.8 bc[v]	3.3 b	1.6 bc	5.5 bc	3.8 abc
2	Admire 32 fl oz/A (5)……..	0.09 e	0.2 d	0.2 g	0.8 e	0.3 e
3	Admire 32 fl oz/A (5)……	0.15 e	0.2 d	0.3 g	0.5 e	0 e
	Kocide 3000 2.5 lb/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)					
4	Citrus oil 235 5% (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)……	1.7 a	11.0 a	3.8 a	18.3 a	5.3 a
5	Citrus oil 235 5% (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)……	0.05 e	0.08 d	0.13 g	0.2 e	0 e
	Kocide 3000 2.5 lb/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)					
6	Actigard 6 oz/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13) ……..….	0.65 bc	3.7 b	1.3 cd	5.1 c	2.8 cd
	Kocide 3000 2.5 lb/A (4,5,6,7,11,12,13)					
	Kasumin 64 fl oz/100 Gal (8,9,10)					
7	K-Phite 6 pt/A (1,3,5,7,8,9,10,11,12,13)……	0.6 bc	3.5 b	1.4 bcd	5.1 c	2.4 cd
	Kocide 3000 2.5 lb/A (2,4,6)					
8	MagnaBon[u] 2.5 gal/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)……	0.5 cd	3.0 bc	1.1 cde	3.7 cd	1.1 de
9	Omega-Plus 5% (1,3,5,7,9,11,13)…….	0.2 de	0.2 d	0.23 g	0.4 e	0.1 e
	Kocide 3000 2.5 lb/A (2,4,6,8,10,12)					
10	Key Plex 3 qt/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)……	0.9 b	4.6 b	2.0 b	8.1 b	4.0 ab
11	Agriphage 1.5 qt/A (7 day interval)[v]……..	0.5 cd	2.9 bc	0.9 def	3.7 cd	3.1 cb
	Dried skim milk 7.5 g/L (7 day interval)					
12	Serenade Max 1 lb/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)……	0.25 de	0.9 d	0.6 efg	1.6 de	0.23 e
	Biotune 1 pt/100Gallons (1,2,3,4,5,6,7)					
	Kocide 3000 2.5 lb/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)					
13	Citrex 0.25% (1,3,5,7,9,11,13)……	0.13 e	0.4 d	0.4 fg	0.8 e	0.3 e
	Kocide 3000 2.5 lb/A (2,4,6,8,10,12)					
14	Kocide 3000 2.5 lb/A (1,2,3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13)……	0.3 de	0.6 d	0.5 fg	0.7 e	0.1 e

[z] 1=12 Feb; 2 =5 Mar; 3 =26 Mar; 4 =16 Apr; 5 =7 May; 6 =28 May; 7 =18 Jun; 8 =9 Jul; 9 = 30 Jul; 10 =20 Aug; 11 =10 Sep; 12 =1 Oct; 13 =22 Oct

[y] DS= 0-9 scale where 0=no disease symptoms and 9=100% foliage affected

[x] Hits= number of discrete areas in tree canopy with clustering of canker lesions

[w] Treatment 11 went out weekly from 12 Feb to 22 Oct

[v] Means followed by the same letter are not significantly different at the 0.05 level.

[u] Trt. 8 also included that methylcellulose adjuvant for the early treatments, but was dropped because of nozzle clogging.

Figure 1. Mean (± SE) percentage undamaged leaves from 3 randomly chosen branches on 4 trees per plot by treatment observed 14 Aug. 2007.