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EVALUATION OF SEVERAL TREE WRAPS ON CITRUS[1]

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Abstract. **Growers have been using a number of different wraps to protect young citrus trees from cold damage. Field observations indicate differences in effectiveness of the various wraps on the market. A field study of seven wraps was conducted over two seasons to determine their effectiveness in protecting young citrus trees during freezing conditions. Also observed was wrap resistance to weathering, ease of installation, effect on the tree during hot weather, and their ability to control sprouts. During the first year of the test, temperatures under the wraps were measured and recorded hourly for 30 days. During the 1980-81 winter ambient air temperatures of 12°F to 14°F were experienced. As a result extensive damage occurred and the wraps were evaluated on the basis of tree damage. Five of the wraps did a satisfactory job of protecting the trees while two did not.**

Widespread use of various tree wraps has stimulated a number of questions regarding the effectiveness, durability and desirability of this method of protecting young trees. This test was conducted to evaluate several new wraps, comparing them to soil banks and previously tested wraps (1, 2, 3, 4), for effectiveness in cold protection. In addition to this primary objective the wraps were evaluated for durability, sprout inhibition, ease of installation and possible adverse tree effects such as bark sloughing, foot rot, sun scaling, and ant activity.

Materials and Methods

The field study was begun during the fall of 1979. Wraps were placed on the trees prior to the winter season. One year old Dancy tangerines (*Citrus, reticulata,* Blanco) on Cleopatra mandarin (*C. reticulata,* Blanco) and Nova tangelos (*C. reticulata* X *C. paradisi*) X *C. reticulata* on sour orange (*C. aurantium* L.) were selected in an area just north of Astatula, Florida. The entire area had a past history of low minimum temperatures with only the hardiest of citrus varieties surviving.

Various wraps were tested the first season with the soil bank as the standard used for comparison (Table 1). Care was taken to have the bank the same height as the wraps. An unprotected check was also included. Each of the 9 treatments was replicated 9 times giving a total of 81 trees in the study.

Table 1. Tree wrap treatments.

1.	Soil bank
2.	Fiberglass — 3 inch foil-backed held in place with 1 inch mesh wire
3.	Polyurethane foam—1 inch foam without skin, wrapped approximately 3 times around tree
4.	Polyurethane foam—1 inch foam with a protective skin, wrapped 3 times around tree
5.	Reese Clip-On®—a rigid two section styrofoam structure with water bags attached to each half and clipped onto trees
6.	Reese Clip-On®—as above without water bags
7.	Micro-foam—1/8 inch thick flexible sheet of insulating material wrapped approximately 8 times around trees
8.	Polyethylene—translucent sheets approximately 1/4 inch thick wrapped 4 times around trees
9.	Check—no protection

From January 24, 1980 until February 27, 1980 trunk temperatures were recorded for two replications at hourly intervals 24 hours per day. Thermistors, connected to a Grant recorder, were taped to the trunk 4 inches above the union and temperatures were recorded on tape for computer analysis. The summer of 1980 could best be described as hot and dry, while the winter was colder than normal with minimum temperatures reaching record lows. In 1980-81 temperatures were monitored on grove thermometers in the area. Since extensive damage occurred, three measurements were taken to determine tree condition. The trunk circumference just above the bud-union, the circumference of the smallest live limb, and the height of the tree after pruning were measured. The results of all three are shown in Tables 2, 3, 4.

Results and Discussion

During the winter of 1979-80 minimum temperatures dropped to the mid-twenties on several occasions, with a

[1]Appreciation is extended to Dr. George Yelenosky, USDA, Orlando, FL for help in measuring temperatures.

Table 2. Bud union circumference (inches).

	**z
Check	4.4 a
Fiberglass	3.6 b
Polyurethane—no skin	3.5 b
Polyurethane—with skin	3.5 b
Reese Clip-On® with no water	3.4 b
Soil bank	3.2 b
Reese Clip-On®	3.1 b

zSig. at 99% level.
All treatments followed by the same letter do not differ significantly according to Duncan's multiple range test.

Table 3. Cut circumference (inches) of smallest live wood measured March 11, 1981.

	**z
Check	4.2 a
Reese Clip-On® with no water	2.1 b
Fiberglass	1.8 bc
Polyurethane—no skin	1.8 bc
Reese Clip-On®	1.6 bc
Polyurethane—with skin	1.5 bc
Soil bank	1.2 c

zSig. at 99% level.
All treatments followed by the same letter do not differ significantly according to Duncan's multiple range test.

Table 4. Tree height (inches) measured after dead wood had been removed March 11, 1981.

	**z
Soil bank	20.2 a
Polyurethane—no skin	16.4 ab
Reese Clip-On®	16.3 ab
Polyurethane—with skin	16.1 ab
Fiberglass	15.8 ab
Reese Clip-On® no water	14.0 b
Check	3.0 c

zSig. at 99% level.
All treatments followed by the same letter do not differ significantly according to Duncan's multiple range test.

heavy frost on March 3rd, however no significant cold damage was observed. Tree wrap performance is shown in Fig. 1 taken the morning of February 4th. Since a critical temperature for foliage was not reached the trees showed no signs of cold damage. The degree of protection under the wraps, however, showed definite differences between wraps, check and soil bank as shown in Fig. 1 and Table 6.

The following summer observations were made on wrap durability, sprout control, and tree damage. Six months after installation the micro-foam and polyethylene materials were already breaking down with sprouting in evidence. More importantly, there were 4 dead trees showing extensive

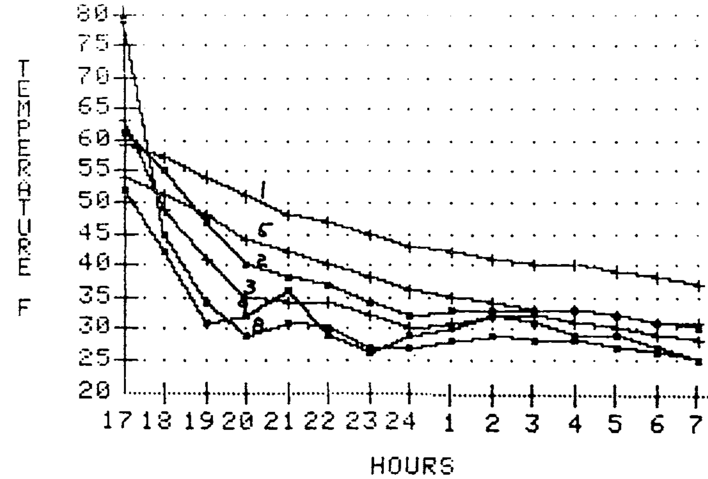

Fig. 1. Hourly minimum temperatures Feb. 3-4, 1980. 1 = soil bank, 2 = fiberglass, 3 = polyurethane foam, 5 = Reese Clip-On®, 8 = polyethylene, 9 = check.

bark sloughing of the 9 with the polyethylene wrap. Fig. 2 and Table 5 suggest what the problem could have been. If temperatures were 23-24°F above ambient temperatures during February under this wrap they could have been even higher in the spring and summer.

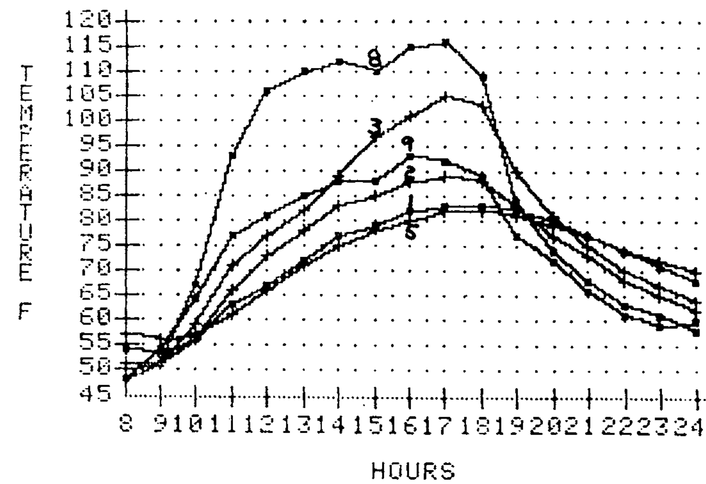

Fig. 2. Hourly maximum temperatures Feb. 22, 1980. 1 = soil bank, 2 = fiberglass, 3 = polyurethane foam, 5 = Reese Clip-On®, 8 = polyethylene, 9 = check.

The first inspection also revealed 3 fiberglass and 1 polyurethane with skin-wrapped trees had died to the top of the wrap. These wraps were then lowered and all 4 trees sprouted from live wood and recovered quickly. Two of the trees under the Reese Clip-On® wraps had sprouted.

Table 5. Maximum temperature 2/22/80. DEG F

Time	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Treatment																	
Polyethylene	49	51	67	89	99	102	106	105	110	114	109	85	76	70	62	62	59
Soil Bank	57	56	57	62	67	73	77	81	83	84	84	83	80	77	74	72	70
Check	48	55	65	78	83	85	89	88	92	91	83	78	72	66	61	60	60
Fiberglass	51	52	59	70	75	79	83	84	86	86	85	80	75	72	67	64	62
Reese	55	54	57	63	68	73	78	80	82	83	83	82	80	77	74	71	69
Polyurethane	51	52	59	69	74	79	84	90	93	97	96	87	80	75	70	67	64
Other Treatments																	
Micro-Foam	50	51	62	73	81	86	92	95	98	100	98	84	76	70	65	62	60
Reese No Water Bag	51	53	59	71	75	74	77	78	79	80	78	78	74	70	65	63	61

Table 6. Minimum temperature 2/3 - 4/80. DEG F

Time	17	18	19	20	21	22	23	24	1	2	3	4	5	6	7
Treatment															
Fiberglass	58	52	45	39	38	37	34	32	33	33	33	33	32	31	30
Soil Bank	61	58	54	51	48	47	45	43	42	41	40	40	39	38	37
Check	51	42	32	33	37	30	27	30	30	32	31	29	30	27	26
Reese	53	51	48	44	42	41	38	37	35	34	34	33	32	31	32
Polyethylene	80	48	36	30	32	31	28	28	29	29	29	29	28	27	26
Polyurethane	60	50	42	36	35	35	33	31	31	32	32	31	31	30	29
Other Treatments															
Micro-Foam	68	50	39	33	34	33	30	29	30	30	30	30	29	28	28
Reese No Water Bag	53	46	39	34	36	35	32	31	33	33	33	32	31	30	30

By the second winter the micro-foam had completely disintegrated and the polyethylene had broken down so badly on the remaining 5 trees that both were removed from the test.

The winter of 1980-81 subjected the wraps to a severe test. Individual tree temperature was not monitored, but grower records indicated ambient air temperature at the trial as low as 13°F on the morning of January 13, 1981. Shortly after, all tops were observed to be killed indicating critical temperatures had been reached. By late February all of the trees had been cut back and wraps removed. On March 11, 1981 the trees were measured to determine how well they had done during the freeze.

There was no difference in bud circumference above the bud-union among the treatments. Trunk circumference of the check was larger simply because of the 9 check trees only 2 of the largest survived. This suggests a positive relationship between cold tolerance and tree mass. There was no statistical difference in tree mass between treatments other than the check.

Both cut circumference and tree height showed the same results. Only 2 check trees survived and they were cut back just above the union. Cut circumference and tree height had a very high negative correlation, $r = 0.9891$. Cut circumference was significantly larger for the check. While the Reese Clip-On® with no water performed as well as all other wrap treatments, it was however the only treatment not statistically equal to the soil bank, see Table 3.

Since tree height had such a strong negative correlation with cut circumference, the same treatment effects can be seen with tree height, see Table 4. For this field study there was no significant difference in tree protection between the soil bank and all of the commercial wraps tested.

A few additional observations are worthy of mention. Four of the 18 Reese Clip-On® wraps came off the trees after one year in the grove, and several water bags were punctured. When setting up the field study all wraps were easy to install except the polyurethane foam which took two people to wrap and tie. Lastly, since the Reese Clip-On® is rigid it could not be pushed down to allow sprouting from live wood as with the other wraps.

Conclusions

1. For maximum cold protection the soil bank is still the most effective and reliable method of protecting young trees.
2. There was no difference among the fiberglass, polyurethane foam ± skin, Reese Clip-On® or banks as far as protecting young citrus from freeze damage.
3. Wraps should be checked periodically especially after a freeze. It may be necessary to remove the wrap and allow the tree to sprout. They should also be inspected during the summer for sloughing and ants.
4. When evaluating a new wrap use only a few to see how they perform.
5. The tree wraps tested during 1980-81 including fiberglass, polyurethane foam and Reese Clip-On® all were effective in protecting young trees at ambient temperatures as low as 13°F.
6. Evaluate the other advantages of wraps such as sprout control, protection from mechanical, chemical, and rodent damage, and ease of installation before selecting a tree wrap for widespread use.

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