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ECONOMIC STRATEGY FOR REHABILITATING, SELLING, OR ABANDONING A 'VALENCIA' GROVE UNDER VARYING SITUATIONS

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Abstract. **Florida citrus growers face pressures from increased urban development, rough lemon decline, and damage due to freezes. The economics of citrus production, focusing on decisions required in keeping an individual grove in production, in respect to these problems, is examined. A hypothetical grove, described by a number of different conditions, is considered and the options of rehabilitating, selling, or abandoning the grove are evaluated with comparisons of the present value of the stream of income for 10- and 20-year periods for each alternative.**

Unprecedented pressures are being exerted upon Florida citrus growers. Urban development, rough lemon decline, plus the recurrent possibilities of freeze damage make it imperative that the citrus grower take a long, hard look at the projected returns from his grove. He must decide whether or not to continue production and if so, how.

The purpose of this paper is to present an economic decision-making framework to assist the grower in evaluating the alternative courses of action that may be available. Since many of the decisions become irreversible, involve considerable expenditure and loss of production, careful analysis of the options must be made.

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Method of Analysis

The expected costs and returns from a hypothetical grove will be budgeted over 10 and 20 years and analyzed under varying conditions. The variables will be the level of freeze damage, rough lemon decline and land values. The options considered will be to do nothing, rehabilitate, sell or abandon. The annual returns will be discounted to their present value to enable comparisons from the same base. It must be strongly emphasized that, in an analysis of this type, assumptions play a dominant role and projections into the future involve great uncertainty.

The hypothetical grove consists of 'Valencia' orange on 'Rough' lemon rootstock, 30 years of age, planted 70 trees per acre on soil with no inherent problems. Five alternative conditions are explored: Case I, Normal; Case II, Freeze Damage; Case III, Rough Lemon Decline; Case IV, Sale of Grove; and Case V, Grove Abandonment.

Case I Normal. This situation, with no serious problems, serves as a standard base. Yield is taken at 5.5 boxes per tree and assumed constant throughout the 20-year period with an on-tree price of $1.87 per box (5). The production cost used is an average of operating costs as reported by Brooke (3). This cost includes expenditures for labor, machinery, fertilizer, spray, state and county taxes, and miscellaneous items. It does not include charges for interest on grove valuation, land or management.

Table 1 shows the computation of annual costs and returns from the grove for the first 10 years. A gross return per acre of $720 minus the $200 operating cost produces an annual return of $520. Discounting at 10% this annual stream of income to its present value (PV) results in a 10-year total of $3196 and a 20-year total of $4429. Discounting to the present value is neces-

Table 1. Costs and returns from a hypothetical thirty-year old 'Valencia' grove.

Year	Age of tree	Yield per tree	Yield per acre	On-tree price per box[z]	Value per acre	Prod.[y] cost per acre	Return per acre	Present Value 10% Factor	Present Value 10% Total[x]
		--boxes--		---------dollars--------				-%-	dollars
1	30	5.5	385	1.87	720	200	520	.9091	473
2	31	5.5	385	1.87	720	200	520	.8262	430
3	32	5.5	385	1.87	720	200	520	.7513	391
4	33	5.5	385	1.87	720	200	520	.6830	355
5	34	5.5	385	1.87	720	200	520	.6209	323
6	35	5.5	385	1.87	720	200	520	.5645	294
7	36	5.5	385	1.87	720	200	520	.5132	267
8	37	5.5	385	1.87	720	200	520	.4665	243
9	38	5.5	385	1.87	720	200	520	.4241	221
10	39	5.5	385	1.87	720	200	520	.3855	201
Ten-year total									3196
Twenty-year total									4429

[z]Five season average (67-68 to 71-72) 'Valencia' on-tree price per box, Florida Crop & Livestock Reporting Service (5).

[y]Five season average (66-67 to 70-71) of citrus production costs, Brooke (3).

[x]In this table and all following tables, calculations are rounded off to nearest whole number.

sary to reflect the fact that a dollar is worth more today to the holder than the same dollar received in future time and allows direct comparisons of alternative actions. The discount factors used for each year are shown in Table 1, with constant yields, prices, and production costs assumed for the entire period.

The importance of the basic assumptions is tested by varying price, yield, and production cost levels. Three price levels, two yield levels and two cost levels were considered. The results of the alternative groupings of these levels on the 10-year total are shown in Table 2. Variations in price and yield were found to be important. Lowering price from $1.87 to $1.37 (50c or 27%) lowers the PV from $3169 to $2014 (at a yield of 5.5 boxes per tree and a cost of $200). Lowering the yield from 5.5 boxes to 4.125 (25% decrease) lowers the PV from $3196 to $2090 (at a price of $1.87 and a cost of $200). Variations in production costs per acre have less influence on returns. An approximate 10% increase in production cost per acre reduces the PV from $3196, only 4.0%, to $3072.

Table 2. Effect of alternative values for price, yield, and production cost for ten-year time horizon.

On-tree price per box	Cost of production per acre 200 Yield 5.5	200 Yield 4.125	220 Yield 5.5	220 Yield 4.125
	----------dollars----------			
2.37	4379	2978	4255	2853
1.87	3196	2090	3072	1966
1.37	2014	1203	1889	1196

Case II Freeze Damage. Two conditions are considered: a major freeze and a minor freeze. For the major freeze (without frost cankers) a 4-year effect on yield was assumed. Beginning with the grove just damaged by a freeze (Table 3) the percentage of yield achieved by year is taken at 0, 31, 51, and 72 (1). In year 1, an additional rehabilitation cost for pruning and other work of $25 per acre is incurred. The on-tree price per box of fruit is maintained at $1.87, although, following a freeze of this magnitude, there may be an increase in the price of fruit for several years.

Table 3 shows that the present value, after 4 years, is $218 per acre. After 10 years it is $1706, and after 20 years, $2938. Over a 20-year period it is unrealistic to assume that further freeze damage to this grove would not be experienced. Thus, if a similar freeze occurs in year 11, the contribution to the present value of the second 10 years would drop to $658, with the 20-year value becoming $2364.

The effect of a minor freeze on returns is negligible. If 10% of the yield in the first year were lost to the freeze, the 10-year PV would only drop $65 to $3131.

Case III Rough Lemon Decline. Because of its potential impact on the Florida Citrus Industry rough lemon decline is of great concern. Although

Table 3. Effect of major freeze damage.

Year	%[z] Yield achieved	Yield per acre	Value[y] per acre	Prod. cost per acre	Return per acre	Total present value
		-boxes-		--------dollars----------		
1	0	0	0	225	-225	-204
2	31	119	223	200	23	19
3	51	196	367	200	167	126
4	72	227	518	200	318	218
5	100	385	720	200	520	323
6	100	385	720	200	520	294
7	100	385	720	200	520	267
8	100	385	720	200	520	243
9	100	385	720	200	520	221
10	100	385	720	200	520	201
Ten-year total						1706
Twenty-year total						2938

[z]Anderson (1).

[y]Calculated with on-tree price of $1.87.

the cause of this disease is yet unknown, grove owners must take some action such as replanting with rootstocks other than rough lemon. Only the future will validate these actions.

Four alternatives are considered after the grove is affected by rough lemon decline. The percentage of productive trees remaining is taken at 97, 93, 92, 85, 76, 56, 16 and 0 for the first 8 years, respectively. Although some effect on the yield of the remaining trees may be expected, no data on this aspect are available. Therefore, yield per tree is continued at the previously stated rate of 5.5 boxes per tree.

In the first example, the trees are simply allowed to go out of production. No rehabilitation program is followed. Table 4 shows the annual returns resulting from these assumptions. By the seventh year, the annual return becomes negative, and by the eighth year the grove is no longer in production. In year 6, the PV of the returns from the grove is $1800, dropping to $1758 in year 7 because of the negative return in this year.

The second example illustrates the case where trees are replaced as they go out of production. The same percentages as in the previous example are assumed for the original trees remaining in production. The yields of the newly planted trees by age are taken at the values determined by Savage and listed in (6). The grove does not return to full production at maximum yield until year 33, due to replanting the grove in increments with the final resets being planted in year 8. The basic production costs are taken at a constant value, although they may be reduced somewhat when the majority of the grove comprises young trees. Additional expenses will be incurred in resetting trees and the special care required for young trees. The costs for the first 4 years of the existence of resets are $20.62, 5.94, 3.94 and 2.68 per tree (2). The cost for the first year includes the cost of removing and burning the tree, preparing the tree site, cost of new tree, cost of ringing, setting, and banking, and cost of water, fertilizer, and herbicide. Since new trees are planted through the eighth year, it is not until the twelfth year that no additional costs are incurred for young tree care.

The resulting loss in production from the grove is shown in Table 5. Production remains relatively high through the first six years, decreases drastically, and then gradually increases as the new trees yield more. It is not until year 17 that production exceeds 200 boxes per acre.

The corresponding present value totals show this yield aspect plus the effect of the additional expenditures. The 5-year total is $1376 after which returns become negative. The 10-year total drops to $444 with the 20-year total only increasing to $670.

The third example is to bulldoze the entire grove in the first year. After land preparation, the grove is replanted with trees of another root-

Table 4. Effect of rough lemon decline with no replacement of trees going out of production.

Year	% Prod. trees	Yield per acre	Value[z] per acre	Prod. cost per acre	Return per acre	Total present value
		-boxes-		--------dollars--------		
1	97	373	698	200	498	453
2	93	358	670	200	470	388
3	92	354	662	200	462	348
4	85	327	612	200	412	282
5	76	293	547	200	347	216
6	56	216	403	200	203	115
7	16	62	115	200	-85	-43
Seven-year total						1758

[z]Calculated with on-tree price of $1.87.

Table 5. Effect of combatting rough lemon decline by resetting trees as they go out of production.

Year	% Orig. trees remain.	Yield per acre	Value[z] per acre	Young tree care cost	Total[y] cost per acre	Return per acre	Total present value
		-boxes-		----------dollars----------			
1	97	373	698	41	241	457	416
2	93	358	670	74	274	396	327
3	92	355	664	45	245	419	315
4	85	330	617	125	325	292	200
5	76	297	556	165	365	191	119
6	56	224	456	344	544	-88	-50
7	16	76	142	695	895	-753	-386
8	0	25	47	458	658	-611	-285
9	0	46	86	201	400	-314	-133
10	0	60	112	113	313	-201	-77
Ten-year total							444
11	0	90	168	29	229	-61	-21
12	0	113	211	0	200	-11	-4
13	0	130	244	0	200	44	13
14	0	151	282	0	200	82	22
15	0	170	317	0	200	117	28
16	0	188	352	0	200	152	33
17	0	205	383	0	200	183	36
18	0	222	415	0	200	215	39
19	0	238	445	0	200	245	40
20	0	253	473	0	200	273	41
Twenty-year total							670

[z]Calculated with on-tree price of $1.87.

[y]Young tree care cost plus basic production cost of $200 per acre.

stock. Thus any production that may have resulted, before decline injures all the trees, is lost. In the first year, the annual return is–$699, reflecting the cost of removing the trees. Returns through year 6 continue to be negative, the development costs (4) being greater than the value of production. The 10-year PV is –$740 and 20-year PV is –$105. The grove returns to maximum production in year 25.

The fourth example illustrates scion-rooting of the entire grove prior to serious inroads of young tree decline. Still in the experimental stage, this technique is appealing because the trees are not lost. Since no reliable estimates of influence on yield are available, rough estimates are used. In year 1 the yield drops to 80%, followed by yearly reductions to 60%, 40%, 30%, leveling out at 25%, and then returning to 100% in the same increments. Thus in year 10, the yield returns to 100%. Additional production costs for the first two years are assumed to be $797 and $189, and consisted of scion-rooting costs of $2.00 per tree plus banking and additional irrigation.

These assumptions produced the results in Table 6. The annual returns are negative in year 1 due to the scion-rooting cost and year 5 due to low yield. The 10-year present value is $242, while the 20-year total is $1474.

Case IV Sale of Grove. Much of Florida's prime citrus growing acreage is located in the same areas that are experiencing an urban or recreational development. The resulting increased land values and competition for other resources require a strict evaluation of highest and best use of the land. Three land values based on different locations of the grove are considered. The first location is in a choice development area with the value of the land taken at $15,000 per acre. The grove at the second location has a value of $5000 per acre. A third situation considered is the expectation that the land will be worth $10,000 per acre at the beginning of year 6. When land values reach these levels, the prudent investor needs to consider what these dollars would return in alternative investments. To analyze this potential return, a conservative rate of six percent per annum is applied with all interest reinvested. Table 7 shows the PV from the stream of income generated from investing the equivalent of the land values. As it can be seen, in 10 years the $15,000 produces a discounted cash flow of $6965 (20 years, $11,774). The $5000 produces $2322 and $3925 for the 10- and 20-years' totals. The $10,000 in year 6 yields $1575 and $3970 for the same periods. These latter figures do not include the possible returns from the first 5 years of grove production.

Case V Grove Abandonment. A grove would be abandoned when the returns cannot be expected to meet the variable costs of production. Abandonment should not be considered a long term solution, but a temporary action until eventual sale or another use can be made of the land. The only cost of abandonment considered here is a tax charge of $45 per acre per year. Additional costs not included, but which may be experienced are the interest and principal payment on the mortgage if still in effect. However, these costs are not included in the other examples so they are not included here. Taking the value of –$45 per year as the return and discounting it to the present, the 10-year total is –$277 and the 20-year total –$383.

Table 6. Effect of combatting rough lemon decline by scion-rooting.

Year	% Yield achieved	Yield per tree	Yield per acre	Value[z] per acre	Scion-root cost	Total[y] cost per acre	Return per acre	Total present value
		boxes			dollars			
1	80	4.4	308	576	797	996	-420	-382
2	60	3.3	231	432	189	389	43	36
3	40	2.2	154	288	0	200	88	66
4	30	1.65	116	216	0	200	16	11
5	25	1.375	96	180	0	200	-20	-12
6	30	1.65	116	216	0	200	16	9
7	40	2.2	154	288	0	200	88	45
8	60	3.3	231	432	0	200	232	108
9	80	4.4	308	576	0	200	376	160
10	100	5.5	385	720	0	200	520	201
Ten-year total								241
Twenty-year total								1474

[z]Calculated with on-tree price of $1.87.

[y]Scion-rooting cost plus basic production cost of $200 per acre.

Discussion and Conclusions

Table 8 gives a summary of all the grove

Table 7. Present value of investing the specified value for land at six percent.

Land value per acre	Total present value 5 yrs.	10 yrs.	20 yrs.
	dollars		
15,000	3804	6965	11774
5,000	1268	2322	3925
10,000	0	1575	3970

Table 8. Summary of present values of grove returns for alternative conditions and options.

Case	Present Value 10 yrs.	20 yrs.
	------dollars-----	
I Normal	3196	4429
II Freeze		
major	1706	2938
minor	3131	4363
III Rough lemon decline	1758	-
no replacement	(7 yrs.)	
replace with resets	444	670
replant entire grove	-740	-105
scion-root	241	1474
IV Sale of grove		
15,000	6965	11774
5,000	2322	3925
10,000 (Yr. 6)	1575	3970
V Abandon grove	-277	-383

conditions and projected returns from each option considered here.[1]

The only option listed where the return exceeds the PV of Case 1 is the option of selling the grove at $15,000 and investing it at 6%. In addition, a combination of operating the grove for 5 years and selling at $10,000 per acre exceeds the total of keeping the grove in production for the entire 10 years.

The effect of a major freeze is a significant drop in the present value of returns from grove production. When a freeze of this magnitude occurs and fruit prices remain constant, it is favorable to sell if the land value is above $5000. However, the grove should not be abandoned because after the first year, returns exceed costs. Even in the case where the grove will be sold after 5 years, positive returns result from keeping the grove producing whereas losses result from abandonment.

When the grove has been affected by rough lemon decline, the situation becomes more complicated since the number of alternatives increases. Conducting no rehabilitation results in a positive return for the first few *years, but* the grove is out of production by the eighth year. Replacing the trees going out of production with resets appears to have an advantage when a 10-year time horizon is considered. If the assumptions of the yield effect of scion-rooting are realistic, it becomes the preferred course of action for the 20-year time horizon. However, more information needs to be collected on scion-rooting before its true value can be assessed.

Once the grove has been affected by decline, and the grove is in an area of urban development, sale of the grove becomes very appealing. The question then becomes when to sell the grove. If the land value is $15,000 per acre, there may be little hesitation. The interesting situation is the choice of taking a $5000 now versus a $10,000 offer in year 6, and what actions to take in the interim. As previously discussed, $5000 invested at 6% produces a discounted cash flow of $2322 over the next 10 years. But keeping the grove for 5 years and then selling for $10,000 would result in the following present values over the 10-year period: no replacement, $3261; replacement with resets, $2951; scion-rooting, $1293; abandonment, $1404; and replanting the entire grove at the same time, $720. Based on these values, a combination of production for 5 years with either no replacement or replacement with resets would be preferred to taking the $5000 offer in the first year. Furthermore, because of the small difference between no replacement and replacement with resets ($311) a program of resetting trees as they go out of production may be preferred since flexibility can be increased at a modest expenditure.

A decision framework has been suggested that may be used by growers seeking answers to the problems discussed. Grove owners who face different conditions can apply the same type of analysis to their own situation.

[1]Income tax effects are not included in this analysis. Nor was it possible to consider the overall financial position, tax bracket, ability to accept risk, or desire to remain in citrus production. Hopefully, each individual can modify this analysis to fit his own circumstances.

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