

Plant total mineral nutrient content for each element also reflected the dry weight differences (Table 2). The quantity of N "harvested" was less than 2 lb./1000 plants to about 5 lb. for container and field-grown trees, respectively. The calcareous nature of the site where nursery D was located was evident in the plant Ca content.

The data in Table 2 are not complete without considering the roots left in the soil after digging field trees or the stems and leaves removed when the trees are headed, and prepared for shipment. The container-grown trees were clipped once or twice but the field trees were commonly clipped 3 to 4 times between budding and shipping; also, all trees had the portion of the rootstock seedling above the bud union removed. We determined from samples of these additional tissues, or from estimates, that the total amount of nutrients removed from the nursery increased about 10% for the container-grown trees and 20% for the field trees when the removed tissues are included.

The nutrient quantities in the plants are about 5 to 20% of the amount applied. Such levels of "recovery" are difficult to interpret. The fate of the remaining portions of the nutrients applied is unknown. Some nutrients may have been present in the field soil or container medium or were leached. The amounts "recovered" seem reasonable

when our results are compared with studies of older plants (3, 4). Nevertheless, Bridges and Youtsey reported in 1977 that in Florida citrus nurseries, annual rates of 800 to 1,000 lb. N/acre were common (1). They expressed the opinion that these rates were probably excessive. Our study showed that fertilizer rates have increased considerably and the production time for a field-grown nursery tree has decreased since 1977. The shorter production cycle may be directly related to a higher fertility level but this is not known. Our results suggest that further study is needed to determine if the current nursery fertilizer rates are necessary and the extent of leaching that might be occurring.

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AN ECONOMIC ANALYSIS OF REPLANTING EXISTING GROVES VS. BUYING NEW LAND FOR CITRUS PRODUCTION

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Abstract. The recent December 1989 freeze has forced many citrus growers in northern citrus production areas to reevaluate the production of citrus at their current locations and/or investigate the possibility of purchasing land further south. The research presented in this paper analyzes the economics of the decision to replant existing grove land as opposed to the purchase of new land for citrus production in other southern production areas. The two strategies are compared based on capital budgets prepared for a fifteen-year planning horizon. Various production alternatives and cultivars are also considered in the analysis and reported in the paper.

The decade of the 1980s was a period of expansion for the Florida citrus industry as new plantings increased dramatically in Southwest Florida. Much of the establishment of new groves in Southwest Florida was precipitated by the

decision of grove owners and managers to relocate groves that were severely damaged or destroyed in the freezes of the 1980s rather than risk replanting in the colder Central Florida area. Although Central Florida and the Ridge area, in particular, have proven to be highly productive growing regions, many producers are reassessing their grove locations in light of the 1989 December freeze. This paper addresses under what condition a Central Florida citrus grower would want to relocate to Southwest Florida.

Methodology and Data

An investment decision may depend on financing, cash flow, and perceived risk (3,4). However, the primary consideration should always be profitability (2). If the investment is not profitable, then the other facets of the decision-making process will not be considered. One measure of profitability is called the internal rate of return. The internal rate of return (IRR) is simply a measure of what percentage profit is made on an initial investment over the life of the investment. The IRR is an annual rate of return, however, so that it can readily be compared to other investments, such as certificates of deposit or other savings plans.

The approach taken in this paper is to compare the profitability of the production of 'Hamlin' oranges in Central and Southwest Florida without accounting for land costs. In today's land market a possible gain in land transactions may be realized when land in the Central region is sold and land is purchased in the Southwest region. The gain in the land transactions can then be added to the initial investment cost in the Southwest cash flow and in-

creased until the IRR for each production area is the same. The resulting figure that equates the two IRRs can be thought of as a breakeven land transaction gain. It would be the minimum land transaction gain from selling land in Central Florida and purchasing land in Southwest Florida that would be required to make the relocation of citrus production a profitable venture. To illustrate this concept, if the breakeven land gain is \$900, then the land in Central Florida must sell for \$900 or more than it would cost to purchase new land in Southwest Florida for the move to be more profitable than staying and replanting in Central Florida. The \$900 figure must be net of all real estate transaction costs and federal income tax expenses associated with the sale and purchase of land.

The production assumptions used in the analysis are presented in Table 1. No land cost is charged to the grove in the Central region since grove owners will be replanting existing citrus land. No land charge was included for the Southwest region because we are looking for the net gain in land transactions that would quote profits in both regions. Irrigation charges are assumed to be \$1350 and \$1000 per planted acre for the Central and Southwest regions, respectively (Ford, et al.). Land preparation in the Central region consists of pushing out dead trees while in the Southwest land must be cleared and have suitable drainage systems in place.

The processing price received is assumed to be \$1.25 per pound solids in each region. Yield peak at 4.95 boxes per tree with 5.75 pound solids per box in both regions. A six percent yield penalty was also assessed to the Central region to account for possible freeze damage to fruit. Grove care costs are assumed to be somewhat higher in the Southwest region (5,6). Finally, only 70 percent of purchased land is planted to grove in the Southwest while 95 percent is planted in the Central region. Additional land must be used in the Southwest for ditching, drainage, and water retention areas that is not required in the Central region.

Fifteen-year cash flows were calculated for 'Hamlin' orange production for the Central and Southwest regions under the assumptions described above (1). The resulting cash flows are presented in Table 2. Table 2 also contains the cash flow for oranges in the Southwest if there were a one-year lag in production between the time when production stopped in the Central region and the new grove was established in the Southwest. The lagged cash flow is the same as the Southwest cash flow except that the cash amounts are realized one year later.

Results

The internal rate of returns were calculated for the cash flows and are presented at the bottom of Table 2. The

Table 2. Comparison of income streams and IRR of 'Hamlin' oranges planted in the Central, the Southwest, and in the Southwest with a one-year lag.

Year	North	Southwest	Southwest with one-year lag
(dollars per acre)			
1	-1734	-2873	0
2	-1611	-1334	-2873
3	-628	-627	-1334
4	-437	-422	-627
5	-124	-94	-422
6	169	189	-94
7	752	815	189
8	1317	1421	815
9	1865	2007	1421
10	2150	2315	2007
11	2429	2619	2315
12	2539	2746	2619
13	3279	2687	2746
14	2405	2618	2687
15	2362	2573	2618
IRR	16.5%	15%	14%

return on investment for the Central region is calculated to be 16.5 percent which is 1.5 points higher than in the Southwest. These rates of return are exclusive of inflation. Constant costs and returns have been used. No land charges for the initial investment have been included in the investment analysis, nor has the market value of the grove been included at the end of the fifteen-year investment period. The inclusion of these two figures will change the IRR substantially.

The IRRs for the Southwest region would be equal to the 16.5 percent IRR for the Central region if there was a net gain in the land transaction of \$540 (Table 3). That is, if the grove owner sold land in the Central region for \$540 more than the total transaction's cost of purchasing land in the Southwest, then the initial investment in the first year in the Southwest (\$2873) could be reduced by \$540 and the return on investment could be improved. Thus, for any gain on the land transaction of \$540 or more, the move to Southwest Florida would be profitable. Similarly, if the gain were \$540 or less, then the move would be unprofitable.

The same calculation was performed to compare the Central region with the Southwest with a one-year lag in establishment. In that case, the gain required on the land transaction would be \$840. The increase in required gain arises from the discounting of future returns that would be received one year later.

One further adjustment is required. The required gains calculated above are both on a planted acre of grove basis. However, only 70 percent of the land purchased for the Southwest grove is planted. Consequently, the figures

Table 1. Production and Management Assumptions.

	Central	Southwest
(dollars per acre)		
Land Cost	\$ 0	Solve
Irrigation	\$1350	\$1000
Land Preparation	\$ 350	\$1300
Freeze Penalty	6%	None
Percent Acreage Planted	95%	70%

Table 3. Net gain on land transaction gain necessary for selling land in Central Florida and purchasing land in Southwest Florida.

	Net Planted Acre	Total Land Acre
(Dollars per Acre)		
Planted in same year of Land Sale/Acquisition	\$540	\$400
Planting one year after Land Sale/Acquisition	\$840	\$600

must be adjusted to a gross land basis. The net land transaction gain required on a gross acre basis would then be approximately \$380 if the land was acquired immediately or \$590 if there would be a lag of one year between sale and purchase. Current land values suggest that such land transaction gains are possible and that relocation to the Southwest region would be economically feasible. However, as the percent of land utilized for actual planted acreage decreases, the net land transaction gain required to equate the profitability of the Central and Southwest regions will increase.

Summary

This paper has analyzed the profitability of two investments in groves of 'Hamlin' oranges; one to be replanted on land in Central Florida and one to be newly established in Southwest Florida. The intent of the analysis is to identify the contribution to establishment costs that would be required from a net gain from the sale of old grove land and the purchase of new land to equate the two investments. The results indicate that the net gains required per planted acre would be in the \$400-\$600 range for 'Hamlin' oranges if planted in the same year of land transactions and \$540-\$840 if planted one year later.

Growers must understand that the results of the analysis presented in this paper rely on several specific assumptions and may only hold specifically for 'Hamlin' oranges. Citrus growers considering a move to the Southwest region should analyze their own grove information in a similar way to assess the profitability of such a move. An

analysis of other cultivars and changes from one cultivar to another e.g., 'Hamlin' orange in Central region with 'Valencia' orange in Southwest region, could also be handled in the same manner.

Growers should also recognize that there are additional risks associated with production in the Southwest that may outweigh the risk associated with the possibility of freeze in the Central region. The Southwest is not totally immune to freeze risk and also faces production risk from environmental and water policy regulation. Further, since the Southwest region is a relatively new production region, not all risks may be known at this time. An analysis of the relative profitability of citrus production in the Southwest, however, is the first step in the decision to relocate.

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PROFITABILITY OF CITRUS CULTIVARS BY REGION AND MARKETS

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Abstract. Many Central Florida citrus growers now face replanting and/or expansion decisions as a result of the 1989 December freeze. Little analysis on the profitability of many of the citrus varieties has been done in recent years. The research presented in this paper looks at the profit potential of several citrus varieties in different geographic regions of Florida. Costs of production, crop yields, and fruit prices are used to determine profits for mature groves over a fifteen-year investment planning horizon beginning when trees are set. Once this budget work has been completed, risk factors associated with varieties, regions and product marketed can be accounted for in the profitability analysis.

Florida citrus production consists of a large number of cultivars grown in several locations in the state. Citrus can also be marketed as processed or fresh fruit. Little work has been done, however, to quantify the relative profitability and risk associated with a particular cultivar/market/region combination. The research presented in this paper compares the historic profitability of 48 such combinations and ranks them accounting for their relative riskiness. The information resulting from a comparison of relative profitability and risk among citrus varieties, markets, and locations should provide insight for growers deciding which cultivars to establish in either newly established or replanted locations.

In summary, the results of this paper indicate that cultivars marketed fresh are usually preferable to processed market fruit from a risk efficiency viewpoint. Early and mid-season oranges and 'Valencia' oranges are the more risk efficient cultivars for the processed market in all three regions. Early and mid-season oranges and tangerines are the dominate cultivars for fresh markets in all three regions. The Indian River region appears to be more-risky/less-profitable for citrus production than the central and southwest regions except for colored grapefruit for the fresh markets. And last, the difference in the profitability and risk across the three regions is that the variability in gross returns arises from yield differences. Historically, the