Return-on-investment Potential of Citrus Under Protective Screens (CUPS)

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To exclude the Asian citrus psyllid (ACP, *Diaphorina citri*) vector of huanglongbing (HLB) and thereby produce disease-free healthy fruit, fresh citrus can be grown under protective screen structures. The expected economic benefit from adopting CUPS and excluding the Asian Citrus Psyllid (ACP) is increased yield and quality of fruit, which in turn, are expected to contribute to increased sustainability and profitability of citrus production. However, CUPS is a relatively new citrus production system and, therefore, involves new challenges and hurdles. The most salient economic hurdle is that CUPS significantly increases the cost of grove establishment due to the high cost of screen-house construction. Hence, in this article, we summarize the analysis that addresses the question of whether CUPS is an economically feasible investment for fresh-fruit citrus growers to deal with HLB.

Assumptions and Considerations

For the analysis, we assume that the investment is for Fresh 'Ray Ruby' grapefruit planted and use the data available generated from the CUPS pilot project at the CREC in Lake Alfred, FL. The pilot project has generated production and input data for years 1 through 7 out of a 10-year horizon. For years 8 through 10, revenue and cost are assumed to remain at year 7 levels. Tree spacing is 5 x 10 ft., which translates into a per acre density of 871 trees. We use the data available to compute the annual budget and estimate the annual cash flows, which are key to evaluate the profitability of adopting CUPS by computing the investment's internal rate of return. In addition, we also conduct a sensitivity analysis to examine the robustness of the results to changes in key variables, in particular, the cost of establishment. For most machinery and irrigation calculations, we assume we are dealing with a 20-acre operation. Based, on input from growers, the annual cost of insuring the CUPS structure against hurricanes is $2,200 per acre. We also assume that land is already owned and estimate that the real residual land value after 10 years is $2,803 per acre, which accounts for the increase in land value and the cost of clearing the land.

Caveats of the analysis include the following. First, the amount invested in Machinery and Irrigation will depend on whether the grower is establishing a new operation or switching from another crop. Second, the analysis is based on retail chemical prices, but some growers may get up to 20% discount for purchasing large chemical volumes. Third, given the experimental character of the CUPS at CREC, plants were originally planted in pots but became root-bound, causing lower vigor, diminished fruit size, and lower yields. Thus, they were transplanted into the ground, which caused yield to decline significantly the year in which they were transplanted. Importantly, if the results of the analysis show that adopting CUPS is profitable even when considering retail chemical prices and diminished yields due to transplanting, it would imply that a grower that can get a discount for purchasing large volumes of chemicals and does not lose yield due to transplanting would get an even higher return for adopting CUPS relative to those presented here.

Combining all the information and data available, including the investment requirement, cost of production, yields, and prices, we computed a financial budget. Such a budget is the basis for conducting an investment analysis, which is the typical methodology for establishing the profitability of a long-term investment for which we need to consider the time value of money. The net present value (NPV) is one possible method for evaluation because it considers the time value of money as well as the size of the stream of cash flows. In using such method, the discount rate is key because it represents the cost of capital (or its opportunity cost). As a rule of thumb, investments with a positive NPV should be accepted and those with a negative NPV, rejected. The rationale for accepting investments with positive NPVs is that they yield higher returns than the discount rate (i.e.: cost of capital). However, it would be impossible for us to choose or estimate a discount rate that would represent the cost of capital of all growers because each individual grower has a different opportunity cost of capital. Therefore, we compute the internal rate of return (IRR), which is the actual rate of return on the investment. The IRR is the discount rate that makes the NPV be zero. As such, it depends only on the cash flows of the investment.

Results

Given the significance of the cost of the CUPS structure and the divergence that there could be among growers in its construction, in Figure 1 we present the results of the economic analysis for costs ranging from $30,000 to $45,000 per acre (or equivalently, from $0.69 to $1.03 per sq. ft.) when considering the residual value of land at the end of the investment. The results illustrated in Figure 1 depict two cases: first, a case in which the grower purchases the insurance for the structure against hurricanes (denoted by the orange line) and, second, a case in which the grower self-insures (denoted by the blue line). Thus, Figure 1 shows that when the grower self-insures, the IRR ranges from 11.99% to 16.38% as the cost of the structure decreases from $1.03 per sq. ft. to $0.69 per sq. ft. implying that, the investment in CUPS is profitable as long as the cost of capital (of the individual grower) is less than the obtained IRR. Figure 1 also shows that when the grower purchases insurance for the structure against hurricanes, the IRR ranges from 9.21% to 13.10% as the cost of the structure decreases from $1.03 per sq. ft. to $0.69 per sq. ft., again, implying that, the investment in CUPS is profitable when the cost of capital (of the individual grower) is less than the obtained IRR. The profitability of the investment in CUPS is driven not only by the increased yield per acre and high packout rates resulting from the ACP exclusion but also by the significant increase in the prices of fresh fruit in the last few seasons.

Summary

In this article, we address the question of whether CUPS is an economically feasible investment for fresh-fruit citrus growers to deal with HLB. By using the data available for fresh ‘Ray Ruby’ grapefruit from the pilot CUPS project at the CREC in Lake Alfred, FL, and combining it with assumptions for the remainder of the years for which data has yet to be collected, we performed an economic analysis and found that the investment can be profitable for such a citrus variety given the combination of higher yield and quality of the fruit together with higher market prices.

Figure 1. Internal Rate of Return for Different Structure Costs for a Self-insured Grower and for a Grower who Purchases Insurance for the Structure against Hurricanes