Container production of citrus nursery trees has increased in importance, although fewer than 20% of all nursery trees are probably grown by this method. There are no indications that this situation will change significantly during the next decade.

The major issue facing citrus nurserymen today concerns the general area of plant nutrition and in particular the potential for groundwater contamination. Our conclusion is that this is the priority area for research and extension support. A second area of need concerns budwood quality, selection and bud forcing. Recent research elsewhere (R. E. Rouse, personal communication) shows the usefulness of plant growth regulators to promote budbreak at forcing and heading. Initiating and continuing research and extentsion activities in these areas should help to improve the efficiency of citrus nursery operations.

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RELATIONSHIP BETWEEN TREE COUNTS AND CITRUS GROVE PRODUCTION

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Abstract. **Grove mapping is an important part in determining the status of trees in groves managed by the Haines City Citrus Growers Association (HCCGA). Grove owners joining the HCCGA must have their groves mapped upon being accepted into membership. A study of 3 typical groves in Polk County was made to determine from ground surveys the relationship and yield comparisons between tree counts with full, partial potential mature tree stands, and actual counts of different size trees. Results of the comparisons indicated that reduction of tree stand to 64.63% lost a hypothetical production of 2,589.15 boxes at an estimated value of $1,192.00 per acre (fresh fruit) and $1,143.30 per acre (processing) (1987-88 prices). Estimated production costs were the same whether the grove had a potential 100% stand or a low of 64.63%, so that groves with low counts (656 instead of 1,015) not only lost yield, but had higher production costs per tree, $24.00 instead of $15.51.**

Variations in groves limit the possibility of finding a single method, practice, or group of factors that will maximize yield and profit for all groves. A program may give good yields in one grove but will seldom work well in another grove if used without modifications. Successful growers consider the grove record a valuable piece of equipment and they keep it in use regardless of current fruit prices. Maintenance of accurate grove records contribute a great deal to the efficiency of the enterprise. Tree counts and grove maps provide baseline information that will enable managers to make accurate decisions (2, 6).

Annual tree counts provide a growth and development chart for monitoring grove progress to determine if tree production is profitable or whether the trees should be replaced (1, 2, 8). The method most commonly used for grove mapping involves the use of a diagram on graph paper and marking desired symbols, letters, or numbers in a square to record a particular tree's condition. The use of plastic overlays has been successfully tested (3). The majority of groves in HCCGA range from small (less than 20 acres) to medium (from 100 to 660 acres) in regular blocks with even spacing between trees and with 2 or 3 different varieties within a grove. There are no standard types of groves. Thus, production managers have to adapt management and operations to each grove.

This presentation deals with the conventional method of grove mapping to demonstrate how tree counts can be used in estimating grove production and potential income when compared to the potential production of a mature grove.

Materials and Methods

Best grove maps were obtained with quarter-inch graph paper on a legal size clipboard. Each square represented a tree and was marked with an appropriate symbol indicating the health condition, size of tree, as well as the variety. Field information forms attached to each grove map provided information required by other departments to assign costs and labor expended (Table 1).

Grove mapping was quite tedious in groves where many varieties were intermixed as sequential trips were made to verify the correct identification of both scion and rootstock. In these experiments, no information was recorded on tree nutritional deficiencies, herbicide use, or damage.

Once a grove map was made, it was duplicated (6 copies) and incorporated with other grove records such as:

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Table 1. Example of a field information recording form used by the Haines City Citrus Growers Association for annotating field information to be included with each grove map.

FIELD INFORMATION RECORDING FORM

Date: _____

Grove No. _____ S__ T__ R__

Grower: _____ Location: _____

Address: _____

Phone: _____

ORIGINAL TREE SPACING

Tree Category	Variety Code	
1. Healthy producing mature	HT – Honey	V – Val
2. Healthy " (< 5 boxes)	OT – Osceola	M – Mids
3. Sick tree – needs pruning	M – Mids	S – Sunburst
4. Vacancy	D – Duncan	MS – Marsh
5. 1-2 yr old reset	R – Reds	P – Paige
6. 3-4 yr old reset	N – Navel	T – Temple

Rootstocks

Rough Lemon – RL; Sour Orange – SO; Sweet Orange – WO

Cleopatra Mandarin – CM; Trifoliate Orange – TO; Carrizo – CR

Varieties	Tree Category 1	2	3	4	5	6
1.						
2.						
3.						

Varieties	Tree Category 1	2	3	4	5	6
4.						
5.						
6.						

1) Nursery requirements (number of trees needed), 2) Tree removal, 3) Fertilizer requirements, 4) Irrigation needs (equipment or necessary water amounts), 5) Crop production estimates, and 6) Previous grove maps, harvesting, and production records.

Three groves in Polk County were selected from a group managed by the HCCGA for yield and cost comparisons between actual tree counts with different size trees, actual tree counts with large size trees (over 20 years old), and expected tree counts (from planting distances) with large size trees. Data is presented for 1 grove only. Similar patterns were observed in the other 2 groves.

Trees were classified and counted according to size and condition of health to indicate their production potential. Yield was estimated by multiplying tree counts by the number of average boxes produced per tree reported by Muraro (6). Yield adjustments were made according to the tree categories from the field information form (Table 1). Expected production figures were obtained from various sources (2, 4, 6, 7), and the most recent Agricultural Statistics Citrus Summary for 1987-1988 (6).

Results and Discussion

Inventories of trees in the groves selected for study indicated that none had a complete stand (Table 2) and were losing potential income according to the estimates made (Table 3), on cost and production (based on 1987-1988 prices) (4, 6).

An analysis of tree stands in the 3 groves suggested that it would be advantageous to initiate a replanting program in order to maximize income from the groves (Table 3) (1).

Tree counts of the grove indicated that an additional income of $21,231.15 or $1,192.75 per acre (Table 3) for the fresh market, and $20,350.72 or $1,143.30 per acre for processing, would be possible if hypothetically the grove had a 100% stand of mature trees instead of the 64.63% tree stand, potentially producing an expected 6.1 number of boxes (6) (Table 2). If the potential fruit production were sold in the fresh market, a potential income of $50,770.30 or $2,852.20 per acre would be possible at 1987-1988 prices and $48,665.20 or $2,734.00 per acre if sold for processing (Table 3).

Table 2. Tree count and calculated production of 17.8 acre Valencia/rough lemon groves with 1,015 tree spaces. Production calculated as 6.1 boxes per tree for large (category 1) trees, 5.0 boxes for smaller (category 2) trees, and 0.75 boxes for young (category 6) trees.

Varieties	Category of trees 1	2	4[z]	5	6	Total producing trees	Total number trees
Valencia	305	347	359	2	1	655	1,014
Reds	1					1	1
Total No. trees						656	1,015
Yield/box/tree	6.1	5.0			.75		
No. boxes	1,866.6	1,735.0			0.75	3,602.35	

[z]category 4 = vacancy

The cost of production was the same, regardless of the tree count; however, with a reduction of the number of trees (64.63% stand), the cost per tree increased from $15.51 to $24.00, regardless of tree size, an increase of 154% over the cost production with a 100% tree stand (Table 3).

Similar results were obtained with 2 other groves studied when tree counts were used to estimate grove production with hypothetical full stands.

Table 3. Comparisons between hypothetically full, partial stands of trees, and actual tree counts in estimating yield, income, and costs of production for a 17.8 acre Valencia orange grove.

Grove A orange	Hypothetical full stand large trees	Actual count different size trees	Lost income large trees
Tree counts	1,015	656	359
Percent stand	100%	64.63%	35.37%
Total boxes	6,191.5	3,596.5	2,589.15
Potential %	100%	58.09%	41.80%
Total income[z] fresh fruit	$50,770.30	$29,491.30	$21,279.00
Per acre	$2,852.20	$1,671.03	$1,192.75
Total income processed	$48,665.20	$28,268.50	$20,350.72
Per acre	$2,734.00	$1,601.73	$1,143.30
Income/tree fresh fruit	$50.02	$44.90	$59.14
Income/tree processed	$47.94	$43.00	$56.69
Production costs (17.8 acres):			
Fresh fruit: $884.60/acre = $15,745.88			
Processed: $748.75/acre = $13,327.76			
Fresh fruit:			
Production/tree	$15.51	$24.00	$43.86
Percent costs	—	154.73%	208.28%
Processed:			
Production/tree	$13.13	$20.32	$37.12
Percent costs	—	174.76%	282.71%

[z]Price/box (fresh $8.20 and processed $7.86) quoted from Fla. Crop. Rpt. Ser. 1987-1988.

The results of the ground surveys of the groves were distributed to the Production Department and Harvesting Department and incorporated into other grove records for processing and planning procedures. Conferences were held with the respective owners of the groves to show them the results of the ground surveys and discuss various options for optimum production, since the HCCGA operates in agreement with the wishes of the respective owners.

Nursery orders to replace missing and dead trees were placed annually. A careful watch of tree counts was maintained to detect those producing less than the optimum number of boxes, until it became necessary to replace them (when the cost of production per tree falls below the income they produce).

Tree counts from the 3 test groves indicated that it was worthwhile to know the condition of the grove, particularly when compared with previous records. Repetitive surveys delineate trends of events that may be used to improve the accuracy of management decisions.

While it would be ideal to have original surveys and historical records of each grove, the HCCGA accepts members who have recently purchased groves that do not have continuous records. Therefore, it is always necessary to map the grove and determine which available options are best for the owner and the HCCGA.

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