The Case of the Missing Citrus

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If a man has a $13,000 per year job he expects his pay checks to show a gross total of that amount. However, if the gross total is only $7,850, even before taxes, he knows something is wrong and does something about it.

When an Arizona industry has a potential gross income of $13,279,625 but receives only $7,844,095 per year, the thousands of industry members are not taking home their full pay check.

As startling as they may seem, the figures quoted above show the potential and actual returns for the Arizona citrus industry for 1962. The computations are based on the actual bearing acreage (trees 8 years old or older) for each type of citrus: oranges, grapefruit, lemons, and tangerines.

Actual yields and average returns per field box are calculated for each crop. These are compared with the potential yields and returns — which is what the industry could get if losses from diseases, physiological disorders, detrimental environmental influences and faulty cultural procedures could be averted completely.

$5½ Million Loss

Let's look at the figures in Table I. The difference between actual crop value, $7,844,095, and the potential value, $13,279,625, means that $5,435,530 has been lost somewhere along the line. Somehow, 41 per cent of the industry pay check has simply vanished. Perhaps a little detective work will expose the culprits.

Table II lists some of the various causes which have brought about this $5½ million loss. The percentage taken by each of them — fungi, viruses, nematodes, disorders and frost, has been estimated by University of Arizona citrus specialists. This percentage can be converted easily into the dollar value of lost or damaged citrus.

This table also shows that the known culprits have taken more loot from some crop areas than from others. Valencia and sweet orange income has been reduced by 31 per cent — amounting to a hefty $1,623,650. Navel oranges lost 31 per cent or $1,176,440; white grapefruit, 25

(Continued on Next Page)

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Table I. Comparison of current actual and potential annual production returns from Arizona citrus varieties.

Variety	*Bearing Acreage*[1]	*Actual Yield Field Boxes/A*[2]	*Average Return per Field Box*[3]	*Actual Crop Value*[4] *Per Acre*	*Actual Crop Value*[4] *Total*	*Potential Yield Field Boxes/A*[5]	*Potential Crop Value*[6] *Per Acre*	*Potential Crop Value*[6] *Total*	*Dollar Value Lost for Various Causes*[7]
Valencia Oranges	4,009	320	$2.25	$720.00	$2,886,480	500	$1,125	$ 4,510,125	$1,623,645
Sweet Oranges	1,074	320	2.00	640.00	687,360	500	1,000	1,074,000	386,640
Navel Oranges	4,600	140	2.75	385.00	1,771,000	300	825	3,795,000	2,024,000
White Grapefruit	5,131	750	.20	150.00	769,650	1000	200	1,026,200	256,550
Red Grapefruit	426	750	.55	412.50	175,725	1000	550	234,300	58,575
Lemons	2,766	640	.75	480.00	1,327,680	1000	750	2,074,500	746,820
Tangerines	377	200	3.00	600.00	226,200	500	1,500	565,500	339,300
	17,335				$7,844,095			$13,279,625	$5,435,530

[1]Acreage data based on Hilgeman, R. H., and C. W. Van Horn, 1955. Citrus Growing in Arizona. Ariz. Agr. Exp. Sta. Bulletin 258 (Revised). Modified by additional data, June 1962, from Orange and Grapefruit Prorate Offices and Sunkist Exchange to account for acreage subdivided in the Salt River Valley.

[2]Estimates based on packing house data and yield records of Branch Citrus Experiment Stations at Tempe and Yuma.

[3]Average returns are estimates based on limited information from packing houses in Yuma and Salt River Valley and on returns received by Tempe Citrus Station.

[4]Calculated on basis of returns from acreage at least 8 years old.

[5]Potential yield estimates based on specific knowledge of selected bearing acreage of the several varieties where detrimental effects of diseases, pests, weather, and cultural malpractices are nearly minimal. Estimates are regarded as conservative in all categories.

[6]Based on present average return per field box.

[7]Difference between "Actual" and "Potential" crop values. Causes include horticultural and pathological problems.

(Continued from Previous Page)

per cent or $256,540; red grapefruit, 25 per cent or $58,550; lemons, 17 per cent or $352,660; and tangerines, 33 per cent, for a loss of $186,610. It is readily apparent that the diseases and parasites are truly big time operators.

Virus Loss $1 Million

When the UA Plant Pathology Department scientists finished assigning the culprits into causal groups, the results are reported in Table III. The fungi and nematodes account for $304,140 and $621,540, respectively. The viruses managed to get away with the largest amount, $1,200,450. Physiological disorders, granulation and frost took a large share, $439,420, $306,980 and $781,920, respectively.

These causes total only $3,654,450 of the citrus loss. There still exists the difference between $3.6 million (Table III) and the $5.4 million reported lost (Table I). We believe the missing $1,781,080 can be attributed to such physical causes as faulty irrigation, nutritional deficiencies, root-stock problems, salt problems, poor drainage, pruning difficulties, weed competition and minor other unidentified causes.

A new enemy of citrus, tristeza virus, possibly has been dipping into the cash drawer, too, but the amount lost cannot be reported at this time.

UA Scientists Working On It

What is being done about these things which pare away $5½ million from Arizona's annual citrus income? In the College of Agriculture, the Departments of Plant Pathology and Horticulture are very much aware of this multiple problem. The viruses (tristeza, psorosis, xyloporosis, exocortis, Stubborn Disease, and a few others) are being subjected to an extensive (and very expensive) virus indexing program at the Yuma Branch Citrus Station.

Work on the Arizona Budwood Improvement Program is being pushed by UA and USDA plant scientists. These workers have imported more than 50 good citrus varieties to check virus diseases and rootstock problems. The fungi are being attacked through experiments on Phytophthora root rot, Rio Grande Gummosis, Dry Root Rot and Hendersonula rot.

Granulation, irrigation, nutritional deficiencies, frost injury and pruning are being worked over by the Horticulture Department. Nematodes are being checked by UA and USDA scientists. Increased usage of nematocides and wind machines help curb nematodes and frost injury. A few of the lesser criminals, though still on the loose research-wise, are still on the "wanted list."

Needs Bigger Police Force

And so we come to the final chapter of "The Case of the Missing Citrus." The Arizona citrus industry is being robbed of 5.5 millions of dollars each year. Certain thieves have been apprehended

(Continued on Next Page)

Table II. Estimated annual production losses from Arizona citrus groves, eight or more years old, due to diseases and other conditions.

Disease or Condition	*Valencia and Sweet Oranges* Estimated Per cent Loss[1]	*Valencia and Sweet Oranges* Thousands of Dollars Loss[2]	*Navel Oranges* Estimated Per cent Loss	*Navel Oranges* Thousands of Dollars Loss	*White Grapefruit* Estimated Per cent Loss	*White Grapefruit* Thousands of Dollars Loss	*Red Grapefruit* Estimated Per cent Loss	*Red Grapefruit* Thousands of Dollars Loss	*Lemons* Estimated Per cent Loss	*Lemons* Thousands of Dollars Loss	*Tangerines* Estimated Per cent Loss	*Tangerines* Thousands of Dollars Loss
Root rot fungi	1.0	55.84	1.0	37.95	2.0	20.52	2.0	4.69	1.0	20.74	—	—
Psorosis virus	3.0	167.52	3.0	113.85	5.0	51.31	5.0	11.71	—	—	—	—
Xyloporosis-Cachexia	1.5	83.76	1.5	56.92	1.0	10.26	1.0	2.34	1.5	31.12	5.0	28.28
Stubborn Disease	4.5	251.28	10.0	379.50	1.0	10.26	1.0	2.34	—	—	—	—
Rio Grande Gummosis	—	—	—	—	1.0	10.26	1.0	2.34	—	—	—	—
Nematodes	5.0	279.20	5.0	189.75	5.0	51.31	5.0	11.71	3.5	72.61	3.0	16.96
Mesophyll Collapse	1.0	55.84	1.0	37.95	1.0	10.26	1.0	2.34	—	—	—	—
Alternaria rot-fungus	—	—	4.0	151.80	—	—	—	—	—	—	—	—
Splitting-physiological	1.0	55.84	1.5	56.92	—	—	—	—	—	—	—	—
Breakdown-physiological	2.0	111.68	2.0	75.90	0.5	5.13	0.5	1.17	1.0	20.74	1.0	5.65
Granulation	2.0	111.68	2.0	75.90	0.5	5.13	0.5	1.17	—	—	20.0	113.10
Freeze Injury	10.0	451.01[3]	—	—	8.0	82.10	8.0	18.74	10.0	207.45	4.0	22.62
	31.0	1,623.65	31.0	1,176.44	25.0	256.54	25.0	58.55	17.0	352.66	33.0	186.61

[1]Based on averaged reports by several citrus specialists. Adjusted by acreage for districts. Figures adapted from typewritten report by R. H. Hilgeman to H. L. Keil, U.S.D.A., dated May 9, 1962.

[2]Losses calculated from "Potential Crop Values" shown in Table 1.

[3]Valencia oranges only.

Table III. Annual production losses from Arizona citrus groves, eight or more years old, according to causal groups. (Expressed in thousands of dollars.)

Causal Group[1]	*Sweet and Valencia Oranges*	*Navel Oranges*	*White Grapefruit*	*Red Grapefruit*	*Lemons*	*Tangerines*	*Total*
Fungi (Items 1, 5, 8)	55.84	189.75	30.78	7.03	20.74	—	304.14
Viruses (Items 2, 3, 4)	502.56	550.27	71.83	16.39	31.12	28.28	1,200.45
Physiological (Items 7, 9, 10)	223.36	170.77	15.39	3.51	20.74	5.65	439.42
Nematodes (Item 6)	279.20	189.75	51.31	11.71	72.61	16.96	621.54
Unknown (Granulation) (Item 11)	111.68	75.90	5.13	1.17	—	113.10	306.98
Environmental (Item 12)	451.01*	—	82.10	18.74	207.45	22.62	781.92
	1,623.65	1,176.44	256.54	58.55	352.66	186.61	3,654.45

[1]Groupings are from following listed diseases or conditions:

1. Root rot fungi
2. Psorosis virus
3. Xyloporosis-cachexia virus
4. Stubborn disease virus
5. Rio Grande Gummosis fungus
6. Nematodes
7. Mesophyll collapse — physiological
8. Alternaria rot fungus
9. Splitting — physiological
10. Stem-end or rind breakdown — physiological
11. Granulation — cause unknown
12. Freeze injury

(Continued from Previous Page)

and are being questioned by lawmen of several departments of the UA College of Agriculture and by USDA scientists. The criminal elements, fungi and viruses, of the citrus disease mob are netting an annual haul of $1,504,590. The disease research force combatting these criminals had an operating budget, exclusive of salaries, of $12,600 for fiscal year 1962. This budget is only .8 of 1 per cent of the citrus loss. It would appear that a larger budget would be a wise investment.

Cotton's Hunger Can Be Measured, Says T. C. Tucker

Cotton plants can tell farmers whether they are hungry for more nitrogen or are receiving enough for a successful crop.

This advanced technique was presented before the Western Cotton Production Conference at Phoenix last March by Dr. T. C. Tucker, professor of agricultural chemistry and soils at The University of Arizona.

The method he outlined was analysis of stems from the cotton plant's leaves, and he said it was more effective if used in connection with soil testing to cover the whole season.

Stem analysis, or petiole analysis, is done by collecting 25 or 30 of the stems that connect the leaf to the stalk, then sending these stems to a laboratory to find out the nitrate nitrogen level. The samples are first collected when young squares begin to appear, then every two weeks until early August.

Dr. Tucker said farmers should select stems from the youngest mature leaf from the sample plants. Usually, this would be the third or fourth leaf from the top of the plant, he said.

Soil readings are taken before the squares start forming so the nitrogen in the soil can be adjusted early in the season. The stem readings then take over when the plant starts squaring.

"If the soil nitrate level is between 20 and 30 parts per million, nitrogen fertilizer will not be needed before petiole analysis data can be used . . .," he told his audience.

As cotton plants get older and near the fruiting stage, it's desirable to let the nitrogen level decline some, he pointed out. Levels desired in the various stages for Arizona conditions are: 15,000 to 18,000 parts nitrate nitrogen per million when first squares form; 12,000 to 14,000 parts per million when flowering begins; 6,000 to 10,000 parts per million as the first bolls form; and 4,000 parts per million at the time the first bolls are opening. All of this information can be gained from analysis of the stems so the fertilizer program can be adjusted to obtain these desired concentrations of nitrate nitrogen.

Dr. Tucker emphasized that petiole analysis is most valuable when used with soil analysis for nitrate nitrogen, then he told what the analysis system could NOT do.

"These tools cannot be used to increase the maximum yield possible or to correct any factor limiting yield that is not nutritional. Therefore, the most effective use of these tools will not always increase yields. They can aid only in insuring that adequate nitrogen is available for the maximum yield possible under existing conditions. In many cases, the only benefit that the grower can derive from the use of these tools is the assurance that the nitrogen fertilizer program was adequate and that excessive fertilizer was not used," he said.

3 UA Men Honored By Veterinarians

Three University of Arizona animal pathologists have been named honorary members of the Southern Arizona Veterinary Medicine Association.

Those honored were Dr. Richard H. Diven, Dr. Leonard W. Dewhirst and Robert J. Trautman. None is a veterinarian.

"Although these men are not veterinarians, they have worked so closely with our association and are so familiar with our problems that we felt they deserved honorary membership," said Dr. Lloyd Orsborn, Tucson veterinarian and spokesman for the association.