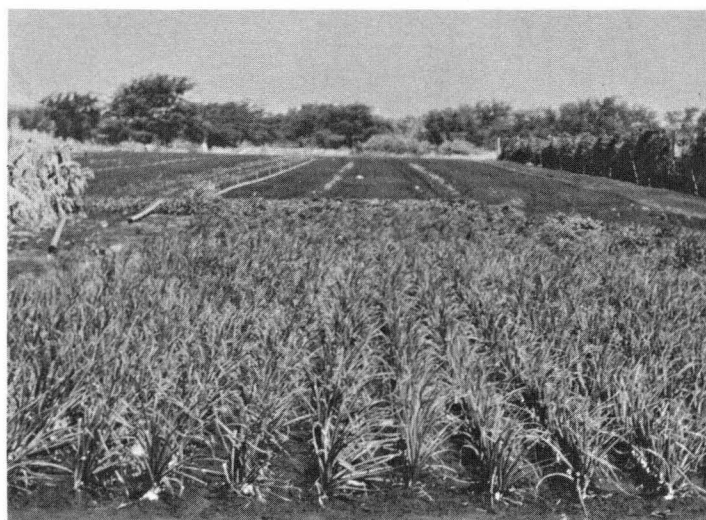


Economic Evaluation of Winter Vegetable Production on Molokai: Molokai Demonstration Farm, Results for 1964-65

L. B. Rankine, A. B. Larson, and R. E. Green



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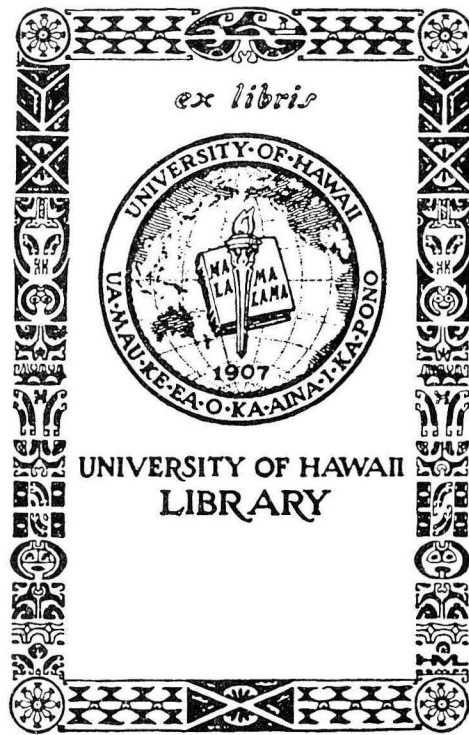


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COVER PHOTOS

Onions, cucumbers, tomatoes, and squash grown on the Molokai Demonstration Farm, during the 1964-65 season. (Photos by Richard E. Green.)

ECONOMIC EVALUATION OF WINTER VEGETABLE PRODUCTION ON MOLOKAI:

MOLOKAI DEMONSTRATION FARM, RESULTS FOR 1964-65

Lloyd B. Rankine,^{1/} Arnold B. Larson,^{2/} and Richard E. Green^{3/}

INTRODUCTION

This report summarizes and evaluates the costs and expected returns for selected vegetables that were produced on the Molokai Demonstration Farm during the 1964-65 winter season.^{4/} Results of the previous years' operations, 1962-63 and 1963-64, have been published in Progress Reports.

In this report, information about several vegetables is provided. Major emphasis is placed on the inputs and related costs for the production of tomatoes, cucumbers, squash, bell peppers, and dry onions. In addition, estimates on potential returns from sales of these vegetables in Honolulu and San Francisco are included mainly to indicate the more profitable market.^{5/}

Consistently high yields and good quality produce were obtained on the Farm during the 1964-65 season. The major portion of the produce was sold in Honolulu, and was readily accepted by wholesalers. These results were obtained with a high level of management that would not exist on many commercial farms. The high production achieved demonstrates the potential productivity of small commercial farms on Molokai.

COST AND RETURN ESTIMATES FOR SELECTED VEGETABLES

The cost and return estimates for the specified vegetable commodities are based on the results of the Molokai Demonstration Farm, and therefore are

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^{4/} This farm was established at Hoolehua, Molokai, in 1960, to explore the economic feasibility of producing winter vegetables for export to the U. S. mainland.

^{5/} Potential returns for dry onions are based on prices in the Honolulu market and are treated separately.

most applicable to those lands that are included in the Hoolehua area. However, this does not preclude their use in other areas. All data used, except for the labor estimates, are unadjusted and their costs are based on commercial prices (inputs) that are available to farmers from local distributors. Dollar values for returns from estimated market sales are based on a two-year average wholesale price for the winter months, December to May. This is true for both the San Francisco and Honolulu market estimates. Minor cost items, such as gross income tax and telephone bills, for which no clear-cut figures can be given, are grouped together as sundry items and estimated as a percentage of the total costs. An important factor to be considered here is the transferability of the data to a commercial operation. The operations of the Demonstration Farm are designed to test recommended varieties and cultural practices under Molokai conditions, and the Farm is in some ways different from a commercial operation.

Attention is focused on variable costs in this report, but there is a lump-sum estimate for cost of land, building, and equipment included in the costs. This item in particular is probably not representative of conditions as they would exist on a commercial operation. The cost and return estimates for the various crops cover only one production period which could vary from four to five months of operation.

Cost and Return Estimates

The data presented in the tables and discussed below show cost and return estimates for tomatoes, bell peppers, cucumbers, zucchini squash, and dry onions on a per acre basis. The data were first computed on the basis of the actual size of the production area for each crop (these areas varied from 0.09 acre for onions to 0.27 acre for tomatoes), and then extended to one acre assuming a linear input and output relationship. These estimates reflect in detail most of the relevant information that would affect net returns to commercial growers of these vegetables on Molokai during 1964-65.

Table 1 shows a summary of the costs and net returns assuming that sales were made in the San Francisco wholesale market at prices that prevailed during the winter months, December through May, 1963-65. Table 2 shows a similar summary but for sales in the Honolulu market during the corresponding period. Some of these costs are based on reported expenditure while others are synthetic, i.e., similar to those that would occur if vegetable shipments were actually made to these markets (San Francisco). The San Francisco wholesale market is used to represent any of the major West Coast markets mainly because transportation cost from Hawaii to any of the markets such as Los Angeles and Seattle are similar. Other cost items such as those for building and equipment use are yet to be determined accurately. These amounts are only indicative of the likely costs and are similar in total to those used in a study now in progress.^{6/}

The magnitude of the difference between the net returns from the Honolulu and San Francisco markets can be seen by comparing Tables 1 and 2. Estimated average monthly sales in the San Francisco wholesale market between December and May show net profits for all the specified vegetables. Tomato is by far the

^{6/} Lloyd B. Rankine and Arnold B. Larson. Winter Export Potential for Molokai-Produced Tomatoes. (In progress.)

Table 1. Net Returns Per Acre Assuming Sales of Specified Vegetables to San Francisco Wholesale Market (Molokai Demonstration Farm, 1964-65)

| Costs | Tomatoes one acre | Bell Peppers one acre | Zucchini Squash one acre | Cucumbers one acre |
|--|----------------------|--------------------------|-----------------------------|-----------------------|
| | <u>Dollars</u> | <u>Dollars</u> | <u>Dollars</u> | <u>Dollars</u> |
| Labor | 2,496.25 | 1,206.25 | 673.75 | 810.00 |
| Materials and Equipment Use | 945.19 | 593.35 | 395.49 | 525.05 |
| Marketing Charges | 10,345.58 | 3,800.70 | 1,986.23 | 1,906.32 |
| Cost of Land, Building, and Equipment | 185.18 | 136.61 | 136.61 | 136.61 |
| Sundries ^{1/} | 279.44 | 114.74 | 63.84 | 67.56 |
| Total Costs | 14,251.64 | 5,851.65 | 3,255.92 | 3,445.54 |
| Costs Per Pound (in cents) | 12.94 | 15.52 | 15.70 | 18.49 |
| Gross Returns Based on 1963-1964, 1964-1965 San Francisco Prices | 20,156.44 | 8,615.62 | 4,063.49 | 4,430.93 |
| Gross Returns Per Pound | 18.30 | 22.89 | 19.60 | 23.84 |
| Net Returns | 5,904.80 | 2,763.97 | 807.57 | 985.39 |
| Saleable Yield Per Acre | 110,144 lbs. | 37,639 lbs. | 20,732 lbs. | 18,617 lbs. |

^{1/} Sundries include gross income tax which has been assessed at one-half of one percent of gross returns and costs such as telephone and insurance, which are assessed at approximately two percent of the total costs.

Table 2. Net Returns Per Acre Assuming Sales of Specified Vegetables to Honolulu Wholesale Market (Molokai Demonstration Farm, 1964-1965)

| Costs | Tomatoes one acre | Bell Peppers one acre | Zucchini Squash one acre | Cucumbers one acre |
|---|----------------------|--------------------------|-----------------------------|-----------------------|
| | <u>Dollars</u> | <u>Dollars</u> | <u>Dollars</u> | <u>Dollars</u> |
| Labor | 2,496.25 | 1,206.25 | 673.75 | 810.00 |
| Materials and Equipment Use | 945.19 | 593.35 | 395.49 | 525.05 |
| Marketing Charges | 5,223.88 | 1,847.78 | 880.41 | 752.97 |
| Cost of Land, Building, and Equipment | 185.18 | 136.61 | 136.61 | 136.61 |
| Sundries ^{1/} | 177.02 | 75.68 | 41.72 | 44.50 |
| Total Costs | 9,027.52 | 3,859.67 | 2,127.98 | 2,269.13 |
| Costs Per Pound (in cents) | 8.19 | 10.24 | 10.26 | 12.18 |
| Gross Returns Based on 1963-1964, 1964-1965 Honolulu Wholesale Prices | 25,002.68 | 8,920.44 | 4,001.27 | 3,332.44 |
| Gross Returns Per Pound | 22.70 | 23.70 | 19.30 | 17.90 |
| Net Returns | 15,975.16 | 5,060.77 | 1,873.29 | 1,063.31 |
| Saleable Yield Per Acre | 110,144 lbs. | 37,639 lbs. | 20,732 lbs. | 18,617 lbs. |

^{1/} Sundries include gross income tax which has been assessed at one-half of one percent of gross returns and costs such as telephone and insurance, which are assessed at approximately two percent of the total costs.

largest earner of returns above the estimated costs, followed by bell peppers, cucumbers, and zucchini squash. Net returns from estimated sales in Honolulu at wholesale market prices followed a similar pattern except that profits on zucchini squash were larger than those for cucumbers. This is due to a difference in the cost-price structure of these vegetables.

This wide gap in net returns between the two markets, Honolulu and San Francisco, can be attributed to two main factors: (1) differences in winter wholesale prices and (2) differences in marketing charges.

Differences in Wholesale Prices

The two-year average monthly wholesale prices for tomatoes and bell peppers were higher in the Honolulu market than in San Francisco. Those for zucchini squash and cucumbers were higher in San Francisco than in Honolulu. Higher prices for vegetable items such as tomatoes in Honolulu during the winter, December to May, than on the West Coast should not be surprising since during this time a large amount of Honolulu supplies are obtained from mainland sources. Honolulu prices should be higher by a minimum amount that is equivalent to the transportation costs.

Differences in Marketing Charges

Marketing charges not only include transportation and commission charges but also costs for produce fumigation, since fumigation is a precondition for entry of Hawaiian vegetable items into the West Coast markets. Of these charges, fumigation costs are quite low but the operation itself is of prime importance. During 1963-64, extensive observations were made on the ability of tomatoes to withstand fumigation treatment and still survive the shipping conditions which were simulated at the Plant Physiology Laboratory, University of Hawaii. The test results, which are presented in detail in the report of the 1963-64 operations of the Molokai Demonstration Farm,^{7/} showed that mature greens are best suited for shipping, but early pinks would do almost as well.

A charge of 15 percent of the wholesale price has been assessed for wholesale commission both in the Honolulu and San Francisco markets. Each shipping crate is assumed to contain 30 pounds of fresh tomatoes, or other vegetable, when shipped from Molokai to Honolulu or San Francisco. The only foreseeable charge besides commission costs is that for transportation. Two rates were used in these estimates, \$7.00 per ton from Molokai to Honolulu and \$5.04 per cwt. from Honolulu to San Francisco. A comparison of the marketing charges in Tables 7 and 8 indicates that if shipments terminate at the Honolulu wholesale market, vegetable farmers could save an additional 5-6 cents on each pound of produce. Because of this, farmers who are interested in shipping vegetable commodities to the West Coast market should weigh the market alternatives since the wholesale price differential on the West Coast and Honolulu must be able to absorb the extra expense of fumigation and shipping and still leave the farmers with some net profit. Presently, ocean transport seems to be the only economically

^{7/} Arnold B. Larson, R. E. Green, L. B. Rankine, and R. R. Romanowski, Jr., Progress Report on the Molokai Demonstration Farm of the University of Hawaii for the 1963-64 Fiscal Year. Technical Progress Report No. 151, Hawaii Agricultural Experiment Station, University of Hawaii, June 1966.

feasible means of transport to the West Coast. Air shipment costs are almost three times the cost of ocean freight.

Another highly important factor that can be seen in these tables is the tabulated costs for labor operations. These will be discussed below.

Cost and Returns for Dry Onions

Table 3 shows a summary of the estimated costs of production and marketing and net returns from onion sales in Honolulu. Estimated returns from sales show a net profit of close to \$1,900 per acre. Costs estimates for labor are shown in detail in Table 4 while those for materials and equipment use are presented in Table 5. Marketing charges as well as those for sundries are explained at the bottom of the table. Estimates for cost of land, building, and equipment were obtained from the same source used for the other vegetables.

Labor Estimates

Table 4 shows detailed labor estimates for the respective operations that relate to the production and marketing of the specified vegetable crops. These estimates are based on \$1.25 per hour and do not include charges for labor management. Labor costs vary between 18 percent and 23 percent of the total costs of producing these vegetables on Molokai and selling them in San Francisco. If these vegetables are sold in Honolulu, labor costs vary between 27 percent and 35 percent of the total production and marketing costs. As shown in Tables 8 and 9, labor costs for tomatoes are approximately 2.26 cents per pound while those for bell peppers, zucchini squash, and cucumbers are approximately 3.20 cents, 3.25 cents, and 4.35 cents per pound, respectively. No additional labor costs were estimated for handling produce that is intended for export purposes. These costs were subsumed in the commission charges shown in the estimates for marketing costs in Table 6.

Most of the labor estimates were for highly labor intensive operations. Some exceptions are land preparation, fertilizing, washing, and grading, which were largely mechanized. Even for mechanized operations the labor efficiency might be expected to be low since the production units were small. Labor, therefore, represents a critical input cost for all the crops considered here. Although labor records were kept on most operations at the Molokai Demonstration Farm, in some cases the costs for small experimental units, when extended to the one-acre basis, were clearly too high. The labor requirements shown in Table 4 were in some cases reduced to levels thought to be realistic for a commercial operation. Labor costs shown in other tables are based on these estimates of labor requirements.

Materials

Table 5 shows data for the estimated quantities of materials and also the number of hours allotted for equipment use on an acre basis. These estimates cover the entire production and marketing season for the specified vegetables. Individual items included are:

Table 3. Net Returns Assuming Dry Onion Sales in the
Honolulu Wholesale Market
(Molokai Demonstration Farm, 1964-1965)

| Items | Honolulu | |
|--|------------------------|--------------------|
| | Dollars per acre | Cents per pound |
| <u>Costs</u> | | |
| Labor | 608.75 | 1.54 |
| Materials and Equipment Use | 524.43 | 1.33 |
| Cost of Land, Building, and Equipment | 136.61 | 0.34 |
| Marketing Charges | 1,190.35 ^{1/} | 3.02 |
| Sundries ^{2/} | 45.20 | 0.12 |
| ----- | | |
| Total Costs | 2,505.34 | |
| ----- | | |
| Costs Per Pound | | 6.35 |
| Gross Returns Based on 1963-1964, 1964-1965 Honolulu Wholesale Prices | 4,383.33 | |
| Gross Returns Per Pound | | 11.10 |
| Net Returns | 1,877.99 | 4.75 |
| Saleable Yield Per Acre | 39,444 lbs. | |

^{1/} Marketing charges for sales in Honolulu include cost of shipping crates at 35 cents each, freight by barge at \$7 per ton, and commission charges at 15 percent of the gross returns from sales.

^{2/} Sundries include gross income tax which has been assessed at one-half of one percent of gross returns and costs such as telephone, writing materials, etc., which are assessed at approximately two percent of the total costs.

Table 4. Labor Estimates for the Production of Specified Vegetables
on the Molokai Demonstration Farm, 1964-1965

| Crops | Tomatoes | | Bell Peppers | | Zucchini Squash | | Cucumbers | | Dry Onions | |
|--|----------------|---------------------------|----------------|---------------------------|-----------------|---------------------------|----------------|---------------------------|----------------|---------------------------|
| | Hours per acre | Percent of total for crop | Hours per acre | Percent of total for crop | Hours per acre | Percent of total for crop | Hours per acre | Percent of total for crop | Hours per acre | Percent of total for crop |
| Land Preparation | 21 | 1.0 | 16 | 1.7 | 11 | 2.0 | 14 | 2.2 | 28 | 5.7 |
| Planting and Nursery Care | 74 | 3.7 | 94 | 9.7 | 54 | 10.1 | 53 | 8.2 | 71 | 14.6 |
| Cultivation | 81 | 4.0 | 86 | 8.9 | 33 | 6.1 | 27 | 4.2 | 79 | 16.2 |
| Setting up Trellises | 134 | 6.7 | -- | -- | -- | -- | -- | -- | -- | -- |
| Pruning, Trimming, and Tying | 691 | 34.6 | -- | -- | -- | -- | -- | -- | -- | -- |
| Fertilizing | 71 | 3.6 | 33 | 3.4 | 10 | 1.9 | 10 | 1.5 | 6 | 1.2 |
| Spraying | 96 | 4.8 | 23 | 2.4 | 42 | 7.8 | 42 | 6.5 | 31 | 6.4 |
| Irrigation | 105 | 5.3 | 41 | 4.3 | 25 | 4.6 | 25 | 3.8 | 13 | 2.7 |
| Harvesting, Selecting, Packing, and Shipping | 724 | 36.3 | 672 | 69.6 | 364 | 67.5 | 477 | 73.6 | 259 | 53.2 |
| Total Hours | 1,997 | 100.0 | 965 | 100.0 | 539 | 100.0 | 648 | 100.0 | 487 | 100.0 |
| Cost at \$1.25 Per Hour | \$2,496.25 | | \$1,206.25 | | \$673.75 | | \$810.00 | | \$608.75 | |

1. Sprays

Sprays include herbicides, fungicides, and insecticides. These materials are nearly the same as those used on the Demonstration Farm in the previous year (1963-64). The amount spent on these items can hardly be reduced (except for minor savings from bulk purchases) since these are continuous operations irrespective of the presence or absence of pests and diseases. It is generally more profitable to prevent or reduce losses due to insects through continuous applications than to spray sparingly.

2. Fertilizers

Fertilizer costs are based on commercial rates that are available to farmers in Hawaii. Since the phosphorus requirement is less after the initial year of cropping, fertilizer costs were lower in 1964-65 than in 1963-64. Fertilizer costs varied between \$60 and \$100 per acre for the selected vegetables.

3. Irrigation Costs

The costs for irrigation water will become more relevant when the water from the Molokai Project distribution system becomes available. Rather than charge these items at the current rates, estimates are based on the announced price of 8 cents per 1,000 gallons and an assessed fee of \$1.10 per acre per month. Estimates for irrigation water are highest for tomatoes and are followed closely by bell peppers. In cases of unusually dry weather more water will be required with greater frequency of application.

4. Miscellaneous Items

Items included in this group are seed and electricity costs. Seeds are quite expensive, though they do not constitute a major item of total cost. Cucumber and onion seeds were the most expensive. Most of the electricity costs are charged for the refrigerator which was used to hold the produce for varying numbers of days, especially when harvesting did not coincide with shipping dates. Because of the larger volume of crop per acre, tomatoes consumed about 25 percent of the total electricity charges for the five crops.

Equipment Use

Estimates for tractor and truck are based on the number of hours spent on the various operations. The respective estimates are based on 90 cents and 80 cents per hour. The tomato crop was the heaviest consumer of these items, due mainly to the larger volume handled and the larger plot size. Estimates for hourly truck use include on-farm use as well as off-farm uses, such as haulage of produce to the pier.

Table 5. Material and Equipment Inputs for Vegetable Production on the Molokai Demonstration Farm, 1964-1965

| | TOMATOES | | BELL PEPPERS | | ZUCCHINI SQUASH | | CUCUMBERS | | DRY ONIONS | |
|-------------------------|----------------------------|-----------------|----------------------------|-----------------|----------------------------|-----------------|----------------------------|-----------------|----------------------------|-----------------|
| | Amounts Used (one acre) | Dollar Value | Amounts Used (one acre) | Dollar Value | Amounts Used (one acre) | Dollar Value | Amounts Used (one acre) | Dollar Value | Amounts Used (one acre) | Dollar Value |
| Sprays: | | | | | | | | | | |
| <u>Insecticides</u> | | | | | | | | | | |
| Blackleaf 40 | | | 5.4 pts. | 17.16 | | | | | | |
| Diazinon | 62.0 lbs. | 135.37 | 39.62 lbs. | 85.19 | 5.46 lbs. | 11.75 | 5.46 lbs. | 11.75 | 13.8 lbs. | 29.88 |
| D.D.T. | 11.1 lbs. | 3.55 | 22.0 lbs. | 7.00 | | | | | | |
| Parathion | 8.3 lbs. | 5.70 | 5.46 lbs. | 3.72 | 8.2 lbs. | 5.57 | 8.2 lbs. | 5.57 | | |
| <u>Herbicides</u> | | | | | | | | | | |
| Dacthal | | | | -- | | | | | 16.6 lbs. | 31.77 |
| Dymid | 5.5 lbs. | 18.88 | 8.20 lbs. | 27.87 | | | | | | |
| Vegadex | | | | | 11.0 lbs. | 14.53 | 11.0 lbs. | 14.53 | | |
| <u>Fungicides</u> | | | | | | | | | | |
| Dithane Z78 | 74.0 lbs. | 62.22 | 38.25 lbs. | 32.13 | | | | | 16.6 lbs. | 14.00 |
| Karathane | | | | | 2.7 lbs. | 14.21 | 2.7 lbs. | 14.21 | | |
| Tribasic Copper Sulfate | 75.0 lbs. | 43.55 | 46.4 lbs. | 26.94 | 47.8 lbs. | 27.70 | 47.8 lbs. | 27.70 | 11.1 lbs. | 6.33 |
| Spray Total | | 269.27 | | 200.01 | | 73.76 | | 73.76 | | 81.98 |
| Fertilizer: | | | | | | | | | | |
| Sulfate of Potash | 255.5 lbs. | 9.88 | 361.0 lbs. | 13.94 | 252.0 lbs. | 9.73 | 252.0 lbs. | 9.73 | 255.5 lbs. | 9.88 |
| Urea | 588.8 lbs. | 36.81 | 218.5 lbs. | 13.66 | 109.3 lbs. | 6.83 | 109.3 lbs. | 6.83 | | |
| Ammonium Phosphate | 611.0 lbs. | 49.66 | 600.0 lbs. | 48.85 | 600.0 lbs. | 48.85 | 600.0 lbs. | 48.85 | 611.0 lbs. | 49.66 |
| Zinc Chelate | 1.0 lbs. | 1.44 | 5.5 lbs. | 7.92 | | | | | | |
| Fertilizer Total | | 97.79 | | 84.37 | | 65.41 | | 65.41 | | 59.54 |
| Irrigation Water | 1,220,740 gals. | 97.66 | 703,278 gals. | 56.28 | 291,666 gals. | 23.33 | 291,666 gals. | 23.33 | 593,055 gals. | 47.44 |
| Miscellaneous Items: | | | | | | | | | | |
| Seed | .10 lb. | 20.81 | 1.36 oz. | 15.85 | 5.40 lbs. | 38.25 | 2.73 lbs. | 136.61 | 5.46 lbs. | 133.33 |
| Electricity | | 212.96 | | 155.24 | | 155.24 | | 155.24 | | 155.24 |
| Miscellaneous Total | | 233.77 | | 171.09 | | 193.49 | | 291.85 | | 288.57 |
| Equipment Use: | | | | | | | | | | |
| Tractor | 155 hrs. | 139.50 | 40 hrs. | 36.00 | 11 hrs. | 9.90 | 35 hrs. | 31.50 | 29 hrs. | 26.10 |
| Truck | 134 hrs. | 107.20 | 57 hrs. | 45.60 | 37 hrs. | 29.60 | 49 hrs. | 39.20 | 26 hrs. | 20.80 |
| Equipment Total | | 246.70 | | 81.60 | | 39.50 | | 70.70 | | 46.90 |
| Total | | 945.19 | | 593.35 | | 395.49 | | 525.05 | | 524.43 |

Marketing Costs

Two sets of marketing costs are shown in Table 6, expenses involved in making sales to the Honolulu market and for estimated sales in the San Francisco wholesale market. Shipping crates are valued at 35 cents each, barge transport to Honolulu at \$7.00 per ton, and ocean freight to San Francisco at \$5.04 per cwt. Commission charges are estimated at 15 percent of the gross sales in both markets, assuming that sales are made through the wholesale market. If sales in Honolulu bypass the wholesale market, which is unlikely on the West Coast, a farmer could eliminate this expense item but would have to pay an alternative charge for delivery to the buyer.

Present marketing expenses tend to be very high. They account for more than one-half the total expenses involved in producing these vegetables for sale on the West Coast. These relatively high costs make Honolulu presently the more lucrative of the two markets despite some price differentials between the two.

Cost of Land, Building, and Equipment

The data for cost of land, building, and equipment are yet to be determined accurately. These estimates are similar to those used in a study on tomatoes now in progress.^{8/} They represent approximate costs as they would exist on a commercial operation. All these costs are charged to the current crop of each of the selected vegetable commodities.

KEY FACTORS AFFECTING PROFITS

The costs and returns for selected vegetables shown above would not be duplicated on a commercial farm due to the many uncertainties that characterize vegetable production. Whether a farmer succeeds in making profits using the data given here as a guide depends on how well these practices are adapted. Some of the important factors that will affect profitable returns are grouped together under production and marketing and discussed below.

1. Production Factors

Among the many problems that will affect vegetable production in a new area such as Hoolehua, Molokai, is that of obtaining high yields at minimum costs. The yield that a vegetable farmer on Molokai will require to break even depends largely upon his ability to minimize production costs, since he has very little control over the marketing costs. This break-even yield for the respective vegetables can be computed by dividing the average wholesale prices received into the total production costs. These are shown in Table 7. Any yields in excess of these represent potential gross profits. The net profits he will earn depend on the costs of handling this additional amount of produce. Yield is a function of many factors which to the average farmer may seem unimportant. Some examples which require particular attention include variety selection; planting date; seeding rate; spray, irrigations, and fertilizer programs; and timely harvest, each factor affecting yield in a different way.

^{8/} Lloyd B. Rankine and Arnold B. Larson. Winter Export Potential for Molokai-Produced Tomatoes. (In progress.)

Table 6. Per Acre Marketing Costs in San Francisco and Honolulu for Specified Vegetables Produced on the Molokai Demonstration Farm, 1964-1965

| Items | Tomatoes | Bell Peppers | Zucchini Squash | Cucumbers |
|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | <u>Dollars</u> <u>Per Acre</u> | <u>Dollars</u> <u>Per Acre</u> | <u>Dollars</u> <u>Per Acre</u> | <u>Dollars</u> <u>Per Acre</u> |
| <u>Marketing Costs--San Francisco</u> | | | | |
| Shipping Crates | 1,102.22 | 378.14 | 207.65 | 187.98 |
| Fumigation Charges | 297.37 | 101.64 | 51.58 | 50.27 |
| Transportation to Honolulu | 371.26 | 131.58 | 72.57 | 65.13 |
| Ocean Freight to San Francisco | 5,551.25 | 1,896.99 | 1,044.92 | 938.30 |
| Commission Charges (Valued at 15% of the average 1963-1964, 1964-1965 San Francisco wholesale prices) | 3,023.48 | 1,292.35 | 609.51 | 664.64 |
| Total | 10,345.58 | 3,800.70 | 1,986.23 | 1,906.32 |
| <u>Marketing Costs--Honolulu</u> | | | | |
| Shipping Crates | 1,102.22 | 378.14 | 207.65 | 187.98 |
| Transportation to Honolulu | 371.26 | 131.58 | 72.57 | 65.13 |
| Commission Charges (Valued at 15% of the average 1963-1964, 1964-1965 Honolulu wholesale prices) | 3,750.40 | 1,338.06 | 600.19 | 499.86 |
| Total | 5,223.88 | 1,847.78 | 880.41 | 752.97 |

Table 7. Estimated Yields Per acre that are Required to Cover
Production and Marketing Costs at 1963-1965 Input
and Product Prices
(Molokai Demonstration Farm, 1964-1965)

| Crops | San Francisco Wholesale Market | Honolulu Wholesale Market |
|-----------------|--------------------------------|---------------------------|
| | <u>Pounds</u> | <u>Pounds</u> |
| Tomatoes | 77,900 | 39,800 |
| Bell Peppers | 25,500 | 16,300 |
| Zucchini Squash | 16,600 | 11,000 |
| Cucumbers | 14,500 | 12,700 |
| Dry Onions | -- | 22,600 |

In addition, vegetable farmers need the cooperation of good weather and prices. Often a farmer is more efficient if his operations are mechanized. However, the absence of farm machines should not be an excuse for inefficiency. Most of the data generated on the Demonstration Farm were with a limited use of farm machinery but should vegetable farming become a reality, the use of machinery could be extended.

2. Marketing Factors

For a vegetable farmer on Molokai, the marketing factors that will tend to affect his profit are effective shortly after harvesting. Operations such as on-farm handling, selecting, packaging, and storing are crucial points in the whole farm operation since these functions can greatly affect the quality of the end product.

Produce is sold on the market by grades, and only top quality vegetables will meet the specifications that go with top prices. Grading and standardization are important. Top quality vegetables, besides bringing higher prices, will withstand longer storage, a factor which is of special importance if produce is bound for West Coast markets. Investigations on the effects of precooling on selected vegetables are underway at the Hawaii Agricultural Experiment Station, University of Hawaii. The results, if favorable, will lengthen the storage life of some of these vegetables without excess loss in quality.

A vegetable farmer has very little control over the price he normally receives in the market. However, he can obtain a relatively stable price if he sells on contract. Contracts are beneficial since producers are often protected from violent fluctuations in market prices.

SUMMARY AND CONCLUSIONS

During the winter season 1964-65, tomatoes, cucumbers, bell peppers, zucchini squash, and dry onions were successfully grown on the Molokai Demonstration Farm. Generally, the results that are presented in the report lead to essentially the same conclusion as those made in a previous report for the 1963-64 season.^{9/}

Production costs and returns per pound from assumed sales of specified quantities of these vegetables in San Francisco and Honolulu wholesale markets are presented in Tables 8 and 9. These data were obtained by dividing the estimated yield per acre into the various cost and return totals. Interpretation of the information that is contained in each table as well as the entire report should be made with the following in mind:

^{9/} A. B. Larson, R. E. Green, L. B. Rankine, and R. R. Romanowski, Jr., Progress Report on the Molokai Demonstration Farm of the University of Hawaii for the 1963-64 Fiscal Year. Technical Progress Report No. 151, Hawaii Agricultural Experiment Station, University of Hawaii, June 1966.

Table 8. Costs Per Pound, Net Returns, and Break-even Yields for Specified Vegetables, Assuming Sales in the San Francisco Wholesale Market, December Through May (Molokai Demonstration Farm, 1964-1965)

| Items | Vegetables | | | |
|---|--------------|--------------|-----------------|--------------|
| | Tomatoes | Bell Peppers | Zucchini Squash | Cucumbers |
| | <u>Cents</u> | <u>Cents</u> | <u>Cents</u> | <u>Cents</u> |
| <u>Costs</u> | | | | |
| Labor | 2.26 | 3.20 | 3.25 | 4.35 |
| Materials and Equipment Use | 0.86 | 1.57 | 1.91 | 2.82 |
| Fixed Cost of Equipment, Land, and Building | 0.17 | 0.36 | 0.66 | 0.73 |
| Sundries | 0.25 | 0.30 | 0.30 | 0.36 |
| Marketing Charges | 9.40 | 10.09 | 9.58 | 10.23 |
| Total Costs | 12.94 | 15.52 | 15.70 | 18.49 |
| <u>Returns</u> | | | | |
| Gross Returns | 18.30 | 22.89 | 19.60 | 23.84 |
| Net Returns | 5.36 | 7.37 | 3.90 | 5.35 |
| Saleable Yield Per Acre (in pounds) | 110,144 | 37,639 | 20,732 | 18,617 |
| Break-even Yield Per Acre (in pounds) | 77,900 | 25,500 | 16,600 | 14,500 |

Table 9. Costs Per Pound, Net Returns, and Break-even Yields for Specified Vegetables, Assuming Sales in the Honolulu Wholesale Market, December Through May (Molokai Demonstration Farm, 1964-1965)

| Items | Vegetables | | | | |
|---|--------------|--------------|-----------------|--------------|--------------|
| | Tomatoes | Bell Peppers | Zucchini Squash | Cucumbers | Dry Onions |
| | <u>Cents</u> | <u>Cents</u> | <u>Cents</u> | <u>Cents</u> | <u>Cents</u> |
| <u>Costs</u> | | | | | |
| Labor | 2.26 | 3.20 | 3.25 | 4.35 | 1.54 |
| Materials and Equipment Use | 0.86 | 1.57 | 1.91 | 2.82 | 1.33 |
| Fixed Cost of Equipment, Land, and Building | 0.17 | 0.36 | 0.66 | 0.73 | 0.34 |
| Sundries | 0.16 | 0.20 | 0.20 | 0.24 | 0.12 |
| Marketing Charges | 4.74 | 4.91 | 4.24 | 4.04 | 3.02 |
| Total Costs | 8.19 | 10.24 | 10.26 | 12.18 | 6.35 |
| <u>Returns</u> | | | | | |
| Gross Returns | 22.70 | 23.70 | 19.30 | 17.90 | 11.10 |
| Net Returns | 14.51 | 13.46 | 9.04 | 5.72 | 4.75 |
| Saleable Yield Per Acre (in pounds) | 110,144 | 37,639 | 20,732 | 18,617 | 39,444 |
| Break-even Yield Per Acre (in pounds) | 39,800 | 16,300 | 11,000 | 12,700 | 22,600 |

1. The data used are based primarily on the results of the 1964-65 operations of the Molokai Demonstration Farm. These operations were designed to be as realistic as possible under Molokai conditions.
2. The on-farm data used herein were generated from small plots that varied in size from .09 acre to .27 acre.
3. The crop yields that were obtained on these class B lands^{10/} are considerably higher than the average yields obtained in the State. The State's average yields per acre for tomatoes, cucumbers, bell peppers, zucchini squash, and dry onions are 21,300 lbs., 19,500 lbs., 18,000 lbs., 14,500 lbs., and 11,100 lbs., respectively.^{11/}
4. The following varieties were used:
 - (a) Tomatoes ----- N-55
 - (b) Cucumbers ----- Burpee Hybrid
 - (c) Bell peppers ----- Keystone Giant
 - (d) Squash ----- Zucchini Hybrid
 - (e) Onions ----- Granex
5. The yields (Tables 1 and 3) reflect the high levels of technology and management that were employed.
6. The prices that were used to estimate the market values for the various commodities are based on average monthly prices for two years. Input prices are based on the current prices that are available to farmers from local commercial firms.
7. Many minor overhead costs such as insurance, telephone bills, and other incidentals have not been estimated explicitly but are accounted for as a lump sum estimate, under sundries. No management costs are included.
8. In-transit losses due to spoilage and shrinkage were not included in the calculations of gross returns to each crop. Preliminary results of both actual and simulated shipments to the West Coast indicate that under present conditions, spoilage losses can be substantial. However, it may be possible to avoid such losses through improved packing and shipping procedures. Unless spoilage losses can be held at very low levels, the produce will probably not be accepted in West Coast markets. Comparisons of gross returns in the two markets, West Coast (San Francisco) and Honolulu, were made disregarding spoilage losses even though this matter is still unresolved.

Based on estimates of net returns on the West Coast, tomatoes and bell peppers show the highest promise as winter export crops. Cucumbers and zucchini squash were less profitable. However, the question of post-harvest handling and subsequent market acceptance is yet to be answered. Currently, studies on the

^{10/} Baker, H. L. Molokai: Present and Potential Land Use. Land Study Bureau Bulletin No. 1, University of Hawaii, August 1960.

^{11/} Hawaii Crop and Livestock Reporting Service. Statistics of Hawaiian Agriculture, Hawaii Department of Agriculture, State of Hawaii, 1965.

effects of various methods of precooling selected vegetables are underway at the Hawaii Agricultural Experiment Station. It is hoped that the results will provide some economically feasible ways of extending the keeping quality of these vegetables. The increase in storage life may make substantial contributions to the feasibility of exporting vegetables during the winter months. But this alone will not be a sufficient condition for successful winter exports. Unless some suitable methods of pre-export treatment and handling such as fumigation and packing are found to ensure the arrival of high-quality vegetables on the West Coast, it appears that under the present conditions these vegetables should be produced for sale in the Honolulu market. A more complete evaluation of current export potentials for these crops, particularly tomatoes, will be made during the winter of 1965-1966.

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