Watermelons

PRODUCTION RESPONSES BY AREA
FOR FLORIDA WATERMELONS

by Suzanne L. Morris

Total United States production of watermelons was 22,606 thousand cwt. in 1980, of which Florida produced 7863 thousand cwt. (34.8 percent). The total value of United States production of watermelons was 149.2 million dollars in 1980. The value of the Florida watermelon crop was 46.5 million dollars, or 31.1 percent of the United States total. This indicates that the Florida watermelon industry supplies a major proportion of the total domestic U.S. market. For example, during the 1980 spring production season in the U.S., Florida produced 72.3 percent. The value of only the watermelons produced in Florida comprise 7.8 percent of the total value of the principal vegetables produced for the fresh market in Florida.

Production of watermelons occurs in nearly all of Florida's 67 counties. Florida is divided into four areas - west, north, central and south (see Figure 1). These areas match those currently in use by the Florida Crop and Livestock Reporting Service in recording annual production and acreage data for watermelons.

For all practical purposes, watermelons are harvested and shipped in the four month period of April, May, June and July. Shipping from all areas of Florida does not occur simultaneously because the planting dates vary so much in the state. South Florida watermelon farmers have the distinct advantage of usually being able to plant in December. The north and west areas usually do not plant until late February or early March.

Acres of watermelons planted governs the amount harvested and, hence, the value of the crop. Figure 2 compares the number of acres planted in each area of Florida, as well as the total acres planted. Since 1977, overall acreage has decreased and value (AVY) has increased (see Figure 3).

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Economic Model

Acreage of watermelons planted in Florida has varied considerably throughout the years. This figure ranges from the very highest amount, 98,000 acres planted in 1954, to a range from 65,000 acres in 1976 to 45,000 acres in 1980. Total production reached a peak of 990,000 cwt. in 1976. The figures vary so much because of the many different planting decisions that watermelon producers in each area of Florida have to make. This study presents a model of the Florida watermelon industry by area, and measures the quantitative relationships between watermelon production in each area and lagged economic factors.

Time series data were used in an ordinary least squares regression to estimate the relationship that the independent variables chosen had on the acres planted in that area of Florida.

The general model used was:

$$Y = B_0 + B_1X_1 + B_2X_2 + B_3X_3 \; (+B_4X_4)$$

(where B_0, B_1, ..., B_4 are the estimates of the model parameters).

The models specified:

Linear:

$$PR\_ = B_0 + B_1 \; PL\_2 + B_2 \; TC2 + B_3 \; AVM2 \; (+ B_4 \; TOTSH2)$$

$$PR\_ = B_0 + B_1 \; PL\_2 + B_2 \; RAVM2 + B_3 \; PPI2$$

Logarithmic (because it may be observed that the variables chosen have a curvilinear relationship (and thus, a constant elasticity) to production of watermelons):

$$LPR\_ = B_0 + B_1 \; LPL\_2 + B_2 \; LTC2 + B_3 \; LAVM2 \; (+ B_4 \; LTOTSH2).$$

$$LPR\_ = B_0 + B_1 \; LPL\_2 + B_2 \; LRAVM2 + B_3 \; LPPI2$$

Quadratic (because diminishing marginal productivity is observed in any production process):

$$PR\_ = B_0 + B_1\ PL\_2 + B_2\ AVM2 + B_3\ PL\_2sq + B_4\ AVM2sq\ (+ B_5\ PL\_AVM)$$

$$PR\_ = B_0 + B_1\ PL\_2 + B_2\ TC2 + B_3\ PL\_2sq + B_4\ TC2sq\ (+ B_5\ PL\_TC)$$

Where: PR (W,N,C,S) = total production sold

LPR_ = logged production

PL_2 = acres planted last year

LPL_2 = logged, lagged acres planted

AVM2 = average value for that month (price)

LAVM2 = logged, lagged price

TOTSH2 = shipments from states (lagged)

LTOTSH2 = logged, lagged shipments

RAVM2 = lagged real price = $\frac{AVM}{CPI}$

PPI2 = lagged producers price index

TC = total cost to produce the crop

TC2 = lagged total cost

Market Characteristics

While a production function describes an input-output relationship, the models specified here describe more what would influence the production of the crop. For example, in the last ten years, a substantial change in the shares of production between the producing areas in Florida has taken place. In 1979, the north Florida area alone accounted for 64 percent of the total harvested acres of watermelons in Florida, while west Florida, on the average, abandons 27 percent of the acres planted in that area.

The price that producers in Florida receive (P_y) varies directly with the time of season that the product goes to market. Prices for the first six weeks of the season (defined as beginning with the first week in April) are highly variable. After the sixth week, the price declines steadily, usually until July 4 (viewed as the season's end in Florida). The seasonal pricing pattern in Florida is mainly due to market competitors in other states and countries. The first early season melons usually bring higher prices than those shipped later in the season. They are harvested in the Immokalee-Lee area in early April. At this time, though, Texas and Mexico, South Florida's major competitors, have already established the dominant position in the market. As the season progresses, areas to the north come into production and shipments increase. In June, Florida consistently dominates the market. This is when the north Florida area, with the highest percentage of land in watermelons, begins harvest. This is also when Florida is competing directly with other producers in the southeastern U.S. who have a locational advantage to most of the eastern and midwestern markets. Although no information is available on the prices received by the specific areas in Florida, the April prices are good estimations for the south, as May prices are for the central area. Because Northern Florida comes into production in June, these prices can be used for that area, and July prices for West Florida.

Statistical Model

It is theorized that planting decisions are made on the basis of information from the previous year with expectations of trying to "do better this year." If the prices were high the year before, growers will tend to increase planted acreage and, thus, production (which causes the total value of the crop to decrease). For this reason, it is expected that the lagged price variable (AVM2), for each of the areas in Florida, is positively related to production in that area.

The acres planted in the previous year for each area (PL_2) is expected to be positively related to the amount produced in the present year.

Any costs of production would be negatively related to the dependent variable.

The variable included in some models to measure the effects of shipment from other states is TOTSH. This variable includes shipments from Texas, Mexico, California, Arizona, Alabama, Mississippi, Missouri, Georgia, South Carolina, and Virginia. It is hypothesized that the supply of watermelons from the competing states is negatively related to production.

Results

The models formed in this study estimated the historical relationships that determine the response of production of watermelons in the next year. The values from the statistically preferred models are as follows:

Production Response Equations

$$PRW = 11.53 + \underset{(.4834)}{.21\ PLW2} - \underset{(-1.86)}{.0065\ TC2} + \underset{(1.1415)}{1.21\ AVM2} - \underset{(-0.604)}{.0003\ TOTSH2} \qquad R^2 = .48$$

$$PRN = -4.74 + \underset{(4.8)}{.87\ PLN2} - \underset{(-1.48)}{.01\ TC2} + \underset{(3.5)}{7.17\ AVM2} - \underset{(-3.82)}{.00001\ TOTSH2} \qquad R^2 = .84$$

$$LPRC = 9.37 - \underset{(-2.428)}{.555\ LPLC2} - \underset{(-2.929)}{.42\ LTC2} - \underset{(-3.433)}{.59\ LAVM2} - \underset{(-3.826)}{.28\ LTOTSH2} \qquad R^2 = .88$$

$$LPRS = 1.72 + \underset{(2.465)}{.745\ LPLS2} - \underset{(-0.282)}{.1024\ LTC2} - \underset{(-0.522)}{.128\ LAVM2} - \underset{(-2.27)}{.125\ LTOTSH2} \qquad R^2 = .93$$

The numbers in parentheses are the t-test scores.

The models were chosen on the basis of the significance of the variables, and the amount of variation that is explained within the model. Points of production as a function of an input cannot be derived from these functions. The nature of the independent variables chosen serve to explain some of the characteristics of the producers in the different areas in the state.

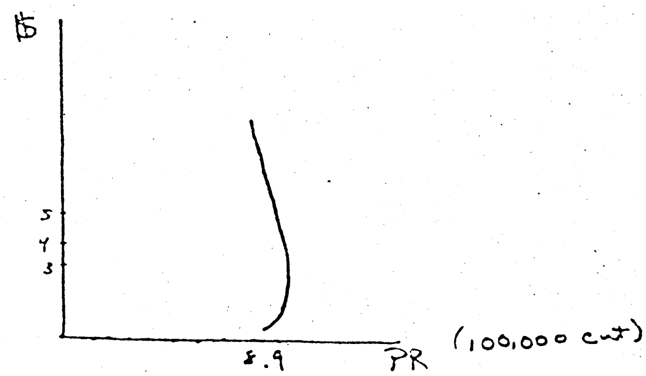
With the dependent variable being the production of watermelons in that region, the relationship that can be derived is a supply function. For example, the function in the south:

PRS = f (AVM / PLS2 TC2 TOTSH2)

An average for the variables held constant was taken and the intercept term was calculated using the base e = 2.712, such that the empirical equation is:

$$PRS = 2.712^{1.72} + AVM2^{.128} + 2.15^{.745} + 6.598^{-.1024} + 7.985^{-.125}$$
$$= 4.82 + AVM2^{.128}$$

Graphically:



This function is only the supply curve for the south. A supply curve for each area would have to be calculated, and thus an aggregate supply curve derived for the state of Florida. This endeavor was not undertaken because of the flaw which this author admits is present in the west, north and central models. Cost statistics were recorded from the D. L. Brooke publication, Costs and Returns from Vegetable Crops in Florida. The data for watermelons applies only to the Immokalee-Lee South Florida area. North Florida producers can generally operate at a lower cost. For example, in 1979, southern producers spent an average of $205.50 on fertilizer, while northern producers spent only $98.53. This explains why the total cost variable in the West Florida models was so significant, because the costs, in reality, are not quite as high. Data was not available to distinguish cost between areas. For this reason, the producers price index for production items was included in a model for each area. The results were similar, cost of production are insignificant in South Florida and significant in northern Florida.

From the results, it appears that the west, north and central farmers are most cost consciencious than the south producers. This is because the southern growers are almost always assured some net return from costs because of the high prices at the beginning of the season. The earlier they are sold, the more likely a producer is to get a better price. It is for this reason too that the price was relatively insignificant in the models for South Florida.

Profits for the southern producers can be accurately derived by the following equation:

Crop Sales - Total Crop Cost

Yield (cwt./acre) * AVM (per cwt.) - Total Cost (per acre)

For Example, in 1979:

$\$7.20/_{cwt.} * 231.961\ cwt./_{acre} - \$1308.00 = \$362.00$

($\$1670.00/_{acre}$) (net return per acre harvested)

Crop Sales can be calculated for the other areas:

West	90 cwt.	*	$\$3.40/_{cwt.}$	= $ 306.00
North	129	*	4.20	$ 541.80
Central	155	*	7.20	$1116.00

It was expected that revenues from West Florida be the lowest. A key factor when looking at this equation is "per acre harvested." It was noted earlier that West Florida abandoned an average (for years 1970-1979) of 27 percent of the crop. This explains the depressed revenues from that area. Further study can be undertaken to estimate the effect of abandoned acres on watermelon production. It would have a negative effect, especially in West Florida.

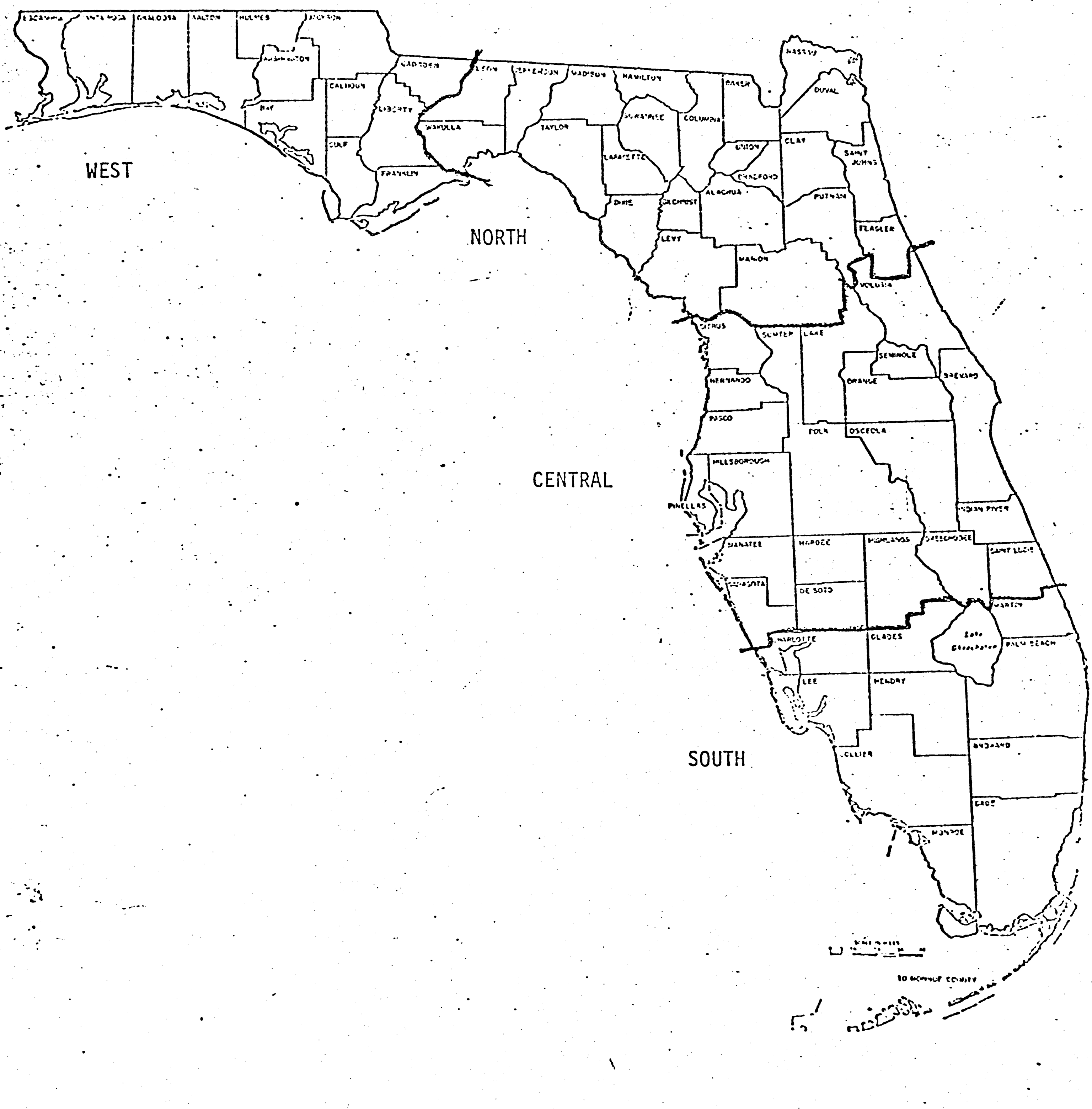
Further study can also be done with shipments from other states. The fact that the TOTSH2 variable was not significant in the west and north, but was very significant in the central and south, says that the producers in the south watch shipments (mostly from Texas and Mexico) more closely. Shipments from Georgia and South Carolina would probably be significant in the West Florida models.

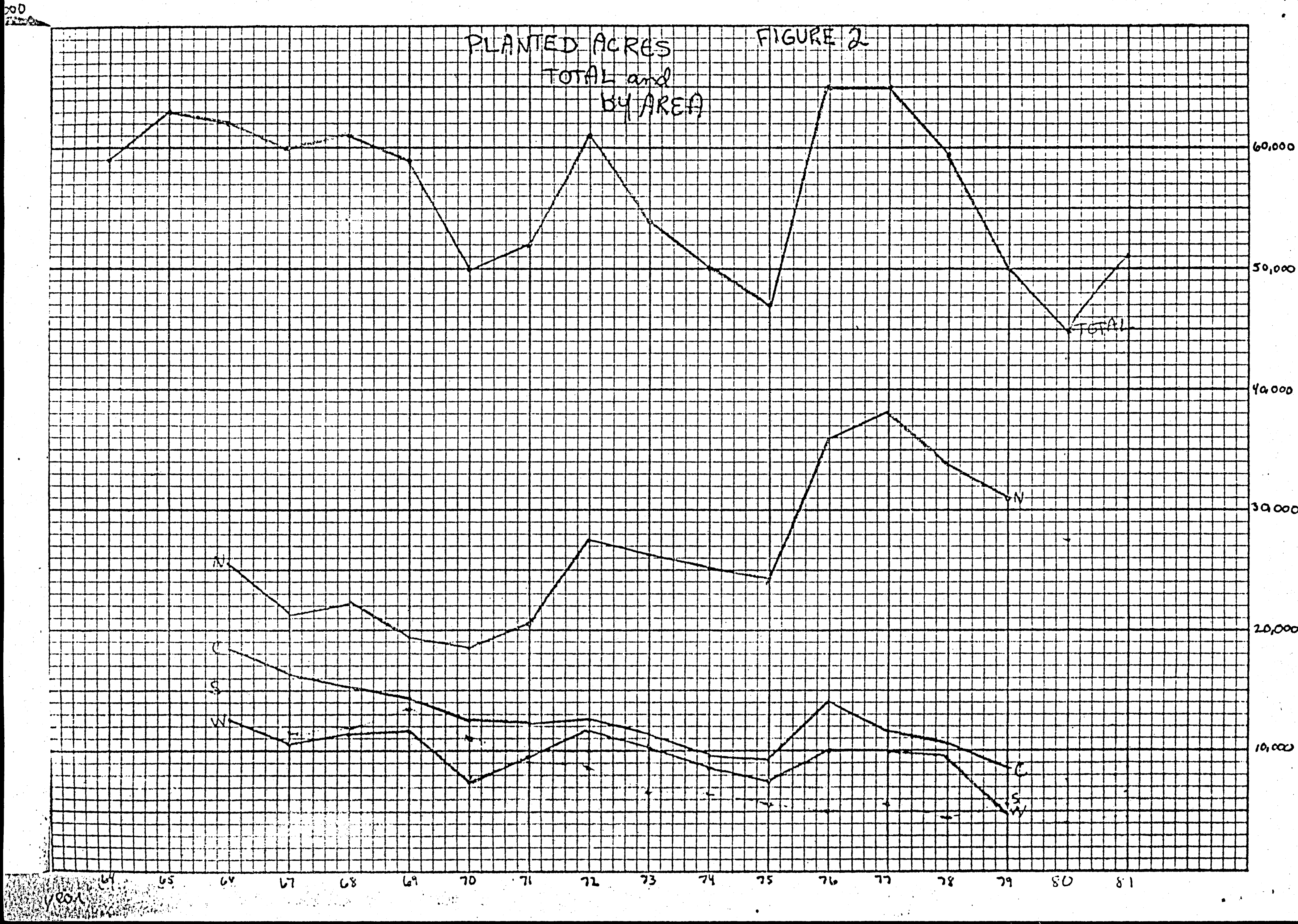
A dummy variable was put in for 1975 when the weather yielded an exceptionally good crop, and also for 1977 when there was a freeze. Now that tje 1980 Vegetable Summary is out, the data can include 1980 and another dummy be put in for the recent freeze. The freeze caused South Florida producers to sell their product at a later time, thus causing a downward pressure on prices for 1981. (1980 was not included because all the data necessary was not available at the time).

Conclusion

It can be concluded from the models considered that there are definite characteristics unique to the different producing areas of watermelons in Florida. This study could only be the beginning to mark the specific reasons and justifications for the different production patterns in each of the four regions in the state of Florida.

AREAS IN FLORIDA




PLANTED ACRES
TOTAL and
BY AREA
FIGURE 2
60,000
50,000
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year

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