planning for environmental betterment of the State. Some of us who have worked with the water element are not at all satisfied with that element that is now written.

It is also true that most of the people who worked on the agriculture element under the Comprehensive State Plan are not at all satisfied with it. There are several points of contention in both elements that may need to be looked into before any decision on adoption is made and put in effect.

We know from the experience that we have incurred in the last 10 years of working with the governments, Federal and State, that the horticulturists of tomorrow have got tremendous problems facing them, mostly brought on by government policy which is more restrictive than the economic policies that we have had to live with in the past. The permits, rules and regulations that we will contend with in the future will create problems that only the best of minds can exist with. We think it behooves all members of this Society to study the government *rules and regulations*, both State and Federal, and add our expertise in the decision making process if we are to be able to feed our society in the future.

Proc. Fla. State Hort. Soc. 90:363-365. 1977.

THE SUBTROPICAL VEGETABLE INDUSTRY OF DADE COUNTY

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Additional index words. boniatos, malanga, calabaza, yuca, cassava.

Abstract. **The emergence of the subtropical vegetable industry in Dade County has contributed an added dimension to the agricultural industry of the area. From a modest, cottage type industry supplying a decidedly local market to a large rapidly expanding segment of the county's agricultural economy the subtropical vegetable industry has faced, and is facing, problems common to any emerging industry. Acreage has grown from 3200 acres in 1970 to 10,600 acres in 1977 with a corresponding increase in value.**

For better than a half century the mention of Dade County agriculture conjures up visions of vast acres of fresh winter tomatoes, rows of pole beans, sweet corn, mangos, avocados, limes and a host of other vegetables and fruits that are grown in the winter months. These crops are still of major importance to the agricultural economy of Dade County but a new industry is rapidly emerging as a major addition to the total value of agriculture. This addition is the subtropical vegetable industry. While new in terms of Dade County, subtropical vegetables have been grown for centuries in other parts of the world. The subtropical vegetable industry was first given the name Cuban vegetables since the majority of the farmers so engaged were from the Cuban sector of the county's population. In subsequent years the industry was called the Latin vegetable industry to more nearly reflect the fact that these particular vegetables were certainly not exclusively Cuban or even Cuban grown. An expanded title was needed when it was finally realized that the vegetables that are included in the industry grow worldwide in the subtropical regions. Thus by usage the Cuban-Latin vegetable industry has been renamed the subtropical vegetable industry to truly reflect the fact that these crops are grown throughout the subtropical regions of the world.

Perhaps there has alwas been a segment of the population of Dade County that grew subtropical vegetables for home and local use. Certainly there have been families of Latin extraction who have resided in the county and no doubt desired the types of food that they were accustomed to in their native lands. However a major impact was not felt until the late nineteen sixties or early seventies. The first acreage report for subtropical vegetables listed only 3200 acres so it was possible that there had been 1000 acres or more in prior years that were not identified and were widely dispersed throughout the county. This first report, given in the 1970 Dade County agricultural values bulletin, showed only estimated acreages and values. In the estimate for 1976-77 there are 10,600 acres of subtropical vegetables in the county. This is a 231% increase in only 6 years.

Subtropical vegetables is rather a broad, all encompassing term for crops grown in the subtropical latitudes of the world. Specifically in Dade County we have 4 major subtropical vegetable crops with a few potential, though minor species. The major crops are: boniatos, malanga, calabaza and yuca.

Malanga

The malanga (*Xanthosoma caracu* Koch and Bouché) is a member of the Araceae family and according to some researchers (3, 5) gives rise to a great deal of taxonomic problems. For years it was assumed that the malanga in Dade County was *X. sagittifolium* (L) Schott but recent articles (3) indicate that this designation is not correct. For our purposes and to avoid conflict with taxonomists we can consider the malanga on the basis of its use as a root crop without regard to the species conflict. It is important however to consider the genus *Xanthosoma* since there is a similar root crop grown in Dade County that resembles the malanga very closely. This other crop is the dasheen or taro (*Colocasia esculenta* Schott). A comparison of the 2 reveals the difference in leaf structure (2, 3). There is little confusion among the Latin growers regarding these 2 distinct root crops mainly because very little taro is grown in Dade County. Also the dasheen can be grown on lower, wetter soils than malanga and at further extremes of the subtropical zone.

Currently there are 4100 acres of malanga grown in Dade County. The individual units range in size from less than 1 acre to a few plantings of as high as 200 acres in one block. The average acreage per unit would be in the neighborhood of 3-5 acres.

Malanga, also called cocoyam in other parts of the world, (1) has a central corm that is surrounded by smaller tubers called cormels. These cormels are potato-sized and are the parts of the plant used for food. In other areas partial harvesting is done by leaving the plant in the ground and picking individual cormels as they reach the preferred size. In

Dade County however the tops are cut off and the entire crop of cormels is harvested by hand. Hand harvesting is beginning to give way to mechanization as more growers are utilizing machines to loosen the soil and uncover cormels to be hand placed in picking crates. One large grower is contemplating a completely mechanical harvesting technique and has arranged for the equipment.

Currently in Dade County malanga is grown both on the marl soils and the rock soils with the predominant acreage being on rock. This is due to the competition with potato growers for a limited amount of marl soils.

Malanga yields in Dade County vary widely with respect to the type of soil they are grown in and do not seem to approach the yields obtained in other areas of the world. On the rock soils where the majority of the acreage is grown the yield is 10,000 to 16,000 lbs. per acre. On the marl soils yields of 20,000 lbs. per acre can be obtained. In some areas of the world yields of 12-24 tons of cormels per acre have been reported (1). The reasons for our lower yields are not fully understood and a great deal of research on improved varieties, fertility requirements, pest problems, weed control, spacing and the physiology of the plant itself needs to be done. Superior varieties could be selected for their nutritional and yield characteristics.

Based upon an average yield of 12,000 lbs per acre,[1] which approximates the yield on rock soils, and an average price of $5.00 per 50 lb. sack the total value of malanga on a gross return to grower basis is $4.9 million for the crop in Dade County. Naturally due to a Latin population in excess of one half million people, a major market exists within the county. There is, however, a significant amount shipped to other areas with a Latin population such as New York City and Tampa. In addition there have been some exports from Dade County to Puerto Rico and other Caribbean countries.

Malangas are harvested into field boxes that hold 50 lbs. They are transported to packing houses and after a rudimentary grading are shipped in 50 lb. sacks. For the most part malangas are not washed although there has been a gradual trend toward washing.

The rapid rise in malanga acreage will apparently continue. Prices have been favorable, marketing problems are being solved and more Latin growers are either entering farming or expanding their operations. The future looks good for malangas as research is being initiated that will help solve many of the production problems.

Boniatos

Boniatos (*Ipomoea batatas* (L) Lam.) are grown throughout the tropics for their edible tubers (4). Most of you will recognize the generic name as the sweet potato which is widely grown in North Carolina, Louisiana and other states.[2]

In Dade County boniatos are considered with malanga and other subtropical crops due to the fact that they are grown almost exclusively by Latin growers much as they were in Cuba.

It is estimated that there are approximately 5000 acres of boniatos planted in Dade County with the individual unit size being somewhat larger than with malanga. That is there are more large plantings of boniatos (50-100 acres) than there are of malanga which causes the average size unit to be 5-10 acres.

The average growing season for boniatos is 150 days although it is common practice to harvest whenever the tuber is of a size that can be sold. This leads to problems, however, when tubers are essentially stored in the ground while awaiting favorable prices. Larger tubers than desired, decay and extensive insect damage all combine to negate some of the supposed advantages of ground storage.

Like malanga, boniatos are grown much as they are in Cuba. Very little in the way of variety selection, fertility requirements, insect and disease control, and post harvest treatment is known for Dade County conditions. Certainly there is extensive research on sweet potatoes and quite possibly much of this research could be adapted to the situations encountered in Dade County. As with all of our Latin grown subtropical vegetables, research needs only became significant when the industry grew to a size that justified the expenditure of funds.

Yields have been rather sporadic which could be attributed to inconsistent variety selection. Growers will plant all of the slips they harvest rather than selecting superior clones and increasing them in beds. Average yields are approximately 5 tons per acre in Dade County which is significantly less than the reported 8 tons per acre in North Carolina and elsewhere (4).

Based on average yields and an average price of $4.00 per 50 lb. sack the total value of the boniato industry in Dade County is $4 million. Prices have fluctuated greatly on the Miami market ranging from $.99 per 50 lb. sack to over $10 per sack currently.

Calabaza

The calabaza (*Cucurbita moschata* (Duch. ex Lam.) Duch. ex Poir) is a member of the Cucurbitaceae family that tolerates hotter conditions than other members of the family (4). As such it is the most widely grown species of *Cucurbita* in the tropics. It is called "Cuban pumpkin" or "Cuban squash" in Dade County.

At present there are approximately 1300 acres of calabaza grown in Dade County. Yields are not as good as they potentially could be due to a lack of good varieties, insect and disease problems and the need for more production knowledge. The current yields are 3 tons per acre with a potential yield of 5 tons per acre under optimum conditions. Given average yields at an average price of $4.00 per 50 lb. sack the value of the calabaza crop in Dade County is $624,000.00.

Due to widely fluctuating prices and a general lack of understanding about how to use the calabaza in cooking, except by Latins, the calabaza acreage is predicted to remain relatively stable or decrease slightly.

Research at the Agricultural Research and Education Center—Homestead on calabaza is being conducted by Dr. Ray Volin. It is hoped that a superior, high yielding, disease resistant variety can be obtained to increase its profitability.

Yuca

Yuca (*Manihot esculenta* Crantz) also called cassava, manioc or tapioca (4) is the fourth major subtropical vegetable crop grown in Dade County. There are currently 200 acres of yuca planted which is down from 500 acres a year ago. The freeze in January 1977 reduced the available planting material which along with slackened demand resulted in the decreased acreage.

The root tubers are the part of yuca that is used for food. In Latin cooking the tubers are boiled and served with onions and a sauce. It is interesting that in many Cuban

[1]For metric equivalents see the Table near the front of this Volume. Ed.

[2]The *most obvious* distinction is that boniatos are white fleshed rather than yellow or orange as for the sweet potato. Ed.

restaurants the yuca is preferred as a vegetable to the more extensively grown malanga. As the synonyms imply yuca is also used throughout the tropical regions as a source of starch and in the production of tapioca.

Yields are variable with an average of 5 tons per acre. Based on an average price of $6.00 per 50 lb. sack the value of the yuca crop is $240,000.

As in the other crops, much work needs to be done on variety selection, production techniques, insect and disease control and post-harvest problems.

Summary

The subtropical vegetable industry of Dade County has grown rapidly in the last six years both in size and in value. Acreage has increased from 3200 acres in 1971 to 10,600 acres in 1977 while farm values for these crops have risen from $1.9 million to $9.7 million. As Latin farmers and others begin to solve many of their production and marketing problems it is anticipated that the industry will continue to expand. Vitally needed research has been started and as this research becomes available improved varieties and production techniques will be utilized to further increase the value.

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Proc. Fla. State Hort. Soc. 90:365-367. 1977.

EFFECT OF CULTIVATION ON CABBAGE YIELD AND HEAD WEIGHT[1]

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Additional index words. cultural practices, root pruning, *Brassica oleracea* var. capitata L.

Abstract. **Combinations of sweep sizes and cultivation depths were used to study the effect on marketable weight, average head weight, and percent marketable heads cut at first harvest over 3 seasons of cabbage grown in 'flat' culture. Plots receiving one cultivation with a rolling cultivator approximately 2 weeks after transplanting had a higher average marketable weight and average head weight than the other nine cultivation treatments studied. Cultivating to a depth of 4 to 5 inches with combinations of 22, 18, and 8-inch sweeps reduced the average marketable weight per plot and the average head weight. Cultivating deep with wide sweeps tended to reduce the percent marketable heads. Lowest yields were obtained when the combination of 22 and 18-inch sweeps were used to cultivate throughout the season.**

Cultivation of vegetable crops is an old and well established practice. However, there is a great deal of misconception as to the benefits from cultivation. Some of the benefits given are: weed control, conservation of moisture, increased aeration (favoring nitrification) and increased absorption and retention of heat (6).

Cabbage has an extensive shallow root system that fills the soil to the surface at an early stage of development (1, 8, 9). About the time the heads are two-thirds mature, the roots may spread laterally for 3.5 feet. A mature plant may draw upon more than 200 cubic feet of soil for water and nutrients (9). The fibrous roots are found chiefly in the upper layer of the soil. Disruption of this root system by cultivation will have an effect upon the plants ability to take-up water and nutrients.

Studies on cultivation of cabbage have established that the most important benefit derived is from weed control (2, 3, 4, 5, 7, 9). Only minor differences were found between no cultivation and cultivation in moisture content of the soil, soil temperature, and nitrification (3, 5, 7).

The objective of this study was to determine the effect of the common practice of using wide sweeps at a depth of 4 to 5 inches throughout most of the growing season on cabbage yield and average head weight.

Materials and Methods

Three plantings of cabbage were made on Manatee and Myakka (formerly mapped as Leon) fine sand to investigate the effect of sweep size, cultivation depth, and frequency of cultivation on marketable yield and head weight.

A soil fumigant was applied 6 weeks prior to transplanting for nematode control. A broadcast application of 500 lb/acre of a 5-5-8 fertilizer was applied and disked in before transplanting. Two additional applications of 500 lb/acre of a 5-5-8 and one application of 500 lb/acre of a 10-4-10-3 fertilizer were applied as a side placement on 13, 31, and 42 days, respectively, after transplanting. The November and December plantings received an additional fertilizer application of 500 lb/acre of a 5-5-8 on the 57th day after transplanting. This was due to apparent slow growth related to cold weather.

The cultivar, 'Little Rock', was transplanted on February 12, 1976. The cultivar, 'Market Prize', was transplanted on November 16 and December 13, 1976. A "flat" culture method of growing the cabbage was used with rows 30-inches apart and plants set 12 inches apart in-the-row.

Cultivation treatments when applicable, followed one day after side placement of fertilizer to aid in its incorporation. All plots were cultivated with a rolling cultivator two weeks after transplanting. On the 32nd day 22-inch, 8-inch, or no sweeps were used to cultivate the plots. Plots (treatments) 2, 3, 4, and 9 were cultivated to a depth of 4 to 5 inches. Plots 5, 6, 7, 8, and 10 were cultivated to a depth of

[1]Florida Agricultural Experimental Station Journal Series No. 833.