PROCEEDINGS

OF THE

CARIBBEAN FOOD CROPS SOCIETY

FIFTH ANNUAL MEETING

PARAMARIBO, SURINAM

JULY 24 – 31, 1967

VOLUME V

Druk. : Leo Victor

The influence of the time of planting on food crop production in Puerto Rico — George Samuels

INTRODUCTION

To the tourist visiting Puerto Rico from temperate climates, it seems rather inconceivable that with our mild tropical climate we should not be able to produce high yields of food crops all the year round. In temperate climates, food crop production is limited in most places by freezing winter temperatures, whereas in Puerto Rico, our mean daily temperature varies from but 73.2°F. in February to 80.0° in August. Yet, this small difference in temperature plus small differences in daylength are sufficient to cause large variations in yields of food crops during the year.

The Puerto Rican farmer is not necessarily concerned with temperature nor daylength difference when he plants his food crops. He has learned from experience to plant his crops at various times of the year. Many of the planting dates used are based on sound practical reasons of both climate and economics. However, data are not always available for the influence of planting dates on yields when irrigation or agronomic techniques can be brought into use. The knowledge of variation of yield with planting season is also needed for planning in the canning or freezing of food products as well as for the fresh market.

This paper on the influence of time of planting on food crop yields has made use of data from the Seeds Farms Division of the Agricultural Experiment Station, University of Puerto Rico as well as from specific experiments done by the Station on time of planting.

CLIMATE

The climatic picture associated with the various seasons is presented in figure 1 to help in the interpretation of the variation of yield with time of planting. The climatic data used are from the Rio Piedras area of Puerto Rico which is located on the north-central coast and is rather representative of the areas where the food crops were planted.

The possible hours of sunshine of daylength varies from a low of 11 hours and 3 minutes in December to a high of 13 hours and 12 minutes in June or a difference of 2 hours and 9 minutes.
Rainfall is highest in the summer months with a peak of 9 inches in August decreasing to the lowest value of 2.6 inches in March with the drier months from January to April. There is usually a sharp increase in rainfall in May.

Temperatures are a their highest from June to October where average daily temperatures range from 79° to 80°F. and then drop to a low of 73° in February. Minimum daily temperatures reach a low of 63.1° in February, and a high of 71.3° in July. Maximum daily temperature is also lowest in February with 82.9° and highest in August with 88.9°F

These climatic factors combine to produce a rather dry and slightly cool winter with shorter daylength followed by still dry spring until May. The summer is highest in rainfall as well as temperature and daylength. The fall still has good rains and high temperatures. but daylength begins to shorten.

RESULTS

Corn

Highest yields of Mayorbela field corn were obtained with planting dates in April with lowest yields in June to December (figure 2). April plantings allowed the corn to grow through the longer days as well as receive good rainfall and yet, not the highest temperatures. McClelland (3) noted that native corn exposed to 15 hours of daylight instead of 10 tasseled quite late with consequential increases in vegetative growth and less number and size of ears. Whyte (7) cites the approximate climatic requirements for high yields of corn are summer temperatures of 75°F. with night temperatures of 58° and a growing season of 140 days.

Corn varieties are usually developed to adjust to the daylength characteristics of particular latitudes. In general, the shortening of daylength from that to which a variety is adopted results in earlier flowering and decreased leaf area and more ears. The reverse of this feature can be made use of when choosing corn varieties for use as fodder or silage, by using short daylength varieties in longer daylength areas to obtain excess leafage.

Cucumbers and Tomatoes

Cucumbers and tomatoes responded rather similarly in regards to time of planting in yields with highest yields obtained with October-December plantings and lowest with summer plantings (figure 2). Tomatoes tended to show a narrower range for response than did cucumbers. Winter plantings of cucumbers and tomatoes allowed these plants to develop under conditions of shorter daylength, lower rainfall, and lower temperatures. These conditions appear to be more conducive to higher yields under local conditions.

Went(6) has shown that the tomato is photoperiodically indifferent, but sensitive to variations in day and night temperatures. For best growth and fruit set, the day temperature should be 78°F. and the night temperature 59—65°. The cool period for optimum development is effective only in darkness or least in greately reduced light. Since no fruit set is possible above 72°F., tomatoes do not bear fruit during hot spells in summer even though day temperatures are within the rather wide range of possible growth of 59—95°F. Breeders can and are developing varieties that set fruit with higher night temperatures.

It can be seen that low tomato yields in summer for Puerto Rico, are due in part to the poor set caused by high night temperatures over 70°F. from June to September. However, rainfall must also be considered. The heavy summer rains at times cause physical damage to the young seedlings. Also the high moisture and temperatures are conducive to many disease problems for both tomatoes and cucumbers. These same problems are not as prevalent for the drier winter planting months.

Pigeon Peas

Highest yield of pigeon peas (**Cajanus cajan**) were obtained with April plantings (figure 3). Riollano et al. (4) obtained 45 hundredweights per acre of peas with an April planting, 25 in June, and only 2 with and August planting. The pigeon peas is photoperiodic and generally blooms

and produces a crop during the months of December to February regardless of season of planting. Thus planting in April when rains are adequate allow sufficient time for the plant to grow before flowering occurs and higher yields can be obtained. The height of the plant can be controlled by time of planting. This fact may be of advantage for more efficient picking of the crop by hand or machine.

Soybeans

Soybeans planted in June—August gave highest yields (figure 3); whereas, winter plantings produced lowest yields.

Experiments on influence of daylength on soybean production by the Agricultural Experiment Station, University of Puerto Rico (1) showed that as daylength increased from 7 to 18 hours dry weight of the total plant increased. Daylength avove 11 hours produced poor flowering with no pods.The response of soybeans to differences in daylength permits the farmer to time his planting. For forage use, plantings are made so that growth occurs during the longer days of summer; for grain, the soybeans can be planted during the summer to make use of the shorter winter days for highest grain yields.

Whyte (7) reports experiments in which the oil content of soybeans as substantially increased by increasing day temperatures from 70 to 85°F.

White Beans

The yield of white beans (**Phaseolus vulgaris**) is highest when planted in February—April, then it decreased sharply with May—July plantings (figure 3). The response of time of planting for white beans and pigeon peas is similar for highest yields. Whyte(7) states that the peas respond to a long daylength period for highest yields.

Pineapples

Pineapple yields varied with the planting season giving highest yields when planted in January and April—June (figure 4) However, in February and March plantings low yields were obtained similar to those made from October—December. Van Oberbeek(5) in his studies of flowering in pineapple found that floral initiation occurs in November which corresponds with shortest daylength. Experiments with the Red Spanish variety also revealed that flowering could be initiated earlier by low night temeratures similar to the winter temperatures of 60—62°F. Pineapple growers use chemical methods to control flowering of pineapples on a commercial scale. Initially, acetylene and ethylene were used, now naphthaleneacetic acid, 2, 4-D, and BOH can be used to force flower initiation.

White Potatoes

High yields of white potatoes were found with winter plantings of December—February and lowest yields with summer plantings (figure 4). McClelland (3) studied the effect of daylength on several varieties of white potatoes in Puerto Rico and found that 10 hours of daylight gave siginificant increase in yield as compared to 15 hours for all but one variety, Red Bliss.

Driver and Hawkes (2) cite that the best conditions for maximum vegetative activity are long, warm days of moderate light intensity;

whereas for stolon growth suited for production of tubers, short-day conditions are best. As daylength decreases, ability to utilize the products of photosynthesis for growth decreases more rapidly than the decrease in photosynthetic activity. There is thus a large surplus of available carbohydrates, and tuber formation is consequently much increased. Total yield, however, depends on total available carbohydrates; it may happen that highest yields are obtained under long-day conditions in which, although the proportion of available carbohydrate is low, the plants are so large that the total carbohydrate available may be greater than from the smaller though more efficient short-day plants.

Sweet Potatoes

The sweet potato gave highest yield when planted from about July through February. Low yields were obtained only in March to June plantings (figure 4). The time of planting for low yields places the growth of the plant during the lower rainfall and temperature months as well as longer daylength.

SUMMARY

The time of the year a crop is planted affects not only the germination of the plant, but its growth, maturity, and quality. Cucumbers, tomatoes, and white potatoes gave lowest yields when planted from March to August and highest when planted in the cooler and drier late fall and and winter months. Corn produced lowest yields in May to November plantings with highest in April plantings. Unlike white potatoes sweet potatoes had lowest yields in March to June plantings. White beans were similar in response with lowest yields in May to September.

Pigeon peas and soybeans were somewhat opposite in their responses to time of planting with the former having a peak yield with March plantings while the latter did best in June to August plantings.

Temperature, daylength, and rainfall were discussed as factors influencing the response of these crops to time of planting in Puerto Rico

LITERATURE CITED

1. Anonymous, Annual report 1943—44, Puerto Rico Agr. Exp. Sta., p. 48, 1944.
2. Driver, C. M. and Hawkes, J. G., Photoperiodism in the potato. Cambridge Imperial Bureau of Plant Breeding and Genetics. Communication N. 10, 36 pp., 193.
3. McClelland, T. B., Studies of photoperiodism of some economic plants. **J. Agr. Research** 37 (10) 603—28, 1928.
4. Riollano, A., Pérez, A., and Ramos, C., Effects of planting date, variety and plant population on the flowering and yield of pigeon peas, J. **Agr. Univ. P.R. 46** (2) 127—34, 1962.
5. Van Oberbeek and Cruzado, H. J., Note on flower formation in the pineapple induced by low night temperatures. **Plant Physiology 23:** 282—85, 1948.
6. Went, F. W., The Experimental Control of Plant Growth, Chronica Botanica Co, Waltham, Mass. 343 pp., 1958.
7. Whyte, R. O., Crop Production and Environment. Farber and Farber, London, 392, pp., 1960.

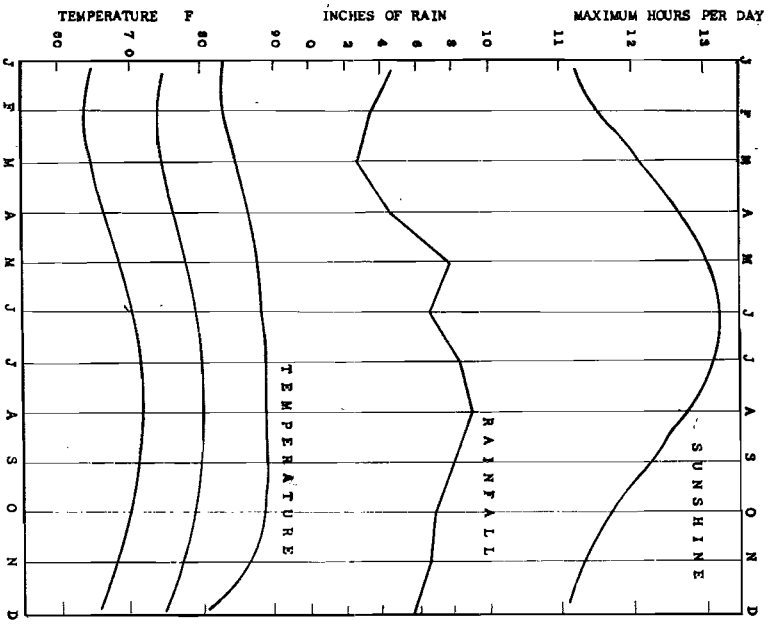

Fig. 1. Climatic data for Rio Piedras, Puerto Rico

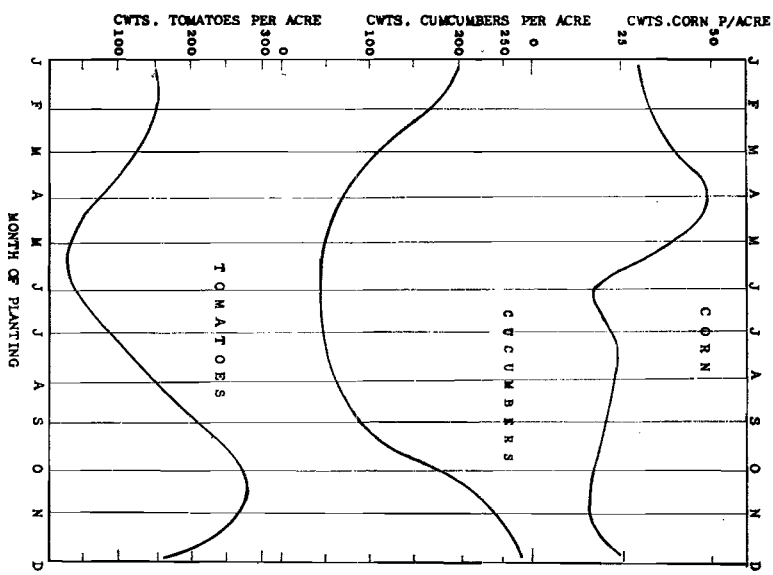

Fig. 2 The influence of time of planting on yields of corns, cumcumbers, and tomatoes.

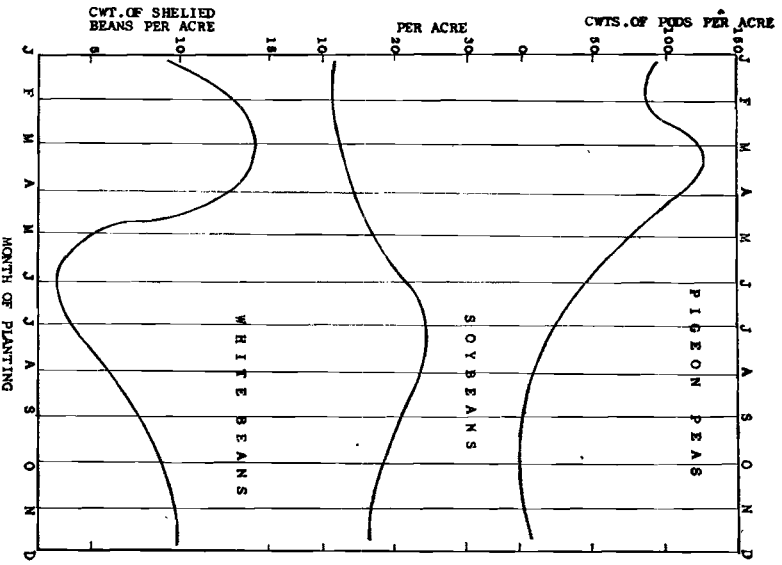

Fig. 3 The influence of time of planting on yields of pigeon peas, soybeans, and white beans.

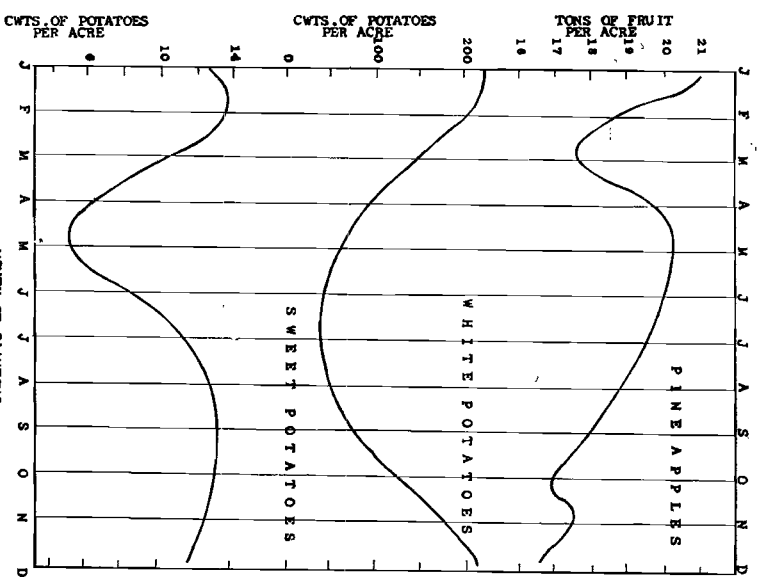

Fig. 4 The influence of time of planting on yields of pineapples, white potatoes and sweet potatoes.