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FIELD EXPERIMENTS ON YAMS IN BARBADOS  
1965-66

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ABSTRACT

The yam (*Dioscorea alata*) is a staple, low priced carbohydrate foodstuff in Barbados and currently some 15,000 tons are produced annually as a catch crop from land which is in preparation for sugar cane. An export trade has been started, which has considerable potential.

Planting of yams has hitherto normally been at 5 ft. x 5 ft. (25 sq. ft. per plant), the same as for sugar cane, but experiments in the 1965-66 season have clearly demonstrated that on a wide range of soils and under a range of rainfall conditions, closer spacing would give higher yields per acre. In fact, no competition between plants could be detected until the territory per plant was reduced to 15 to 20 sq. ft.: at higher planting densities the yield per plant and the size of tubers was diminished (the smaller, better-shaped tubers resulting were more desirable for export), but the yield per acre increased within the range of the experiment, i.e. 1,400 to 8,000 plants per acre. In commercial practice it appeared that anywhere in Barbados a density of about 3,500 plants per acre would be practicable for preparation land and would give substantially higher yields than are currently obtained.

Comparisons of cultivars showed that Puerto Rican Buck Yams, cultivar Barbados (from Trinidad) and Grenada Hunt all gave yields comparable with the commonly grown Crop Lisbon yams.

Growth studies showed the general trend of development of the aerial parts and tubers; particularly notable was the very rapid rate of bulking of the tubers between the 26th and 36th weeks from planting - lending strong support to the planters' contention that yams should be planted in May.

INTRODUCTION

The tubers of the yam plant (*Dioscorea alata*) are one of the most important of the staple carbohydrate foods in Barbados. Some 15,000 tons are annually produced from about 500 acres, and are sold, ex-field at 3-4 cents per pound. Recently an export trade requiring 1,000 to 2,000 tons annually has been started. The most popular cultivar is the so called Crop Lisbon or White Lisbon; several other types are grown in small quantities but are reported to give substantially lower yields and in some cases to be more difficult to harvest: on the other hand the Crop Lisbon is poorly shaped with clusters of "toes" making it wasteful to prepare in the kitchen and difficult to pack for export.

Yams are exclusively grown in land that is being prepared for sugar cane. In those areas of sugar lands that are to be replanted the land is ploughed as soon as possible after the canes are cut, April or May, and ridged or cane holed. Yams are then planted between the cane holes on the banks, or on the ridges, usually towards the end of May: the spacing between yam plants is commonly 5 ft. x 5 ft. The canes are planted in October/November, between the now well developed yam plants. The main harvest of the yams is in January/February.

The need to increase Barbados' food production on her limited acreage triggered investigation on yam production designed:

(1) To ascertain the maximum potential of this crop under the different soil and rainfall conditions in different parts of Barbados.

(2) To obtain information which would lead to the development of planting and fertilizer treatments which would enable a substantial yield increase to be obtained, without losing the advantages of the present system of growing yams in cane land.

(3) To obtain some preliminary information about relative yields of certain selected cultivars.

(4) To obtain basic information about the pattern of growth of the yam plant.

#### 1 and 2 - Potential of the Crop and Fertilizer Treatments

It seemed that the usual spacing of 5 ft. x 5 ft. was probably excessive, and in any case the use of this same spacing could hardly be justified at all localities in an island where the annual rainfall ranged from about 40 inches to over 80 inches. Rainfall records were kept at all localities.

#### RESULTS

In all cases increasing planting density was accompanied by:

- (a) Increase in yield per acre
- (b) Decrease in yield per plant
- (c) Decrease in tuber size;

but while the increase in yield per acre was shown throughout the range of plant spacings, the decrease in yield per plant and tuber size did not appear until the territory occupied by each plant had come down to about 16 sq. ft. (about 2,700 plants per acre). Figure 1 shows a typical result for an intermediate rainfall estate, Edgumbe. This indicates that at spacings wider than this 2,700 plants per acre the yam plants are not even in competition with each other.

Six localities were selected representative of the six major soil types and ranging from the wettest to the driest areas of Barbados. The following spacing treatments were used:

TABLE I YAMS 1965-66

## PLANTING DISTANCES

Plot	Distance between ridges	Distance between plants	Approx. area per plant (sq. ft.)	No. of plants per acre
A	2 ft. 6 ins.	2 ft. 0 ins.	5	8,700
B	5 " 0 "	2 " 0 "	10	4,350
C	5 " 0 "	3 " 0 "	15	2,900
D	5 " 0 "	4 " 0 "	20	2,200
E	5 " 0 "	5 " 0 "	25	1,750
F	5 " 0 "	6 " 0 "	30	1,450
G <sup>(1)</sup>	5 " 0 "	5 " 0 "	25	1,750

(1) The G plots were not ridged but dug in cane holes at 5 ft. x 5 ft.

Fertilizer treatments were the following:

- Just after sprouting (about 7 weeks):  
2 cwt. superphosphate (21%  $P_2O_5$ ) + 1 cwt. muriate of potash per acre.  
At "second spires" (about 3 months):  
2 cwt. sulphate of ammonia per acre.
- As (1), except that 2 cwt. of muriate of potash were used instead.
- Plot size was 20 ft. x 40 ft.

The actual yields at the different localities were very different (the maxima for each locality are shown in Table II). Comparison of these with the rainfall during the growing period showed that there was a relationship, though a complex one. It was found that the rainfall in the period May to November was particularly important, and the effect of soil evaporation in the eight weeks following sprouting was critical.

TABLE II. YAMS 1965-66

## MAXIMUM YIELDS AT THE DIFFERENT LOCALITIES

Lion Castle	34,500 lbs.
Greenland	24,500 lbs.
Edgecumbe	22,600 lbs.
Farm	18,900 lbs.
Waterford	16,500 lbs.
River	1,540 lbs.

In a completely separate experiment, set up by a local planter in a field planted at the normal 5 ft. x 5 ft. one acre was planted at 5 ft. x 2 ft. 6 ins. Harvest results were as follows:

TABLE III. YAMS 1965-66

## ROWANS SPACING EXPERIMENT

Spacing	No. of plants per acre	Average Wt. of tubers per plant (lb.)	Average Wt. per tuber (lb.)	Yield per acre (lb.)
5'0" x 5'0"	1,740	7.8	1.9	13,600
5'0" x 2'6"	3,480	6.9	1.4	24,000

The general conclusion from the various experiments was that the Crop Lisbon Yam could yield up to at least 16 tons per acre of tubers under reasonably favourable conditions - though

these conditions occurred in only limited areas of the island. In practice, taking into account the increasing number of small yams at higher spacings, commercial planting anywhere in the island at about 3,500 per acre instead of the currently used 1,740 should be quite feasible and should very substantially increase yields and profits. (Further trials on this basis are now underway).

3. The experiments comparing the yields of certain cultivars were straightforward comparisons in adjacent plots; there was insufficient planting material for more elaborate layouts. However, it is still thought worth including these results for the record (Table IV).

#### 4. Growth patterns

In combination with another fertilizer trial growth measurements were made on samples from each treatment. These measurements included:

- Area of ground covered
- Length of main stem
- Total length of all stems
- Number of leaves
- Total area of leaves
- Leaf area index (i.e. area of leaves divided by the area of ground covered, a measurement of the extent of overlap of the leaves)
- Total fresh weight of shoot system
- Dry weight of shoot system
- Fresh weight of tubers
- Dry weight of tubers

In addition a record was kept of day to day rainfall.

From these several sets of data a picture of the growth of the plant emerged, though no difference due to fertilizing were detected due mainly to limitations of sampling.

In general development was as follows:

(i) The shoot system developed very slowly for the first eight weeks, but then grew with increasing rapidity to the 30th week after planting, subsequently dying back quite sharply. Second spires i.e. new shoots emerging from below ground appeared at 10-12 weeks.

(ii) Tuber initials appeared at about 10 weeks as small hard 'buds' on the old tuber at the base of the shoots; from these incipient tubers grew the new shoots that formed the second spires.

TABLE IV. YAMS 1965-66  
COMPARISON OF CULTIVARS

Locality :	Type of yam :	No. of plants : per acre :	Yield per plant : (lb.) :	Yield : per acre : (lb.) :
Waterford	Puerto Rican Buck	5,130	3.3	17,060
Waterford	Crop Lisbon	6,380	2.8	16,500
Waterford	Barbados	2,830	4.2	11,770
Waterford	Crop Lisbon	2,400	4.4	10,800
Edgecumbe	Grenada Hunt	2,300	4.4	10,260
Edgecumbe	Crop Lisbon	2,210	5.8	12,800

(iii) Bulking of the new tubers did not start until about the 22nd week and was extremely rapid after the 26th week up to the 36th week, during which period the tubers put on about 80 grams dry weight per plant per week. At the 36th week the yams were harvested.

(iv) The general dying back of the shoot system after 30 weeks was associated with a cessation in growth of the stems and a reduction in the number of leaves. (A well grown yam plant at 30 weeks has a total stem length of some 220 feet and about 500 leaves; one plant had a total stem length of 410 feet and 632 leaves).

(v) The leaf area index rose rapidly to 2.7 by the 16th week and then remained very steady until the 26th week, subsequently falling rapidly owing to the loss of leaves. Assuming that loss of efficiency does not occur until the leaf area index exceeds 3.0 none of the several hundreds of measurements taken in the course of the current experiments suggests that yam plants, spaced at 5 ft. x 5 ft., trailing on the ground, lost photosynthetic efficiency by mutual shading of the leaves.

The above outlines some of the field experiments undertaken on yams in 1965-66. The first year of such experiments can, of course, never be conclusive, but they do at least give strong indications and serve to point out the lines to be followed in future work.



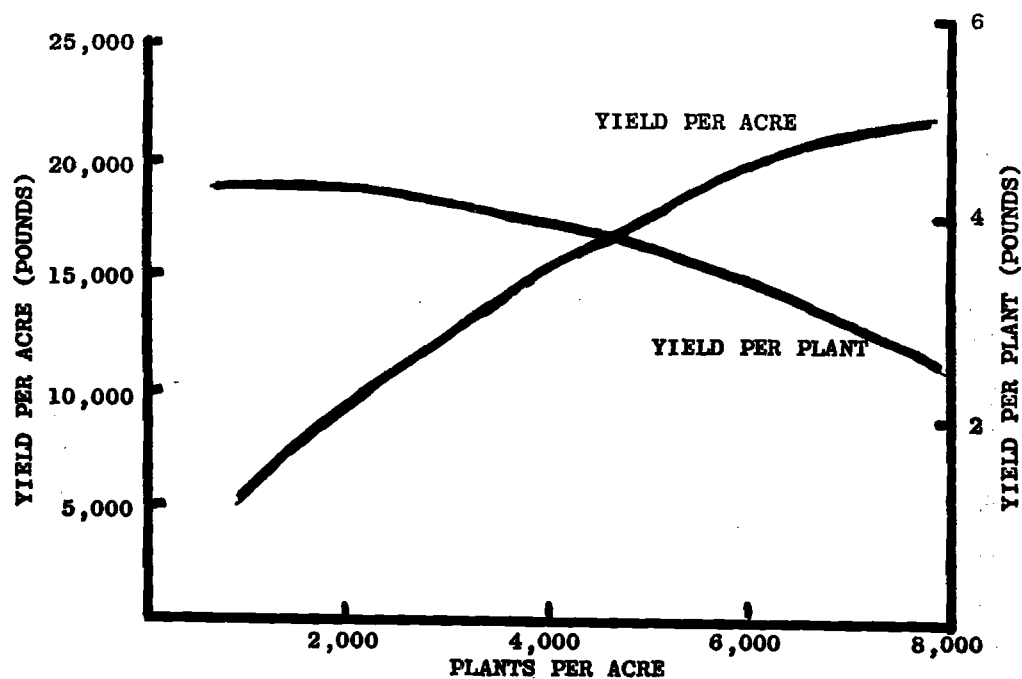


Fig. 1 - Yams 1965-66. Yield and plant density, Edgumbe.

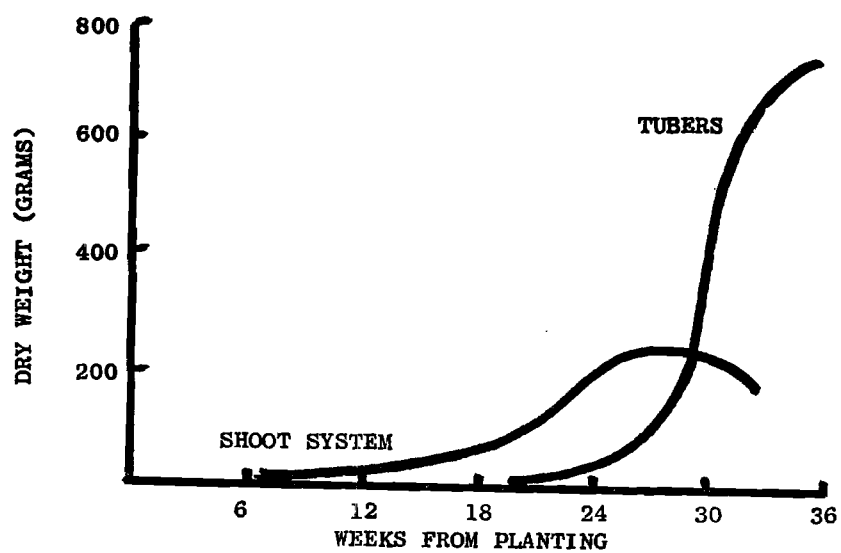


Fig. 2 - Growth of shoot system and tubers.