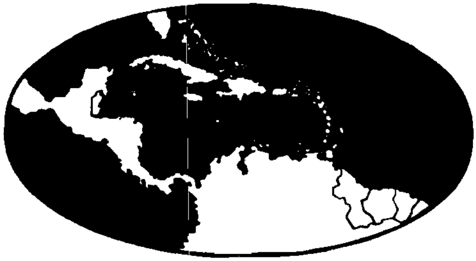
CARIBBEAN FOOD CROPS SOCIETY



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THE EFFECT OF SPACING OF POLE SUPPORTS ON YAM (*DIOSCOREA CAYNENSIS*) VINE EXPOSURE AND YIELD ON CONTINUOUS MOUNDS - MANCHESTER, JAMAICA

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SUMMARY

The traditional system of yam cultivation on individual hills with vines supported by poles is used exclusively on approximately 28,000 acres (11340 hectares) devoted to this crop annually. The use of continuous mounds in areas suitable to mechanized operations has not gained favour with farmers inspite of its adaptability to mechanical construction because too many questions of support and exposure of vines remain unanswered.

In a 2 x 4 randomized block trial, located at Cocoa Walk, Manchester, comparison was made of two arrangements of pole supports for yellow yam (*Dioscorea caynensis*) grown on 5 ft. (1.52 m) wide continuous mounds of the St. Ann's Bay clay loam.

In arrangement # 1 poles were placed at 2 ft. (61 cm) intervals in alternate furrows as against arrangement # 2 where poles were placed at 4 ft. (122 cm) intervals along every furrow.

In the first case, vine development created a "wall" type exposure of foliage, whereas in the latter, each pole support acted as an individual unit of cylindrical or spheroidal configuration.

Width of intervening spaces in arrangement # 1 made cultural operations far more easy than in the latter where extreme care was required to avoid disturbance of vines.

In general, growth in arrangement # 1 appeared more vigorous although this was not substantiated sufficiently in yield to be of significance. High variability in yield characterised the results (C.V. = 27.58%).

Pending further investigations, recommendation is for the adoption of arrangement # 1 in view of increased efficiency and ease of cultural operation.

INTRODUCTION

In 1972 yam production in Jamaica exceeded 160,000 short tons (145,120 metric tons) from an estimated area of 28,000 acres with an overall average yield of 5.85 short tons per acre (13.14 metric tons/ ha). Production was exclusively by the traditional system of cultivation in which planting occurs on individual hills with vines supported by poles. This exclusive use of the traditional system occurred inspite of the fact that research had long (1957) established the superiority of yield obtainable from continuous mounds which have the added advantage of soil conservation and adaptability to mechanical construction. The advantages of continuous mounds have not been realized for a number of reasons. Most yam cultivations occur on hillsides too steep for mechanized operations. In these areas the soils are too shallow (either naturally or as a result of past erosion) to produce a mound with sufficient depth of soil for proper tuber development as is possible with individual hills. Even on the major yam producing soil types, St. Ann's Bay clay loam # 78 and Chudleigh clay loam # 73 (Red and brown bauxite) and in other areas of gentle slope with a good depth of soil the use of continuous mounds in yam cultivation have failed to gain favour with small farmers. The reason in this latter case is that important questions of vine support and exposure need to be answered. The use of trellises with vines supported by binding wire, hogwire, or other strands in turn mounted on cables suspended by large poles have all proven of high initial cost. The "flagging" of vines in high winds when not sustained by rigid supports such as poles, have also caused crop losses. With these considerations in mind and the ease of cultural operations as a prime factor, the first trial of a series planned to establish the optimum spacing and arrangements of poles as vine supports was undertaken on the very extensive St. Ann clay loam, where mechanically constructed mounds hold the greatest promise.

EXPERIMENTAL

The trial occurred on a gently sloping (2.5^{o}) deep phase of the St. Ann's Bay clay loam located at Coco Walk, an area typical of the dry southern region of the parish of Manchester.

Experimental design and treatment

The experiment was a randomized block design with two staking treatments replicated four times. Each plot was 30' x 30' (9.14^2m) and provided space for six (5 ft or 1.52 m wide) banks. The crest of the banks were constructed to a uniform height of 18 inches (45.7 cms) above the level of their intervening furrows which possessed an east/west orientation.

Planting at 2' (61 cm) intervals along the top of banks was carried out with treated yellow yam heads. Although the size of the seed piece varied from 1½ to 3 lb (0.67 - 1.34 kg) the total weight of planting material used to establish each plot was similar. Shortage of planting material caused establishment of the blocks in two stages.

The first two blocks were planted on the 29th March, the remaining two blocks were established on 19th Apirl, 1974. Staking was carried out at sprouting of vines. In staking, the length of poles were adjusted so that their heights were uniformly 10 ft. (3.04 m) above the crest of banks. Stake arrangement # 1 was created by placing poles two feet (61 cm) apart in alternate furrows only. Corresponding pairs of plants one from each adjoining bank were encouraged to share the centrally located support, Figure 1.

Stake arrangement # 2 was formed by locating poles 4 ft. (122 cm) apart in every furrow and vines from pairs of plants on the same bank encouraged to share the support that occurred midway between them, Figure 2. Hence, in both treatments the number and height of stakes used were identical and provided support for two plants.

The difference in the treatments was the spacing of poles each providing support for a different combination of paired vines.

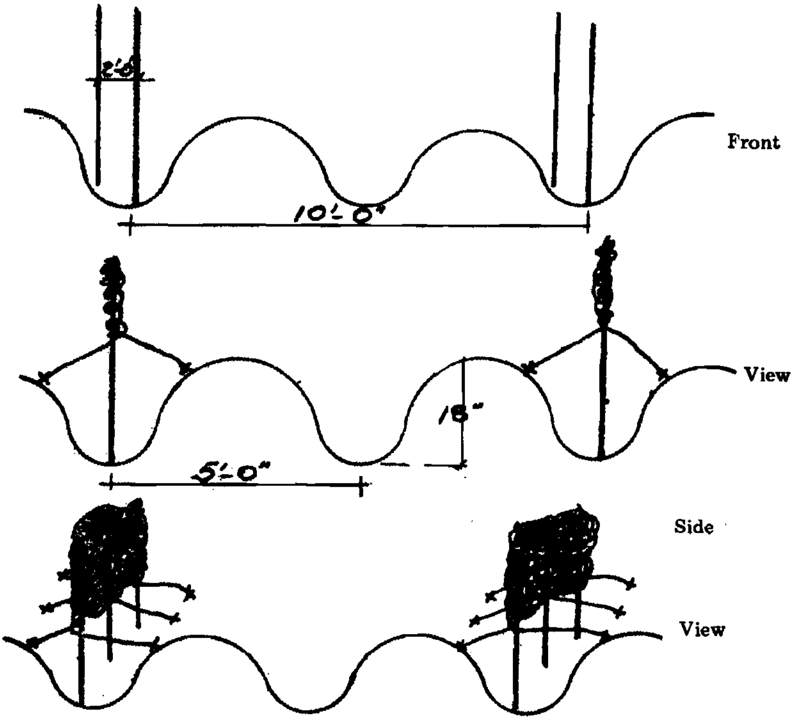
Crop Husbandry

The area was maintained in a weed free condition during early stages of vine development by moulding up operations. Fertilizing was carried out on 28th April with uniform application. 5 cwts (627 kg/ha) of 12.24.12 per acre distributed in a circular band around each set and covered.

Heavy mulching with Guinea grass cuttings aided weed control that was carried out by hand. Only one shoot was permitted to grow from each set. Pruning of auxillary shoots clustering near the soil surface was practised. Excellent protection against pest and diseases was achieved by monthly spraying with a mixture of Dithane (fungicide) and trichlorphon, Carbaryl or Malathion (insecticides) and triton sticker all at standard rate of application.

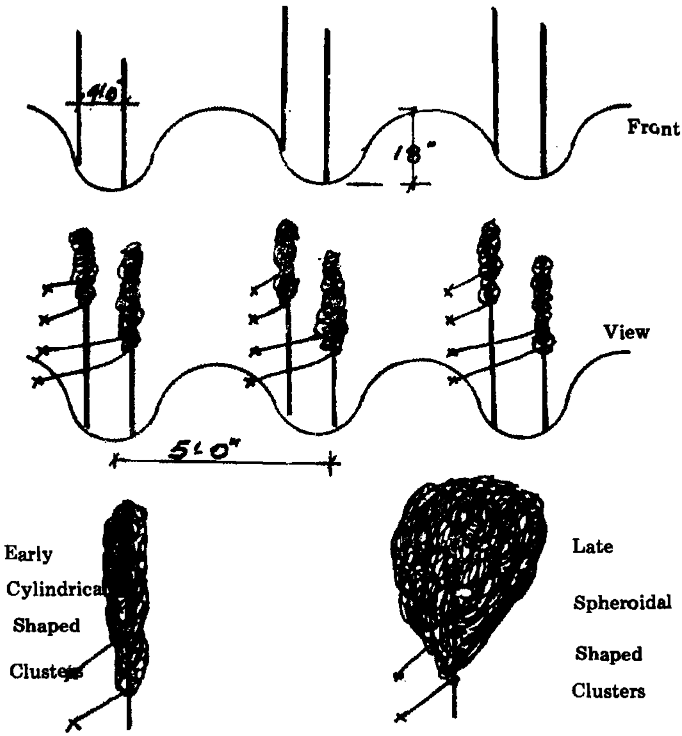
Crop Performance

On development, the vines in plots of stake arrangement # 1 crossed from one support to another and quickly produced a "wall" of foliage. See Figure 1. Weed growth in furrows with stakes was



Wall Type Exposure of Foliage

Fig. 1 Poles in Alternate Furrows - 2' - 0" x 10' - 0" spaces



Independent Units of Foliage

Fig. 2. Poles in every Furrow - 4'- 0" x 5' - 0" spaces

effectively shaded out. The 10 ft. (3.04 m) wide intervals between the walls of foliage were brightly lit by the rays of the sun as permitted by their East/West orientation. All cultural operation, spraying, weeding, mulching and finally harvesting were greatly facilitated. In stake arrangement # 2 vine development was not accompanied by sharing of supports from separate pairs of plants. The foliage around each support existed as distinct entities; firstly cylindrical and finally spheroidal in configuration. Only diffused light reached the soil surface and cultural activities were somewhat impeded. Mulching and weeding were difficult and spraying and harvesting operations called for much care to avoid disturbance of the vines.

The earlier planted blocks benefitted from fairly moist conditions that prevailed immediately after establishment and maintained their "head" start over the late planted blocks. Inspite of the limited rainfall (Appendix 2). The overall yield of the trial was 11,233 lbs per acre (12,592 kg/ha) which compared most favourably with those of small farmers in surrounding districts and as a consequence the trial had much demonstrational value to Jamaica's drive for increased productivity.

RECORDS AND RESULTS

Rainfall records were collected from a station in the vicinity (Appendix I). Harvesting was carried out in two stages. The more advanced plots were reaped on January 10th, the remaining plots on January 17, 1975. On harvest, records were kept of the number of plants reaching maturity, the number of tubers and their weights on a per row basis for each plot prior to aggregation.

The marked difference in vigour between the early and late planted plots was reflected in yield. The early plots averaged 14,044 lb per acre (15,744 kg/ha) compared to 8,422 lb per acre (9,441 kg/ha) from the late plots.

TABLE 1. Average yields of Yellow Yam (lb/ac or kg/ha) by Treatment

	Arrangement 1		Arrangement 2		Means	
	lb/ac	kg/ha	lb/ac	kg/ha	lb/ac	kg/ha
Early Plot	14,294	16,024	13,794	15,463	14,044	15,744
Late Plot	8,664	9,712	8,180	9,170	8,422	9,441
Means	11,479	12,868	10,987	12,316	11,233	12,592

C.V. = 27.58%

The total weight of tubers from Arrangement # 1 was slightly greater than that obtained from Arrangement # 2. However, statistical analysis revealed no significant effect of treatment.

TABLE 2. Average No. of Tubers per plot and Weight per Tuber by Treatment

	Arrangement 1			Arrangement 2				
		Wt. per tuber			Wt. per tuber		Means	
	No. of Tubers	lb	kg	No. of Tubers	lb	kg	lb	kg
Early Plot	82	3.95	1.80	79	3.64	1.65	3.79	1.73
Late Plot	85	2.22	1.01	89	1.90	0.86	2.06	0.94
Means	84	3.08	1.40	84	2.76	1.25	2.93	1.34

C.V. = 10.26%

The average weight per tuber from the early established plots was almost twice that of the late plots - 3.79 lb (1.73 kg) as against 2.06 lb (.094 kg). But differences in tuber size due to treatment were not statistically demonstrated. However, in this yield component, there was a definite trend in that tubers from arrangement # 1 was consistently larger than those from arrangement # 2.

DISCUSSION OF RESULTS AND CONCLUSIONS

Proper exposure of yam vines is an important aspect of efficient yam production. Payne (1974) compared the effects of tall and short pole supports for yam vines on continuous mounds and established, irrespective of plant population, that tall poles gave significantly bigger tubers and increased yield. In the light of this experience the present results indicating no significant difference in yield of the two pole arrangements is difficult to explain and disappointing.

The fact that there was a marked difference in growth and finally yield between early and late established plots brings to the forefront the importance of moisture, which was certainly the limiting factor under the conditions of the experiment (a similar situation commonly obtains in soil fertility where there is no crop response to applied fertilizer where moisture is limiting).

Many interesting aspects of the relative efficiency of light and the effects of wind or ventilation on moisture demand and crop yield are involved in these two methods of vine exposure. Mathematical considerations of the total leaf area exposed to direct sunlight for photosynthesis suggest that the aggregated leaf area of the cylindrical and or spheroidal clusters would have exceeded that on the "wall type" foliage. Similarly aerodynamic considerations suggest that turbulence would also have been greater since the crop would have been "aerodynamically rougher" than in arrangement # 1 where wide intervals facilitated wind flow. It therefore follows that evapotranspiration would have been greater in arrangement # 2. Under conditions of high rainfall, where the majority of yams are grown in Jamaica, arrangement # 2 might well be the better arrangement to maximise yield and indeed furnish scientific justification for traditional practices. However, under conditions of limited moisture, as obtained in the trial and representative of Southern Manchester, arrangement # 1 being less demanding of moisture would be the superior method. Although the results failed to establish a significant difference between the arrangements the trend of higher yield and larger tubers from arrangement # 1 lend support to claims of its superiority as a dry farming technique. Further investigation is needed. A larger trial would not only ensure greater precision for the comparison of treatments but would permit micro-climatic differences to be intensified for better evaluation.

From the practical point of view, the concern of the farmer is not in general, the attainment of maximum possible yield but that which gives the greatest cash return. The ease of cultural operations in arrangement # 1 is a distinct advantage and on this aspect alone should win favour.

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APPENDIX 1.

RAINFALL

	1974 Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1975 Jan.	Total for Period
Inches	6.87	Nil	0.43	0.76	5.31	19.15	5.49	4.84	Nil	0.67	43.02
Cms.	16.18	-	1.09	1.93	13.49	48.64	13.95	12.29	-	1.70	109.27