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A New Approach to Improvement of Yam *Dioscorea rotundata*

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A new approach to improvement of yam *Dioscorea rotundata*

EFFORTS to improve the yam, *D. rotundata*, through hybridisation have been frustrated by the low rate of flowering, the very low rate of fruit setting and poor seed germination[1-3]. These constraints have confined the availability of genetic resources for selection to the small number of cultivars which have been vegetatively reproduced from time immemorial. This continued vegetative propagation and the lack of hybridisation have precluded the possibility of introduction of new genetic characteristics, resulting in a stagnation of yam improvement. To facilitate yam hybridisation, we have re-examined the problems of flowering and seed germination. We first reported[4] yam seed germination in November 1973, and Doku stated that he had germinated yam seeds of *D. rotundata* (unpublished). Here we report the feasibility of germinating yam seeds, the rapid improvement of flowering, and the opportunity this development affords for expanding present germ plasm collections, thus facilitating yam improvement.

After a series of unsuccessful attempts, we obtained good germination in early 1973 when two important limitations for seed germination became evident[5]. First, the majority of the seeds were found to lack embryos or endosperms and second, they were found to possess a dormancy period of about 3 months after harvest. Having discovered these two limitations, seeds that seemed to contain embryos were selected and stored at room temperature until the end of the dormancy period. Seeds were sown in Petri dishes in March 1973, and in about 3 weeks more than 50% of the seeds germinated. After germination and the appearance of the first leaf, some 600 seedlings were transplanted into small pots and a month later, were transferred to larger pots and grown in the greenhouse. Tuber formation began about a month after transplanting. Flowering of some plants began in July 1973 with all the flowering plants bearing staminate flowers. None of the plants had produced any pistillate flowers by plant maturity. The plants showed a great deal of variability with respect to leaf shape, size and colour, canopy structure, stem colour and shape, plant height, and tuber shape and size. Tubers were forced to maturity by gradual decrease in watering and were harvested in February and March 1974, at which time most of the tubers weighed more than 500 g, which contrasts markedly with the observation of Waitt[2], whose material took 2 yr to produce a 450 g tuber from seed.

On April 1, 1974, each tuber was divided into several 'seed' (vegetative) pieces and planted in the field. The purpose of this second planting was to facilitate maximum growth, flowering and fruiting under field conditions and to provide at maturity, seeds to produce plants of a second generation in 1975. Throughout the growing season, data were collected on all phases of plant growth characteristics with special attention to date and degree of flowering and plant sex. Male plants began to flower in early July while female plants began to flower in late July and early August.

It was observed that the percentage of flowering plants, particularly females, was greater in the population originating from seeds than in those originating from tuber cuttings obtained by continuous vegetative propagation (Table 1). The degree of flowering per plant had also increased. Whereas plants grown from tuber cuttings usually produce less than 200 pistillate flowers per plant, plants originating from seed produced from 500 to 11,000 pistillate flowers. Furthermore, 4.7% of the plants derived from seeds, produced both staminate and pistillate flowers on the same plant (monoecious), which is an important departure from the usual production of either staminate or pistillate flowers on separate plants (Table 1). This quantitative and qualitative change in the flowering habit of plants of the first generation presumably resulted from our conscious selection for flowering through propagating plants from seeds. Since the low degree of flowering has been one of the major limiting factors in seed production, it is expected that after several generations the degree of flowering will increase to an extent such that it should be feasible to produce enough seeds to make yam propagation through seed a reality on a commercial basis. The increase in flowering and fruiting of plants produced from seed, did not reduce tuber yield. Tubers of up to 9 kg per plant were produced by plants from seed. It was notable that non-flowering plants yielded less than flowering plants and pistillate lines yielded more than staminate lines, thus suggesting that attention should be given to the former in selecting for high yields.

In a continued effort to increase our germ plasm collection by propagating plants from seeds, mature yam fruits were collected in October and November 1973 from eight sources in Nigeria. The seeds were germinated at the termination of the dormancy period as described earlier and the established seedlings were planted directly in the field. Seedling survival in the field was about 95% (Table 2), thus establishing the feasibility of planting yam seedlings directly in the field without the need

Table 1 Comparison of the degree of flowering and plant sex between plants of *D. rotundata* originated from continuous vegetative propagation and from seeds

	Flowering (%)	Non-flowering (%)	Flowering plants (%) Male	Female	Monoecious
Plants from continuous vegetative propagation	47.1	52.9	69	31	0.0
Plants from tubers originating from seeds	72.3	27.7	53.6	41.7	4.7

Table 2 Seed germination and seedling establishment of eight Nigerian yam populations

Parent and source	No. of seeds tested	Germination (%)	No. of seedlings transferred to field	Seedling survival (%)
Ihobia (IITA)	330	90.0	89	43.8
Iwo (Kwara State)	2,175	99.3	1,385	88.2
Laoko (IITA)	50	—	9	100.0
Mixed (IITA)	360	—	37	100.0
Okunmodo (IITA)	260	92.4	58	34.5
Umudike (East Central State)	1,269	98.5	977	85.9
Unknown	230	—	12	100.0
Wild (IITA)	500	—	416	100.0
Total	5,147	95.1	2,983	95.7

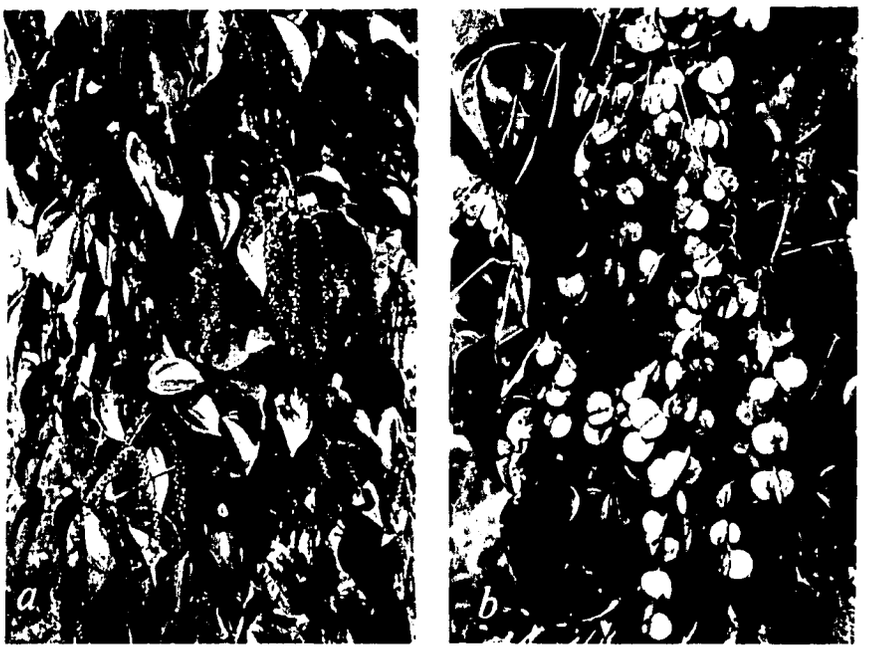

Fig. 1 Degree of yam flowering and fruit set. *a*, Male plant; *b*, female plant at the fruiting stage.

for a pre-growth period in the greenhouse. Tremendous morphological differences exist between plants with regard to their canopy structure, leaf shape and size, climbing habit, stem colour and thorniness, date of flowering and abundance of flowers.

This study clearly demonstrates the feasibility of yam seed germination on a large scale and the possibility of greatly increasing the potential for improving genetical diversity and breeding resources. Whereas breeders have hitherto been limited in their selection schemes to the narrow genetic base in cultivars that have been under continuous vegetative propagation, it is now possible to select for desirable characters from almost unlimited numbers of new lines.

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1 Coursey, D. G., *Yams* (Longmans, London, 1967).
2 Waitt, A. W., *Ann. Rep., Fed. Dept. agric. Res., Nigeria* (1959–61).
3 Waitt, A. W., *Fld Crop Abstr.*, 16 (3) 145–157 (1963).
4 International Institute of Tropical Agriculture, letter No. 3 (1973).
5 Sadik, S., and Okereke, O. U., *Ann. Bot.* (in the press).

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