Tropical Root Crops

PRODUCTION AND USES IN AFRICA

Proceedings of the International Symposium of the National Society for Root Crops —
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The International Society for Tropical Root Crops — Africa Branch was created in 1978 to stimulate research, production, and utilization of root and tuber crops in Africa and the adjacent islands. The activities include encouragement of training and extension, organization of workshops and symposia, exchange of genetic materials, and facilitation of contacts between personnel working with root and tuber crops. The Society’s headquarters are at the International Institute of Tropical Agriculture in Ibadan, Nigeria, but its executive council comprises eminent root and tuber researchers from national programs throughout the continent.

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TROPICAL ROOT CROPS: PRODUCTION AND USES IN AFRICA
ABSTRACT

A mixture of original research, updates on procedures, literature reviews, and survey reports, this document resulted from the second symposium of the International Society for Tropical Root Crops — Africa Branch, with 77 participants from 16 countries. The focus was cassava, yams, cocoyams, and sweet potatoes, from the perspectives of breeders, agronomists, soil specialists, plant pathologists, entomologists, nutritionists, food technologists, etc. Learning from past successes and failures, many of the researchers directed their efforts toward problems obstructing progress in reaching improved production and use of root crops and attempted to view, realistically, the context in which their results would be applied.

RÉSUMÉ

Résultats de recherches récentes, mises à jour sur les méthodes de recherche, revues de publications et rapports de sondages sont contenus dans ce document issu du Deuxième symposium de la Société internationale pour les plantes-racines tropicales — Direction Afrique, qui a réuni 77 participants de 16 pays. Des communications sur le manioc, le taro, le yam et la patate douce ont été présentées par des phytoselectionneurs, des agronomes, des pédologues, des phytopathologistes, des entomologistes et des spécialistes de la nutrition et des aliments, entre autres. Tirant leçon de leurs succès et de leurs échecs, beaucoup de ces chercheurs ont dirigé leurs efforts vers la solution des problèmes qui entravent l’augmentation de la production et de la consommation des plantes-racines et ont tenté de considérer d’un œil réaliste le contexte qui sera celui de l’application de leurs recherches.

RESUMEN

Una mezcla de investigaciones originales, actualizaciones de procedimientos, reseñas de literatura e informes de encuestas, este documento es el resultado del segundo simposio de la Sociedad Internacional de Raíces Tropicales, Filial Africana, que contó con 77 participantes de 16 países. El simposio se centró en la yuca, el yam, el cocoyam y las batatas, desde la perspectiva de los fitomejoradores, los agrónomos, los especialistas en suelos, los patólogos vegetales, los entomólogos, los nutricionistas, los tecnólogos alimenticios, etc. A partir de los éxitos y fracasos anteriores, muchos de los investigadores encaminaron sus esfuerzos hacia los problemas que obstaculizan el avance para lograr una producción y un uso mejorados de las raíces y trataron de obtener una visión realista del contexto en que los resultados pueden ser aplicados.
TROPICAL ROOT CROPS: PRODUCTION AND USES IN AFRICA

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PROCEEDINGS OF THE SECOND TRIENNIAL SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS — AFRICA BRANCH HELD IN DOUALA, CAMEROON, 14 – 19 AUGUST 1983
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RESPONSE OF CASSAVA TO FERTILIZERS AND TOWN REFUSE UNDER CONTINUOUS CROPPING

S.O. Odurukwe and U.I. Oji 1

We sought to determine whether, and at what levels, NPK fertilizer and compost could be used to sustain continuous cropping with cassava. NPK and compost were each tested at three levels. Experimental design was 34 factorial arranged in nine incomplete blocks of nine treatments. The experiment lasted 4 years (1974–76 and 1978). Results showed that only K consistently affects root yield significantly. There was a decline in yield with years of continuous cropping — for 1975, 1976, and 1978, respectively, 33.8%, 45.8%, and 49.1%. The yield decline was attributed to depletion of trace and minor elements, proliferation of pests and diseases, and physical deterioration of the soil. Under the heavy rainfall common in the area, the fertility and productivity of the soil could not be maintained by application of fertilizers and refuse.

The experiment described in this paper was designed to test the feasibility of maintaining the fertility and productivity of a soil continuously cropped with cassava by application of fertilizers and town refuse and to determine the levels of NPK and compost that would sustain such a system.

METHODS AND MATERIALS

The design of the experiment was 34 factorial arranged in nine incomplete blocks of nine treatments. The factors and their levels were nitrogen: 0, 22, and 44 kg/ha as ammonium sulfate; phosphorus: 0, 17, and 34 kg/ha as triple superphosphate; potassium: 0, 45, and 90 kg/ha as muriate of potash; and compost: 0, 10, and 20 t/ha. The compost was actually town refuse collected from the dumps in Umuahia and sifted so that the broken bottles, pieces of wood, iron, and polyethylene materials were removed.

The site was a sandy loam soil on the Western Farm of the National Root Crops Research Institute (NRCRI) at Umudike. The initial characteristics of the soil were pH 4.98 ± 0.12; total nitrogen 0.08 ± 0.03%; organic carbon 1.4%; available phosphorus 6.39 ± 2.48 ppm; and exchangeable calcium, magnesium, and potassium, respectively, 0.53 ± 0.22 meq/100 g; 0.61 ± 0.12 meq/100 g; and 0.22 ± 0.42 meq/100 g.

The experiment was carried on for 4 years (1974–76 and 1978). At the beginning of each cropping season, the sifted refuse was applied in the furrows of the ridges of the previous year and then ridged over manually. The cassava cultivar Nwugo, a local best, which is early maturing, was used and was always harvested at 12 months. Cassava population density was 6700 stands/ha; gross and net plot sizes were 0.012 and 0.009 ha.

Fig. 1. Mean response of cassava to fertilizers and town refuse on soils continuously cropped for 4 years.

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respectively. The fertilizer was applied in rings around the plants at 4 weeks after planting. Because of the high prevalence of pest damage, stand count was used as a covariate. The results at the end of each season were analyzed statistically. A combined analysis was done for the four croppings after the homogeneity of variances for the 4 years had been confirmed.

**RESULTS**

For the duration of the experiment, the effect of K was significant every year except 1978. In contrast, 1978 was the only year when the response to N was significant (P < 0.05); response to the application of refuse was significant only in 1975; and, in 1974, N × P interaction was significant (P < 0.05) (Fig. 1).

With the 1974 yields as the baseline, the yields (Fig. 2) declined 33.8%, 45.8%, and 49.1% for 1975, 1976, and 1978, respectively.

**DISCUSSION AND CONCLUSION**

This experiment indicates that, under the heavy rainfall conditions at Umudike, yields cannot be sustained in continuous cropping of cassava by yearly fertilizer, compost dressings. A resting period or fallow is necessary. This was also the finding in a companion experiment (Odurukwe and Oji 1981) where yields of yam, maize, and cassava, as well as total productivity declined with years of continuous cropping. Results from earlier work (Obi 1965) indicated that maize, yam, and cassava gave their best yields when preceded by bush fallow and worst yield when succeeded by themselves. Yields of a second crop of yam, maize, and cassava declined to 68%, 83%, and 60%, respectively, of the 1st year's yields. Similarly, in the forest zone of Ghana, soils maintained under a continuous rotation of maize and cassava for 8 years showed a steady decline in yield, even with soil amendment with compost and fertilizers (Nye and Greenland 1960).

Reports in the literature tend to indicate that, under other ecological conditions, yields can be sustained in continuous cropping by fertilizer application. Donnison (1961) showed that in the southern guinea zone of Nigeria, the usual 3-year fallow following the cropping cycle was unnecessary if farmyard manure were supplied at a rate of 5 t/ha. Similar results were obtained at Kano with guinea corn, millet, and groundnuts (Obi 1965) and in the savanna zone of Ghana under continuous rotation of maize and cassava (Nye and Greenland 1960). The discrepancies among the results obtained from the heavy rainfall vs savanna zones probably reflect the rapid leaching of nutrients and decomposition of organic-matter common in the humid tropics.

Considering the levels of fertilizers used in this experiment, we believe the yield declines reflect a depletion of the trace and minor elements contained in the soil, proliferation of pests and diseases, and physical deterioration of the soil. Continued use of ammonium sulfate lowers the pH of the soil and results in depletion of divalent cations, and regular application of phosphorus may promote potassium deficiency (Djokoto and Stephes 1961).

The results of this experiment are controversial, particularly with respect to responses to compost application. Perhaps the poor response to compost application stemmed from the use of town refuse rather than rural household refuse, the former varying widely from day to day and location to location.

We wish to express our thanks to the Director of the National Root Crops Research Institute, Umudike, for granting permission for publication of this paper. The experiment was designed and initiated in 1974 by Dr J.B. Okeke and carried through 1976 under the late J.K. Obi. Their contributions are acknowledged.