Indian J. Genet., 50 (3): 216–220 (1990)

EVALUATION OF COCOYAM (*XANTHOSOMA SAGITTIFOLIUM*) CLONES FOR ROOT ROT BLIGHT COMPLEX RESISTANCE

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(Received: January 27, 1989; accepted: April 24, 1989)

ABSTRACT

The cocoyam root rot blight complex is a major constraint to cocoyam production in Cameroon. The use of fungicides such as Ridomyl (Metalaxyl) and cultural practices are known to have reduced losses, but the ultimate goal remains the breeding for resistant varieties. Some clones obtained from 1980 and 1981 crosses show some degree of resistance to the root rot blight complex. The negative correlation (r = 0.516) between yield and disease score indicate the absence of the disease will result in higher plant yields and vice versa. Hence breeding efforts should be directed towards improving yields in cocoyam producing areas.

Key words: *Xanthosoma sagittifolium*, *Pythium myriotylum*, yield, root rot, resistance.

The root rot blight complex of cocoyam (*Xanthosoma sagittifolium*) constitutes a limiting factor to the production of cocoyam in the agroecological zones of the humid lowland forest region of Cameroon. The causal agent(s) for the disease complex have remained largely undetermined. However, several fungi have been implicated, such as *Pythium myriotylum*, *Fusarium solani* and *Rhizoctonia solani*. They are believed to function individually or in association with each other [1–9].

The severity of the disease has led to a gradual replacement of *Xanthosoma* by the more tolerant *Colocasia* sp. even though the former is still the preferred species. The use of fungicides such as Ridomyl and cultural practices like tapping and the use of second year cormels and suckers for planting are known to have reduced annual losses, yet the devastating effects of the disease remain a serious concern. Therefore, the need for resistant varieties cannot be over-emphasized. However, only limited work has been done for breeding for disease resistance. The current research efforts at the Institute of Agronomic

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Research are aimed at developing varieties that are not only agronomically acceptable but also resistant to the root rot disease complex. But much of the breeding work began only in the last decade [10, 11]. This paper reports the performance of clones currently under evaluation for resistance to the disease.

MATERIALS AND METHODS

PRODUCTION OF CLONAL MATERIALS

As part of an on-going Root and Tuber Crops Research Breeding Program at the Institute of Agronomic Research (IAR), Njombe, Cameroon, a range of phenotypically acceptable parents were selected to form the source population and categorized into diploids and tetraploids due to unsuccessful attempts already encountered in crossing material with different ploidy level [12]. Progenies were produced from several crosses and cloned for field evaluation.

FIELD TRIALS

The selected clones were then grown at a site with heavy infection of the root rot blight pathogens. This is because a reliable screening technique for root rot blight complex using artificial inoculation of fungi is not yet available. The selected location is also characterized by poorly drained soils, a pH about 6.0, high temperature (18–34°C) [8], and has been under cocoyam cultivation for the past 8 years without interruption. The development of *Pythium myriotylum* is favoured by the mean temperature 26°C, relative humidity 89%, and rainfall 400–700 mm (from July to September, in Njombe agroecological zone) [8].

The experiment was laid in a randomized complete block design with four replications. Each plot consisted of two ridges of 10 plants each at a spacing of 1 mx1 m. Observations were recorded on all plants of each replication. Disease score rating was done over a 3-year period (1985–1987). In each year, observations commenced 3 months after planting. Ratings were done every 15 days to determine the severity and development of symptoms in each clone during the growing season (March through October). The 0 – 4 scale described by Nzietchueng [8] and adopted in the Cameroon National Root Crops Improvement Programme (CNRCIP) is as follows: 0 = no symptoms on the leaves (resistant); 1 = 25% symptoms on the leaves (few symptoms); 2 = 50% symptoms on the leaves (moderate symptoms); 3 = 75% symptoms on the leaves (severe symptoms); and 4 = 100% symptoms on the leaves, very severe symptoms, dwarf (very susceptible). For cocoyam yields, only the 16 middle plants were harvested and weighed to evaluate the effect of disease on yield of the selected cocoyam clones. The Local White variety was used as check in the trials. Data analysis was done on plot means. The square root transformation was performed for the disease score rating prior to analysis.

RESULTS

The mean yield of clones over 3 years ranged from 1.62 to 3.06 tonnes/ha (Table 1). In 1985, only clones 80071 and 80005 yielded significantly more than check. In 1987, the check yielded more than many of the selected clones. The yields were generally low over the 3-years period. Also, the yield of clones declined from 1985 to 1987, except for clones 80005, 81286 and 81034, where yields in 1986 were lower than those of 1987.

The clonal means for disease score ratings are also presented in Table 1. During the 3 years, the mean disease score for each clone was significantly lower than the check. The least disease score was obtained for clone 81281, while clone 81034 had the highest score next only to the check. A declining disease incidence was not observed from 1985 to 1987 as was the case for yield. In fact, two clones (80048 and 81286) showed higher susceptibility to the disease over 3 years.

Table 1. Performances of 10 cocoyam clones tested at Njombe from 1985 to 1987

Clone No.	Yield (tonnes/ha)				Root rot score			
	1985	1986	1987	mean	1985	1986	1987	mean
80071	5.48	2.65	1.07	3.06	1.35	1.21	1.07	1.21
81281	3.35	2.21	1.28	2.28	0.60	0.34	0.68	0.54
81391	3.72	1.83	1.30	2.28	1.43	0.99	1.30	1.24
80048	3.47	1.68	1.61	2.25	0.72	0.82	1.60	1.04
80005	4.12	1.00	1.13	2.08	1.19	1.50	1.13	1.27
81286	2.86	1.08	2.04	1.99	1.35	1.70	2.04	1.69
81417	3.32	1.60	0.98	1.96	1.47	1.02	0.98	1.15
81034	2.70	0.53	2.08	1.77	2.17	2.67	2.08	2.30
81210	2.71	1.48	0.68	1.62	0.96	1.10	0.68	0.91
Local White	3.32	0.39	2.50	2.07	2.57	2.93	2.50	2.66
$LSD_{0.05}$	0.42	0.16	0.24	1.03	0.05	0.03	0.08	0.006

Combined analysis of variance revealed significant ($P = 0.001$) differences among the clones for yield and disease incidence (mean squares at 9 d.f. 5.43 for yield and 0.49 for disease score). Differences for the years of observations were also significant ($P = 0.001$). However, the year x clone interaction effect was nonsignificant. Combined year correlation coefficient analysis indicated negative but nonsignificant relationship ($r = -0.516$) between yield and disease occurrence.

DISCUSSION

The yield reduction of clones from 1985 through 1987 may be due to the fact that the same plot was used for cocoyam growing over a long period without fertilization. Nzietchueng [8] also reported reduction of cocoyam yields under continuous cropping in the same plot. Our results are in agreement with those of [13–15] who reported that continuous cropping on the same plot favours accumulation of pathogenic inoculum which becomes a limiting factor for plant growth and development.

The relatively high yields of the check variety in spite of high incidence of the disease suggest its ecological adaptability/tolerance to the root rot blight complex. Therefore, it will be necessary to use this check variety as a parent in any future breeding programme so that tolerant/resistant genes for the disease could be incorporated into few high yielding cocoyam clones and varieties.

The nonsignificant year x clone interaction for both yield and disease incidence may be due to the fact that the frequency of disease occurrence is dependent on the prevailing weather conditions [5, 8]. Thus, in very wet years high disease incidence will reduce yields. However, if the rains start late, the clones may be well established and so will be able to escape the more severe forms (dwarfing) of the disease [5] and subsequently have a good productive year. Furthermore, cocoyam clonal performance depends to a large extent on the cultural practices adopted for cultivation even when the genetic potential exist for high yield. This is also reflected in the significant clonal effects obtained from combined analysis.

ACKNOWLEDGEMENT

The authors thank Dr. S. N. Lyonga, Chief of Cameroon National Root Crops Improvement Programme, for helpful advice, and Prof. J. Wutoh, College of Agriculture, University of Maryland Eastern Shores, Princess, Ann. Maryland, U.S.A., for useful comments and criticism.

REFERENCES

1. A. F. Posnette. 1945. Root rot of cocoyam (*Xanthosoma sagittifolium*) Schott. Trop. Agric., 22(9): 164–178.

2. C. W. D. Brathwaite. 1972. Preliminary studies on plant parasitic nematodes associated with selected root crops at the University of the West Indies. Pl. Des. Rep., 56(12): 1077–1079.

3. O. B. Arene and E. U. Okpala. 1980. A disease of cocoyam in Nigeria caused by *Corticium rolfsii*. *In*: Tropical Root Crops: Research Strategies for the 1980s (eds. E.R. Terry, K.A. Oduru and F. Caveness). IDRC, Ottawa: 239–246.

4. O. B. Arene and E. V. Okpala. 1981. Effect of previous cropping on cocoyam disease in Nigeria caused by *C. rolfsii* (Socc) Curzi. Niger. J. Pl. Prot., **5**: 90–93.

5. K. G. Steiner. 1981. A root rot of macabo (*Xanthosoma* sp.) in Cameroon, associated with *Pythium myriotylum*. Pl. Dis. and Prot., **88**(10): 608–613.

6. S. Nzietchueng. 1984. La pourriture racinaire du macabo (*Xanthosoma sagittifolium*) au Cameroon 1. Symptomatologie et etiologie de la maladie. L'Agron. Trop., **38**(4): 321–325.

7. S. K. Hahn. 1984. Cocoyam. Tropical root crops. Their improvement and utilization. Conference Paper 2. IITA. Ibadan: 25–28.

8. S. Nzietchueng. 1985. Genre *Xanthosoma* (macabo) et constraintes de production: Cas particulier de la Pourriture Racinaire Causee par *Pythium myriotylum* au Cameroon. These doctorat es sciences naturelles 253 pp. Universite de Yaounde, Cameroon: 253.

9. C. A. E. Ofoegbu, K. A. Oduro and M. F. Yankson. 1986. A simple laboratory technique for studying the role of *Rhizoctonia solani* and *Fusarium solani* in the decline disease of cocoyam in Nigeria. 3rd Triennial Symp. Int. Soc. Trop. Root Crops-AB. 17–23 August 1986, Owerri, Imo State Nigeria.

10. A. Agueguia. 1988. Progress in cocoyam (*Xanthosoma sagittifolium*) breeding in Cameroon—1979 to 1987. Paper presented at VIII Symp. Intern. Soc. Trop. Root Crops. Bangkok, Thailand, Oct. 30–Nov. 5, 1988.

11. A. Agueguia and S. Nzietchueng. 1984. Production of hybrid *Xanthosoma sagittifolium* and test for resistance to *Pythium myriotylum*. *In*: Tropical Root Crops: Production and Uses in Africa (eds. E. R. Terry, E. V. Doku, O.B. Arene and N. M. Mahungu). Proc. 2nd Triennial Symp. Intern. Soc. Trop. Root Crops - Africa Branch - Douala, Cameroon, IDRC. Ottawa, Canada: 169–171.

12. M. N. Alvarez and S. K. Hahn. 1983. Chromosome behaviour and crossability of cocoyams. Abstr. 6th ISTRC Symp. Lima (Peru), Feb. 20–25, 1983: 113.

13. S. D. Garret. 1970. Pathogenic Root Infecting Fungi. Cambridge University Press. Cambridge: 273.

14. P. J. Shipton. 1975. Take-all-decline during cereal monoculture. *In*: Biological Control of Soil-Borne Plant Pathogens (ed. G.W. Bruell). The American Phytopathological Society. St. Paul, USA.

15. P. J. Shipton. 1977. Monoculture and soil borne pathogens. Ann. Rev. Phytopathol., **15**: 387–407.