Effect of Extracts from *Bauhinia monandra*(Kurz) Seeds on Cassava[1]

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ABSTRACT

Cassava stem cuttings were partially soaked in aerated and non-aerated aqueous extracts from the seeds of butterfly-flower (*Bauhinia monandra*(Kurtz)) and then planted in the field. Both seed coat and cotyledon extracts increased tuber yield, shoot weight and leaf number/plant. The aerated cotyledon extract increased the leaf content of N, Ca, K, Mn and Zn by 40.0%, 17.2%, 12.2%, 15.3% and 43.0% more than the control, respectively, while the seed coat extract increased N, Ca, Fe, Mn and Zn by 12.0%, 4.9%, 5.1%, 8.4% and 44.0% more than the control, respectively. Both extracts increased K, Mn and Zn in the tubers, but reduced cyanide content by 43.0-46.0%.

COMPENDIO

Se sembraron esquejes de tallo de mandioca, luego de ser sumergidos parcialmente en un extracto gaseoso y en uno acuoso no gaseoso de semillas de *Bauhinia monandra* (Kurtz). El extracto de cáscara de semilla y de los cotiledones aumentó la producción de ese tubérculo, el peso de los retoños y el número de hojas por planta. El extracto gaseoso del cotiledón elevó el contenido de N, Ca, K, Mn y Zn en las hojas en un 40.0%, 17.2%, 12.2%, 15.3% y 43.0%, respectivamente, más que del control; mientras que el extracto de la cáscara de semilla lo hizo en un 12.0%, 4.9%, 5.1%, 8.4% y 44.0%, respectivaente más que del control. Ambos incrementaron el contenido de K, Mn y Zn en los tubérculos, pero redujeron el de cianita en un 43.0% a un 46 por ciento.

INTRODUCTION

Extracts were collected from numerous and different wild plants in southern Nigeria and tested for their effect on cultivated crops. Aqueous extracts from the seeds of butterfly-flower (*B. monandra* (Kurz) increased leaf size and grain number/cob in maize (8). The same extracts also increased pod number/plant, seed size and induced profuse nodulation in groundnut plants (9).

These extracts were not tested previously on tuber crops. Thus, the objective of this paper was to study the effect of the extracts from the seeds of butterfly-flower on cassava plants.

MATERIALS AND METHODS

The experiments were carried out in May 1985-March 1986 and in May 1986-April 1987 at the University of Port Harcourt farm, Rivers State, Nigeria.

Ripe and dry pods of butterfly-flower were first harvested. The seeds were then removed from the pods and each seed was separated into its seed coat and cotyledon.

Water was used as an extraction medium. The water was first distilled using a double distiller and then sterilized by boiling.

The following treatments were then tested for the 1985-1986 experiment:

(a) Three grams of the seed coat was soaked in 1 l of the sterile distilled water and the container housing the soaked seed coats was left exposed to the air for 60 h;

(b) the same as in (a) except that the container was kept airtight;

(c) three grams of the cotyledon was soaked in 1 l of the sterile distilled water and the container housing the soaked cotyledon was left exposed to the air for 60 h;

(d) the same as in (c) except that the container housing the soaked cotyledon was kept airtight;

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(e) only sterile distilled water was used; and

(f) controlstems were not treated at all with any type of solution.

The solutions in extracts (a) to (d) were filtered using Nylon cloth after 60 h of soaking. This was meant to remove intact tissues of the seed coat, cotyledon and any fibrous material.

Commonly grown local cassava variety, called "Nwacha" was used. The cuttings (30 cm long) were partially soaked in the extract by placing the older portion of the stem in the solution for 96 hours. The soaked and the control (soaked and unsoaked) were then planted in the field in May 1985 at 1 m x 1 m spacing and harvested in March 1986. A randomized complete block design with five replications was used and there were 6 rows of 15 plants in each replication. This number may be low, but a minimum of 16 and a maximum of 32 plants are needed to give a reliable estimate of tuber yield in cassava (10). Data for treatments (e) and (f) were combined because there was no significant difference between them.

Weight of tuber and shoot were recorded from each plant during harvest, while leaf number/plant was recorded about two weeks earlier.

In the 1986-1987 experiment, only the aerated extracts, treatments (a), (c) and (f), were used. However, preparation of the extracts, amount of the extracts, length of cuttings, duration of soaking the cuttings and spacings used remained the same as in the 1985-1986 experiment. The variety used was TMS 30572. It was obtained from the International Institute of Tropical Agriculture(IITA), Ibadan, Nigeria.

The cuttings were planted in May 1986 and harvested in April 1987. There were two rows of eight plants for each treatment/replication. A complete randomized block design with eight replications was used.

Weight of tubers and shoots, leaf number/plant, cyanide content in tubers and nutrient content of the tubers and leaves were recorded. Leaf number/plant was recorded two weeks before harvest. The leaves' nutrient content was measured when plants were eight months old. The remaining characters were recorded during harvest.

To determine nutrient content of the leaves, one leaf of similar size was picked from each plant. Leaves from replication one to four were bulked as one sample and leaves from replication five to eight were bulked as a second sample. Dried plant samples were then analyzed for N (Micro-Kjeldhal method), P (Van-damolybdate) and for Mg, Mn, Cu, Ca, K, Fe and Zn (atomic absorption spectrometry).

To determine cyanide content, a similar procedure was used, except that there was only one bulked sample/treatment. Cyanide content was determined using the procedure of Rao and Hahn (7). Both cyanide and the nutrient contents were analyzed at the IITA, Ibadan, Nigeria.

RESULTS AND DISCUSSION

The 1985-1986 results are presented in Table 1. All extracts significantly (P) increased tuber yield, shoot weight and leaf number/plant. But plants treated with the cotyledon extract had higher values than those plants treated with the seed coat extract. The aerated extracts appear to be more effective than the non-aerated extracts in increasing tuber yield, shoot weight and leaf number.

Table 1. Effect of aerated and non-aerated extracts from the seed-coat and from cotyledon of *B. monandra* on tuber yield, shoot weight and leaf number/plant of cassava plants (1985-1986 experiment, variety 'Nwacha').

Extract	Tuber yield (t/ha)	Shoot weight (t/ha)	Leaf number/ plant
Seed-coat (non-aerated)	26.8	9.4	449.6
Seed-coat (aerated)	28.6	9.3	525.8
Cotyledon (non-areated)	42.4	21.3	583.0
Cotyledon (aerated)	47.8	16.1	643.9
Control	23.5	7.0	305.6
LSD (P=0.05)	3.01	2.01	61.82

The 1986-1987 results are given in Table 2. The results are very similar to those of 1985-1986. Again the effect of the cotyledon extract was much more pronounced than the effect of the seed-coat extract.

There seems to be a positive relationship between leaf number/plant and tuber yield (Tables 1 and 2). This is in agreement with the findings of IITA (4).

Table 2. Effect of aerated seed-coat and aerated cotyledon extracts from *B. monandra* on tuber yield, shoot weight and leaf number/plant of cassava plants (1986-1987 experiment, variety TMS 30572).

Extract	Tuber yield (t/ha)	Shoot weight (t/ha)	Leaf number/ plant
Cotyledon (aerated)	45.1	19.8	1 133.6
Seed-coat (aerated)	27.3	10.6	723.0
Control	20.4	10.6	694.0
LSD (P=0.05)	3.77	0.78	97.43

It must be noted (Tables 1 and 2) that the shoot weight (t/ha) is less than the actual value; it was difficult to assess the total weight of leaves produced since there was leaf fall throughout the growing period.

The aerated cotyledon extract increased leaf content of N, Ca, K, Mn and Zn by 40%, 17.1%, 12.2%, 15.3% and 43.0% more than the control, respectively (Table 3). Similarly, the seed coat extract increased leaf content of N, Ca, Fe, Mn and Zn by 12.0%, 4.9%, 5.1%, 8.4% and 44.0%, respectively (Table 3). It is clearly seen that the cotyledon extract increased K, but the seed-coat extract decreased it.

Both the aerated seed-coat and aerated cotyledon extracts increased the amount of K, Mn and Zn (and P, slightly) in the tubers, but both extracts decreased N, Mg and Fe. K showed the highest concentration in the tubers and the second-highest in the leaves. This was true in all treatments (Table 3), and agreed with the view that cassava has a high K requirement (6).

The reason for the high tuber yield in the extract-treated plants (Tables 1 and 2) was probably due to an increase in nutrient content of the cassava plants as shown in Table 3. This is likely because IITA (4) reported that N and K increased root initiation, tuber size and root number in TMS 30572. Also, Howeler and Onwueme (3, 5) reported that N and K are the most important elements in increasing tuber yield of cassava.

Furthermore, an increase in Zn produced by both extracts and in both the roots and leaves of the cassava plants is of special significance. This is so because cassava is particularly susceptible to Zn deficiency and it is the most important micro-nutrient that limits tuber yield in cassava (3, 5). Howeler (3) reported that Zn deficiency have been observed in both acid and alkaline soils throughout the world.

The amount of cyanide in the control, seed-coat treated and in the cotyledon-treated tubers were: 13.47 mg, 7.26 mg and 7.64 mg of HCN/100 g of dry weight, respectively. Such a reduction in cyanide, as a result of treating the stems with extracts, is very desirable.

This is so because the presence of poisonous cyanogenic glucoside (HCN) in the tubers has, to some extent, limited its use in human diets as well as in livestock rations.

The active substances in the butterfly-flower seeds are still unknown. Bidwell (1) reported that Zn is directly involved in the synthesis of indole acetic acid. Whether the high amount of Zn (43%-44% more than the control) in the cassava leaves (Table 3) suggests the presence of a hormone related to IAA is unknown. As far as we know, no study has been carried out on the effects of butterfly-flower seed extracts on the growth of plants.

From the stem of *B. variegata*, Gupta, Vidyapati and Chauhan (2) isolated 5.7 dimethoxy 4'hydroxy flavanone for the first time from a natural source. They did not apply this compound on plants.

Table 3. Effect of aerated cotyledon and aerated seed-coat extracts from *B. monandra* on nutrient content of leaves and tubers of cassava plants (Second (1986-1987) experiment, Variety 'TMS 30572').

	N	P	Ca	Mg	K	Mn	Fe	Cu	Zn
Extract	Dry matter (%)					(Ppm)			
Cotyledon	3.5(0.10)	0.25(0.27)	1.43(0.12)	0.30(0.11)	1.75(0.81)	116.9(8.6)	120.1(1.4)	11.8(1.4)	71.5(7.2)
Seed-coat	2.8(0.14)	0.26(0.13)	1.28(0.15)	0.32(0.08)	1.48(0.87)	109.9(21.9)	150.2(16.1)	12.4(2.9)	72.0(11.7)
Control	2.5(0.16)	0.27(0.12)	1.22(0.13)	0.31(0.14)	1.56(0.60)	101.4(5.7)	142.9(18.6)	12.8(1.4)	50.0(4.3)

Numbers in parentheses are for nutrient content of tubers.
The cotyledon and seed coat extracts were both aerated.

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RESEÑA DE LIBROS

BRIDGES, E.M. 1990. Soil horizon designations. Wageningen, The Netherlands, International Soil Reference and Information Centre (ISRIC). Technical Paper no. 9. 111 p.

Hace varios años reseñé el libro titulado Suelos del Mundo (Turrialba 29(4):332) escrito por el profesor E.M. Bridges, estudioso inglés de gran experiencia. Hoy, me ocupa un segundo texto del mismo autor, titulado Nomenclatura de los Horizontes del Suelo, que resume los diferentes sistemas empleados en el mundo sobre el tema.

El libro está escrito en términos sencillos y cubre, en varios capítulos, de manera histórica y pedagógica el conocimiento disponible sobre el tema. Describe la forma en que se usa la designación de horizontes, cómo reconocerlos (a través de propiedades como profundidad, color, entre otros), su génesis y nomenclatura de horizontes de diagnóstico. Al final presenta cinco estrategias para abordar el tema del documento en el futuro y el consenso alcanzado por el ISRIC en 1987, así como algunas conclusiones del autor.

Por lo conciso, puede emplearsele como texto de referencia en los capítulos iniciales de los cursos sobre suelos en posgrado y como obra de consulta en los trabajos de correlación de suelos. En general, la edición es excelente, sin embargo, hay que alertar al lector sobre la inversión de títulos en las figuras 4a y 4b.

A pesar de ser un documento reciente, no se discuten en él los conceptos de propiedades ándicas y vítricas, esenciales en la definición de andisoles, ni los problemas de la morfología de horizontes derivados del uso de suelos en arroz anegado. El libro puede adquirirse escribiendo el ISRIC, P.O. Box 353, 6700 AJ Wageningen, The Netherlands (ISBN 90-6672-041-7).

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