African Journal of Biotechnology Vol. 7 (20), pp. 3795-3798, 20 October, 2008
Available online at http://www.academicjournals.org/AJB
ISSN 1684–5315 © 2008 Academic Journals

Full Length Research Paper

Nutrient composition of climbing and prostrate vegetable cowpea accessions

A. O. Ano[1]* and C. I. Ubochi[2]

[1]Soil Chemistry Laboratories, National Root Crops Research Institute, Umudike, Umuahia, Abia State, Nigeria
[2]Department of Pure and Industrial Chemistry, Imo State University, Owerri, Imo State. Nigeria

Accepted 8 September, 2008

The study evaluated the nutrient content of different accessions of two vegetable cowpea genotypes. The mineral content of the vegetable cowpea accessions were high. Potassium content of the accessions of the climbing genotype "Akidi enu" ranged from 1.25 to 1.52% with a mean value of 1.43 ± 0.13% while in the accessions of the prostrate genotype "Akidi ani" the range was from 1.26 to 1.45% with a mean value of 1.36 ± 0.10%. "Akidi enu" had a mean P content of 0.74 ± 0.13% which was lower than a mean value of 0.87 ± 0.14% obtained for "Akidi ani". "Akidi enu" had higher Ca content than "Akidi ani". Protein contents of the vegetable cowpea genotypes were quite high ranging from 19.89 to 26.56% with a mean value of 23.52 ± 2.75% in "Akidi enu" and from 24.68 to 25.25% with a mean value of 24.97 ± 0.29% in "Akidi ani". Among the trace metals (Fe, Zn, Mn and Co), iron had the highest values, in the climbing genotype (Akidi enu), Fe ranged from 82.75 to 125.00 mg/kg with a mean value of 102.69 ± 17.33 mg/kg. The prostate genotype of the vegetable cowpea (Akidi ani) had slightly lower amount of this nutrient with a mean value of 95.31 ± 27.19 mg/kg and a range of 68.12 to 122.50 mg/kg. Zinc content of the vegetable cowpea ranged from 27.62 to 37.62 mg/kg with a mean value of 32.58 ± 4.08 mg/kg in "Akidi enu". The content of this element was slightly higher in "Akidi ani" which had a mean value of 36.50 ± 9.00 mg/kg and a range of 27.50 to 45.50 mg/kg. It was concluded that both cowpea genotypes were high in nutrient content.

Key words: Nutrient composition, vegetable cowpea, protein, micronutrient.

INTRODUCTION

Cowpea (*Vigna unguiculata* (L) Walp) is one out of 6 major cultivated *Vigna* species which in turn is one of the 25 - 36 cultivated legumes in the family of Leguminosae of which there are over 18000 species (Okigbo, 1986). Cowpea originated from West and Central Africa (Faris, 1965). Though the crop originated from Africa, it is widely grown in Latin America and South-East Asia. It is estimated to be grown on over 8 million hectares world-wide (Okigbo, 1986). Grain cowpeas are better adapted to the semi–arid and subtropical environment. In Nigeria, grain cowpea is mostly grown in the drier climate of the North than in the humid south, where high humidity causes diseases and drying problems (Aggarwal et al., 1982). In the South-Eastern Nigeria, the traditional farming systems have evolved the vegetable cowpea which shows remarkable adaptation to the prevailing humid climatic condition (Ezueh and Nwoffiah, 1984). Two genotypes of vegetable cowpea exist in the farming systems of South-Eastern Nigeria namely those with climbing habit called *V. unguiculata* subspecies *sequiped alis* (Redden, 1981) commonly called "Akidi enu" and those with prostrate habit referred to as *V. unguiculata* subspecies *dekintiana* and *mensensis* (Steele and Mehra, 1980) commonly known as "Akidi ani". Most of the information on cowpea in Nigeria is on the grain cowpea. Vegetable cowpea belongs to the group called "neglected legumes". They are grown by resource-poor farmers and information on the crop is scarce and mostly on the agronomy (Udealor, 2002; Ano, 2006). There is no literature on the nutrient composition of this crop which is playing an important role in the diet of many families in South-Eastern Nigeria. The objective of this work is to determine the nutrient composition of accessions of vegetable cowpea.

*Corresponding author. E-mail: anthonyosyano@yahoo.com.

Table 1. Proximate composition of vegetable cowpea accessions.

Genotype	Accession	Moisture (%)	Ash (%)	K (%)	P (%)	Na (%)	Ca (%)	Mg (%)
"Akidi enu"	AKER	6.60	3.16	1.25	0.81	0.16	2.80	0.56
	AKEP	6.30	4.10	1.52	0.56	0.17	1.80	0.36
	AKEB	6.60	2.89	1.52	0.86	0.17	1.33	0.52
	Mean ± SD*	6.50 ± 0.14	3.38 ± 0.57	1.43 ± 0.13	0.74 ± 0.13	0.17 ±0.01	1.98 ± 0.61	0.48± 0.09
"Akidi ani"	AKAB	6.60	4.45	1.26	0.73	0.17	1.66	0.56
	AKAS	6.30	1.97	1.45	1.01	0.21	1.66	0.56
	Mean ± SD*	6.45 ± 0.15	3.21 ± 1.24	1.36 ± 0.10	0.87 ± 0.14	0.19 ±0.02	1.66 ± 0.00	0.56 ± 0.00

* SD = Standard deviation.

MATERIALS AND METHOD

Sample description

Two genotypes of vegetable cowpea are grown in South-Eastern Nigeria. They include: those with climbing habit called *V. unguiculata* subspecies *sequiped alis* commonly called "Akidi enu" and those with prostrate habit referred to as *V. unguiculata* subspecies *dekintana* and *mensensis* commonly known as "Akidi ani". "Akidi ani" has two accessions which are similar in many respects to one another except in the size of their seeds. Their seeds have black testa, The major difference between the two accessions is that the seed of one of the accessions is about twice in size of the seed of the other. The ones with bigger seeds are designated AKAB, while the other accession with smaller seeds are designated AKAS. "Akidi enu" has three accessions. The seeds of one the three accessions have a reddish brown testa and is designated AKER. The second accession has a pinkish testa and is designated AKEP, while the third accession has a black testa and is designated AKEB.

Sample collection

Samples of the vegetable cowpea accessions were purchased from New Market, in Enugu, Enugu State of Nigeria. The samples were taken to the Farming Systems Department of the National Root Crops Research Institute, Umudike, Umuahia, Abia State, Nigeria, for proper identification.

Laboratory analysis

Samples of the vegetable cowpea were weighed into porcelain crucibles and then placed in moisture extraction ovens at 60°C. The samples were thereafter dried to a constant weight and the moisture content determined. The dried samples were then milled using a Wiley milling machine. The milled samples were used for the chemical analysis. The nutrient compositions of the samples were determined using the methods of the Association of Official Analytical Chemists (AOAC, 1990). Nitrogen was determined by the micro-Kjeldahl method described by Pearson (1976) and the percentage nitrogen was converted to crude protein by multiplying by 6.25. The minerals and trace metals were analysed from solutions obtained by first dry-ashing the sample at 450°C and dissolving the ash in 0.1 M HCl and transferring to 100 ml volumetric flask using distilled water to make it up. Phosphorus in the solution was determined by spectrophotometry while Na and K were determined by flame photometry. Calcium and magnesium in the solution were determined by EDTA titration. Trace metals in the solution were determined by Atomic Absorption Spectrometry (UNICAM 919 Model).

RESULTS AND DISCUSSION

Proximate compositions of the vegetable cowpea

The proximate compositions of the vegetable cowpea accessions are given in Table 1. The moisture contents of the two vegetable cowpea genotypes were low. The climbing and prostrate vegetable cowpea genotypes had mean moisture content values of 6.50 ± 0.14% and 6.45 ± 0.15% respectively. The mean ash content of the climbing vegetable cowpea was higher than that of the prostrate cowpea which indicated that the former had more metallic composition than the prostrate genotype. The mineral content of the vegetable cowpea accessions were high. Potassium (K) content of the climbing genotype "Akidi enu" ranged from 1.25 to 1.52% with a mean value of 1.43 ± 0.13% while in the prostrate genotype "Akidi ani" the range was from 1.26 to 1.45% with a mean value of 1.36 ± 0.10%. It can be concluded that "Akidi enu" has slightly more K than "Akidi ani". Ene-Obong et al (1992) had reported a K content value of 25 mg/kg for grain cowpea. "Akidi enu" had a mean phosphorus (P) content of 0.74 ± 0.13% which was lower than a mean value of 0.87 ± 0.14% obtained for "Akidi ani". Both genotypes had higher P content than 0.44% obtained for grain cowpea (*V. unguiculata* (L) Walp) (Ene–Obong et al., 1992). Calcium (Ca) contents of all the genotypes were more than the magnesium (Mg) contents. "Akidi enu" had higher Ca content than "Akidi ani". Within the "Akidi enu" genotype, AKER accession had the highest Ca content with a value of 2.80%. Calcium is a very important mineral in the body. It is necessary for bone formation.

Legumes are incorporated into the farming systems because of their ability to improve the protein content of the systems. In subsistence agriculture such as the one practiced in South-Eastern Nigeria, greater percentage of the protein requirement of the farming families are supplied by legumes. Protein contents of the vegetable cowpea genotypes were quite high ranging from 19.89 to 26.56% with a mean value of 23.52 ± 2.75% in "Akidi enu" and from 24.68 to 25.25% with a mean value of 24.97 ± 0.29% in "Akidi ani" (Table 2). The protein con-

Table 2. Protein content of vegetable cowpea accessions.

Vegetable cowpea genotype	Accession	Protein content (%)
"Akidi enu"	AKER	19.89
	AKEP	24.11
	AKEB	26.56
	Mean ± SD*	23.52 ± 2.75
"Akidi ani"	AKAB	25.25
	AKAS	24.68
	Mean ± SD*	24.97 ± 0.29

* SD = Standard deviation.

Table 3. Trace metal (micronutrient) composition of vegetable cowpea.

Vegetable cowpea genotype	Accession	Trace metal content (mg/kg)			
		Fe	Zn	Mn	Co
"Akidi enu"	AKER	100.31	32.50	2.75	0.00
	AKEP	82.75	27.62	3.50	0.50
	AKEB	125.00	37.62	2.50	0.50
	Mean ± SD*	102.69 ± 17.33	32.58± 4.08	2.92 ± 0.42	0.33 ± 0.24
"Akidi ani"	AKAB	68.12	27.50	3.00	0.63
	AKAS	122.50	45.50	2.50	0.00
	Mean ± SD*	95.31± 27.19	36.50 ± 9.00	2.75± 0.25	0.32 ± 0.32

* SD = Standard deviation.

tent of these vegetable cowpea genotypes compared favorably with a mean value of 24.8% reported for grain cowpea (*V. unguiculata* (L) Walp) by Wiley and Bressani, (1994) and 26.3, 24.4 and 24.8% obtained by Ene-Obong et al (1992) for white, brown and Crowther varieties of cowpea (*Vigna unguiculata* (L) Walp), respectively.

Micronutrient (Fe, Zn, Mn, Co) content of the cowpea

The micronutrient (essential trace metals) content of the vegetable cowpea genotypes are shown in Table 3. Iron had the highest values of the four micronutrients studied, in the climbing genotype (Akidi enu), Fe ranged from 82.75 to 125.00 mg/kg with a mean value of 102.69 ± 17.33 mg/kg. The prostate genotype of the vegetable cowpea (Akidi ani) had slightly lower amount of this nutrient with a mean value of 95.31 ± 27.19 mg/kg and a range of 68.12 to 122.50 mg/kg. The values obtained in this study were far higher than a mean value of 56.0 mg/kg reported by Ene-Obong et al. (1992) for some varieties of cowpea (*V. unguiculata* (L) Walp). This indicates that vegetable cowpea is a rich source of Fe. Fe is essential in red blood cell formation. Iron deficiency results in decrease in red blood cells. Too little iron in the diet could cause poor absorption of iron by the body. Other symptoms of iron deficiency include low blood pressure and rapid and forceful heart beat. Human beings having diets of vegetable cowpea would not have such symptoms associated with Fe deficiency because of the high level of Fe in the cowpea.

Zinc (Zn) is an important trace element in human nutrition and fulfills many biochemical functions in human metabolism. It is the activation factor of several enzymes (carboanhydrase, alkaline phosphatase, and of several enzymes of the nucleic acid synthesis), it stabilizes the structure of RNA, DNA and the ribosomes, and it influences hormone metabolism (Roth and Kirchgaessner, 1991). Zinc deficiency of the human organism occurs in cases of inadequate zinc absorption, increased zinc losses from the body or increased requirement for zinc. It leads to several disorders such as growth retardation, diarrhea, and interferences of cerebral functions (Institute of Medicine, 2001). Zinc content of the vegetable cowpea ranged from 27.62 to 37.62 mg/kg with a mean value of 32.58 ± 4.08 mg/kg in "Akidi enu". The content of this element was slightly higher in "Akidi ani" which had a mean value of 36.50 ± 9.00 mg/kg and a range of 27.50 to 45.50 mg/kg. The levels of Zn in the vegetable cowpea genotypes studied were lower than mean values of 60.00 mg/kg reported by Ene-Obong et al. (1992) for cowpea varieties and 800 mg/1000 g reported by Olaofe and Sanni (1988) for soyabean.

Manganese (Mn) is necessary for proper function of the reproductive organs. Deficiency of Mn leads to impaired growth in humans. Cobalt (Co) deficiency, on the other hand leads to loss of appetite and weight loss. Manganese content of the vegetable cowpea was low

compared to values reported in the literature for grain cowpea. Mean Mn and Co values of 2.92 ± 0.42 mg/kg and 0.33 ± 0.24 mg/kg respectively were obtained for "Akidi enu", while for "Akidi ani" the mean values of Mn and Co were 0.33 ± 0.24 mg/kg and 0.32 ± 0.32 mg/kg. Ene-Obong reported mean Mn value of 22.0 mg/kg for some varieties of cowpea.

Conclusion

Analysis of vegetable cowpea indicated that this legume had high protein content which compared favorably with the protein content of the popular cowpea "beans" (*V. unguiculata* (L) Walp). The mineral and trace metal (especially Fe) contents of vegetable cowpea were also high, indicating that this is a highly nutritious crop. The cultivation of this crop should therefore be encouraged especially in areas, such as Southeastern Nigeria, where the climatic conditions are not suitable for the growth of the popular cowpea (*V. unguiculata* (L) Walp).

REFERENCES

Aggarwal KD, Ntare, RB Smithson JB (1982). The relationship among yield and other characteristics of vegetable cowpea and effects of different trellis management system on pod yield. Trop. Grain Legume Bull. 25: 15-20.

Ano AO (2006). Effect of vegetable cowpea population on component crop yields and productivity of yam, minisett based system. Niger. J. Agric. 37: 81-84.

AOAC (1990). Association of Official Analytical Chemists, 15th edition, Washington, DC.

Ezueh MI, Nwoffiah GN (1984). Botanical observation on a local collection of vegetable cowpea cultivars in Southeastern. Niger. Trop. Grain Legume Bull. 29: 2-7.

Faris DG (1965). The origin and evolution of cultivated forms of *Vigna sinersis* L., Can. J. Genet. Cytol. 7: 433-452.

Institute of Medicine, Food and Nutrition Board (IMFNB) (2001). Dietary Reference Intake for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc. National Academy Press, Washington DC.

Okigbo BN (1986). Welcome address. In: Tropical Grain Legume Bulletin. Proc World Cowpea Res. Conf. 5(9)32: 5-9.

Olaofe O, Sanni CO (1988). Mineral content of agricultural products. Food Chem. 30: 73-77

Pearson D (1976). Chemical analysis of foods, 7th Edition, J and A Churchill, London, pp. 34-36

Redden RJ (1981). Vegetable cowpea breeding at IITA. Trop. Grain Legume Bull. 23: 13-17.

Roth H, Kirchgaessner M (1991). Zink, biochemie, physiologie, patho-physiology und klinik des stoffwechsels des Menschen. In: Holtmeier HJ Kruse-Jarres J (eds) Wissenschaftliche, Verlagagesellschaft mbH. Stuttgart. pp. 67-101.

Steele NM, Mehra KS (1980). Structure, evolution and adaptation to farming systems and environments in Vigna. In: Summefield RJ, Bunting AH (eds), Advance in Legume Sci. Royal Botanical Gardens UK.

Udealor A (2002). Studies on growth, yield, organic matter turnover and soil nutrient changes in cassava (*Manihot esculenta* Crantz) vegetable cowpea mixtures. PhD Thesis, University of Nigeria, Nsukka, Nigeria.