

PJN

ISSN 1680-5194

PAKISTAN JOURNAL OF
NUTRITION

ANSI*net*

308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

***Azanza garckeana*: A Valuable Edible Indigenous Fruit Tree of Botswana**

W. Mojeremane and S.O. Tshwenyane
Botswana College of Agriculture, P/Bag 0027, Gaborone, Botswana
E-mail: wmojerem@bca.bw

Abstract: *Azanza garckeana* (morojwa) is a valuable edible indigenous fruit tree species confined to east and southern Africa. Because of its multiple use the species is selected and retained by farmers in Botswana when they clear the woodland for crops and building house. It is one of the indigenous fruit tree species that is semi-domesticated by local people in Botswana. The species is an important indigenous source of food in Botswana. Besides proving people with fruits, the tree also provides goods (timber, firewood, fodder etc.) and services (soil conservation, shade etc.). The species is an important source of essential minerals particularly P, Ca, Mg and Na. This paper reviews *Azanza garckeana* as an important multipurpose indigenous fruit tree with high potential social and economic value in Botswana.

Key words: *Azanza garckeana*, edible indigenous fruit tree, Botswana

Introduction

Indigenous fruit trees although undomesticated play many important roles in people living in rural areas of Botswana. Indigenous fruit trees are important traditional sources of nuts, fruits, spices, leafy vegetables, edible oil and beverages (Okafor, 1985). Like vegetables, indigenous fruit trees provide vitamins and minerals essential for the proper maintenance of human health (Saka *et al.*, 1994). According to FAO (1982) and Maghembe *et al.* (1994), the nutritional value of indigenous fruit bearing tree species indicate that many are rich in sugars, essential vitamins and minerals while others are high in vegetable oil and proteins. In addition to fruit production and cash, the extensive list of benefits includes firewood, fodder, building material, shade and medicine to rural communities.

Indigenous fruit trees are particularly used during periods of seasonal food shortages and are often the only available fruit source of high nutrients. In Botswana indigenous fruit trees yield a crop in poor rainfall years when arable agriculture fails, thereby improving food security for rural households. The growing of trees means less dependence on arable agriculture, which in turn decreases environmental degradation. On average, one year in three years is a crop failure for arable agriculture in Botswana, hence the importance of indigenous fruit trees. *Azanza garckeana* is one of the indigenous fruit tree species found in cropland and protected by local people (Mojeremane, 1999). It is the only indigenous fruit tree species that is semi-domesticated by local people in Botswana who grow it in their homesteads and crop fields (Taylor and Kwerepe, 1995; Taylor *et al.*, 1996).

Distribution: *Azanza garckeana* is widely distributed in east and southern Africa (ICRAF, 1992; Palmer and

Pitman, 1972). The specific countries where the species is found are Botswana, Kenya, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe (Palmer and Pitman, 1972; Palgrave, 1988). ICRAF (1992), Mbuya *et al.* (1994) and Mulofwa *et al.* (1994) reported the species growing from Sudan to South Africa. The species grows naturally in all types of woodlands from sea level to about 1700 m above sea level (White, 1962; Palgrave, 1988; Mbuya *et al.*, 1994; Mulofwa *et al.*, 1994). It grows in semi-arid areas receiving lowest annual rainfall of 250mm and highest rainfall of 1270mm (FAO, 1983). Over the range in its entirety, the species grows in a variety of soils and is found on or near termite mounds and deserted village fields (White, 1962; FAO, 1983; Mbuya *et al.*, 1994; Mulofwa *et al.*, 1994). In Botswana *Azanza garckeana* grows in open woodland in north-eastern parts of the country.

Description: *Azanza garckeana* is a semi-deciduous tree/shrub with a rounded medium crooked stem (Storrs, 1979; Palgrave, 1988). The tree can grow to a height of 3-15metres depending on the environment in which it is growing (Hutchison and Danziel, 1954; White, 1962; FAO, 1983; Palgrave, 1988; Palmer and Pitman, 1972; Mulofwa *et al.*, 1994). The tree is multi-stemmed with straight or crooked stem, which is sometimes forking from the base, and the stem can reach up to 25cm in diameter breast height. The bark is rough and greyish-black to brown, fibrous with longitudinal fissures (White, 1962; FAO, 1983, ICRAF, 1992; Mulofwa *et al.*, 1994). The twigs are hairy when young but become smooth with age and branches have wooly hairs (Palmer and Pitman, 1972; ICRAF, 1992).

The leaves are distinctively rounded 8 by 12 cm on long stalks. They are always simple, alternate and roundish. The leaves have 3 to 5 lobes, which are covered in

Mojeremane and Tshwenyane: *Azanza garckeana*: A Valuable Edible Indigenous Fruit Tree

brown star-shaped hairs, and have longitudinal fissures in the midrib (Palmer and Pitman, 1972; FAO, 1983; ICRAF, 1992; Palgrave, 1988). The tip of the leaf is usually bluntly pointed or rounded. The base of the leaf is heart-shaped and is 5 to 7 nerved. The leaf margins are untoothed often-large 5 to 20cm in diameter, hairless or hairy and rough above and below and rough with veins raised (Palmer and Pitman, 1972; Palgrave, 1988; ICRAF, 1992). The young leaves are bronze in colour and velvety (Palmer and Pitman, 1972).

Flowers are large up to 6 cm long, solitary on long pedicels in axils of uppermost leaves (Palmer and Pitman, 1972; Palgrave, 1988; FAO, 1983). The flowers have a conspicuous cup like calyx with which the calyx is fused. The flowers have many stamens and 5 petals, which are yellow or purplish in colour with dark purple or dark red centre (Palgrave, 1988). The flowers are bisexual with all floral parts in five's (FAO, 1983). They are showy yellow, ageing to purplish in colour with a maroon patch at the base of each petal. It flowers in wet season and fruits in dry season (April through August) (FAO, 1983).

The fruits are spherical and woody, 2.5cm to 4cm in diameter long with short hairs. The fruits are divided into 4 to 5 sections. They are yellowish to brownish green and hairy when mature and tardily dehiscent (Palgrave, 1988; ICRAF, 1992). Despite their hard woody nature the fruits are edible and chewed like a chewing gum producing a sweet glutinous slime (Palgrave, 1988; Taylor and Kwerepe, 1995). Fruits are edible from August. The seeds are hemispherical in shape up to 10mm long and 7mm thick with brownish and woolly floss (Palmer and Pitman, 1972; Storrs, 1979; FAO, 1983; Tietema *et al.*, 1992). The wood is greyish in colour and the heartwood is dark (Lectcher and Shirley, 1992). It is hard, durable and strong.

The tree is susceptible to leaf defoliation by insects (*Empoasca*) and fungi (*Phakopsora*) (Von Carlowitz *et al.*, 1991). Taylor and Kwerepe (1995) reported that trees could be attacked by leafhoppers both in the field and nursery. *Azanza garckeana* is a host to the cotton stainer and black beetle and therefore should not be planted in cotton producing areas (Palmer and Pitman, 1972; Storrs, 1979; Mulofwa *et al.*, 1994).

Resources role of *Azanza garckeana*

Fruits and leaves: The fruits are the most useful resource of *Azanza garckeana*. The fruits are eaten while slightly green or when ripe. They are persistent, therefore are picked on repining. Some people dry them and reconstitute them later (Taylor and Kwerepe, 1995). The fruits can be soaked in a small amount of water to make jelly (Palmer and Pitman, 1972). They can also be boiled and used as relish or made into porridge (Storrs, 1979). Leaves are used for making relish and can be burned to produce salt (Mateke *et al.*, 1995; Storrs,

1979). The leaves can be cooked and used as vegetables. The leaves can also be used as green manure to improve land productivity.

Table 1: Chemical composition of *Azanza garckeana* fruits

Dry matter	52.8%
PH (at 2.5C)	5.96
Ascorbic acid (mg/100g of fresh weight)	20.5 (1.8)
Crude protein	12.0%
Fat	1.1%
Fibre	45.3%
Total carbohydrate	35.2%
Energy value	810 kJ/100g
Phosphorus	1476 µg/g
Calcium	95 µg/g
Magnesium	1453 µg/g
Iron	84 µg/g
Potassium	26 190 µg/g
Sodium	202 µg/g

Source: Saka *et al.*, 1994

The fruits of *A. garckeana* have been reported in a number of African markets (Kwesiga and Mwanza, 1995; Taylor *et al.*, 1996). This is an indication that the species is not a simple and occasionally exploited tree of the wild vegetation but has a role in economic systems of farmers.

Timber: The wood of *Azanza garckeana* has many uses, which are, appreciated by people living in rural areas. The wood is a source of fuel wood in areas where there is shortage of firewood and it can also be converted into charcoal (Storrs, 1979; Palgrave, 1988; Mulofwa *et al.*, 1994; Mateke, 1998). The wood is used for construction materials, poles, fencing posts, farm implements, tool handles and domestic utensils (Storrs, 1979; Palgrave, 1988; ICRAF, 1992; Mulofwa *et al.*, 1994).

Fodder: Leaves are eaten by game and livestock and are a source of fodder during the dry season (Storrs, 1979; Mulofwa *et al.*, 1994; Mateke, 1998). The leaves also provide bees with forage (ICRAF, 1992; Mulofwa *et al.*, 1994).

Miscellaneous uses: The long shoots are traditionally used as whips (Palmer and Pitman, 1972) and the inner bark is a source of fibre (Palmer and Pitman, 1972; Storrs, 1979; ICRAF, 1992; Mateke, 1998). *Azanza garckeana* is commonly used for ornamental purposes. The species is not associated with any medicinal uses. Trees left when clearing crop fields provide shade to people during the cropping season. *Azanza garckeana* suckers freely and has been used in soil conservation

Mojeremane and Tshwenyane: *Azanza garckeana*: A Valuable Edible Indigenous Fruit Tree

projects (Von Carlowitz *et al.*, 1991) and leaves have been used for mulching and as green manure (ICRAF, 1992).

Husbandry and management: Within its geographical range the *Azanza garckeana* occurs naturally as a component of open vegetation and pure stands are not common. Conventional plantations are not common but management and planting of few or single trees interspersed with land devoted to other uses takes place. Organised planting of *Azanza garckeana* has not occurred. However, the species regenerates naturally from seed, coppice and suckers (FAO, 1983; ICRAF, 1992, Mbuya *et al.*, 1994; Mulofwa *et al.*, 1994). The seeds germinate readily when conditions are favourable. The seeds can achieve acceptable germination percentages without any pre-treatment. Coppice shoots are produced after the tree has been felled.

Agroforestry potential: *Azanza garckeana* is an incidental component of many farming systems. Traditionally many crops (maize, millet sorghum etc.) are grown under the canopy of *Azanza garckeana*. The advantages of intercropping these crops with *Azanza garckeana* have not been scientifically studied. However, causal observations indicate that crops grow better under the canopy. There is no information available on the species contribution to crop production and soil fertility. Most recently it has been planted intentionally as an agroforestry tree in trials in Botswana and other countries but conclusive results of the trials are not yet available.

Conclusion and recommendation : *Azanza garckeana* is an important multipurpose edible indigenous fruit tree in Botswana. The species has great potential to be used as an agroforestry species. No organised planting of *Azanza garckeana* has been reported in Botswana, therefore it is recommended that farmers should be encouraged to establish small plantations or orchards of the species.

References

FAO, 1982. Fruit bearing forest species. Technical notes. Food and Agricultural Organization, Forestry Paper No. 34. Rome.

FAO, 1983. Food and Fruit bearing forest species. Examples from eastern Africa. Food and Agricultural Organisation, Forestry Paper 44/1. Rome.

Hutchison, J. and J.M. Danziel, 1954. Flora of west Africa. Volume 1, Part 1. Crown Agents for Overseas Government and Administration. London.

ICRAF, 1992. A selection of useful trees and shrubs for Kenya. International Centre for Research in Agroforestry. Nairobi.

Kwesiga, F. and S. Mwanza, 1995. Under-exploited wild genetic resources: the case of indigenous fruit trees of eastern Zambia. In J.A. Magehembe, Y. Ntupanyama and P.W. Chirwa (eds.): Improvement of indigenous fruit trees in the miombo woodlands of southern Africa. ICRAF, Nairobi, Kenya.

Lectcher, R.M and I.M. Shirley, 1992. O-Naphthoquinones from the heartwood of *Azanza garckeana*. *Phytochemistry*, 31: 4171-4172 .

Maghembe, J.A., F. Kwesiga, M. Ngulube, H. Prins and F.M. Malaya, 1994. Domestication potential of indigenous trees of the miombo of southern Africa. In R.R.B. Leakey and A.C. Newton (eds.) Tropical trees: the potential for domestication and rebuilding of forest resources, HMSO, London.

Mateke, S.M., 1998. Questions and Answers about: how to grow morojwa (African chewing gum). Veld Products Research and Development. Gabane, Botswana.

Mateke, S.M., C.S. Kamara and P. Chikasa, 1995. Ripening periods of edible indigenous fruits of Zambia: Implications of utilisation and domestication. In J.A. Magehembe, Y. Ntupanyama and P.W. Chirwa (eds.): Improvement of indigenous fruit trees in the miombo woodlands of southern Africa. ICRAF, Nairobi, Kenya.

Mbuya, L.P. C.K. Msanga, C.K. Ruffo, A. Birnie and B. Tenge, 1994. Useful trees and shrubs of Tanzania. Regional Soil Conservation Unit/SIDA.

Mojeremane, W., 1999. *Azanza garckeana*: a review and field evaluation in a village context in Botswana. Unpublished BSc. thesis. University of Wales, Bangor.

Mulofwa, J., S. Simute and B. Tenge, 1994. Agroforestry manual for extension workers in the southern Province, Zambia. Technical Handbook No.4. Regional Soil Conservation Unit/SIDA.

Okafor, J.C., 1985. Selection and improvement of indigenous tropical trees. *J. Trop. Resour.*, 1: 87-95.

Palmer E. and P. Pitman, 1972. Trees for southern Africa covering all known indigenous species in RSA, South West Africa, Botswana, Lesotho and Swaziland Volume 2. A.A. Balkema. Cape Town.

Palgrave, K.C., 1988. Trees of southern Africa. Struik Publishers. Cape Town.

Saka, J., J.D. Msothi and J.A. Maghembe, 1994. The Nutritional value of edible fruits of indigenous wild trees of Malawi. *Forest Ecology and Management*, 64: 245-248.

Storrs, A.E.G., 1979. Know Your Trees. Some of the most common trees found in Zambia. The Forest Department. Ndola, Zambia.

Taylor, F. and B. Kwerepe, 1995. Towards domestication of some indigenous fruit trees in Botswana: In J.A. Maghembe, Y. Ntupanyama and P.W. Chirwa (eds.): Improvement of indigenous trees of miombo woodlands of southern Africa. ICRAF, Nairobi, Kenya.

Mojeremane and Tshwenyane: *Azanza garckeana*: A Valuable Edible Indigenous Fruit Tree

- Taylor, F., S.M. Mateke and K.J. Butterworth, 1996. A holistic approach to the Domestication and commercialization of non-timber products. In R.R.B. Leakey, A.B. Temu, M. Melnyk and P. Vantomme (eds.): Domestication and commercialization of non-timber forest products in agroforestry systems. Non-Wood Products 9. FAO, Rome.
- Tietema, T., E. Merkesdal and J. Schroten, 1992. Seed germination of indigenous trees in Botswana. ACTS Press. Nairobi.
- Von Carlowitz, P.G., G.V. Wolf and R.E.M. Kamperman, 1991. The Multipurpose tree and Shrub database (version 1.0 electronic form). ICRAF, Nairobi, Kenya.
- White, F., 1962. Flora of Norythen Rhodesia. Oxford University Press. London.