



Full Length Article

Kenaf (*Hibiscus cannabinus*) and Allied Fibres for Sustainable Development in Swaziland

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ABSTRACT

The economy of Swaziland is agri-based with an emerging strong emphasis on the development of small and medium enterprises (SMEs) in different sectors. A significant sector of the population relies on the sale of handicrafts made from locally available raw materials that are timber and non-timber materials. A substantial amount of research has been done in documenting indigenous medicinal plants and herbs in pursuit of plant identification with pharmaceutical or therapeutic effects and on indigenous dye plants that are used by rural women for the production of folk art works. Limited documentation, if it exists is available on traditional plants that can yield fibres for textile production or that can provide renewable resources for environmental protection. This paper is aimed at documenting existing traditional cellulosic fibres in Swaziland, with the view to take stock of what is available and to explore the potential economic benefits. Data was sought through content analysis and brief interviews from key informants in the communities.

Key Words: Kenaf; Sisal; Hemp; Bagasse; Cellulosic natural fibres

INTRODUCTION

Swaziland is located in the Southern African Community Development (SADC) region with a population of 1126 million people (Thompson, 2005). It covers just over 17,000 square km with four ecological zones called the Highveld, Middleveld, Lowveld and Lubombo Plateau See Fig. 1. In Southern Africa, it is situated between the Republic of South Africa and Mozambique along the 31 degrees latitude, 30 min East of Greenwich line and a longitude of 26 degrees, 30 min South of the Equator (Thompson, 2003). Swaziland is regarded as a developing country, but not one of the least developed countries, although grappling with poverty problems. The economy of Swaziland is agri-based. The diverse agricultural activities, which occur in the country include sugar, citrus fruit, maize and other cereal crops, cotton, forestry and livestock (Thompson, 2003). Exports of agri-based products include sugar, citrus, forestry and beef. Swaziland Meat Industries exports beef to EU countries under a quota arrangement and to other markets, while Swazican Company exports most of the pineapples and citrus it processes to the European Union (EU) (Thompson, 2003). Value addition through textile industry in Lahore, Pakistan plays a vital role to limit poverty going out of proportion by promoting exports in the wake of dynamically changing global scenario and declining prices of primary commodities (Ellahi, 2005). Swaziland is also committed to the development of small and medium enterprises (SMEs) in order to strengthen the

economy of the country through more participation of Swazis in businesses (Swaziland Government, 2007). A significant sector of the population relies on the sale of handicrafts made from locally available raw materials.

The handicraft industry is dominated by the formal division of educated Swazis, who are engaged in product development of unique craft products targeted at the export market. In the informal division, craft is produced mainly by the indigenous rural-based Swazis, who mainly flood the local market at tourist sites (Swaziland Government, 2007). A few products of the latter group may get to the export market through the Swaziland Trading House, an organ of the Ministry of Enterprise and Employment, which was set up to seek overseas market for Swazi craft and other products or through individuals, who attend trade shows in Europe. The economic activities of the latter group are based on handicraft and they serve as a sole source of their livelihoods.

The craft products are mainly made from locally available natural resources like bones, clay, timber and non-timber (plant sources, fibres, seeds, fruits & stems). A substantial amount of research has been done in documenting indigenous medicinal plants and herbs in pursuit of plant identification with pharmaceutical or therapeutic effects (Swaziland National Trust Commission, 2005; Mndziniso & Dlamini, 2005) and on indigenous flora for dyeing handicraft in Swaziland that are used by rural women for the production of folk art works (Ngubane, 1995). Rural women have been reported to contribute to

socio-economic advancement through increased income generation, health awareness and skills acquisition, especially in the area of improved food processing skills (Akpabio, 2007). Limited documentation, if it exists is available on traditional plants that can yield fibres for textile production or that can provide renewable resources for environmental protection. This paper is aimed at documenting existing traditional cellulosic fibres in Swaziland, with the view to take stock of what is available and to explore the potential economic benefits of other fibres that can be cultivated.

The objectives of the document are to identify the existence of kenaf and allied fibres in Swaziland, determine the growth sites of such fibres in the country, state the current usage of the fibres by the communities and the country and describe the potential economic benefits of such fibres in the country. Data was sought through content analysis of existing documents and through interviews from key informants in the communities.

Functions of Currently Used Plant Fibres

Plants from the wetlands. Leaves and stalks from the *Hyphaence coriacea* (*likwane* or *ilala* in Siswati) plants are found in the wetlands distributed throughout the country. These plant species are fast growing, harvested annually, they ratoon and promote environmental sustainability. The usage of these fibre producing plants by the few marginalised people in rural settings is appropriate for purposes of sustaining the eco-system, where they are harvested. These resources may be limited in size of the wetland, available amounts and may be accessed by mostly the local crafters in their immediate location. The raw material is used for differently woven crafted products like sleeping mats, mini versions of the sleeping mats used as wall decorations and drying mats or trays for fruits and vegetables in the communities. The sleeping mats are used as gifts by the bride's family to the groom's family at a traditional wedding ceremony. Although the sleeping mats are done on a small scale, they assist in the transfer of cultural tacit knowledge and skills on weaving of the mats from generation to generation (Anonymous, 2005). These plants can be exploited for making other products like window blinds, bags and lamp shades.

Banana leaves and pineapple leaves are available in abundance as both fruit plants are grown commercially in Swaziland. Bananas are grown in the Lowveld and to a larger extent in the Middleveld for export. Pineapples are grown in the Malkerns area, within close proximity to the processing company in the Manzini region located in the Middleveld of the country. The production is about 25,000 tonnes per year (Thompson, 2003). Currently the pineapple leaves are used in the manufacture of animal feed. The extraction of fibres from banana and pineapple leaves has not been exploited in the country, yet countries like Phillipines have beautiful fabrics made from pina, a fabric made from pineapple fibres (Price *et al.*, 2005).

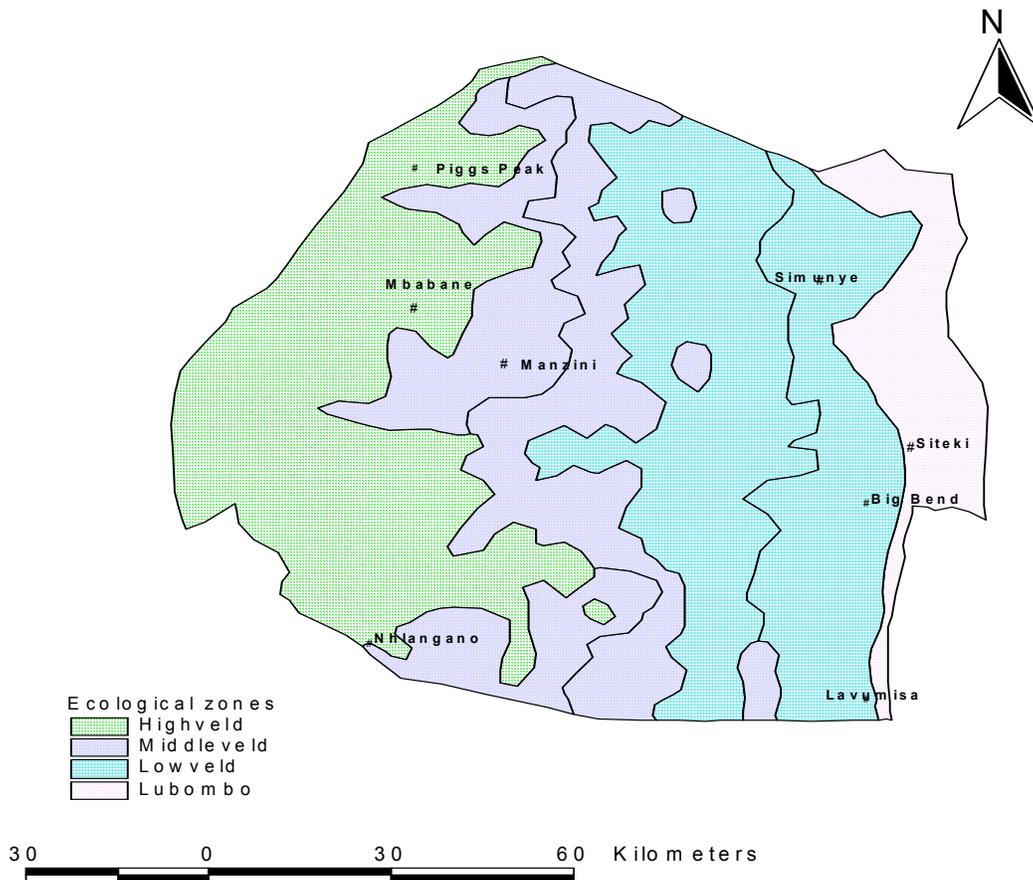
Sugar cane plant is a major cash crop, mainly grown in

the Middleveld and Lowveld that is used to produce sugar and ethanol in Swaziland. For economical production of beef, crop residues like sugarcane tops may be supplemented with seasonal fodders up to 30% in forage feeding system (Riaz *et al.*, 2008). Ethanol production was 32 million litres last year and sugar production was 6,52,689 tonnes last year. Revenue generated from sugar export was valued at E 711.8 million last year (Thompson, 2003 & Swaziland Government, 2007). The revenue income for Swaziland from sugar sales translated to 7% of the GDP generated from exports (FAO/WFP, 2007). Bagasse, a fibrous by product, from the stems of sugar cane is currently used as an energy source for boilers by companies producing sugar. Bagasse has been used for trials in geotextiles production in other countries like the USA (Ramaswamy *et al.*, 1995). Efforts on value addition on bagasse have not been made and it is one potential fibre to be explored for other uses in Swaziland.

Sisal fibres, from the *Agave sisalane* Perrine plant are mainly used for producing beautiful craft baskets and earrings that are exported, bags, floor mates etc. Sisal plants are used as homestead and garden fencing in the rural areas. There were once commercial plantations of sisal plants in the southern part of the Middleveld, which were disbanded, when cotton brought more economic returns in the 1970's. The sisal plant is found scattered throughout the country, but mainly in the Middleveld and Lowveld. Fibres are manually extracted and spun using crude technology by rural women involved in the construction of sisal baskets, table mates and floor mates. Efforts have been made by Zwane and Cloud (2002) to improve the pliability of the fibres through chemical treatment. However, technology to mechanically spin the softer fibres has not been accessed in the region, which can lead to diversified end uses of sisal fibres.

Industrial hemp. (*Cannabis sativa*) is a non-intoxicating stem fibre that is grown in sub-tropical and tropical countries of the world e.g., India. Currently this plant is not grown in Swaziland, but could be tried in the Highveld and Middleveld. Swaziland Government (2007) noted that the Integrated Regional Information Networks (IRIN) reported that Swaziland is considering conducting research trials that may allow small-scale farming to see if the crop can be economically viable. This consideration is propelled by the falling prices of sugar and particularly cotton in the global market, which has ramifications on increased unemployment and poverty in rural areas. The scepticism in promoting and pursuing the growth of the crop vigorously in Swaziland is due to the crop's erroneous association with marijuana, a different breed of the same species grown illegally in the kingdom.

It is an environmentally friendly crop that matures within four months and requires moderate water and fertilizer input. It is referred to as a money spinner with incredible orders from Canada of T-shirts made from this fibre. Apart from making textile products, it can also be used to make durable building materials, paper products,

Fig. 1. Ecological zones of Swaziland

natural medicines, healthy oils and lotions, paints and vanishes, ink, industrial lubricants and fuel (Swazil & Government, 2007).

Morphology of kenaf. Kenaf (*Hibiscus cannabinus* L.), which belongs to the Malveceae family like cotton and okra is a common wild plant in tropical and subtropical Africa, which is probably its original home (Purseglove, 1974). The cultivated forms of kenaf are erect herbaceous annuals, 2.5-4 m tall, with well developed tap roots, stems are straight and slender, glabrous or prickly, green, red or purple in colour (Purseglove, 1974). Leaves are alternate; petiole long, red or green in colour in some cultivars leaves are cordate, others all deeply divided in others lower leaves are cordate with upper leaves deeply divided 5-7 lobed; lobes oblong-lanceolate, sinuous, dentate (Purseglove, 1974). Flowers are up to 10 cm in diameter and are pale yellow, greyish or white in colour with a dark purple center. Some cultivars are self pollinating although cross pollination also occurs. World production of kenaf is about 1 million tonnes of which half is produced by Thailand with other major producers being China, India and Pakistan, while minor producers include Egypt, Morocco, Mozambique, Zimbabwe, Nigeria, Ethiopia, Angola and Mexico (Anonymous, 2007a). Major importers of kenaf are India and Japan, while EU and the USA are minor importers.

Growing conditions and processing. Kenaf is found growing wild in Southern Africa or as a weed of disturbed and arable areas in Botswana, Namibia, South Africa and Swaziland and can successfully be grown as a commercial crop in areas, where cotton is grown. It is a fast growing bast fibre plant (United States Department of Agriculture, 2005). In Swaziland, kenaf is regarded as a weed, which grows in the Middleveld and Lowveld, as confirmed by the interviewed key informants. Its seeds can remain viable for up to 8 months under ordinary storage conditions, while germination can occur within 72 h. Kenaf is adapted to various soils, but grows best in well drained sandy loam and requires a warm moist climate, tropical or sub-tropical, without excessive heavy rains or strong winds (Encyclopaedia Britanica, 2007). For fibre production a seed rate of 25-30 lb per acre in drills eight inches apart with two to three inches between plants in the rows, appears to give the highest yields (Purseglove, 1974). Dense sowing is normally practiced, when cultivation is for seed production. Some varieties need at least 12 h of light each day throughout the growing season (Encyclopaedia Britanica, 2007) a condition, which is met during the summer season in Swaziland. For most varieties kenaf, can be harvested after 4-6 months post the sowing phase. The best time to harvest is when about 10 flowers are in bloom, at which

time the fibre is at its best quality and more easily separable (Purseglove, 1974). The most serious diseases recorded are: dry rot, *Macrophomina phaseoli* (Maubl) Ashby; leaf spot, *Cercospora hibisci* Tracy and Earle; leaf blight, *Phyllosticta hibisci* Peck; stem rot, *Diplodia hibiscina* Cke and Elb and anthracnose, *Colletotrichum hibisci* Poll. Root knot nematodes (*Melodogyne* spp) attack the crop, while reported insect pests include *Podagrica* spp. and *Argilus acutus* Thumb (Purseglove, 1974).

Kenaf of good quality is harvested by hand; however, a delay in harvesting results in coarser fibre, which lack lustre. Fibre strands of about 0.9 m long are usually separated from the stalks mechanically, although in some areas retting, followed by hand stripping is still practiced (Encyclopaedia Britannica, 2007). Retting is a process in which the stems are soaked in water for some time so that the woody parts of the stem are rotted (Anonymous, 2007a). After retting the material is scorched (pounding to separate fibres), washed and dried. Fibre strands are lustrous and pale in colour and of comparable strength to that of jute. Leading producers include China, India and Thailand. The Thai grading system is most commonly used based on colour, softness, fibre length and cleanliness (Anonymous, 2007a). Moisture content should be 14% or less and bales should be made of a consistent grade. The highest grade is 'Super Grade', which is white and very soft and contains a maximum of two per cent foreign material, with a fibre length of 1.5 m. Grade A is soft and white with a maximum of three per cent foreign material and of fibre length of one metre. Grade B is greyish and moderately soft with a maximum foreign material of four per cent and a length of one metre. Grade C is slightly soft and dark with a maximum foreign material of five per cent and with a fibre length of 0.75 m. Short fibres (cuttings or tangles) also have a market for producing small mats (Anonymous, 2007a).

Uses of kenaf. Kenaf, still fairly new to international trade is used mainly for rope, cordage, canvas and sacking, but is receiving increased consideration for other products, such as newsprint and carpet-backing yarn (Encyclopaedia Britannica, 2007). Kenaf provides raw materials for a growing number of products including paper, particle board, animal bedding and bioremediation aids and can be used as a substitute or blended with jute and other stem fibres (Anonymous, 2007b). Kenaf can be used as animal feed. The seeds contain about 20% oil, which is sometimes extracted and used as a lubricant and for illumination; it is suitable for the manufacture of soap, linoleum and in paints and vanish. Tender young leaves can be used as a pot-herb (Purseglove, 1974).

Recent development in Southern Africa. Clothing and textiles manufacture Sear del has recently invested R 100 million into a project to cultivate and process natural fibre from kenaf for use as a green alternative to plastic (Le Roux, 2007). Part of the strategy is to diversify into the growing industry of green alternatives, which has a big growth potential considering increasing concerns over climate

change. Sustainable Fibre Solutions, a company, selected farmers in the Winterton area of Kwazulu-Natal Midlands to grow kenaf, an alternative source to trees in the production of pulp for paper and for synthetic fibre in the production of thermal and sound insulation, automotive components, bio-composite and compressed non-woven materials (Le Roux, 2007). Swaziland shares a border with Kwazulu-Natal; therefore, the kingdom can produce kenaf to feed the Natal processing plant at relatively reduced transport costs. There has been an increasing trend in the building and motor industry to move away from plastics. Plastics have a problem of not being biodegradable and thus they are environmentally un-friendly in a world, where there is increasing interest in use of natural fibres in diverse industrial sectors. Kenaf is one of the crops with the highest carbon monoxide (CO) absorption capacity, with one ton of kenaf absorbing 1.5 tons of atmospheric CO (Le Roux, 2007). Core fibres of kenaf have an application potential in the oil industry for scrubbing oil spills and related chemicals.

Recommendations and future prospects. The expansion of the agricultural industry, by introducing the cultivation of kenaf and allied fibres, can create employment for local people, who can grow the crop and for people, who can work in downstream industries such as fibre processing and manufacture of fibre based products. Employment creation through commercial kenaf and allied fibre production could help in poverty alleviation in Swaziland. Trials could be conducted in the various agro-ecological regions of Swaziland to ascertain suitable cultivars and appropriate harvest time for high quality fibre. Sub-sequent to the trials, kenaf and hemp therefore could be adapted to the agro-ecological conditions of Swaziland and have a great potential as a commercial cash crop. Kenaf and hemp can be grown in rotation with other crops as an annual and thus serve as a renewable resource, which is environmentally friendly. Environmental management is an integral component of Swaziland's development activities because focusing only on production and profit, while neglecting environmental protection has often led to direct environmental problems (Thompson, 2003).

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