Viability of medicinal plants for the enhancement of food security in the Arid and Semi-Arid Lands (ASALS) of Kenya.

Abstract:
Government policy expects small-scale farmers in the arid and semi-arid lands (ASALs) of Kenya to concentrate on food security rather than commercial agricultural production, for the good reason that drought and famine continually threaten them, making them not only among the poorest of people but also at constant risk of starvation. A case in point is the sorghum and millet improvement programme (SMIP) instituted by the Kenya agricultural research institute (KARI) which develops drought resistant grains for subsistence farmers in the ASALs. Yet several evaluation studies have shown that the target farmers operate within the cash economy, and therefore prefer commercially viable crops such as maize. The ASAL poor have to pay cash for most of their basic needs such as food, education and travel. Unfortunately their efforts more often than not meet with failure because their preferred crops do not thrive in the ASALs. However it is possible that a solution can be found in suitable programmes that combine commercial farming with subsistence farming. However successful commercial farming in the ASALs is a considerable challenge given the constraints and the competition. It would most likely require a competitive edge such as a novel product. One possibility is medicinal plants of which Africa has a wide variety, many of which are found in the ASALs. By and large these plants are harvested in the wild rather than cultivated but given that global trade in medicinal plants exceeds 30 billion dollars (US) per annum, and that many face extinction if the status quo continues, this is an area that deserves serious attention.

Commercial production of medicinal plants would ease the cash requirements of subsistence farmers in the ASALs, thus allowing them to concentrate on food security. This paper will review the findings of two evaluation studies on the SMIP project and explore medicinal plant production as a solution to the dilemmas facing farmers, agricultural support services and policy makers.

Subject:
- Medicine, Botanic (Usage)
- Medicine, Herbal (Usage)
- Food (Safety and security measures)
- Food (Laws, regulations and rules)

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INTRODUCTION:

The situation in the arid and semi arid lands (ASALs)

Only about 20% of the landmass in Kenya is high potential. The rest of the land is in the ASALs, yet agriculture supports over 70% of the population (FAO, 1992). Machakos district is one of twelve districts that comprise the Eastern province of Kenya. It borders several districts one of which is Kitui to east (GOK, 1997). The district is generally hot and dry with an average rainfall ranging from 500mm to 1500mm. Rainfall is unreliable. It has a population of 1,108,415 people, with a male:female ratio in favour of females. Approximately 11% of Machakos is high to medium potential with rainfall above 850mm but over 80% of the land mass is in the ASALs. Drought and famine recurs about every five years. The total area of the district is 6,051 sq km.

Kitui district is also in Eastern province but much more arid than Machakos. It has a landmass of 30,199 sq km and a population of about one million, therefore population density is low. Rainfall ranges from 500mm to 800mm but fails every 5 years. Despite availability of land, mean cultivated areas range from 0.76 to 2.85 acres (Rukadema et al, 1983), probably because of scarcity of labour and low levels of technology.

In most of Machakos and all of Kitui people rely on drought resistant crops such as sorghums and millets, pigeon peas, grams, katumaini (drought resistant) maize and beans.

THE SORGHUM AND MILLET IMPROVEMENT PROGRAMME (SMIP)

SMIP was initiated in 1978 to promote sorghum and millet grains for human consumption in Katumani research station in Machakos district (1). The program had the following objectives:

* To develop varieties or hybrids that are stable, resistant to disease and pests, have good food quality, and mature in a timeframe appropriate to their area of cultivation.

* To develop production technologies that conserve and optimises resource use, and minimise cost and risk, while acknowledging the social and economic constraints of small-scale farmers.
* To develop at the village level methods of processing high-tannin varieties that are less prone to bird damage.

* To undertake quality, processing and utilisation studies for the improvement of food forms, which will increase demand and consequently enhance their position in the national economy.

* To disseminate the results through training and on-farm testing, in collaboration with the extension services.

(Source: Kamau and O'Neil, 1990; M'Ragwa and Kanyenji, 1987)

Over the years SMIP has developed and released many improved varieties of sorghum and millet recommended for each of the crop zones and areas they are commonly found in Kenya.

Under ideal conditions, sorghum (Sorghum bicolor) and millet (Pennisetum americanum) grains have a high yield potential comparable to that of rice, wheat and maize. However, because of their superior adaptability to heat and water stress, they are usually grown where other grain crops cannot compete. Under such less than ideal conditions average yields are low, i.e. averaging 1.5 to 0.5 tonnes per ha (Kamau & O'Neil, 1990). This when compared to the 6 tonnes per hectare considered satisfactory for most grains in the high potential areas, may appear disappointing but it can prevent food shortage, which is very important in the ASALS. Apart from main meals, sorghum can be also be utilised in making; bakery products, malted beverages, popped grain, beer, sweet syrup, fodder, building materials, livestock feeds, fodder for animals, or brooms (Janick et al, 1974). Millets are used mostly for porridge, and sometimes for baking, animal feed or forage. (2)

The SMIP programme successfully developed several varieties of sorghums and millets that were early maturing, high yielding, possessing good processing quality and less susceptible to birds, weeds and disease. The scientists recognised that varieties developed on earlier programmes (3) such as Serena and Dobbs, (and hybrids such as Hijack, Himid and Hibred) were largely rejected by farmers because they had a bitter taste compared to traditional varieties as well as the fact that their seed was expensive. They therefore developed six other varieties of which only S76 and 2Kx17 are still used by farmers. Other varieties subsequently developed included S76 and KARI/MTAMA1 (sorghum), and KAT/PM1 (finger millet), KAT/P1 & KAT/P2 (pearl millet), KAT/PRO1 (proso millet), and KAT/FOM1 (foxtail millet). Seed companies commercially market the two sorghum varieties, and the finger millet variety KAT/PM1. KARI has a list of recommended practices to follow when cultivating these crops as well listing five outlets that buy sorghum and millet grains. KARI also develops recipes for whole grain, dehulled grain, and flour.

Sorghum is acknowledged to be the third most important cereal in Kenya after maize and wheat (KARI/MIAC, 1997; Kamau and O'Neil 1990). Both maize and wheat thrive in high potential areas, and do poorly in marginal areas. Because Kenya's population is one of the fastest growing in the world while 80% of her landmass is in the arid and semi-arid areas (ASALs); it would seem obvious that drought resistant crops are of prime importance. But the production of both sorghum and millet in Kenya has suffered a general decline in the last few decades (M'Ragwa and Kanyenji, 1987). And while the decline of these crops in the high potential areas might have been expected under the onslaught of lucrative commercial farming, real estate development, urbanisation and industrialisation; they have also been declining in the drought prone ASALs.

Two studies were conducted sequentially during the last decade to evaluate the effect of the sorghum and millet improvement programme (SMIP) on some of the rural communities it was intended for. They were entitled "The improved sorghum and millet programme: its socio-economic implications for women farmers in Kitui district, eastern Kenya" and "Technological change and rural third world women: an impact study in Machakos district eastern Kenya", respectively. Both studied the socioeconomic effects of agricultural technology (as embodied in SMIP) on women farmers, one in Kitui district and the other in Machakos district (Odoulu and Karugu, 1993; Bird-David, et al, 2000). Both districts make up part of the Eastern province of Kenya, Kitui being almost entirely in the ASALs as is most of Machakos.

These studies found the following reasons for the decline of sorghums and millets in the ASALs:

* These crops have a lower yield potential than maize except during drought.

* They are highly susceptible to bird damage often resulting in complete crop loss for farmers but scientists have not yet offered a really effective solution.

* They are extremely labour intensive in situations where total labour supply on farms is shrinking due to rural-urban migration, the school system and smaller families.

* They mature late.

* Consumers almost invariably prefer maize to these grains, which results in severe marketing problems.

* Prices tend to be low, especially for sorghum, meaning that farmers do not get adequately compensated.

* The Kenyan legal framework discourages the use of these crops for industrial and commercial purposes.

* They tend to have poor processing quality.


Because of the above reasons SMIP has not been successful in persuading small-scale farmers in Machakos and Kitui to opt for food security by cultivating sorghum and millet. The realities on the ground force farmers to try unsuitable crops such as maize with predictably dismal results. These farmers prefer maize because when it does do well, it has a ready market, and fetches good prices. And these farmers need money to purchase basic needs and wants as there is no escaping the cash economy. However it is reasonable to suppose that if such farmers were presented with an alternative and dependable source of income, they may become more interested in sorghum and millet. Consequently this paper proposes the exploration of commercial production of medicinal plants alongside food crops.
According to the International trade forum (2002), prospects are good for export growth in medicinal plants from the developing world. In fact sales of herbal medicine grew from US$ 12.5 billion to US$ 30 billion between 1994 and 2000. It goes on to point out that markets for herbal medicine in Europe and the United States are highly regulated and difficult to penetrate, particularly for developing countries and less developed countries (LDCs). This is because the products have not undergone the stringent testing required by developed country pharmaceutical manufacturers before mass production. However rising interest in medicinal plants has created a sustained and largely ‘underground’ trade in plant materials, many of which are collected from developing countries and LDCs in an unregulated manner resulting in indiscriminate harvest of wild varieties and serious damage to biodiversity. Because a substantial part of this trade is not recorded, it is not possible to assess global trade in all medicinal plants (ibid).

Major constraints to trade in the developing world include lack of knowledge on supply, limited knowledge of properties and intellectual property rights.

The International trade forum (2002), suggests two solutions, firstly cultivating in a sustainable manner and entering markets at the early stages of the value chain by supplying developed country manufacturers with unprocessed raw materials. Later they can move towards providing herbal supplements before tackling the highly regulated market for herbal remedies. And secondly exploring alternative sales techniques such as the Internet where growth rate in sales of supplements far exceeds that of natural foods, mass market stores and multilevel marketing

Mankind has depended on medicinal plants for many years. Before the emergence of modern medicine, plants were the main source of treatment for all types of diseases. It is estimated that there are between 35,000 and 70,000 plant species that can be used to produce drugs to cure different types of ailments and diseases. Currently, between 4,000 and 6,000 botanicals are of commercial value. And plants continue to play an important part in contemporary medical treatment, for example China derives about 80% of it's medicine from plants as do most Asian countries (International trade forum, 1991).

Large quantities of medicinal plants are used in herbal and medicinal teas (ibid), but plant extracts and medicinal herbs and spices, are also increasingly used in the food, flavour and cosmetic industries. China is the biggest producer and exporter of medicinal plants accounting for 30% of world trade by value, followed by Korea, USA, India and Chile. The major markets are Japan, USA, Germany, France, Italy, Malaysia and Spain.

In Africa traditional healers using remedies made from plants, play an important part in the health of millions of people. According to the California Academy of Sciences (2003), the ratio of traditional practitioners and that of university trained doctors in relation to the whole population in African countries clearly indicates the importance of medicinal plants as a source of drugs.

The above table highlights the fact that the majority of people in Africa have little or no access to modern medicine. However, most do have access to traditional healers. Even South Africa, which has one of the best doctor:patient ratios on the continent, has a significantly better traditional healer:patient ratio. In recognition of the fact that the medicinal plant trade serves 90 million people in the region and that the plants are being depleted by indiscriminate harvesting, South Africa has begun to address the issue of sustainability. It is pioneering agricultural production of medicinal plants through research, nurseries, database and extension (Mander et al, 1995).

Most developing countries are endowed with vast resources of medicinal plants, which have not been fully exploited. Western medicine based on modern science has been glorified at the expense of traditional medicine, which has long been regarded as primitive. Most colonial governments discouraged, and even declared traditional medical practice, illegal. This created a negative attitude to traditional medicine in Africa. However, traditional medicine has continued to thrive in the midst of this discrimination, because the majority of people living in the rural areas of Africa have no access to modern medicine, due to long distance and high cost.

Based on local knowledge, Africa has a long and impressive list of medicinal plants. Medicinal plants have been used to cure different diseases on the continent for centuries, but what is interesting is that one plant species can be used to cure different diseases in different countries (CAS, 2003). For example, securidaca longepedunculata is a tropical plant found almost everywhere in Africa. In Tanzania, the dried bark and root are used as a purgative for nervous system disorders. Throughout East Africa, dried leaves are used for wounds, venereal disease and snakebite. In Malawi, the leaves are put to the same uses as well as being used for coughs, headaches and bilharzia. In Nigeria the dried leaves are used for skin diseases. In other parts of Africa the root in various forms is used to cure malaria, impotence, epilepsy, for psychotropic effect or as an aphrodisiac. This example illustrates the extent to which medicinal plants can be used to substitute western medicine. Furthermore, these plants can and do serve as a source of raw materials for the production of modern drugs.

It has been estimated that 80% of all Kenyans use herbal medicine (KTN, 2003), but the demand for these plants has led to indiscriminate harvesting of spontaneous flora including those in forests (CAS, 2003). The situation is even worse in the ASALs where plant cover is scanty. As a result many plant species have become extinct and many others are endangered.

Like other African countries, Kenya is rich in medicinal plants and the ASALs are also endowed with many different species of such plants. And while the formal medical sector is geared towards western medicine, it is important that alternative forms of medicine be considered since the medical sector is largely unable to cope. Reasons for the inability to cope include:

* medical personnel: patient ratio is too high

* health centres are few and far apart

* health care is expensive and therefore beyond the reach of most people

* patients often have to travel very long distances to health centres
conclusion:

* That herbal medicine be integrated into the formal medical system
* Legal protection of indigenous knowledge, producers, processors and consumers
* Training and regulation of practitioners of herbal medicine
* Market exploration and penetration, including the use of modern methods to promote the concept of traditional medicine
* Research to be conducted on breeding, cultivation, post harvest handling and processing of medicinal plants found in the ASALs
* Training on cultivation and post harvest handling of these plants
* Government to formulate policy on commercial production of medicinal plants

In view of the above analysis the authors make the following recommendations:

In Kenya the establishment is less hostile to traditional medicine than it used to be, with formal training centres opening up to train practitioners. Interestingly enough even personnel from formal medicine, such as clinical officers are enrolling in such courses. Research bodies are also exploring herbal medicine, and practitioners are beginning to network effectively. However a lot remains to be done if herbal medicine is to become an integral part of Kenya's health care system. But in order for herbal medicine to be formalised, there would have to be a continuous supply of the plants that provide the main ingredients in such treatments. However in the face of the depletion of medicinal plants, sustainability is not certain.

Kokwaro (1976) described more than 2,200 species of medicinal plants used in by the different communities in East Africa, to treat ailments ranging from simple headaches to cancer. Kokwaro even included remedies for psychiatric disturbances, and livestock diseases. The following table lists a few of the many plants occurring naturally in the ASALs that are commonly used for medicinal purposes.

<table>
<thead>
<tr>
<th>Medicinal Plant</th>
<th>Common Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aloe vera</em></td>
<td>Anti-inflammatory, wound healing</td>
</tr>
<tr>
<td><em>Euphorbia</em></td>
<td>Analgesic, anti-inflammatory</td>
</tr>
<tr>
<td><em>Eucalyptus</em></td>
<td>Antiseptic, expectorant</td>
</tr>
</tbody>
</table>

The fact that so many plants are widely used for medicinal purposes supports the case for systematic cultivation. In line with the government's policy of food security, such plants can be grown as cash crops in the ASALs to supplement food crops. Further support for this line of argument lies in the fact that the western model of health care has been largely unsuccessful in Africa, Kenya included.

**MEDICINAL PLANTS AND FOOD SECURITY IN THE ASALS**

Africa has an estimated 216,634,000 hectares of closed forest, but the annual loss of forest cover due to deforestation is estimated at 1% annually. The situation is worse in the ASALs where vegetative cover is already scanty. This means that many medicinal plants will be extinct before too long. Indeed many plants including medicinal plants are already considered endangered species. This necessitates urgent measures to arrest the extinction of plants, which are vitally important to a large percentage of people in Africa.

The demand for medicinal plants is increasing very fast worldwide. The pharmaceutical industry began to consider global traditional medicine as source for the identification of bioactive agents that can be used in the preparation of synthetic medicine (CAS, 2003). If many plants become extinct then inputs for such medicines will have to come from a limited medicinal plant base. Yet the West is moving to natural products as indicated by the growing popularity of natural foods, and cosmetic products. There is also a fast growing industry in traditional (alternative) medicine in the West, which largely depends on medicinal plants to formulate natural remedies. This means that medicinal plants will be in even greater demand in the next few years.

Kenya cannot afford to wait until all the rare species of its medicinal plants are exhausted. A solution must be found in the near future. It is the view of the authors that commercial production of medicinal plants will be of great benefit in the future. And that the ASALs would greatly benefit from a policy focussing on commercial production of medicinal plants.

The Kamba, Maasai, Digo and Marakwet tribes are some of the Kenyan communities where food security has been a serious problem. They would therefore benefit from a policy aimed at encouraging them to commercially produce the medicinal plants suitable for their particular areas, alongside traditional food crops. This would enable them to obtain cash while at the same time achieving food security.

**RECOMMENDATIONS:**

In view of the above analysis the authors make the following recommendations:

* illiteracy and ignorance are often a deterrent
* patients often have to wait several hours before they can be attended to
* overworked and poorly motivated staff often treat patients inconsiderately
* patients are rarely informed about the nature of their ailments or offered choices
* treatment is divorced from culture, family and community, i.e. it is purely biological with no spiritual or emotional support.
Food security in the ASALs is of great importance to the government and to the people living there. But food security cannot be tackled on its own, without addressing the issues that may hinder its achievement, such as the people's need for cash. This is due to the fact that the Kenyan economy is highly monetised, therefore it not reasonable to expect the ASAL poor to concentrate on food security to the exclusion of cash. Medicinal plants are a potential source of cash if cultivated commercially in the ASALs.

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Winfred N. Karugu, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya
Meanwhile research on the use of sorghums in animal feeds was in progress at Lanet in Nakuru district.

The term millet covers a number of different genera grown in Africa and the Far East. Major species include foxtail millet, finger millet, pearl millet, and cattail millet.

Sorghum and millet research started in the 1940s under the East African Community (EAC) in the member countries–Kenya, Uganda and Tanzania. It ceased when the EAC collapsed in 1977. In 1974 a programme driven by Kenyan goals was initiated at Lanet in two phases for developing dual-purpose (forage & feed) sorghum. Subsequently the National Agricultural Research Programme (NARP) initiated a three phase project i.e. human resource development (1987-92), research & food security (1993-1995) and finally linkages with the private sector for market value technologies such as processing and utilisation (1996-2013).

Table 1 Ratio of doctors and traditional medical practitioners (TMP) in selected African countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Doctor:patient</th>
<th>TMP:patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>1:7,142</td>
<td>1:987</td>
</tr>
<tr>
<td>Malawi</td>
<td>1:50,000</td>
<td>1:138</td>
</tr>
<tr>
<td>South Africa</td>
<td>1:1,639</td>
<td>1:700</td>
</tr>
<tr>
<td>Swaziland</td>
<td>1:10,000</td>
<td>1:100</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1:33,000</td>
<td>1:350</td>
</tr>
<tr>
<td>Uganda</td>
<td>1:25,000</td>
<td>1:708</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>1:6,250</td>
<td>1:234</td>
</tr>
</tbody>
</table>

Source: World Bank, 1993

Table 2: Some of the medicinal plants found among different communities in the ASALs of Kenya

<table>
<thead>
<tr>
<th>Community</th>
<th>Botanical Name</th>
<th>Vernacular Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kamba</td>
<td>Acacia mellifera</td>
<td>muthia</td>
</tr>
<tr>
<td></td>
<td>Cajanus cajan</td>
<td>musuu</td>
</tr>
<tr>
<td></td>
<td>Solonum icanum</td>
<td>mutungu</td>
</tr>
<tr>
<td></td>
<td>Pappea capensis</td>
<td>muva</td>
</tr>
<tr>
<td></td>
<td>Vernonia lasiispus</td>
<td>mvathath</td>
</tr>
<tr>
<td>Kikuyu</td>
<td>Stephania abyssinca</td>
<td>musuga</td>
</tr>
<tr>
<td></td>
<td>Vernonia auriculifera</td>
<td>muchatha</td>
</tr>
<tr>
<td></td>
<td>Myrfine africana</td>
<td>muga</td>
</tr>
<tr>
<td>Maasai</td>
<td>microgesa pyrifolia</td>
<td>olabai oibo</td>
</tr>
<tr>
<td></td>
<td>Maytenus undata</td>
<td>olamunyai</td>
</tr>
<tr>
<td></td>
<td>Bidellia micrantha</td>
<td>olairagai</td>
</tr>
<tr>
<td></td>
<td>Cissus rotundifolia</td>
<td>ol-airai</td>
</tr>
<tr>
<td>Digo</td>
<td>Acalypha angleri</td>
<td>mvunya jembe</td>
</tr>
<tr>
<td></td>
<td>Alechornea laxiflora</td>
<td>mvunya jembe</td>
</tr>
<tr>
<td></td>
<td>Hibiscus furathenthis</td>
<td>mwawawu</td>
</tr>
<tr>
<td></td>
<td>Cissus quadrangularis</td>
<td>mwacheso</td>
</tr>
<tr>
<td>Marakwet</td>
<td>Peponium vogelli</td>
<td>senobchaw</td>
</tr>
<tr>
<td></td>
<td>Cucumis figarei</td>
<td>sigirgerwa</td>
</tr>
<tr>
<td></td>
<td>Ximum suave</td>
<td>YO/ yoliya</td>
</tr>
<tr>
<td></td>
<td>Ziziphus mauritania</td>
<td>yilomwaw</td>
</tr>
</tbody>
</table>

Source: Kokwaro, 1976

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