

Review Article

Interrogating the Role of Apiculture in Food Security and Nutrition in Kenya

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Abstract - Despite considerable investment in agriculture, Kenya is a net importer of food, with one out of three Kenyans unsure of where their next meal is coming from, according to the “Global Hunger Index 2018”. Two-thirds of Kenya landmass is classified as arid and semi-arid lands (ASAL); the dry areas in Kenya usually face acute food and nutrition insecurity due to the devastating effects of drought, climate change and desert locusts. The ASAL experiences unreliable rainfall, with most of the households practising crop and traditional livestock farming that relies on the rains; thus, they remain food insecure most of the time. The dry areas paradoxically hold a huge honeybee population, and the ability of honey production is high due to different ecological conditions. Bee-keeping (apiculture) is a livestock subsector with a huge untapped potential to contribute to Kenya's rural household income and foreign earnings. It is an uncomplicated venture, relatively cheap to start and enhances the environment through the pollinating activity of bees. Apiculture, therefore, has the potential of promoting economic development by supplementing household incomes from selling honey and other products from the hive and contributing to the management of non-communicable diseases such as diabetes by replacing sugar with honey as a sweetener. Investment in apiculture also contributes to environmental conservation since it reduces pressure on agricultural land due to the limited areas under occupation by beehives as compared to traditional crops and livestock, not to mention that the practice is people and environment friendly. Apiculture does not rely on the rains to improve food security and conserve the environment

Keywords - Apiculture, ASAL, Nutrition, Food security

I. INTRODUCTION

A. Global overview

In recent decades, many communities within rural areas of developing countries have faced crises of poverty and food security (Tiffens, M. (2002). These are the result of complex interactions between environmental and socio-economic factors which have directly affected the lives of millions of people. Agriculture is the main activity that has employed most rural households for food production and

generating their income (FAO 2004). However, following current uncertainties in rainfall patterns as a result of global climatic changes and poor land management practices, farm yields have been declining over time, leaving many families without sufficient food or income to meet their basic household amenities (Nyarik, 2002) and hence lead to major shock due to their lack of ability to respond. According to Ellis (1988), communities in developing countries are more vulnerable to climate change impacts due to their high exposure to natural hazards, their direct dependence on climate-sensitive resources such as plants, trees, animals, water and land, and their limited capacity to adapt to and cope with climate change impacts. Building the resilience of affected people so they can respond positively to these changes requires helping people to cope with current change, adapt their livelihoods, and improve governance systems and ecosystem health, so they are better able to avoid problems in the future. This means that vulnerable people need to be helped in various ways, such as getting access to support programs and adaptive practices. As observed by Koirala and Thapa (1997), food security is not possible without income security.

Bee-keeping is one of the best practices that have been recognized to improve the livelihood of poor farming communities without much investment cost (Baptist and Punchihewa 1983). Apart from being consumed as food, bee products, especially honey, propolis and bee pollens, have long been used in traditional medicine. They provide many bioactivities, such as antimicrobial, anti-inflammatory, free radical scavenging and ant proliferation activities, amongst others (Aizen, M.A. and Harder, L.D. (2009).

According to FAO report 2019, nearly 1 out of every 9 people on earth go to bed hungry every night. Sustainable development goal(SDG) no.2 aims at ending hunger malnutrition, achieving food security, improving nutrition and promoting sustainable agriculture, and this calls for innovation in agricultural practices such as promoting sustainable agriculture and supporting small scale farmers. For the above to be a reality, the 2030 Agenda for Sustainable Development puts forward a transformational



vision recognizing that our world is changing, bringing with it new challenges that must be overcome if we are to live in a world without hunger, food insecurity and malnutrition in any of its forms. Thus innovations such as apiculture practices to promote income and nutritional needs of the most vulnerable people need to be taken into consideration.

Another disturbing fact is that about 2 billion people in the world experience moderate or severe food insecurity. The lack of regular access to nutritious and sufficient food that these people experience puts them at greater risk of malnutrition and poor health. Although primarily concentrated in low- and middle-income countries, moderate or severe food insecurity also affects 8 per cent of the population in Northern America and Europe. In every continent, the prevalence rate is slightly higher among women than men.

More than 820 million people in the world are still hungry today, underscoring the immense challenge of achieving the Zero Hunger target by 2030. Hunger is rising in almost all sub-regions of Africa and, to a lesser extent, in Latin America and Western Asia.

B. Africa situation

The situation in Africa, as reported by FAO (2017), indicates that the prevalence of hunger was on the rise after many years of decline.

The Regional Overview confirms that this trend continues, with Central and Western Africa faring the worst. Today, a fifth of Africans are undernourished, representing a staggering 257 million individuals.

The worsening trend in Africa is due to difficult global economic and worsening environmental conditions and, in many countries, conflict and climate variability and extremes, sometimes combined. Economic growth slowed in 2016 due to weak commodity prices, in particular for oil and minerals. Food insecurity has worsened in countries affected by conflict, often exacerbated by drought or floods. For example, in Southern and Eastern Africa, many countries suffered from drought.

The deterioration of the food security situation and the lack of progress towards the WHO global nutrition targets make it imperative for countries to step up their efforts if they are to achieve a world without hunger and malnutrition by 2030. The call for greater action remains true even as the economic and climatic situation improves, offering hope of renewed progress in reducing food insecurity and malnutrition on the continent.

C. Kenyan situation

Despite considerable investment in agriculture, Kenya is a net importer of food, with one out of three Kenyans unsure of where their next meal is coming from, according to the “Global Hunger Index 2018”. Reports indicate a deficit of 19 million bags of maize in the national granary after the delayed March to May (MAM) 2019 long rains.

The population is estimated to hit 65 million by 2030, as per “The World Population Prospects 2017” by the UN Department of Economic and Social Affairs (Undesa). The glaring state of recurrent food shortages calls for long-term interventions to address the declining food production reported in the “2017 Economic Survey” by the Kenya National Bureau of Statistics (KNBS).

II. SUSTAINABLE

The Sustainable Development Goals aim to end hunger by 2030. Progress towards achieving SDG 2, Zero Hunger, is significantly off-track, with global hunger on the rise rather than falling. In Kenya, it’s difficult to see how SDG 2 can be achieved without a fundamental change in the agricultural sector.

In the Kenyan context, the agricultural sector is the mainstay of Kenya’s economy. The sector directly contributes 24% of the Gross Domestic Product (GDP) and 27% of GDP indirectly through linkages with manufacturing, distribution and other service-related sectors. Approximately 45% of Government revenue is derived from agriculture, and the sector contributes over 75% of industrial raw materials and more than 50% of the export earnings. The sector is the largest employer in the economy, accounting for 60 per cent of the total employment. Over 80% of the population, especially those living in rural areas, derive their livelihoods mainly from agricultural related activities. Due to these reasons, the Government of Kenya (GoK) has continued to give agriculture a high priority as an important tool for promoting national development.

In 2008, the GoK launched Kenya Vision 2030 as the new long-term development blueprint for the country whose focus is to create a “Globally competitive and prosperous country with a high quality of life by 2030”. The Vision also aims at transforming Kenya into “a newly industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment”. The Vision is anchored on the economic, social, and political pillars and will be supported on the foundations of macroeconomic stability; continuity in governance reforms; enhanced equity and wealth creation opportunities for the poor; infrastructure; energy; science, technology and innovation; land reform; human resources development; security; and public sector reforms.

Given the central role the agricultural sector plays in the economy, the Government is in the process of finalizing the development of the Agricultural Sector Development Strategy (ASDS). The overall aim of this strategy is to strategically make the agricultural sector a key driver for achieving the 10 per cent annual economic growth rate expected under the economic pillar of Vision 2030. Through the ASDS, the Government aims at transforming the agricultural sector into a profitable economic activity capable of attracting private investment and providing gainful employment for the people.

A. Food security

The achievement of national food security is to be a key objective of the agricultural sector. Food security, in this case, is defined as “ a situation in which all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (Kenya Food Security Steering Group, 2008). In recent years, and especially starting from 2008, the country has been facing severe food insecurity problems. These are depicted by a high proportion of the population having no access to food in the right amounts and quality. Official estimates indicate over 10 million people are food insecure, with a majority of them living on food relief. Households are also incurring huge food bills due to the high food prices. Maize being staple food due to the food preferences is in short supply, and most households have limited choices of other foodstuffs.

The current food insecurity problems are attributed to several factors, including the frequent droughts in most parts of the country, high costs of domestic food production due to high costs of inputs, especially fertilizer, displacement of a large number of farmers in the high potential agricultural areas following the post-election violence which occurred in early 2008, high global food prices and low purchasing power for a large proportion of the population due to high level of poverty.

B. A case for apiculture

Apiculture or beekeeping is the management and study of honeybees; it also includes the cultivation of bees on a commercial scale for the production of honey and related products; it is the science, art, and practice of rearing bees or keeping bees or cultivating bees as well as the manufacturing of honey, beeswax, propolis, pollen (bee bread), royal jelly and bee venom; for food, medicine and income. Beekeeping is also important for pollination and recreational activities; a honeybee colony typically consists of three kinds of adult bees: workers, drones, and a queen in Kenya has been practised traditionally for many years; however, only 20% of the country's honey production potential (estimated at 100,000 metric tonnes) has been tapped, and approximately 80% of Kenya consists of arid and semi-arid

lands (ASALs) which have high potential in the production of honey, and apicultural activity is a major occupation in these areas due to the abundance of bee flora. ASAL regions also practice beekeeping, while Modern beekeeping in Kenya started towards the end of the 1960s and has since become an important enterprise in the livestock sub-sector where about 80% of the honey comes from the traditional log hive; however, a reasonable amount of hive products is obtained from Kenya Top Bar and Langstroth hives

Apiculture is important because it provides bees with a safe place to work and live. Since bees pollinate many of our food sources, it's important to keep the bee population healthy. Additionally, apiculture provides an environment in which to study bee habitat and behaviour.

Globally there are more honey bees than other types of bees and pollinating insects, so it is the world's most important pollinator of food crops. It is estimated that one-third of the food that we consume each day relies on pollination, mainly by bees, but also by other insects, birds and bats.

Along with other insects, bees play an important part in pollination. Flowering plants need to be fertilised with pollen before they can make seeds and produce new plants. Bees transfer pollen between plants and so help with fertilisation. Without bees, chances of cross-pollination are dim. This drastically reduces food production, a circumstance that worries most agriculturalists. The queen bees are the sole reproductive female in a colony, and the presence of a healthy, high-quality queen is essential for colony survival not only because of their ability to lay large numbers of female and male eggs but also because of the social coherence of a colony depends on her pheromones.

With improved technology, farmers can avoid variability in beekeeping production, with some hives missing honey due to lack of a colony and others having plenty of it.

According to experts, pollinators contribute substantially to the economy of the country and are vital to keeping fruits, nuts, and vegetables in diets.

However, insect pollination is integral to food security. Honey bees enable the production of at least 90 commercially grown crops in the country.

Apiculture is a rewarding and enjoyable occupation with many benefits. It has a number of advantages over other farm enterprises: Requires little land (50 colonies require a ¼ acre) which does not have to be fertile: Honey is a source of non-perishable food: Capital investment is low compared to other farm enterprises: Is cheap and relatively not competitive to other Agricultural enterprises, i.e. does not compete for resources: Labour required is low: Many products can be

obtained which are a great source of income, i.e. honey, beeswax, pollen, propolis, bee venom, royal jelly, bee colonies, bee brood, queen bees, and package bees: Encourages environmental conservation: Bees are good pollinators of plants, trees, fruits and crops, thus playing a big role in bio-diversity and improvement of crop yields; The therapeutic value of most hive products provide a remedy for a number of ailments (Apitherapy)

In conclusion, the reasons why farmers practice beekeeping can be summarized into two, i.e. for economic purposes and environmental conservation. Gidey and Mekonen (2010) opinion are that beekeeping generally supports very many households in Sub-Sahara Africa. Pretty et al. (2005) also observes that beehives are hung on top of trees means that which means that as many trees as possible are required, and this promotes afforestation. Beekeeping requires good vegetation for the requirements of nectar, hence need to avoid deforestation. Fernandes (2006) further argues that, unlike other farming systems that require chemical reinforcements such as fertilizers, pesticides, etc., beekeeping thrive by nature hence do not contribute to environmental pollution.

C. Apiculture policy

According to Kim Flottum (2018), Apiculture or Beekeeping tends to be perceived as ‘a hobby’ or as ‘a sideline activity’. These descriptions may often be true, but a resilient livelihood – one that keeps people out of poverty – is one that has access to a range of options. In this case, apiculture and related trades can be sources of valuable strength to countless numbers of rural people's livelihoods. Rather than just a ‘hobby’, beekeeping may be seen as an important occupation and part of rural life worldwide. In rural communities where access to income is limited, small-scale beekeeping can contribute significantly to livelihood security. Apiculture and related trades tend to be underplayed in both policy and planning. One reason may be the focus of rural development, wherein crop production and livestock rearing are taken to be dominant activities in rural areas. This perspective can render invisible the part beekeeping occupies in social life, culture, and local economies. Bee-keeping does not fit easily into the sectoral divides of rural development: as an activity, it spans forestry, horticulture, agriculture, the natural environment, animal husbandry and entomology without fitting precisely into any one of these sectors. Likewise, pollination is an important part of horticulture, yet the management of bees is often considered part of animal production. Similar problems confront the classification of bee products because honey is a food, yet beeswax is listed amongst non-food waxes and oils. Beekeepers have been categorised in different times and places as farmers, hunters and gatherers, cattle-keepers, or rural dwellers – with beekeeping remaining hidden as an important skill and part of their lives. These ambiguities present complications for development policy-makers, practitioners and researchers,

even though such complexity is in keeping with the way people themselves link different activities, resources and products together in their daily lives. This very complexity explains the attraction of sustainable livelihood approaches for securing a more visible position for beekeeping within rural development (Carney, 1998). Bee-keeping fits well into the people-centred perspectives of sustainable livelihoods approaches. Such approaches have contributed towards moving rural development away from economic and resource-based interventions, towards people and their rights and obligations to the resources on which their livelihoods are based.

D. Apiculture Policy gap

The current policy on Apiculture is broadly to develop a modern beekeeping industry in the country to provide additional income to rural households.

The Policy paper on apiculture is still on the draft proposal stage

E. Youth the missing link to food security, apiculture may meliorate

According to the Kenya census report 2019, the country has a young population — 70 per cent of the population are under 24 years. Twenty-two per cent of the youth aged 15-24 are unemployed, says a 2016 report by the International labour organization (ILO). Many are actively looking for white-collar jobs while there is a decline in youth engagement in agriculture. The burden of food production has been left to the older generation, with the average age of a Kenyan farmer being 60.

According to James E. Tew (2015), older farmers are often unable to adopt new innovations that can ensure sustainable production. It is expected that, by 2030, six per cent of the global urban population will be composed of people under 35, according to the 2016 UN-Habitat Youth Statement report. Rural-urban migration is no different in Kenya, with nearly a third of the population living in towns and cities.

F. Cheap imports

The low engagement of Kenyan youth in agriculture can be attributed to a host of factors. The key among them is that they don't view farming as a profitable enterprise. Unsuccessful attempts at commercialising agriculture have resulted in a widespread negative attitude towards farming, with youth often associating the sector with poverty.

In spite of glowing case studies of quick wins in agricultural ventures, young people's interest in farming as a career remains low. Land productivity is not at its optimum due to low adoption of technologies, high production costs, over-reliance on rain-fed agriculture, the effects of climate

change and farmers' struggles to be profitable amid competition with cheap food imports.

Young people also face significant barriers to entry into agriculture due to their low access to land, skills and capital. The culture of land inheritance means that land ownership remains largely in the hands of older generations while the youth, especially young women, are typically excluded from owning or accessing land.

G. Shelf life

Urgent action is needed to boost the profitability of farming and increase youth involvement. Priorities for government support should be providing targeted technical and business advice to youth producer enterprises and first mile/venture agribusinesses, facilitating access to affordable, high-quality inputs to motivate the adoption of productive technologies, and de-risking youth enterprises to help them manage alternative low-interest loans to service their farm business models since the Youth favour vegetable growing due to the short seasonality (45-90 days) and ease of selling produce.

The private sector is a critical player here. The local agro-manufacturing sector should be developed to help alleviate the 20-50 per cent post-harvest losses farmers incur, as shown by a 2014 UN Food and Agriculture Organisation (FAO) report.

Value addition is another factor. It reduces wastage, increases shelf life and creates jobs for the youth and demand for local raw materials. In turn, diversified local and export markets are likely to spur domestic output and investment in apiculture ventures

H. Gain access

Kenya's youth bulge offers a chance to raise agricultural output and bolster food and economic sustainability. With food security a major component of the 'Big Four Agenda', government empowerment of the country's youth to gain access to the land and finance that they need to engage in agriculture with special preference to apiculture which is key to underpinning it.

Apiculture's role in poverty alleviation and unemployment When apiculture forms part of people's livelihood strategies, there are various possible outcomes. Some of these outcomes will include income and material goods, but also non-material outcomes such as well-being and contentment. In terms of apiculture, the least visible livelihood outcome is the pollination of flowering plants, both wild and cultivated: this is an outcome impossible to quantify. Honey is a traditional medicine or food in nearly all societies, and whether sold in a simple way at the village level or packaged more sophisticatedly, honey generates income and can create livelihoods for several sectors within

society. Beeswax is also a valuable product from beekeeping, although, in some places, its value is not appreciated. Industrialized countries are net importers of beeswax, and the supply comes from developing countries. The beekeepers and other people in a community can create further assets by using honey and beeswax to make secondary products, such as candles, beauty creams or beer. Selling a secondary product brings a far better return for the producer than selling the raw commodity. Bees also generate other products (pollen, propolis and royal jelly) that can, in some situations, be harvested, marketed and made into secondary products: all of these work effectively to strengthen people's livelihoods.

Another crucial livelihood outcome is where, through strengthening people's livelihoods, beekeeping has managed to help a family become less vulnerable, strengthening their ability to look into the future and reducing the chance that they will slip into poverty if a member of the family becomes ill or if a season is bad for farming or other activities. In addition to their financial value, honey and beeswax have many cultural values and form part of ceremonies for birth, marriages, funerals, Christmas and other religious celebrations in many societies. Beekeepers are generally respected for their craft. All of these aspects are Livelihood Outcomes from the activity of beekeeping. While some may be difficult or impossible to quantify, they are real outcomes that strengthen people's livelihoods and, therefore, should be acknowledged by a beekeeping intervention.

I. Cost-benefit analysis for hives as a justification for youth unemployment and poverty reduction

Youth or youth groups interested in venturing into the beekeeping industry needs to know the various costs and production levels of the different hive types. The following are cost-benefit analyses for different hives. Assumptions: An economical unit comprises of at least 20 hives; Occupation rate will be 80% throughout the project's lifespan; The farmer is knowledgeable about beekeeping and will manage the colonies well; Life span of the equipment will be 10 years; Price changes for hive products will be insignificant over the 10 years; The analysis is based on a fixed cost depreciation.

Cost Benefit Analysis of 20 Log Hives Apiary

Table 1. Fixed Costs for Long Hives Apiary

Fixed Cost	Unit	Unit Price	No of Units	Input Costs	Depreciation CostPer Year
Log Hives	No	1000	20	20000	2000
Bee Suit (Without Gloves)	No	3000	2	6000	600
Pair of Gloves	No	380	2	760	76
Pair of Gumboots	No	800	2	1600	160
Bee Brush	No	190	1	190	19
Smoker	No	850	1	850	85
Bucket	No	200	20	4000	400
Knife	No	150	1	150	15
Total Fixed Cost				33550	3355

Table 2. Variable Costs for Long Hives Apiary

Item / Year	1	2	3	4	5	6	7	8	9	10
Labour(Kshs)	6300	6615	6946	7293	7658	8041	8443	8865	9308	9773
Transport (Kshs)	500	550	605	666	732	805	886	974	1072	1179
Incidentals(Kshs)	680	717	755	796	839	885	933	984	1038	1095
TOTAL(Kshs)	7480	7882	8306	8754	9229	9730	10261	10823	11418	12048

Table 3. Total Costs for Log Hives Apiary

Year	1	2	3	4	5	6	7	8	9	10
Fixed Costs /Depreciation	3355	3355	3355	3355	3355	3355	3355	3355	3355	3355
Variable Costs	7480	7882	8306	8754	9229	9730	10261	10823	11418	12048
Total Costs	10835	11237	11661	12109	12584	13085	13616	14178	14773	15403

Source: NationalFarmers Information Services(NFIS) 2020

J. Predicted Income from Sale of Crude Honey as tabulated by National Farmers Information Services (2020)

Assumption:

Number of harvests per year = 3

Occupation rate of beehive = 80%

Yield per hive per harvest = 8kg

Honey Yield:

20 hives x 0.8 x 8kg x 3 harvests/ year) = 384kg

Revenue:

384kgx 400/= per kg = Kshs 153,600 p.a

III. RECOMMENDATIONS

The county needs to partner with other parties(private sector, NGOs, FAO) in commercializing incubation of the queen bee as well as bulk beekeeping to ensure multiplication of colonies and should be supported by the Big Four Agenda kitty

Essential beekeeping equipment such as beehives smokers are made available, accessible and affordable to farmers. This can be made possible through public-private partnerships between government agencies and Non-Governmental organizations. This will ease financial

pressure on the farmers and enable more farmers to practice apiculture.

Trade constraints in beekeeping such as price fluctuations, lack of grading systems, absence of organized market channels, low involvement of the private sector in market development, and lack of appropriate technologies for processing and packaging bee products need to be addressed by relevant government agencies so as to up-scale the productivity and sale of honey and honey products

Sensitization of farmers and the general public on the importance of beekeeping to food security and environmental conservation. This can be done through seminars, workshops or public barazas so as to bridge the existing production and marketing knowledge gaps. Additionally, beekeepers should be trained on how to produce optimally even with farming systems that integrate crop production with beekeeping. With increased access to ready markets and production knowledge, future honey production will be increased.

Destruction of vegetation cover in the process of preparing land for cultivation should be discouraged. Instead, afforestation should be encouraged as bees rely on nectar

from flowers to make honey. Furthermore, vegetation cover acts as a catchment for rain and also helps maintain soil moisture.

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