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The Role of Indigenous Knowledge Systems in Enhancing Agricultural Productivity in Kenya

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Abstract

This paper gives an insight into the role of indigenous knowledge systems in improving agricultural productivity in Kenya. It examines how application of indigenous knowledge can help to scale up sustainable agricultural intensification in order to increase production, protect the environment and reduce poverty. The paper describes different forms of indigenous knowledge and recognizes the important role that indigenous people and their knowledge of the environment, can play in the enhancement of agricultural productivity and environmental protection. While indigenous knowledge has been the basis for local-level decision-making in many rural farming communities in Kenya, the paper finds that, its application has not been wholly integrated into the farming systems not only by local farming communities but also by researchers, extension service providers, scientists, policy makers and planners striving to improve conditions in rural areas and suggests how indigenous knowledge can be applied in improving agricultural productivity among smallholder farmers in Kenya. The paper considers the broad knowledge indigenous people have on how to live sustainably, but discerns that formal education systems sometimes disrupted this sound knowledge by creating an assumption that it is outdated and irrelevant in addressing present-day agricultural challenges. The findings of this paper will help agricultural stakeholders change the perceptions and attitudes they have towards various Indigenous Knowledge Systems in enhancing agricultural productivity and should, therefore, be promoted and that awareness of this importance should be created through policy formulation and implementation in order to foster consciousness among smallholder farmers in Kenya.

Keywords: Indigenous Knowledge Systems, Sustainable Agriculture, Environmental Protection, Farming Communities, Conservation Agriculture

1. Introduction

Indigenous knowledge is the information that local people have established over time, and continues to improve for use. It is founded on the practice and understanding, often tried over times of use; it entails adaptation to native values and environs. It is a verity that People have an intimate knowledge of many aspects of their surroundings and their daily lives and therefore are able to utilize it for survival. Over the years, Kenyan people have learned how to grow food and to survive in difficult environments through adaptation. They have come to gain a clear



understanding of what varieties of crops to plant, and livestock breeds to keep. This local knowledge has been passed from one age group to another habitually by word of mouth and traditional customs, and has been the foundation for their livelihoods; however formal education systems have to some extent disrupted this sound knowledge by creating an assumption that it is outdated and irrelevant in addressing present-day agricultural challenges.

2. Role of Indigenous Knowledge Systems in Enhancing Agricultural Productivity in Kenya

The United Nations Sustainable Development Goals (SDGs) aims to increase agricultural productivity for smallholder farmers at least twofold and thereby double incomes particularly for the vulnerable groups such as women, pastoralists and those engaged in fishing, through safe and impartial access to production resources such as land, capital and extension services by the year 2030, (UN General assembly, 2015) but while the Sustainable Development Goals propose ending poverty in all forms by 2030, this cannot be a reality unless social protection for the underprivileged and people susceptible to weather-related disasters is observed. This means that the role of native knowledge systems in enhancing agricultural productivity cannot be ignored because its application can help to scale up sustainable agricultural intensification in order to increase production, protect the environment and reduce poverty.

The United Nations sustainable development goals draws attention to the fact that the world is confronted by the continuation of inequalities between nations, a deteriorating situation of paucity, starvation, poor health and illiteracy, and the worsening environment on which the well-being of humanity depends, there is, therefore, a need to give greater attention to environment conservation and development concerns should focus on the improvement of the living standards for all, protected and well managed ecosystems will, therefore, guarantee a sustainable future. To solve these problems, it requires the incorporation of both indigenous and conventional methods in increasing agricultural productivity.

In the report 'Realizing the Future We Want', the UN System Task Team on the Post 2015 UN Development Agenda acknowledges the importance of indigenous knowledge for sustainable environment stating that "traditional and indigenous knowledge, adaptation and coping strategies can be major assets for local response strategies" (2012, p.28). Therefore, in light of the new post-2015 sustainability agenda, it is important to investigate the relationships between sustainable agricultural growth and indigenous knowledge. This assessment will offer an opportunity to understand how indigenous peoples in Kenya have been responding to environmental and development challenges, their knowledge systems can be important in maintaining the biodiversity and building resilience to adaptation to climate changes this will eventually enhance agricultural productivity.

Indigenous peoples' cultures and their corresponding knowledge systems have been generally misconstrued or even ignored by development planners. This point was strongly pronounced in a final statement by the Brundtland Commission (WCED): The Commission stated that 'some indigenous lifestyles are susceptible to practical extinction by impervious developments



that discourage participation by the indigenous people. Their traditional knowledge on resource development has neither been acknowledged nor given prominence in policies formulation (Our Common Future, 1987). However, many agricultural stakeholders associated with the formulation and development of policies are now beginning to recognize the important role that indigenous people and their knowledge of the environment, can play in improving agricultural production and thus contributing to food security and economic development.

The picture below shows a traditional Farmer in Kabaune village in Kenya, working in the field with his cattle. In application of the indigenous knowledge, many farmers have been engaged in tree planting projects in order to increase rainwater and for sustainable farming. This has been in response to the disappearing forest cover and the related climate change challenges that have reduced the productivity of land.



(Photo: P. Casier / CGIAR via Flickr (CC BY-NC-SA, 2015)
Fig. 1. Traditional Farming in Kenya

The impetus to turn to indigenous farming practices is as a consequence of the climate change which is one of the severe challenges to Kenya's achievement of its development goals as described in the vision 2030. Kenya is predisposed to climate-related events and predictions indicate that the impacts are likely to affect the country even more in future, thus affecting agricultural productivity and posing a serious challenge on food security. It is a fact that in recent years an increased consciousness has risen of the failure of modern agricultural practices to be successfully applied to the different types of regions in which agriculture is practiced, nevertheless, application of indigenous knowledge can help to scale up sustainable agricultural intensification in order to increase production, for environmental protection and poverty reduction. Paying attention to local or indigenous knowledge can enhance the farming practices and help adapt to climate changes and variability by smallholder farmers in Kenya, considering that farmers capacity to cope with and adapt to the change in climate is dependent on the wider social and institutional context they live in.

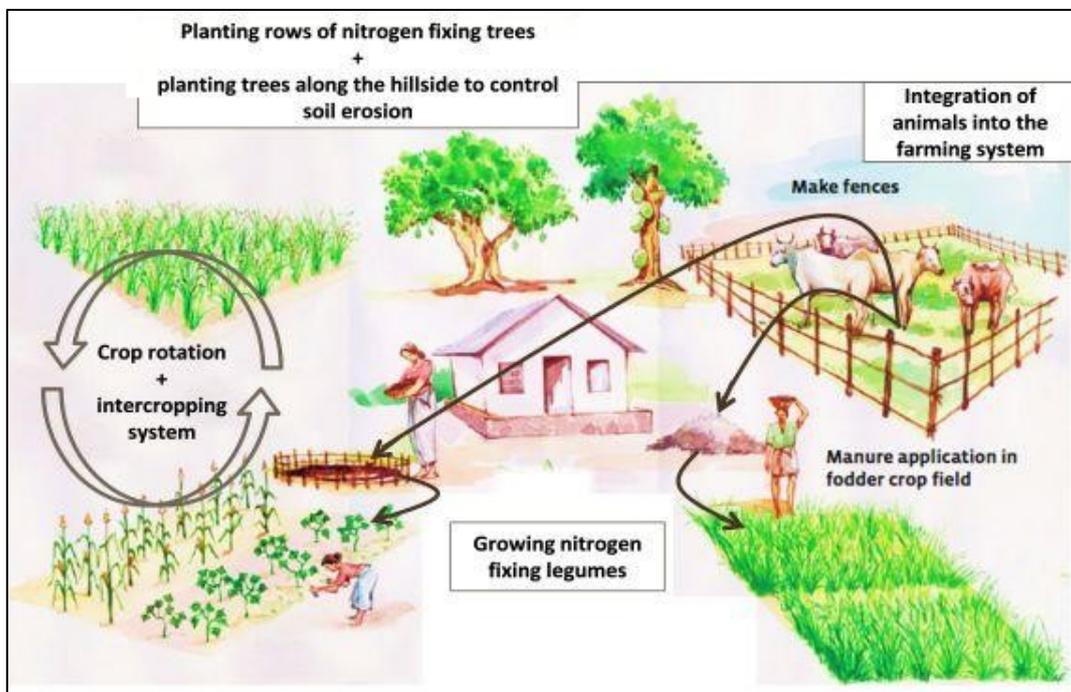


3. Forms of Indigenous Knowledge

Several forms of Indigenous Knowledge are applicable to enhancing agriculture production in Kenya; Agroforestry is an agricultural practise in which trees are incorporated in a farming system around or among crops or pastureland to create a varied, useful ecologically zones which promote sustainable land-use systems considering that the practice is assumed to have an impact on the productivity of land and traditional communities believe in the intercropping of two or more plant species. This practice can be related to modern agricultural practice of incorporation of nitrogen-fixing plants in farming practice with the aim of benefitting from the nitrogen release, in close collaboration, this practice has proven to result in higher yields.

Agroforestry schemes can be beneficial in comparison to conventional agriculture, as they offer better output and thus this indigenous practice has found acceptable application in modern farming and natural resource management of the biodiversity in Kenya, considering that, with two or more relating plant species existing in a given farmland, a more intricate habitat that can sustain a wider variety of birds, insects, and other animals is created.

The figure below show an example of a sustainable indigenous farming system where besides increased production of timber and other tree products for home subsistence and trade, the farm is organized in such a way that it contributes to improved productivity by refurbishing the soil fertility, ensuring water retention through reduced runoff, stabilizing global warming and encouraging climate-smart agriculture through the planting of drought-resistant trees that subsequently produce fodder, fruits, nuts, edible oils, fuel firewood, and timber. Agroforestry has also been successfully used in encouraging reforestation and easing pressure on forests by providing alternative farm-produced fuelwood thus controlling imminence of desertification.



Source: FAO, 2013

Fig. 2. Integrated Farming System



Traditional communities in Kenya have for overages depended on indigenous knowledge to exploit agroforestry for biopesticides and for medicinal purposes where diverse farm outputs have been tapped for better-quality human sustenance. In circumstances where people have limited access to contemporary medications which are expensive, herbal medicine has been an alternative and this can be seen in the growing space for organic and herbal products derived from medicinal plants extracts.

Fallow Agriculture is another form of indigenous farming knowledge that has considerably contributed to increased food security in Kenya; in this system multifunctional sites are created for both crop production and animal grazing. Fallow agriculture entails leaving tracks of land uncultivated for the purposes of regeneration; pest and diseases depression and nutrient build up. Grazing lands are later converted into crop production farms with the desire to benefit from manure from the livestock and this knowledge has generated satisfactory results over time. This indigenous knowledge when practiced properly enhances agricultural production in that it stabilized depleted soils through safeguarding them from erosion, increasing humus content and naturally stabilizing soil PH, no wonder modern agriculture in the recent past has started advocating for a move towards increased use of organic manure to increase the humus content in order to check incidences of nutrient lock up and change of soil ph. as a consequence of increased use of inorganic fertilizers.

Typically, more drought-resistant crops and livestock breeds have been identified through indigenous forms of knowledge and in most parts of Kenya indigenous breed have proved to be more sustainable leading into more research into indigenous breeds of cattle, sheep, goats, and chicken. The result has seen the continued rearing of Ormo, Boran and Zebu cattle, the red Maasai sheep, the Galla goat, and the indigenous poultry breeds, besides the development and expansion of value chains on indigenous fruits and vegetables varieties production. Most of the value chains for the African leafy vegetables have been commercialized but mostly continue to apply indigenous knowledge to produce because it the knowledge has proved to have the ability to maintain the nutritive value of the vegetables while at the same time enhancing

With the realization of the nutritive value of indigenous vegetables so has their economic importance been appreciation, there is now the growing demand for indigenous or African vegetables such as black nightshade, amaranth, cowpeas, pumpkin leaves, black nightshade, Sunnhemp, Jute plant, pigweed, cowpeas, African eggplant and Spider Plant also known as “African Cabbage” The Potential advantage of the traditional African vegetables has been identified in improving soil fertility and Weeds and Pests suppression. There is, therefore, a considerable prospect for the incorporation of organic farming practices with the production of traditional African vegetables. Some aspects of indigenous knowledge have found application in conservation of soil fertility through the composting of plant remains. The figure below shows commercialization of agriculture through application of indigenous knowledge in Kwale and Kilifi counties in coastal region of Kenya for the production of vegetables.





Mulching on Kales



Water and Soil Conservation



Manure on Amaranth

Source: Researcher, 2017

Fig. 3. Application of indigenous knowledge in farming

4. Indigenous Knowledge as a Basis for Local-level Decision-making

Smallholder farming communities have now been accustomed to agroforestry as a mean to influences climate change. A study on Climate Change, Agriculture and Food Security (CCAFS, 2014) established that at least 50% of those households in East Africa practiced conservation agriculture on their farms. The trees grown were found to improve land productivity by helping to alleviate erosion, refining water, and soil quality and providing farmers with fruits, spices, oil, fodder and medicinal products for both subsistence and commercial purposes. The incorporation of trees in a farming enterprise has been a widely adopted adaptation strategies, along with the use of better-quality crop varieties and intercropping. Indigenous knowledge is therefore still applicable and relevant in modern agriculture. Agroforestry is, therefore, one of the indigenous knowledges that has seen wide application in agricultural research in Kenya and has proven to be an agricultural productivity enhancing practice that improves yields, preserve soil and recondition nutrients while



producing wood for fuel, fodder, fruit, and timber. This has contributed immensely to sustainable agriculture for the local communities.

It is an agreed fact that decreasing the losses emanating from crop pests and diseases will help check food insecurity and enhance economic growth in Kenya, however, the prevailing crop and livestock pest and diseases protection management systems that relies on artificial agrochemical has had a negligible impact on the output of many poor smallholder farmers who form a most important section of agriculture in Kenya. This is mainly because of affordability, availability, and ease of use of these chemicals. A solution to managing pest and diseases in farming lies in going back to harnessing of the indigenous knowledge in pest and diseases control. The need to evaluate available biological control measures by tapping into the available indigenous knowledge, such as beneficial insects, predators, and indigenous pesticide plant extracts should, therefore, be exploited. A focus on indigenous farming systems has the potential of tapping into the locally available knowledge on natural resources for improved crop protection practice in Kenya. The consideration of indigenous knowledge on pesticides in the wider context provide valuable ecosystem services that enable better appreciation of their true economic value besides the ability to guarantee environmental protection contrary to the synthetic pesticides that are harmful to the environment.

The use of biological pesticides comprise of several types of pest management intervention: through predatory, parasitic, or chemical relationships. The formulation of these biopesticides borrows a great deal from the indigenous knowledge and the regulations for use can be influenced by public perceptions, as they are considered less harmful to the environment due to the fact that they are extracted from living organisms such as plants, bacteria microbes, fungi, and nematodes. while contemporary agriculture has coined the term integrated pest management (IPM) and the components of the programs have advocated for a wider application of the organic and biological products as substitutes to synthetic chemical products, in real sense the concept of integrated pest management borrows a lot from indigenous forms of pest control measures of indigenous farmers identifying certain types of pesticides derived from their natural environment that acts as repellents and predators. For example, neem extracts, tobacco, pyrethrum flowers, chilies, canola oil and baking soda that have pesticide properties, therefore, considered plant and animal pest protection products.

Biological pesticides are less toxic as compared to conventional pesticides and generally affect only the target pest, in contrast to synthetic pesticides that do not degrade easily, and thus affect the ecosystem and therefore considered safe for use and environmentally friendly. Application of indigenous knowledge in agriculture, therefore, endows the farming community with a safer way to preserve nature while at the same time maximizing yields without exhausting the soil.

According to the Food and Agriculture Organization of the United Nations (FAO), farmers produce enough food to feed its population, yet over 1.2 billion people still go hungry or are undernourished, the reason for this is that over one-third of the food produced globally is never eaten. Given the fact that it is projected that by the year 2015 the global population will have



increased by over 2 billion people, the need to maximize production while at the same time reducing losses is necessary and indigenous knowledge can be applied in proper harvesting, handling, and storage. Traditional storage structures may include rhombus, cribs, shelves, pit/ground storage and guards. Below is an example of a traditional underground grain handling facility.

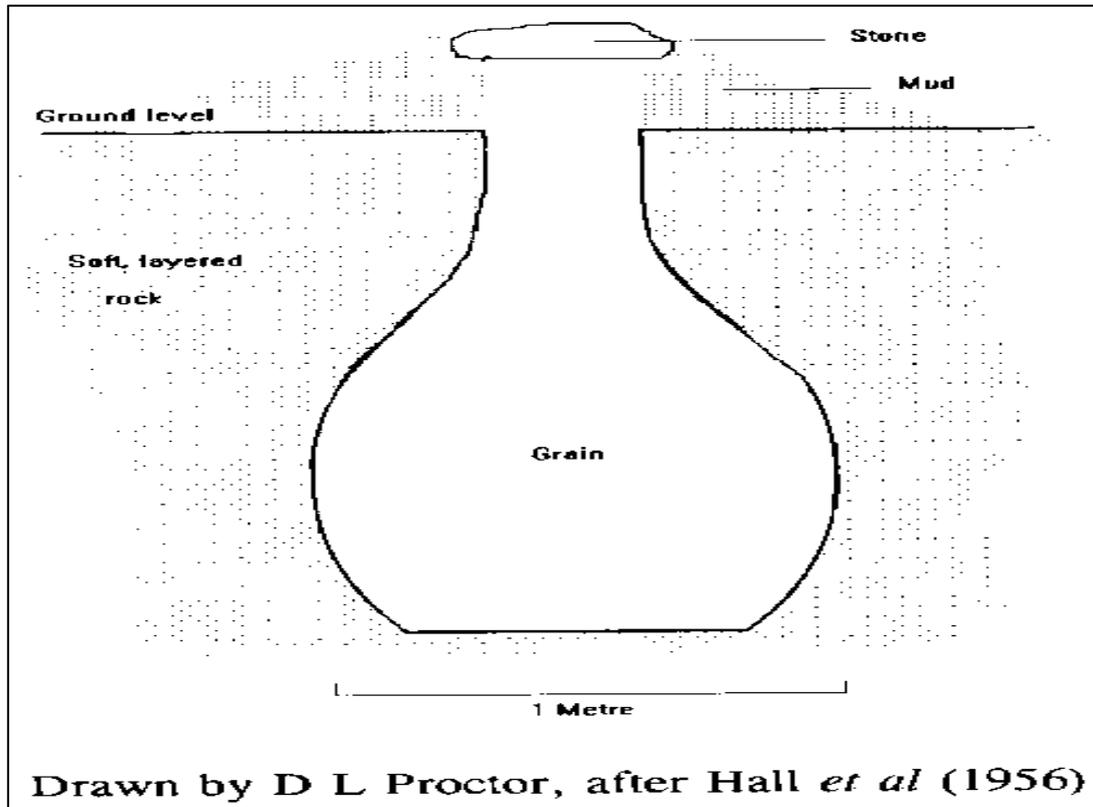


Fig. 4. Pit/ground grain storage facility

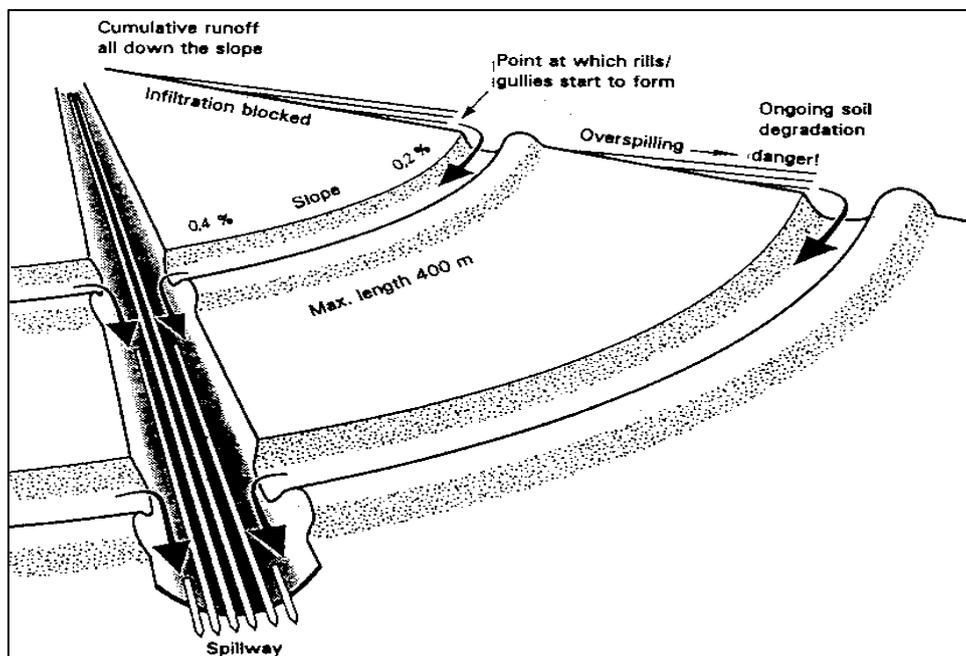
Proper pre-post harvesting and handling methods, as shown above, has proved effective in grain handling and can reduce the food spoilage or wastage and therefore increase the amount of food available to feed the nation. Food loss and waste is a global problem and farmers stand to gain from the indigenous knowledge and technologies for product handling. According to FAO, over 40% (Rockefeller Foundation, YieldWise Initiative 2016) of staple food is lost before reaching the market, this loss is significant and therefore a need to incorporate indigenous knowledge in research and development programs.

According to FAO (FAO soils portal, 2017), preventing soil degradation, improving water retention ability and improving the humus content enhancing agricultural productivity through suitable land use practices are important components in attaining food and livelihood security. Warning signs of a degraded soil may include degeneration of soil fertility, change in soil Ph., poor soil structure, increased wind, and water erosion, low organic matter content, stunted growth of crops and declining pastures. Determinations to reinstate output of degenerated soils must be combined with measures that respond to the land use practices in particular soil and water conservation practices, nutrient restoration, and integrated pest management practices. Indigenous knowledge on soil conservation has proven to be more effective as



compared to the use of inorganic fertilizers that may have side effects such as change of soil PH, soil water retention ability, locking of nutrients thus leading to stunted growth of plants, reduced organic matter and besides increased cost of production.

Indigenous communities clearly understand that the removal of the topsoil affects the productivity of the land as it is necessary for humus content that replenishes nutrients for rapid plant growth, as Eswaran (2001) points out; it is for this reason that Soil conservation is prerequisite to farming, considering that it safeguards the soil from being carried away. In cases of soil erosion, aquatic life is also affected as the pesticides and fertilizers used on agricultural land are harmful to aquatic life. Methods of controlling soil erosion such as contour ploughing and planting cover crops on slopes to prevent runoff is very effective, formation of bench terraces and planting of trees on the farmland also impedes surface flows and keeps nutrients in the farmed land as it checks runoff and can also suppress weeds.



Source: FAO, 2013

Fig.5. Runoff diversion: principles practice and drawbacks

Many different methods have been conceived over the years aiming at preserving the nutrient level of the soil and in reference to Tella, (2007), indigenous knowledge finds relevant application by local people by virtue of their accrued experience, familiar experiment, and appreciation of their environment. The indigenous systems of crop production have developed over centuries of traditional and natural evolution and symbolize the collected and stored experiences of indigenous farmers. The farmers produce indigenous crops through knowledge of ecological conditions and climatic changes without access to modern inputs, capital, and modern extension information. After years of experimenting with indigenous agricultural knowledge, communities have adapted to suitable and environmentally friendly agricultural production methods and adoption of intricate farming systems have helped farmers manage a variety of environments to meet their production needs. It is through the localized indigenous



knowledge that rural communities have been able to produce crops and livestock that continuously provides them with food resources.

5. Summary and Recommendations

Indigenous agricultural and ecological knowledge has gained global recognition (UNCED1992), and currently forms a very valuable resource that provides humanity with understandings on how groups of people can interact sustainably with their changing environment. However, while this indigenous form of knowledge is important for the well-being of humanity, it has remained tacit as very little effort has been made to express it explicitly owing to it remaining unrecorded in any written form and therefore not readily accessible to agricultural stakeholders.

While the role of indigenous knowledge in conserving biodiversity has been recognized as essential to human development, its application into modern farming has remained limited due to inadequate research and development. It is therefore important that both farmers and pastoralists be encouraged to preserve a wide variety of indigenous farming systems because they are greatly adaptable to specific agro-ecological conditions and, at the same time, meet needs for food, fodder, firewood, and timber. In addition, there is need for documenting this knowledge and incorporating it within the conventional farming methods as it is based on generations of experience, informal experiments, an intimate understanding of the biophysical and sociocultural environments

In principle, indigenous food production systems contribute significantly to enhancing agricultural productivity as well as guaranteeing food security and therefore the national and county governments should emphasize the need to incorporate the Knowledge into agricultural research and community development programs for the conservation of the environment, promotion of sustainable agriculture and the general natural resource management systems. This imply that agricultural stakeholders should change the perceptions and attitudes they hold towards various Indigenous Knowledge Systems through the promotion of awareness creation on the importance of this knowledge through policy formulation and implementation in order to foster consciousness among smallholder farmers in Kenya and the starting point should be the formulation of a policy on the retrieval, collection development, preservation and dissemination of this knowledge and to be able to initiate this process, the government of Kenya should immediately set a department at KALRO to develop and promote agricultural indigenous knowledge.

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