Trends in Indigenous Crops Cultivation and Distribution in Yatta Sub County, Kenya

Philip Ogada, Dragon Cigoja, SostheneMubera

Abstract—Evaluation of the diversity, distribution and dynamics of vegetation cover is important in predicting the effects of climate change especially in dryland regions. Rain-fed agriculture is the main livelihood for a majority of small scale farmers in Kenya including most arid regions. Their main farming systems focus on the " major crops/introduced "(maize, wheat, rice and beans) However, strategies to cultivate these crops in the region are no longer sustainable due to reliability on finite resources, high input load and vulnerability to climate change. A key alternative strategy to adapt to a changing climate is the development and promotion of indigenous crop species. These crops are usually highly adapted to harsh and marginal environments making them significant contributors to divergence of biodiversity and resilience of agroecosystems. A good example is finger millet*Eleusinecoracana*which is indigenous to Eastern Africa. It is in line with this that a systematic review of literature was done to establish the status and trends on indigenous crop cultivation in Yatta, Kenya. Analysis of the literature found adopting and promotion of indigenous crops is an important strategy to adapt to a changing climate and improve on food security in Yatta but fewer of these crops are being grown. A clear trend was established in the shift in crop types grown over the two decades with major changes observed from traditional crops that are more adaptable to the regions' local climate to introduced crops, preferred due to their economic advantage. Findings of this review will help characterize and synthesize the understanding of these crops and their importance as well as reaffirm the need for their promotion and cultivation for sustainable agriculture in Kenya.

Index Terms—Agriculture, Climate Change, Food Security, Indigenous Crops, Yatta.

1 Introduction

It has become a global challenge to produce enough food to feed and nourish the increasing global population. This is especially due to climate change's ever increasing threat and impulsive consequences[1].Agricultural productivity is particularly sensitive to environmental stresses, especially temperature extremes and water scarcity. In addition to these, land degradation due to soil nutrient depletion and salinity is becoming another major global issue in recent years, impacting the growth and yield potential of most of the commonly cultivated commodity crops. To understand how these changes affect and interact with global earth systems, information is needed on what changes occur, where and when they occur, the rates at which they occur and the social and physical forces that drive these changes[2]. Comprehensive information on the spatial distribution of the land use/land cover categories and the pattern of their change is a prerequisite for planning, utilization and management of the land resources.

Over 80% of Kenya's landmass is classified as Arid and Semi-arid Lands (ASALs),[3]. Farmers in the ASALs cultivate a variety of economically important crops such as maize, sorghum, green grams, beans and cowpeas under rain-fed agriculture as well as horticultural crops such as mangoes, bananas, tomato, onions, kale, capsicum, pawpaw and citrus. This is however not the case for the farmers in Yatta sub - County who mostly cultivate introduced crops such as maize and beans that are however not adaptable to the harsh climate conditions of the area.The Sustainable Development Goals (SDG-2) signed in 2015 by world leaders strongly advocate for global zero hunger and food security by 2030[4]. It is also noted from SDG 2 that since the 1900s, a big percentage (approximately 75%) of global crop diversity has been lost from farmers' fields 2030[4]. Improved agricultural biodiversity usage can lead to more nutritious diets and enhanced livelihoods for the farming communities as well as more resilient and sustainable farming systems. Of particular concern is the global decline of cultivation of traditional/indigenous crops, in as much as these crops offer big genetic biodiversity and have the potential of improving global food and nutritional security. These crops belong to categories such as cereals, roots and tubers, legumes, nuts, vegetables, oilseeds, and medicinal plants, and have earned collective names such as 'underutilized, 'neglected ', 'orphan', or 'forgotten' crops [5].

2 Methodology

Currently there is an emerging body of studies on climate change and food security in Africa, however limited research has examined the status and significance of Indigenous crops to food security and climate change resilience. This paper systematically reviewed papers and data available on Indigenous in Yatta, Kenya with an aim of establishing their current distribution and dynamics. This can portray their potential of for food security. It will also help characterize and synthesize current understanding on these crops in Kenya, and reaffirm the need for promotion of their cultivation for sustainable agriculture. Specifically, literature reviewed was used to answer two key questions: (1) what are the indigenous crops in Yatta? And, (2) what are their cultivation trends and current distribution?

3 Results and Discussion

3.1 What are Indigenous Crops?

According to Padulosi, "Indigenous crop species" are the native crop species that play an important role in food security, nutrition, and income generation of many resource-poor farmers and consumers in the developing countries, but their potential is not fully exploited due to their limited competitiveness with commodity or main crops in mainstream agriculture[6].While the potential of these crops may not be recognized at national level, they are significantly important to the localities where they are grown. These crops are usually highly adapted to complex, harsh and marginal environments making them significant contributors to divergence of biodiversity and resilience of agroecosystems. This means they are of considerable interest and of great significance for future adaptation of agriculture to climate change. For the purpose of this review we define them as crops that have never been categorized as major crops, have been under-researched on, have low levels of utilization, have great potential of growing in water stressed environments and are mainly confined to smallholder farming areas.Orphan crops cultivated by farmers in Kenya are mainly crops such as finger millet (*Eleusinecoracana*), sorghum *(Sorghum bicolor*) which are indeginous to Africa[8].Cow peas (*Vigna unguiculata*), Bambara groundnut (*Vigna subterranea*), and cassava(*Manihotesculenta)*, among many other traditional crops like Amaranthus species, wild mustard (Brassica spp), sweet potatoes (*Ipomoea batatas*), taro (*Colocasiaesculenta*) and wild melon *(Curcubita spp*.)[9]. They are mostly traditional, underutilized, primarily grown for subsistence and rarely for commercial purposes. This fact has made researchers and industries to neglect them. Orphan crops are culturally and traditionally valued, are often adapted to difficult environments and are targets for food security in most of the African Countries,[10].

3.2Indigenous Crops in Yatta

Yatta being an ASAL region, the indigenous crops here are mostly drought tolerant. And reverting to planting them has been an important strategy for climate change adaptation. Drought tolerant crops were the main sources of food in Yatta before the country was colonized[11], after independence maize, beans, and other legumes among other crops were introduced and became the staple foods . Dry land maize varieties such as Katumani composite were developed. Unfortunately, these saw crops like millet, sorghum and cassava become abandoned. This can be seen in Table 1 below. Nevertheless much has changed since then due to climate change and the country has been faced with recurring droughts. Even the dry land maize varieties are no longer giving sustainable yields[12].In the recent years agricultural experts and food agencies like World Food Program (WFP) have raised the issue on the need for Kenya to shift focus from crops like maize and beans to indigenous/drought tolerant crops [13].

3.3 Indigenous/Traditional Crops vs. Introduced/Major Crops

The area (%) covered by traditional crops and introduced crops in the year 2012 were; traditional crops (Sorghum, finger millet, cassava, dolichos, sweet potatoes, green grams, cowpeas, pigeon pea, pumpkins) (14%), maize (39%) and beans (33%) (Table 1). The area under traditional crops decreased significantly from 36.76% in 1986 to 26.32% in 2000 and to 14.39%in 2012 while area covered by maize increased significantly from 11.43% in 1986 to 16.13% in 2000 and 38.86% in 2012 (Table 1).

	1986		2000		2012		Change (1986-2000)		Change (2000-2012)		(Chi-Square Test)		
Land use/cover	Area (km^2)	% Area	Area (km^2)	% Area	Area (km^2)	% Area	Area (km^2)	%	Area (km^2)	%	X2		P Value
Indigenous Crops	136.80	36.76	97.95	26.32	53.55	14.39	-38.84	-10.44	-44.40	-11.93	35.799	0.000	0.000
Maize Crop	42.53	11.43	60.03	16.13	144.62	38.86	17.50	4.7	84.60	22.73	72.250	0.000	0.000
Bean Crop	24.39	6.55	113.06	30.38	122.76	32.98	88.67	23.83	9.69	2.6	68.546	0.000	0.000
Riverine Forest	34.01	9.14	23.98	6.44	12.33	3.31	-10.03	-2.7	-11.65	-3.13	10.400	0.006	0.006
Shrub Land	133.76	35.94	63.75	17.13	21.68	5.83	-70.01	-18.81	-42.06	-11.3	87.309	0.000	0.000
Bare Land	0.68	0.18	13.40	3.60	17.23	4.63	12.72	3.42	3.83	1.03	13.419	0.001	0.001
Total	372.17	100	372.17	100	372.17								

Table 1. Trends in Crops Cultivation in Yatta

The area covered by beans also increased from 6.55% in 1986 to 30.38% in 2000 to 32.98% in 2012. Traditional crops decreased significantly while the introduced crops (maize and beans) increased significantly in the years 1986, 2000 and 2012, respectively (Figure 2). In 1986, the traditional crops mostly grown were pigeon pea (24%), cowpea (21%), green grams (19%), sorghum (16%) and millet (11%) while in 2000 the common traditional crops grown were pigeon pea (21%), sorghum (21%), cowpea (19%) and green grams (19%). In 2012, the common traditional crops were pigeon pea (23%), sorghum (22%), green grams (22%) and cowpea (21%). Other traditional crops grown though not in significant proportions were dolichos, cassava, millet, sweet potatoes, pumpkins and yams.

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Figure 1. Crop type change over the years

From these observations, pigeon pea, sorghum and cowpea were the most planted traditional crops across the two decades. In Kenya, following the Green Revolution and the push to use modern agriculture to improve food production and security, a high proportion of farmers grew introduced crops. Traditional crops however offer a huge potential for building resilience and adapting to climate change especially in ASALs. Crop choice is very climate sensitive. Change from traditional crops to introduced crops can be attributed to the economic importance attached to these crops hence the abandonment of the traditional crops that are more adapted to the local climate

of the area. Studies have shown that there is a decrease of area under production of other crops in preference to high value crops of economic importance such as maize. This is as a result of both natural and socio-economic factors and their utilization including population increase and modernization and commercialization of agriculture[14]. Poverty and population increase are the major drivers behind increased economic importance attached to cash crops and are therefore the major causes for the change resulting in increased land area under agriculture. Research by [15]in Eastern Kenya revealed that the main crops grown in the area were maize and beans usually intercropped while food crops such as sorghum were also grown but at a lower scale. However, most of the farmers were achieving less than 10 bags of maize per acre due to droughts (climate change). Another study by Maeda [16]in Taita Hills showed that maize and beans were the predominant crops grown in the area while crops that are more resistant to drought such as cassava, pigeon peas and cowpeas were grown on a much smaller scale. Climate variability is another factor contributing to the changing crop type due to the fact that over the years, crop yields have been reducing as a result of climate change translating to reduced economic returns and hence the need for farmers to increase their economic returns by planting introduced cash crops even though they are not adapted to the region. De bie et al.[17]found that disparity between the crop types and the changing crop intensities were attributed to major droughts faced in India during the period of study. Several studies to assess agricultural cropping concentration and crop wise changes, showed changes in crop types grown as a result of migration of people and poor climatic conditions due to climatic changes[18].

4. Conclusion

A tremendous change in crop types and land cover within the last two decades in Yatta sub – County was noted. A clear trend was established in the shift in crop types grown over the two decades with major changes observed from indigenous crops that are more adaptable to the regions' local climate to introduced crops, preferred due to their economic advantage. Research reveals that there is great prospects in adopting and promoting indigenous crops species for drought tolerance and climate resilience. Yatta's current and projected food insecurity problem could potentially be reduced if farmers could grow crop varieties that are more resilient, have more nutritive value and are higher yielding. Indigenous, being more resilient and better adapted to grow in marginal environments than current staple crops, offer cost-effective and viable solutions to sustain farm productivity. However, there are major gaps in our knowledge and capacity to make the best use of these crops because agricultural research has so far paid little attention to these species. Research to increase the value of these crops, broaden their zones and catalyze their uptake should be agitated for. Regional awareness and promotion of the importance of these crops as viable alternatives to the main crops grown Yatta and other ASAL areas should be encouraged. These should be very important crops for farmers and especially in marginalized areas. This review reaffirms that indigenous/traditional crops have big role to play in Kenya's food security and are crops for the future of sustainable agricultural production in ASAL regions.

5. Acknowledgement

I acknowledge Ioana Meza and Maureen Malobafor proof reading this paper and assisting me in preparation and editing work.

5.1 Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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- *Philip Ogada is currently pursuing masters degree program in Environmental management in Tongji University, IESD, Shanghai, China, PH-8613162554770. E-mail: ogadaphil@gmail.com*
- *Dragan Cigojaiscurrently pursuing masters degree program in Environmental management in Tongji University, IESD, Shanghai, China.*
- *SostheneMubera is currently pursuing masters degree program in Environmental management in Tongji University, IESD, Shanghai, China.*