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# **Sustainable value chains in agriculture. The African Indigenous Vegetables in Southern Nakuru County**

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# Sustainable value chains in agriculture. The African Indigenous Vegetables in Southern Nakuru County

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## Acronyms

AFA Agriculture and Food Authority (Kenya)

AFFA Agriculture, Fisheries and Food Authority (Kenya)

IV Indigenous vegetables

ASDSP Agricultural Sector Development Support Programme

CAADP Comprehensive Africa Agriculture Development Programme

HDCA Horticultural Crops Development Authority (Kenya)

KALRO Kenya Agricultural & Livestock Research Organization

KARI Kenya Agricultural Research Institute

KDF Kenya Defence Force

KES Kenyan Shillings

MoALF Ministry of Agriculture Livestock and Fisheries

NAHMIS National Horticulture Market Information System

NUS Neglected Underutilized Species

PBR Plant Breeders Rights

PHL Post Harvest Losses

SPVA Seed and Plant Variety Acts

SSN Seen Saver Network

UPOV International Union for the Protection of New Varieties of Plants USAID

USDA United States Department of Agriculture

## Introduction

Agriculture is enjoying a new centrality in African development strategies in the last few years and, while most local decision makers and international players seem to agree on this priority, differences arise when it comes to identifying more precisely what kind of development is envisaged. Sustainable Development Goal number 2 reads: End hunger, achieve food security and improved nutrition and promote sustainable agriculture. This is very much the purpose of the SASS project, a multidisciplinary program which sees the participation of scholars from both hard and social sciences and whose expertise ranges from economics to nutrition and health, through biology and agronomy. The Agenda 2030 SDGs emphasise three aspects of sustainability: the economic, social and environmental ones, all of them are examined in the SASS project. The present paper will focus mainly on the economic dimension of sustainability but with important connections with the social one.

Another element worth recalling from Agenda 2030 is the emphasis on *leave no one behind*, which has become a sort of motto for all the SDGs. This paper adopts this indication and describes the conditions and the constraints of the poorest people and in our case of the poorest ones among farmers. The final recommendations are geared to preserve the social viability of the most vulnerable ones among farmers. For instance target 2.3 calls for the doubling of “the agricultural productivity and incomes of small-scale food producers” and its indicators require a differentiation among the different classes of farming, something we have constantly kept in mind and which is of paramount importance in the paper, (see Table 4 below).

The value chains considered by this policy paper correspond to neglected and underutilized species (NUS) and more particularly to four African Indigenous Vegetables (IV). These are: spider plant (*Cleome gynandra*), African nightshades (*Solanum scabrum/villosum/americanum/tarderomotum*), cowpeas (*Vigna unguiculate*) and amaranths (*Amaranthus blitum/A. dubius/A. hybridus /A. spinosus*). Such vegetables are considered to have very good nutritional and agronomic properties. Indigenous African leafy vegetables contain higher levels of nutrients than commonly grown exotic species like Swiss chard, kale and cabbage, are rich in proteins (17.4-38.3% of dry matter), carbohydrates, vitamins and minerals and have medicinal properties. These vegetables are popular in Kenyan cultural diets and there is excellent potential for increased production and use in areas of traditional culture, however, constraints to greater production and marketing exist (Weller et al. year NA). Indigenous African leafy vegetables have low chemical input

requirements (Abukutsa-Onyango 2010, Kebebe and Bokelmann 2017) so they have a potential to improve environmental sustainability of agriculture. Based on extensive literature review and field assessment in southern Nakuru County of Kenya, this policy paper offers an economic perspective and analyses the potential of these IVs within the framework of African agricultural strategies of sustainable intensification and inclusive agribusiness development.

Agriculture transformation, priority value chains development, agribusiness, green revolution, and sustainable intensification are keywords of the emerging narrative and, while they raise expectations of modernization, growth and trickledown effects for all, they also raise concerns for environmental impacts of intensification and the transfer of resources from rural livelihoods toward more productive uses (i.e. from poor farmers and communities to markets and investors). Sustainable intensification is about producing more output from the same area of land, generally by using more input, while reducing the negative environmental impacts. While potential trade-offs are there, the African Union Comprehensive African Agricultural Development Programme (CAADP) envisages intensification of African agriculture to increase the productivity of vulnerable rural people in the agricultural sector and along the value chains of agricultural products, opening up opportunities for smallholders' farming, waged farming work, participation in outgrowing schemes, engagement in farmers groups and cooperatives, start-up of traditional and innovative agribusinesses by rural people. The policy paper focuses both on small rainfed farmers, whose access to land and capacity to provide for their livelihoods is to be preserved and strengthened to ensure environmental, social, and economic sustainability of food systems, and on commercial farms, whose potential for employment creation is also not negligible. Intensification is a manifold notion and the input mix can make a difference when environmental and social sustainability are considered. IV are labour intensive and require few commercial inputs and are thus well positioned to pilot sustainable intensification initiatives. The potential of IVs production development are:

- For small rainfed farmers, IV are used as coping mechanism to contribute to cash needs, thus preserving household assets in times of shortage. As they are harvested much earlier than maize, the revenues from IV sale contribute to purchase maize, contributing to fill the gap. Thanks to their low requirement of commercial inputs, IV are also perceived as low risk crops which is very much in line with the risk averse attitude of vulnerable farmers.
- Widespread production of indigenous vegetables also by commercial farms is labour intensive, it is already creating jobs, particularly in small commercial farms, and have a potential to create more. While waged work in agriculture is seldom regarded by youth as a first option (AfDB 2016), it can nonetheless contribute to employment.

The problem of deskilling of rural youth and the downgrading of farming as an occupation in Africa is well documented in the literature (White 2012). Already in the 90s, youths' lack of interest in farming reported by the older generation. A study in Kenya found average age of farmers was late 50s (Torkelsson 2012) and the Gilgil Subcounty Agricultural Officer reported around half of the farmers being above 50 in the area. Agribusiness, a keyword for the CAADP is proposed as a solution to create non-farm employment for the rural people, while contributing to develop the untapped agricultural potential of the continent. The policy paper also focuses on the value chains of IV downward and on their actors. It is well recognized that agriculture alone is unlikely to generate large numbers of employment opportunities with a potential to promote and transform the lives of booming young population. This picture changes instead if the focus shifts from agriculture to the agrifood system more broadly (Chipeta 2013, Mellor and Malik 2017). Agribusiness is often defined with a narrow focus on value addition to agricultural products, or to the provision of inputs and services at different stages of the value chain. The policy paper will address value addition and value chain development for IVs, including the role of traders. The potential of IVs value chain development are:

- IV are perceived as a premium product on the market, demanded by urban middle classes. This mix of tradition and fashion gives IV a potential for “rebranding” of African agriculture which is considered necessary to make farming (and agrobusiness) more appealing for youth and to keep them in the sector, overcoming the ideas of subsistence and uncertainty that prompt disaffection among new generations.
- The opportunities for simple value addition (by drying) also make IV a value chain with a potential for agribusiness development, including off farm activities.
- High perishability of IV makes the role of commercial intermediaries linking farms to markets critical, pointing to the need of a better integration of traders and middlemen into value chains development strategies.

As it will be shown, the production and distribution system of these vegetables is very heterogeneous, including wild production by small scale irrigated and rainfed farming households alongside commercial farms, and including aging barefoot middlemen (middlewomen?) alongside dynamic entrepreneurs, including self-consumption as wild food alongside urban and potentially foreign demand. Such heterogeneity offers a unique angle to assess potential trade-offs that characterize the envisaged transformation of African agriculture, i.e. long vs short value chains, specialization of agriculture vs diversified systems<sup>1</sup>, fashion food vs local and even wild food, household level farming vs commercial farming, value addition by farmers vs centralized processing, efficiency vs inclusiveness, standardization of food products vs diversity.

Similarly, the area selected for the analysis, Southern Nakuru County, is characterized by sharp contrasts that are not unique to this area, but seem instead to be a recurrent feature of today’s Africa and make our area interesting for modernization with sustainability agendas, or, concentrating on agriculture, for the sustainable intensification agenda. It must be emphasised that Southern Nakuru County is going through a period of very important and fast transformations. The region has good agricultural potential, a significant tourism sector, a very important horticultural production for export (based on flowers but also on French beans) which has boomed during the last twenty years. Moreover, it is experiencing infrastructural development due to its proximity to Nairobi, and to its location on the communication corridor towards western Kenya and Uganda<sup>2</sup>. This modernization creates potential market outlets for agricultural production and some opportunities for young people employment and self-employment but it largely coexists with traditional rural livelihoods and widespread rural poverty, with farming increasingly perceived as a poverty activity and abandoned by the youth. Moreover, pressure for new land uses reduces average acreage of plots, stressing the need to increase agricultural productivity and rising land prices also due to the inflows of people from other parts of Kenya. These features make the study area of interest to explore how to remove obstacles to the development of the value chains of IV, while leaving no one behind.

## Policy and strategic framework for Kenyan agricultural development

In 2010 Kenya committed to the implementation of the CAADP. This implies ambitious targets like 6% annual growth in agricultural GDP, and an allocation of at least 10% of public expenditures to the agricultural sector. Kenya only committed for 8% (Republic of Kenya 2010) of public expenditure for agriculture but its Agricultural Sector Development Strategy (ASDS), the main tool for the implementation

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<sup>1</sup> Specialized cropping systems tend to have weak linkages with the socio-economic context. They serve a demand which is broader than the local one, in line with the well-known relationship between specialization and trade (Smith 1976). Moreover, to compete on global markets, specialized systems sometimes rely on a small number of corporate actors who enjoy scale economies.

<sup>2</sup> Northern Corridor is a main international corridor for infrastructural development (see Northern Corridor transit and coordination authority <http://www.ttcanc.org/page.php?id=11#>)

of CAADP sets a target for the annual growth of agricultural GDP of 7% (Republic of Kenya 2009). By signing the CAADP Kenya also committed to identify priority value chains to orient the investments (i.e. promoting specialization). The 2010 Medium-Term Investment Plan (Republic of Kenya 2010b), however fails to select specific value chains. The CAADP Country Review Report (African Union, Comesa, Nepad 2010) pointed to the need of “supplementary analysis be completed as soon as possible to define the priority commodities in each of the rainfall zones being focused on.”

The Agricultural Sector Development Support Programme<sup>3</sup> (MoALF 2017) fills this gap with a throughout identification of priority value chains in (and by) each County. This is in line with the decentralization undertaken in the country with the 2010 Constitution, and with the consequent idea that development of the value chains should be implemented at county level. Despite each County was allowed to identify three or four value chains<sup>4</sup>, the effect of prioritization still emerge very clearly. Figure 1 shows the percentage on mentions divided by groups of value chains, with livestock related and fish value chains accounting for 60% of the mentions, and cereals (maize and rice) for another 8%. Nakuru county is not an exception, because its priority value chains are dairy, fish and pyrethrum, the only noticeable deviation. Local vegetables were only identified as priority value chains by Nyamira County, in a main IV producing area, and Mombasa County whose demand is currently not being met through local production within the county but is supplemented from other neighbouring Counties (MoALF 2017).

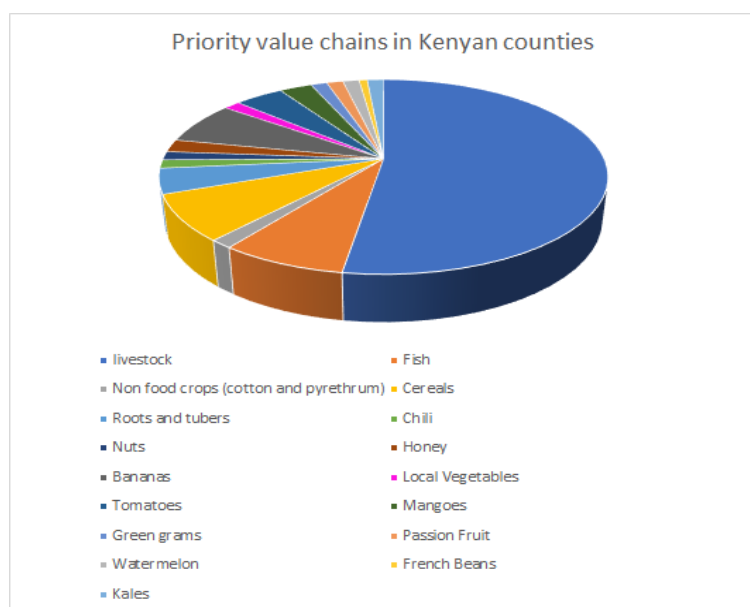


Figure 1: Priority value chains identified at county level

The ASDS 2010 classifies Kenya into areas according to agroecological conditions, that imply distinct investment strategies. Given the heavy reliance on rainfed agricultural production, these distinctions are captured by differences in rainfall as follows: high rainfall areas and marginal areas, which can be further sub-divided into semi-arid lands, and arid lands. According to USAID (2011), Nakuru County falls within High Rainfall Area which is defined as area whose rainfall exceeds 870 mm per year. Government publications (MoALF 2016) show a more nuances

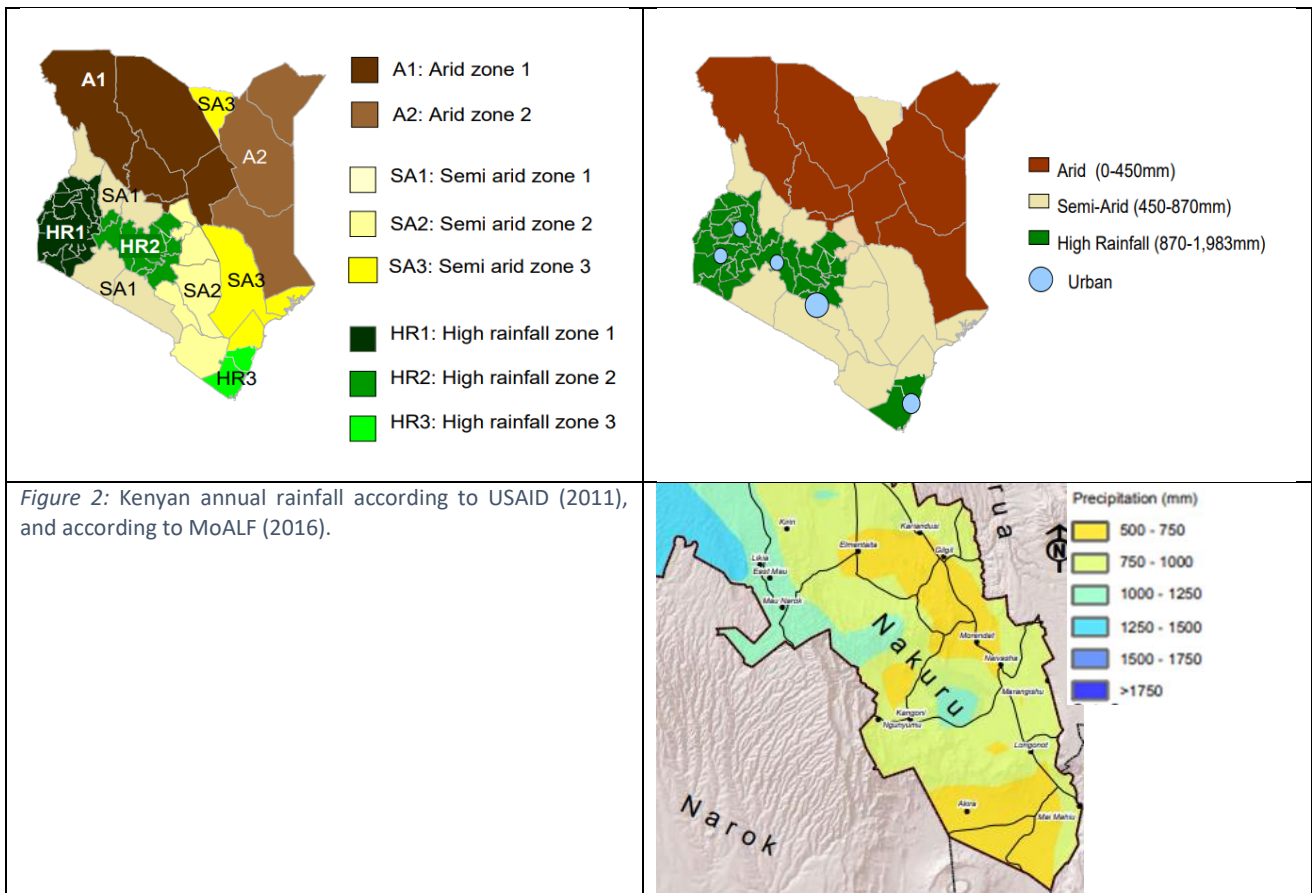
picture for the southern part of Nakuru County which includes a lower rainfall area (between 500 and 870 mm). The National Agricultural Investment Plan (Republic of Kenya 2010b) does not identify exactly the counties within each area, but it takes 870 mm rain per year as a lower bound threshold. In the high-rainfall area farmers grow the full range of crops available in the country, including cereals, pulses, roots and tubers, fruits and vegetables, and a range of livestock. Due to high population density and associated demand for housing, commerce, and infrastructure, land units are small and declining. The HRAs also have large and rapidly expanding urban centres. According to the national agricultural investment plan (Republic of Kenya 2010b), high-rainfall area is prioritized for cropping and investments in the HRAs will focus on

<sup>3</sup> The Agricultural Sector Development Support Programme (ASDSP) is a sector wide programme implemented by the Government of Kenya in collaboration with interested development partners, with the overall aim to support the implementation of the Agricultural Sector Development Strategy 2010 – 20 <http://asdsp.co.ke>

<sup>4</sup> Total number of mentions is 143.



market-driven intensification of farming systems. Sustainable intensification of agriculture is a keyword in the CAADP. Nakuru county also belongs to the so-called High Potential Maize Zone, where, according to Sheahan et al. (2013) farmers' application rates of inorganic fertilizer on maize sometimes exceed rates that maximize profitability.



## Literature review

The present work provides some insights on the following stages of the IV value chain in the target area: provision of inputs, production, processing (or lack of processing) and trading. Within the SASS project a broader angle to the food system in the target area is available in Rampa and Knaepen (2019).

### Agricultural input

Munyi and de Jonge (2018) argue that policy orientations about seeds system in Kenya are biased against farmers seeds systems and pose constraints to input access by small scale farmers. In the 2010 National Seed Policy the informal seed system is defined to include farm-saved seed, seeds purchased, multiplied, or marketed locally between farmers and seed accessed through civil society organizations, or imported by unregistered seed dealers and relief agencies. In the policy, the informal seed system is identified as a problem for the quality of seeds and seed certification is presented as the main tool to address it. The policy envisages targeting of the informal seed systems through 'provision of advisory services with a view to transform it to the formal sector' (Republic of Kenya 2010c), to make farmers appreciate the benefits of

using good quality seed. The 2012 Seed and Plant Variety Act (SPVA) Amendment of the 1972 SPVA aims at upgrading the plant breeders' rights system

from it being based on the 1978 Act of the International Convention for the Protection of New Varieties of Plants (UPOV) to the stricter 1991 Act of UPOV (UPOV 1991). Plant breeders' rights are now largely based on UPOV 1991 principles which should encourage plant breeding by granting exclusive right on the commercialisation of varieties<sup>5</sup>. PBR are expected to incentivize public and private breeding and facilitate the introduction of foreign-bred varieties, providing farmers access to a wider range of improved varieties. However, the UPOV system is likely to affect the informal sector as it does not allow for the exchange of farm-saved seed of protected varieties through the sales of seed surpluses on the local market (De Jonge, 2014).

### Agricultural production

Kebebe and Bokelmann (2017) base their analysis on Hortinlea Suvery, which covered 223 households in Nakuru County. They find that in Nakuru district the only IV produced by a quite high number of households is African nightshade (managu), with 8.5% of sample. Descriptive statistics provided by the survey are about the use of organic vs. inorganic fertilizer for IV. The percentage of households which apply any fertilizer to fields is above 70% for each of the IV considered, composed of a 50% using organic fertilizer, a 30% using the inorganic one, and some using both. Coming to seeds, the survey found that certified and improved seeds are used by 25% to 30% of farmers in the sample. Authors carry out a probit regression for each IV (our four + Ethiopian kale) to identify the determinants of the use of organic fertilizer and find that it is positively affected by availability of family labour, income, distance from markets and living in a rural (vs. peri-urban area), and information on its use. The study supports the argument that IV production follows sustainable practices and recommend promotion of IV.

Ewbank et al. (2007) assess gross margins of IVs production (our four IV) among 500 farmers in Kiambu district. The fragmented nature of cultivation (a quarter of an acre split into 20 or more beds) and the sequential nature of harvesting made assessing land area, yields and labour requirements problematic. The average gross margin (i.e. total value of the produce sold minus total variable costs) for 0.263 acre was calculated to be KSh 97,088, which equates to an annual figure of US\$ 5,274/acre, with irrigation. As an average, the study finds that it takes 4.3 month to recover investment costs for cultivation and irrigation equipment, which ranges from watering cans to motorized pumps. The study also compares the net present value of the total investment (500 farmers) for IVs and for conventional vegetables and finds important difference in favour of the first.

Bymolt and Delnoye (2012) focus on Naivasha basin, without a specific focus on IV, but paying attention to the drivers of the cropping decisions by farmers. The study worries against over-expectations from "magic crops", as all crops are prone to price crashes in the post-harvest. Risk adversity of farmers, in any case, prevents them to invest on one single crop (or group or crops alone). Farmers make rational decision on the crops to grow and that those decisions are based on their own experience, neighbour's behaviour, recommendations from extension agents, contracts from large buyers. To be convinced they need

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<sup>5</sup> The economic ratio of intellectual property rights is related to the features of innovation and knowledge creation, which cannot be classified as a perfectly private good. If inventors or innovators could not rely on some means to protect the knowledge they create, they would be at a disadvantage vis à vis rivals who did not incur the fixed costs of creating that knowledge. Such rivals would presumably be able to imitate it at a much lower cost. Therefore, externalities arise, creating a difference between the private and the social marginal return of newly generated knowledge, which could lead to under-investment in innovation activities. Furthermore, knowledge creation is affected by other market failures, since it is an activity that is subject to high levels of uncertainty and strong indivisibilities. Hence, incentive is needed to spur private agents to devote resources to innovation activities. Breeders' rights aim at providing incentives towards innovation in the agricultural input sector, by ensuring appropriability of innovation benefits (Ahora 2009).

information about production costs, expected yield and returns, but few farmers keep their records to make comparison with their own return.

### Processing and value addition

Processing and value addition are also key components of agribusiness development strategies, because they allow the involvement of many actors not only from the agricultural sector, but also in the secondary, with the so called agriculture based industrialization, and in the services related to each stage of the value chain offering opportunities for inclusive structural transformation. Manufacturing processes are often associated with a certain degree of concentration, due to scale economies and even to regulatory barriers to entry. Value added products in fact, are often devoted to high income or even to export markets and, in any case, they are marketed through formal channels so that they must comply with the regulatory standards in place. Regulation of the food industry is a critical issue in Africa as hygiene and quality standards are highly necessary but there is also a risk to raise regulatory standards above the reach of the existing enterprises. Increased attention to food safety by policy makers can improve conditions within processing plants, assuring safe products and safety for workers. Promising and dynamic enterprises in the agribusiness sector, however, risk to be pushed outside the market by demanding requirements, as they might lack the skills and the access to finance to ensure timely compliance, also resulting in loss of jobs (Brook et al 2013).

Agri-based industrialization is expected to have positive feedback effects on agricultural production and on the livelihoods of farmers. Products requiring a high degree of centralized processing, like tea, vegetables, cotton and tobacco can provide good case for contract farming, or outgrowing contracts. With contract farming, the small scale is maintained at the level of production, with formal agreements between smallholders-scale producers and buyer, while scale economies are enjoyed for the processing and marketing stages of the food and agri-processing value chains. Such schemes are appealing to farmers, because the company is committed to the purchase of the product, reduce the price risk, and it often provides agricultural input in advance, and extension services, fostering modernization and intensification of agricultural practices. Contract farming also enjoys better political acceptance than plantations, because it doesn't involve land deals (Eaton and Shepherd 2001) and a recent study by the OECD shows that contract farming appears to be the main road towards making African agriculture more market-oriented (Felgenhauer and Wolter 2009). Contract farming schemes however often exclude the poorest farmers, particularly landless farmers, youth and women (Sahin et al. 2014, Mirza 2014, Schneider and Gugerty 2010, Maertens and Swinnen 2009). Also, there are problems related to the allocation of risks, information and power asymmetries between the buying company and the farmers, and lack of transparency (Prowse 2012). World Bank and UNCTAD find that, while investors of out-growing schemes are usually recognized to pay better prices than middlemen, but exclusion of farmers from price setting decisions is a main reason for complaints (Mirza et al. 2014). Bymolt and Delnoye (2012) argue that local spot markets are the dominant arrangement for farmers in the Naivasha Basin. Out-grower contracts are also present, but limited and they tend to be perceived as soft contracts.<sup>6</sup> The study points to problems of mutual trust, side selling<sup>7</sup>, price setting with no transparency by large buyers, delayed pick-up during rainy season, suspect of rejection for oversupply rather than, as declared, for quality problems. The study nonetheless points to the potential of contract farming to overcome farmers' risk adversity and promote new/neglected crops. The study also

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<sup>6</sup> According to the study contracts are not binding, so that the parties cannot take each other to court. The horticultural code of practice (see onwards) mentions court mediation but also mediation by the Horticultural Directorate of AFA. Njoro Canning Factory Ltd. Reported experiences with courts so sort out issues raised from contract farming. A good practice for contract farming identified by the Bymolt and Delnoye (2012) is the local agriculture office to co-sign the contract.

<sup>7</sup> Side selling refers to the practice of selling the production to other buyers who offer better prices, despite commitment with contracting company. This opportunistic behaviour is appealing because contracts usually have a fixed price which, in the lean season, tend to fall below market prices (see Njoro Canning Experience onwards).

explains that, in Naivasha Basin, many small farmers want to export themselves or as a group, but they have insufficient capacity and output. Exporters in turn are reluctant to work with small farmers for the challenge of traceability of many small producers, which is time consuming, inefficient and unreliable. Small scale farmers do not keep good records and may even procure from neighbouring farms to satisfy an order, despite neighbouring farms don't meet standards. The study recommends small scale farmers to form groups.

## Marketing

The present literature review covers markets of vegetables, whenever possible of IV vegetables specifically. Particular attention is paid to the target area, and to supermarkets as preferred outlets for farm produce in Kenya.

Otieno Gogo et al. (2018) find that, due to high perishability, African indigenous leafy vegetables (IVs) tend to suffer heavy postharvest loss. Their study sought to assess types and causes of IV loss in the supply chain. The study was done across the IV producing locations of Nakuru, Kisii, and Kakamega, in Kenya. On average, post harvest losses between 10 and 50% were registered. While challenges like those associated to poor roads facilities are common to all vegetables, short IV shelf-life (1–2 days) is a major concern. This makes processing into products with longer shelf life particularly important for IV.

The study by Croft et al. (2016) does not cover Nakuru county, but Western Kenya and analyses different types of vendors of indigenous vegetables, namely the formal ones (mostly selling to supermarkets), and the informal ones. Most supermarkets source vegetables from the surrounding areas. Formal vendors are found to travel on distances that are almost twice those of informal vendors, as an average. Vegetables are sold in 200-500 gr bunches that vary in size with the season and price.<sup>8</sup> Formal vendors tend to diversify market outlets and to have arrangements for the collection of the unsold produce. Formal vendors are also younger. Seasonality, quality, and capital constraints are identified as main problems by vendors. Municipal regulations and consumer demand instead were not reported by vendors as problematic.<sup>9</sup>

Neven et al. (2009) explain that, despite the rise of supermarkets, 90% of consumers in Kenya purchases fresh vegetables from informal open- air markets. The analysis by these authors focuses on kales and supermarkets and it is based on two surveys carried out in Kiambu, Thika and Nyandarua Counties of Kenya in 2003 and 2004. The analysis reveals a threshold capital vector (irrigation, transport and ICT, but even financial, human and organizational capital) for entrance by farmers in the supermarket channel, which hinders small, rainfed farms. Most of the growers participating as direct suppliers to that channel are a new group of medium-sized, fast-growing commercial farms managed by well-educated farmers and focused on the domestic supermarkets' outlet. They heavily rely on hired workers benefits rural households via the labor market. Supermarkets pay the highest wholesale prices in the market (about 10–20% higher than traditional retailers), but other benefits of selling to supermarkets are even more important to farmers than the higher price. Since supplies are order-based, the farmer is certain, before harvesting, that the sale will take place and at what price. Prices paid by supermarkets remain stable over longer time intervals, relative to the traditional channel. Relative to the traditional wholesale and retail buyers, supermarkets order bigger volumes which reduces transaction costs for producers. Their orders are also coming in throughout the year with some reliability. While supermarkets and their suppliers build up long-term relationships, 95%

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<sup>8</sup> See Box 5.

<sup>9</sup> Croft et al. 2016 report that the buying price (at farmgate) of a 50 kg maize bag of indigenous vegetables in Western Kenya was 400 KES for formal vendors and more than double for informal, but the difference was not significant. Conversely selling price was 19 KES per bunch for formal vendors and 11.34 for informal.

of the traditional channel farmers are selling in spot markets, including farmgate selling. According to Neven et al., growers participating in formal markets also receive 57% of retail price as opposed to 17% in informal market channels, as shown in Figure 3.

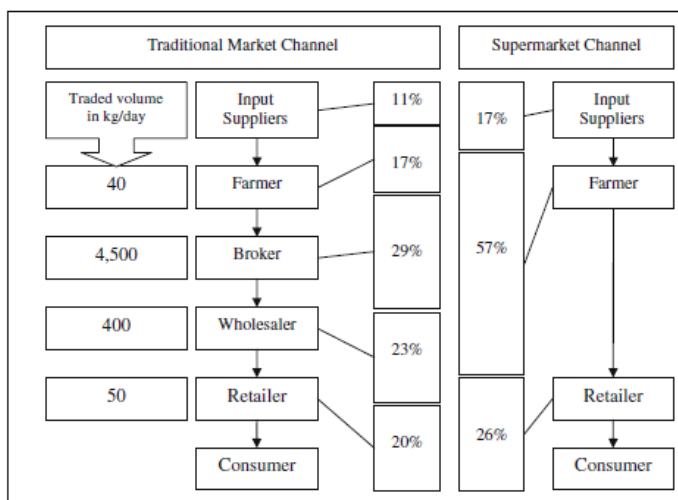


Figure 3: Production and marketing margins in kale supply chains (percentage of retail price earned). Source Neven et al. 2009.

Rao and Qaim (2011) also work on supermarkets. Based on survey data on Kiambu district in 2008, they estimate a production function for fresh vegetables and find that selling to supermarkets has significant positive effects on efficiency of farmers. Propensity score matching allows the authors to reduce endogeneity and reverse causality (i.e. better off and more efficient farmers are able to access supermarket outlets). However, they also recognize that farmers education and land ownership are in turn determinants of selling to supermarkets. According to the authors, participation in supermarket channels improves efficiency, because higher output prices in supermarket channels and better market assurance increase farmers' ability and willingness to upgrade their technology.

FINTRAC (2012) study covers 1,652 retailers throughout Kenya and it focuses on retail trade of fruit and vegetables. Cabbage consumption represents 19% of the horticulture retail market and Sukuma wiki another 16%. The preference for cabbage is explained by its easy transportation and low perishability when compared with Sukuma wiki (kale) and with traditional leafy vegetables. Retailers margin for Sukuma wiki is estimated between 35% and 50%.

Finally, Bymolt Delnoye (2012) offer important insights on farmers access to markets in Naivasha Basin. The problem of market information and information asymmetries is considered. First, it reveals that, in the target area, the benefits of IT in relation to market information is not yet widespread.<sup>10</sup> This is also in line with findings by USAID and HDCA (2014) about the sources of information for farmers about horticultural markets in Kenya, with traders mentioned by 14% of the farmers (ranking third source of information by number of mentions). Second, the study by Bymolt and Delnoye (2012) poses the problem of the exploitative role of traders in the target area. According to the authors it is the high number of actors in the value chains and their inefficiencies, not the exploitation by traders that squeeze everyone's margins.<sup>11</sup>

Abebe et al. (2016) propose important insights from Ethiopia, on the role that middlemen can play by linking farmers to final markets. This is particularly the case in developing countries, where market failure is ubiquitous. Their paper analyses the factors affecting farmers' decision to trade through middlemen and

<sup>10</sup> Standardization of price information seems also to be a challenge (see Box 4).

<sup>11</sup> The study does not consider leafy vegetables (only cabbage and tomatoes). Actually, leafy vegetables are so perishable that the number of actors is not very high, as too many steps would result in huge post-harvest losses. This is also the reason why we fail to classify the traders of AIV here studied into the common categories of assembler traders, middlemen and brokers and we simply refer to all of them as traders.

the impact of this choice on income. They find gross profit to be higher for farmers without intermediation, thanks to access to better quality inputs, better contract specifications and receiving higher prices for their products. Nonetheless, the majority of farmers continue trading via middlemen, as it links them to traders and final markets. Direct trading with wholesalers seemed beneficial for relatively better-resource endowed farmers.

Similarly, Sitko and Jayne (2014) argue that small-scale assemblers are both the most vilified and least understood actors in food value chains in Sub-Saharan Africa. Drawing on data from Kenya, Zambia, Malawi, and Mozambique, they find assembly markets for maize to be highly competitive in terms of the number of traders operating and marketing margins. Farmers’ market access conditions in remote areas are particularly improved by the operation of assembly traders. While smallholder farmers face important marketing challenges, according to the authors the brightest prospects for effectively addressing them require greater support for the development of assembly markets rather than supplanting them. Conversely, there is also literature and development initiatives in the field of indigenous vegetables in Kenya, aiming at ensuring direct access to farmers to supermarket and to allow them to bypass middlemen and traders (Ngugi et al. 2007).

## Field assessment and secondary data analysis

### Agricultural input

While the present legal system forbids sale and even barter of seeds, the limitations it poses to farmers seeds’ systems and described above (Munyi and de Jonge 2015), are simply not enforced. Seeds production, multiplication and exchange remain common practices with informal seed sectors accounting for approximately 80% of the seed planted (Kiambi and Mugo 2016): farmers simply sell seeds pretending them to be grains and there seem to be no institutional initiative to sanction these practices at the small scale. This is not necessarily good news, however for farmers’ seeds systems. While the lack of enforcement allows for business as usual functioning of informal seeds systems, the formal ban nonetheless prevents projects, programs and formal initiatives to develop these systems by improving the quality of seeds and their distribution. The official rhetoric of certified seeds blames farmers seeds for poor quality, but poor quality is likely to be a result, not a cause of the existing legal restrictions that prevent farmers seeds’ systems to be targeted by development initiatives. A kind of self-fulfilling prophecy.

The current constitution and recent amendments to the SPVA law, however, include some provisions which allow for some special treatment of traditional vegetables seed. This is perfectly in line with the “African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources”<sup>12</sup> by the African Union, which recognizes the need to “promote and support traditional and indigenous technologies” and the “rights of local communities over their biological resources”. The 1998 African Model Law was included in Annex X of the 1999 Revised Bangui Agreement on the protection of plant varieties, which the 17th UPOV Council in 2000 recognized as being in conformity to the 1991 Act of UPOV (Munyi et al. 2012). This international orientation was not yet developed in Kenya into any precise law provision or system, and at present the only way for communities to have their rights protected seems to be by undergoing the same procedure designed for commercial breeders and IV don’t enjoy any special status (cowpea seeds is now under compulsory certification and all the considered IV are scheduled by AFA).<sup>13</sup> Nonetheless, both in the national legal framework and in the international orientations there are good elements that pave the way for IV to be proposed as a pilot for local farmers’ seeds systems development (Table 1).

Table 1: Kenyan legal framework for indigenous seeds

Source	Article	Content
SPVA REGULATION 1991	17.1	No seed shall be offered for sale unless it has been certified or it has had its quality declared under regulation 16.

<sup>12</sup> <https://www.wipo.int/edocs/lexdocs/laws/en/oau/oau001en.pdf>

<sup>13</sup> See Appendix.

	18.5	No person shall sell seed unless he holds a valid licence issued under this regulation.
<b>Kenyan Constitution 2010</b>	11(3)(b)	"Parliament shall enact legislation to recognize and protect the ownership of indigenous seeds and plant varieties, their genetic and diverse characteristics and their use by the communities of Kenya."
<b>National Seed Policy 2010</b>	1.3.2	"as farming becomes more commercial the focus is shifting towards formal seed"
<b>SPVA 2012</b>	PART I art 2	"sell" includes barter, exchange, and offering or exposing for sale"
	27A(1)(a)	The functions of the National Plant Genetic Resources Centre shall be to (a) protect the ownership of indigenous seeds and plant varieties, their genetic and diverse characteristics, associated indigenous knowledge and its use by the communities of Kenya;

The protection of such breeders right, as anticipated, aims at ensuring quality of the seeds

- Encouraging international seed companies to introduce their varieties in the country
- Encouraging local breeders to develop new varieties.

The first case does not clearly apply to IV varieties, as international players simply don't produce them, the second point is more controversial. Kiambi and Mugo (2016) show that private sector breeding is very limited in Kenya with the Kenya Agricultural and Livestock Research Organization (KALRO) employing 61% of all the trained crop breeders followed by national universities (23%), private companies (9.6%) and international organizations (6%). Moreover, the quality of local seeds for IV varieties is usually perceived as satisfactory (they are not prone to pests and diseases, as they are very well adapted to the local environment when compared to other, exotic, horticultural crops) and, therefore, the demand by farmers is uncertain. There were thus very few breeders' rights registered for the considered indigenous vegetables. This situation however is changing rapidly, as shown in Table 2 and Figure 2, as research centres (KALRO and KARI), individual academicians (Prof. Abukutsa), and public and private companies (respectively Simlaw and Western Seed Company) are registering new varieties.

Table 2: IV varieties included in the National Variety list (Source Kephis National Variety List November 2018 <http://www.kephis.org/images/Uploads/UPNVLIST.pdf>)

			OWNER(S) LICENSEE	Year of registration	
Black nightshade	1	Nightshade 1	Prof. Abukutsa Mary O.Onyango	2016	
	2	Nightshade 2	Prof. Abukutsa Mary O.Onyango	2016	
	3	Nightshade 3	Prof. Abukutsa Mary O.Onyango	2016	
	4	BG16	KALRO and University of Eldoret	2017	
	5	Ex-Hai	KALRO and University of Eldoret	2017	
Spiderplant	1	Spiderplant 1	Prof. Abukutsa Mary O.Onyango	2016	
Amaranth (for leaves or dual purpose)	1	AM38	KALRO and University of Eldoret	2017	
	2	Ex-Zim	KALRO and University of Eldoret	2017	
	3	KAM 114	KALRO	2018	
	4	Katamani White (KAM 001)	KALRO	2018	
Cowpeas (for leaves or dual purpose)	2	27-1	KARI	1989	
	6	Machakos 66 (M66)	KARI	1998	
	7	K80	KARI	2000	
	10	Kunde 1	Western Seed Co.	ND	
	11	KUNDE MBOGA	Simlaw Seeds Company	2014	
	13	1002/1005/3 (Kunde Faulu)	KALRO	2017	
	14	14.1005/1002/1 (Kunde Tamu)	KALRO	2017	
	Varieties from 15 to 20 are missing in the published list				
	21	1005/1003/3 (KAT Kunde)	KALRO	2017	
	22	1005/1002/1/1/1 (Kunde Soko)	KALRO	2017	

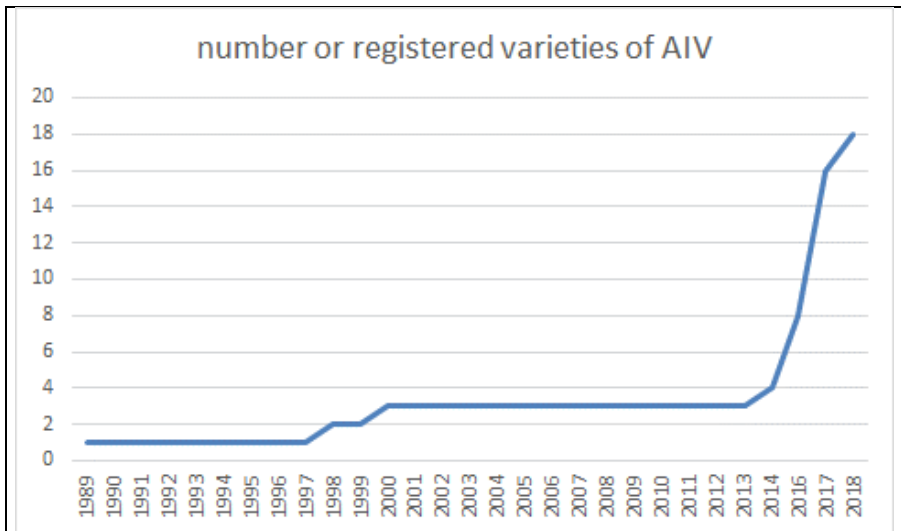


Figure 4: Cumulated number of cowpea, amaranths, spiderplant and blacknight shade varieties registered from 1998 (only leafy and dual purpose (i.e. both for grains and leaves consumption) varieties considered. Source authors elaboration based on KEPHIS National Variety List

Demand by commercial farms can explain the growth of a market for standardized seeds. Also, the interest in IV by research institutions and companies, can be found in seed import data. The volume

of vegetable seeds imported in Kenya have been growing over the last five years. Kenya produces only small amounts of vegetable seeds and vegetable seeds account for the largest share of the planting seed import market (USDA 2011). The challenge with local multiplication of exotic vegetables is related to their adaptation to local environmental conditions. Seeds of African indigenous vegetables instead can be produced and multiplied easily in Kenya.<sup>14</sup>

The trend toward commercialization of indigenous varieties is not negative as such, but points to the importance of defining a domain where indigenous farmers' rights are recognized, with rules other than those of the formal seeds system. The rationale of the protection of breeder's rights is to provide incentives to innovation, while traditional varieties don't need incentives. The managing director of Kephis herself recognizes that "these are selections derived from landraces, whose characteristics have not been documented before in descriptors" and that "questions on benefit sharing<sup>15</sup> are likely to arise" (FAO 2018).

### Agricultural production

Production of IV in Nakuru County is quite negligible when compared to the volume produced in the country overall and with main producing areas (Western part of the country but also Counties neighbouring the main markets and well positioned to serve their demand, like Kiambu for Nairobi and Kilifi for Mombasa). AFA reports only consider Nakuru County for black nightshade and leaf amaranths which, in 2015 and 2016, account for less than 3% of national production both in terms of volume of production and in terms of acreage allocated. The yields of black nightshade are nonetheless higher than the average (respectively 26 and 36 metric tonnes per acre against 23 as an average) and the area devoted to blacknight shade in Nakuru county has almost doubled between 2015 and 2016, from 602 hectares to 1135. All IV are on the rise in terms of acreage in the country but this increase is nonetheless noticeable. In the session about marketing, the effects of increasing acreage and volume of production on prices will also be assessed.

<sup>14</sup> Source Kephis Nakuru interview.

<sup>15</sup> An Access and Benefit Sharing Agreement (ABSA) is an agreement that defines the fair and equitable sharing of benefits arising from the use of genetic resources. ABSAs typically arise in relation to bioprospecting where indigenous knowledge is used to focus screening efforts for commercially valuable genetic and biochemical resources. ABSAs recognise that bioprospecting frequently relies on indigenous or traditional knowledge, and that people or communities who hold such knowledge are entitled to a share of benefits arising from its commercial utilization. Plant Genetic Resources Regulations, in line with SPVA 2012 amendment should streamline the process of access and benefit sharing and farmer exceptions from UPOV.



Producers of IV in the target area are here described and classified.<sup>16</sup> Rainfed farmers produce IV and other horticultural crops, jointly with maize and beans. Their plots range from 1 to 5 acres. The area they devote to IV is as an average 0.3 acres and the modal value is a quarter of acre<sup>17</sup> and it seems to be weakly correlated to the overall dimension of the plot. Many of them do not actually plant IV but they just harvest the wild ones growing spontaneously on their plots. Few farmers use inorganic fertilizer for IV and even less use organic fertilizer (manure). Most seem to use nothing.<sup>18</sup> Moreover, very few farmers used improved or certified seeds from formal markets, with most farmers relying on saved seeds, they produced themselves, on local seeds' banks, promoted by SSN<sup>19</sup>, and on local informal markets. All the farmers purchasing seeds also apply inorganic fertilizers. This is a sub group which is trying to practice a more modern and intensive model of farming, but there seem to be no clear relation between this orientation and their IV yields.

The role of IV in the livelihoods of rainfed farmers is two-folds. First IV contribute to household diet throughout their harvesting season. Second, their marketing contributes to the household finance during a period of the year when it is needed the most. As a matter of fact, rainfed maize is harvested only from September onwards, so that the months from April to September, when IV are harvested, correspond to the so-called lean period, or hungry season for poor farming households (Table 3). IV growing cycle is much shorter, so that selling IV is an important coping mechanism for these households who can use the income to purchase maize or to cater for other basic cash needs, while preserving household assets.

A detailed analysis of a commercial farm with 2.25 acres planted with indigenous vegetables showed that inorganic fertilizers and chemical account for a large share of the total costs. Moreover, the amount of inorganic fertilizer applied was found to be far above the amount that is recommended as an average for maize beans and other crops, despite the fact that for IV its use could be even avoided (Abukutsa-Onyangko 2010, Kebebe and Bokelmann 2017). This commercial farm is irrigated and employed 25 persons overall.

Table 3: simplified crop calendar for rainfed IV and maize

Month		3	4	5	6	7	8	9	10						
commercial and irrigated farms	blacknight shade	P	P		H	H	H	H	P		H				
	amaranth cowpeas spiderplant	P	P		H	H	P		H	H	P		H		
Wild strictly rainfed or	blacknight shade	P	P		H	H	H	H	H						
	amaranth cowpeas spiderplant	P	P		H	H	H	H	H						
Maize		P	P									H	H	H	H

P = planting H = harvesting

<sup>16</sup> A focus group with rainfed farmers and a detailed interview at a commercial farm were held in August and September 2018.

<sup>17</sup> This is in line with Ewbank et al. (2007).

<sup>18</sup> These findings are not fully in line with Hortinlea Survey (Kebebe and Bokelmann 2017) where input intensity was found to be higher, due to the fact that 15 to 20% of the farmers in Hortinlea Survey practiced irrigation. Farming households practicing irrigation were not systematically covered by fieldwork assessment, but as it will be seen onwards in this paragraph, they also represent an important group.

<sup>19</sup> The fact that all farmers are members of seed savers network introduces a bias in our analysis.

Also the crops calendar is different when wild and strictly rainfed production is compared to commercial and irrigated farms. One obvious difference which is not shown in the Table, is that irrigated, farms can produce throughout the year. Blacknight shade is harvested many times from the same plant, while the other vegetables are harvested only once or twice, being uprooted at harvesting time in commercial farms. Some rainfed farmers don't even plant and they simply rely on wild production. Even the ones who plant at the onset of the rain season, then they don't replant, and continue harvesting, despite decreasing quality of the produce. Not surprisingly, we found gross margins among rainfed farmers far below those estimated by Ewbank et al. (2007) and highly variable, mostly due to the fact that, in some cases, farmers experienced complete crop failures.

Table 4 proposes a basic characterization of IV producers, based on prevailing cropping practices and assets for cropping. Irrigated areas are estimated to account for 20% to 30% of total area devoted to horticulture in Gilgil subcounty.<sup>20</sup> This includes both households and commercial farms.

Table 4: Characterization of IV producers by cropping practice and assets

	Types of IV producers	Acreage devoted to IV	Household business/commercial business	Input use
1	Rainfed smallholder households	¼ acre and below*	Household business	Very low
2	Irrigated smallholder households	¼ acre and below	Household business	Variable
3	Commercial farms (irrigated)	Above 1 acre	Commercial	High, including chemicals

\*Some few farmers can be above this acreage but their cropping system is even more extensive.

Kenya is classified as one of the water deficient countries in the world. The country's irrigation-based farming is still limited. Irrigation agriculture in Kenya is mainly developed in form of irrigation schemes and large-scale irrigation of crops such as rice and coffee. The Agricultural Sector Development Strategy points to the fact that the country should be able to harvest from rain and store adequate water for agriculture and other uses. (ASDS 2009), particularly in areas where the water table is deep and underground water pumping too costly, like the target area here considered. Water harvesting is also a first option for Gilgil Subcounty and costs can be estimated from 70.000/80.000 KES for ¼ of acre, dry season, the typical amount of land devoted to IV, to stretch the production season of one more month and around 200.000 KES to cover the whole dry season.<sup>21</sup> This amount, however, is far above the current value of the production by rainfed farmer, so that such investment is unlikely.

### Processing and contract farming

IV value chains development is severely limited by the challenges posed by price seasonality and by the perishability of the product. However, value addition and processing of these vegetables into products with longer shelf life is not performed in Nakuru County. Processing IV into dried product with long shelf life is perfectly feasible, still preserving most nutritional values (Kome et al. 2015), but Nakuru county falls short of experiences in this sector. Processing of vegetables is technically feasible even at the very small scale, and can be carried out by farmers groups, with simple solar drying technologies. The main constraint to the promotion of such income generating activities however seems to lie in the size, features and location of the demand markets. Dried IV can be exported to diaspora communities or sold in the urban centres to the middle and upper middle working class. These consumers rely on formal channels for trade and distribution, which results in high volume and high-quality requirements. Such requirements, also related to compliance to food safety standards and trade licences, can hardly be met by farmers groups (see Box 1).

<sup>20</sup> Interview with the Agricultural Officer of the subcounty.

<sup>21</sup> Source Gilgil subcounty Agricultural officer.

Diatomite Budget group is a group of women from Diatomite area, an irrigated farming area close to Gilgil. The group started its operations in 2003 with 15 members and at present they are 20. In 2013 the group, upon the submission of a written project proposal, was provided with a solar drier for vegetables within a development initiative managed at the subcounty level by the agricultural office. The option for a solar drier was because group members produce vegetables and they wanted to exploit price seasonality by preserving them. The price of the drier was 50,000 KES fully paid from the grant, which also supported agricultural production by group members. The processing capacity of the drier is around 30 kg of leafy vegetables per cycle and a drying cycle lasts 2 days. The drier functions properly but



it was used only 4 times to produce samples. As a matter of fact, the problem was the demand. Demand for dried vegetables was reported to be high in countries where Kenyans and other Africans migrate, and the agricultural office tried to create a market connection through Kenyans living abroad. This proved to be a failure and the group never received any order. We can suppose that, even in case of orders, they would have failed to comply with export standards and procedures. Now the group is engaged in table banking and they purchased a gazebo and chairs to rent for events.

*Box 1: Small scale drying of indigenous vegetables, a failure story*

Development interventions to promote value addition and processing and to improve marketing are necessary for the development of African agribusiness. Moreover, farmers are very likely to benefit from trickle down effects of more structured value chains and value addition. This does not imply however that farmers themselves can become processors or traders, nor individually, nor even as farmers groups. Running a processing business or a trading activity requires knowledge, skills, and entrepreneurial attitudes that are rare even among educated urban population and there is no reason to expect rural Africans to master them, even after short training. Moreover, in the case of vegetable drying there is also a problem with the scale of operations, particularly because production is devoted to export markets and formal urban markets.

At the big scale there are three main investors operating in the vegetable sector in Nakuru county. Njoro Canning factory plant (various vegetables but, despite some trials, no IV), the State Owned Enterprise Kenya Ordnance Factories Corporation in Gilgil (a new plant to dry vegetables, but not including IV at present) and Frigoken, with a centre to collect and sort French beans in Gilgil Subcounty. The Kenyan Ordnance Corporation (<https://www.kofc.co.ke/>) drying plant for green vegetables in Gilgil has a processing capacity of 7 tons per line per day multiplied by 3 lines resulting in a total capacity 63 tons per day. This capacity refers to 24 hours functioning with 3 shifts. Additionally, there is a line for tomato sauce. The technology used is steam and it is powered by electricity as their source of energy. The plant is expected to cater for the army self-consumption, avoiding outsourcing which is now felt to be insecure and make the army prone to terroristic attacks through poisoned food. However, KOFC is also planning, and making local trials, to sell its dried vegetables on the market and outside the army.<sup>22 23</sup> Njoro Canning

<sup>22</sup> This stands in sharp contrast with the target, clearly stated in the Agricultural Sector Development Strategy 2009-2020 (Republic of Kenya 2010a, pp. xiv) of “divestiture in all state corporations dealing with production, processing and marketing that can be better done by the private sector.”

<sup>23</sup> As a matter of fact, dried Sukuma was available at Delamere shop, outside Naivasha town, with 500 grs sold for 1,000 KES. The label declares a ratio of 6 kgs raw Sukuma to 1 kg of dried product, so that 500gr correspond to around 3 kgs. Dividing 1,000 KES by 3 kgs we can see that each raw Sukuma kg is sold at 330 kes. With farmgate price of Sukuma at around 10 kes/kg (source AFA), average wholesale prices in Nakuru around 20 kes/kg, supermarket price around 47 kes/kg in September 2018 this is quite a big mark-up, but an assessment of profitability should be based on data on processing costs.

Factory Ltd (<https://www.njorocanning.co.ke/>) is owned by an Indian businessman producing in Njoro (close to Nakuru). The firm was incorporated in 1948 and, for long time since then, was the only vegetables processing plant in East Africa, enjoying a certain market power. Competition from inside and outside the country is now challenging business profitability. While the firm tried to diversify, the dried vegetables production line are not producing at present or they are producing far below capacity, due to the loss of a main contract with the Kenyan Army which replaced outsourcing from Njoro Cannery with own production among Gilgil new plant facilities in 2018. Frigoken (<https://frigoken.com/about/>) is based in Nairobi, with 100 collection centres over the country. It is a supplier of important European brands of canned French beans. It does not process the produce in Gilgil, so that its main concern is to ensure constant and reliable quality and quantity of fresh produce.

Centralized facilities are combined with contract farming schemes in the three cases. For contract farming, the common trend all of them reported is an orientation towards medium to big scale farmers and farmers with irrigation because of difficulties encountered in working with small producers. Table 5 provides an overview of the contract farming initiatives by the three investors.

Table 5: Three contract farming schemes in the horticultural sector

	Njoro Canning	Frigoken	KOF
<b>Products</b>	Dried frozen and canned vegetables (no IV)	Canned green beans	Dried vegetables (no IV) and tomato sauce
<b>Own plantation</b>	yes	no	Yes
<b>N farmers under contract farming</b>	20 big in September 2018 but reached 10,000 in the past including groups of small farmers	300 for Langalanga (Gilgil) collection centre Now only from medium <sup>24</sup> (they have been working with small for 30 years) because in 2015 failed to reach target production and turned from <i>no profit</i> to <i>for profit</i>	12 large famers who also buy from other small-scale farmers. Suppliers are more of brokers than farmers.
<b>Work with groups of small farmers</b>	Not at present but in the recent past	Yes	Don't work with groups
<b>Min acres</b>	2-10 acres per group Divided among members in parcels of 1/4 of acre	0.5 acres	Not specified / not dealing with small farmers
<b>Irrigation as condition</b>	No	Yes (the condition is 12 months supply)	Not a condition / capacity to supply is more important
<b>Collection /delivery</b>	Now delivery to plant to cut down transport costs	delivery to collection centres by farmers	Delivery to the plant
<b>Price</b>	Below maximum prices on the local markets, but above minimum	Flat throughout the year. Side selling problems are not there because they have an exclusive variety which would be recognized if it reaches any market	NA
<b>Who decide price</b>	Njoro Canning.	from Frigoken Nairobi	KOFC
<b>Contract duration</b>	One season	12 months	12 months
<b>Extension provided</b>	Yes	Yes	Yes
<b>Inputs provided</b>	No, because farmers side sell	Seeds and fertilizer	No
<b>AFA guidelines and HCDA code of conduct</b>	trying to comply with AFA guidelines, but they don't know the code of conduct	They know and are monitored for export standard (not for famers engagement standards) but they don't know the code of conduct	HCDA regulation do not apply to defence force

The problem reported with small producers is twofold:

1. small producers sometimes fail to provide the defined quantities, due to crop failures (particularly relevant for rainfed farmers) or to opportunistic side selling, so that the investment in inputs and technical assistance by the buyer becomes a loss;
2. due to their high number and typically scattered distribution over big areas, small producers are difficult to monitor in their compliance with export standards set by the Agriculture and Food

<sup>24</sup> Frigoken classification is as follows: Small: <10kgs of seeds = up to 0.5 acres. Medium: 10<kgs of seeds<50 =up to 2.5 acres. Big: > 50 kgs of seeds = above 2.5 acres.

Authority (AFA). Such standards refer to inputs and agronomic practices adopted, but also set requirements like the availability of toilets in the fields which can hardly be fulfilled by small scale farmers.

Overall the picture is quite in line with Bymolt and Delnoye (2012) with worsening situation for smallholder farmers, with both Njoro Canning and Frigoken recently reoriented towards middle to big, also for compliance with regulatory standards.

AFA is the successor of former agricultural boards that were merged into Directorates under the Authority, with the Crops Act in 2013. These were Coffee Board of Kenya, Kenya Sugar Board, Tea Board of Kenya, Coconut Development Authority, Cotton Development Authority, Sisal Board of Kenya, Pyrethrum Board of Kenya, Horticultural Crops Development Authority<sup>25</sup>. While such Boards operated through direct participation in the market, by purchasing and selling products, AFA role is now evolving towards regulation. The main concern of the Horticultural Department is to ensure standardization and food safety for compliance with export standards. In principle AFA regulation should cover all production and actors in the sector, but the officers do recognize that outside the export-oriented sub sectors, standards might be too demanding for farmers and challenge their food security (trade-off between food safety and food security). For this reason and for the practical feasibility of monitoring compliance of thousands of scattered producers, at present, AFA regulation are only enforced for investors. An important element of horticultural guidelines issued by AFA is the Horticulture Code of Conduct<sup>26</sup>, which should regulate contractual agreements between the producer and dealer in the industry. Such Code provides for producers engaging in contract farming to be organized into groups (in the case of small-scale farmers) or registered legal entities (for bigger producers). It also mandates the buyer to provide the necessary extension services, establish means and ways of financing the producer where necessary, and be responsible for traceability of the product. Moreover, the buyer should relate directly with the producer and not engage sub-dealers.

*Box 2: Mace experience with IV procurement and processing in Eldoret*

Mace Foods offers an interesting experience with IV processing and contract farming in Eldoret, some 150 kms north-west of Nakuru.

Mace Foods Company Limited is company limited by shares incorporated in Kenya in January 2002. The founding shareholders maintain a vision of balancing commercial profitability objectives with a development contribution to the country. Mace Foods is Fair Trade certified (WFTO) and follows a Corporate Social Responsibility (CSR) policy, in particular gender issues. The headquarters with factory and offices is based in Eldoret Mace Foods Europe Ltd., based in Germany is the sales and marketing unit to ensure a closer relationship to the European customers. Mace foods processes spices and indigenous vegetables into dried products, targeting the demand from the African diaspora in Europe, but also, for an estimated 70% of the production, selling on the Kenyan market. The demand on the Kenyan market is from urban middle and working classes, whose life style is no longer compatible with time consuming vegetables cleaning and sorting. Mace Foods procures raw produce for their drying facilities from 5600 farmers, including many small scale farmers arranged into groups. They work a lot with women self help groups and youth (40% estimated).

## Marketing

Back to the three broad typologies of IV producers identified above (Table 4), it is now possible to cross them with the prevailing marketing model (Table 6). For the sake of simplicity, we only distinguish three models, namely 1) selling at farmgate for the local market, 2) selling at farmgate for the wholesale markets and supermarkets, and 3) selling to supermarkets and wholesale markets straight. Distinguishing between the first and the second group allows us to assess if and to which extent the benefits of premium market

<sup>25</sup> The National Cereals and Produce Board and the Dairy Board are instead still operating.

<sup>26</sup> <https://www.agricultureauthority.go.ke/hcd-code-of-conduct/>

outlets are transferred from traders to farmers. A fourth option, which is also reported by farming household is to reach local markets and collection points themselves, but this is something that most individual farmers only do in particular circumstances, when they have to reach a nearby centre for other purposes, or the price at farmgate drops below acceptable levels, or they have volumes of produce above the normal amounts, that use to be too small to justify a travel.

*Box 3: Box Gilgil rainfed farmers and the market*

Rainfed farmers producing NUS in the area are mostly women in their forties and fifties. They mostly sell their IV to farmgate buyers and they have limited experience of direct access to local markets. Overall, they appreciate the middlemen they work with, because they accept the small quantities they produce. Farmers recognize that direct access to markets is costly (they mention transport and tax collection costs), time consuming, and that connections are necessary. Bega-bega boys are market intermediaries that receive farmers at the market gate and offer their services to carry the produce and to connect to a buyer (bega-bega means carry-carry and comes from the world they repeat to attract customers). Farmers referred to bega-bega boys as an additional cost to access the market but even as a cheating risk. Farmers tend to have a trader they trust, and they call this trader when the produce is ready (in some cases traders harvest the produce themselves). A certain degree of competition among traders in the same areas is there, so that farmers do have alternative middlemen who come to the farmgate. Farmers however tend to charge higher prices to alternative traders, who might ask for their produce when they experience undersupply by their usual suppliers. The reference traders instead enjoy better prices, but in turn he/she has to ensure regular collection. Farmers don't perceive those traders to be rich, with their most cited means of transportation being boda-boda, which is motor-bikes. In many cases boda-boda are actually functioning as taxi service and they are not owned by the traders. Other most cited means of transportation are bicycles and foot, while donkeys and motor-vehicles other than boda-boda are rare.

Commercial farms instead sell in wholesale markets<sup>27</sup> or to local supermarkets<sup>28</sup>. It is important to notice that most commercial farms do not sell only their own production, but they also act as middlemen for other farmers in their neighbourhoods. Moreover, all farmers acting as middlemen and accessing wholesale markets and supermarkets, buy from irrigated farms. This is explained by the fact that they resort to production other than their own to reach the volumes demanded by their customers. In the case of supermarkets such volumes are defined by the buyer, in the case of wholesale markets big volumes are necessary to justify transport costs. In both cases these commercial farms need reliable partners, who do not only supply year-round, but who can also cope with unexpected dry spells during rainy season.

*Table 6: Characterization of IV producers by cropping practice and marketing channel*

	Sell at farmgate for the local market	Sell at farmgate for wholesale markets and supermarkets	Sell in wholesale markets or to supermarkets
Rainfed smallholder households			
Irrigated smallholder households			
Commercial farms			

Following Neven et al. (2009) we decompose the price of IV into the shares captured by actors along the value chain (Figure 6). We refer to the combinations of cropping practice and marketing channel identified in Table 6 and resulting in 4 cases, and we further distinguish into retail and wholesale markets. It is

<sup>27</sup> Nairobi Markets, but even Nakuru and Naivasha markets work as retail market at daytime and as wholesale markets during night, which is when traders go to deliver their produce. There are no cooling facilities. Main Nairobi markets for vegetables are Gikomba, Marikiti, Muthurwa, and City Park. Buyers in these markets mostly measure quantities through bunches, while scales are only used when prices are very low (i.e. 30 KES/kg for black night shade) and upon buyer request.

<sup>28</sup> Out of 3 supermarkets chains surveyed in Nakuru County 2 sourced horticultural products locally and one received them from Nairobi central procurement.

important to remember that some of commercial farmers (Table 4 and Table 6) do not sell only their own production, produce and purchase from other farmers can account for a large share of their business. For this reason, when assessing the share of the price they capture in the value chain, we should consider that, under the farmers share, we do find a mix of income from farming and from trading. Moreover, for commercial farmers, the cost of labour can account for an important share of total cost of production but we don't classify it under input provider, but under farmer's share. This aims at recognizing that rural casual labour is also farming. Last, the shares of each actor are to be considered as gross shares, before post-harvest losses are subtracted. For traders supplying local market particularly, Post-harvest losses are huger than for traders supplying supermarkets, leading to some overestimation of traders shares on these markets. It can also be noticed that the share by irrigated farmers seems to be lower than that of rainfed farmers, due to higher input intensity. However, one should also consider that farmers who practice irrigation sell offseason so that the final price can be much higher and a lower share can still correspond to more money. Last, it should be noted that in some cases, in local markets, the trader and the retailer are the same person, so that their shares sum up. Overall our findings are quite in line with those of Neven et al. (2009), but the emphasis on higher margins for farmers with direct access to supermarkets is reduced by the awareness that supermarket suppliers are commercial farms and traders rather than famring households as such. The same applies to wholesale markets. These considerations point to a qualitative difference between them and farmers, so that upgrading from one group to another is less straightforward then might be expected, and to the need to better consider the role of traders.

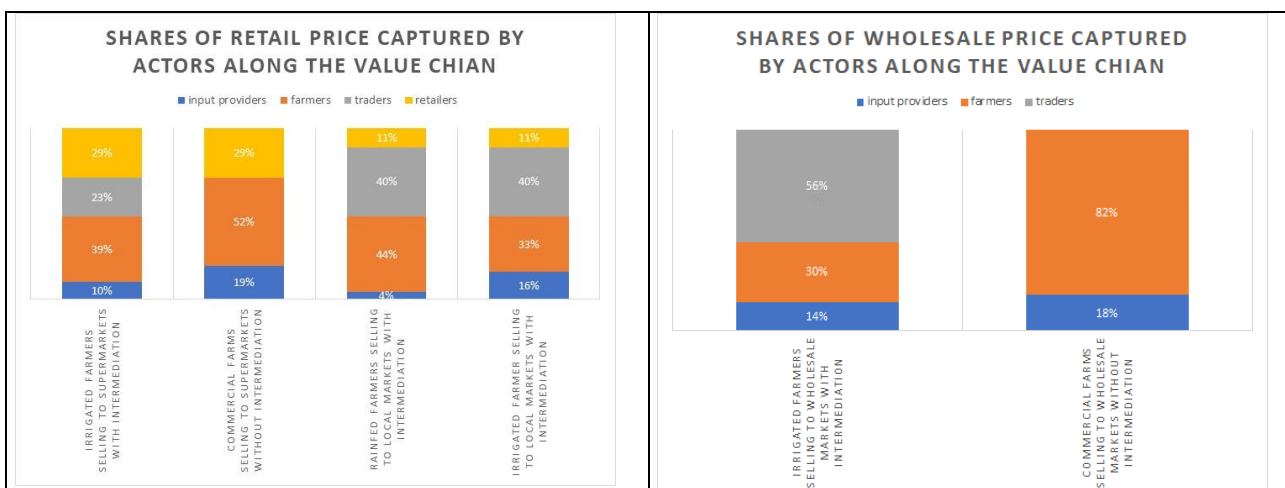


Figure 5: Share of price captured by actors in the value chains

We assess if the higher profitability of indigenous vegetables compared to exotic vegetables registered by Ewbank et al. (2007) in Kiambu is also confirmed as a general rule and for Nakuru County particularly. Our analysis is relevant for the subset of farmers selling at farmgate and corresponding to the widespread model of household level farming units (Table 6). We can decompose higher profitability of IV into two components, namely:

1. Lower production costs per unit of produce;
2. Higher farmgate price per unit of produce.

The first point is itself twofold because unit cost of production depends on input use and yields. The use of inputs was reported by farmers households to be lower for IV than for other exotic vegetables. This is particularly the case when only inputs purchased from the market are considered because farmer rely on saved, multiplied and even wild seeds for IV production and sometimes they apply the manure they produce, or no manure at all. Yields seem to be quite similar for African indigenous vegetables and other leafy vegetables, like spinach and kales, as shown in Figure 7.

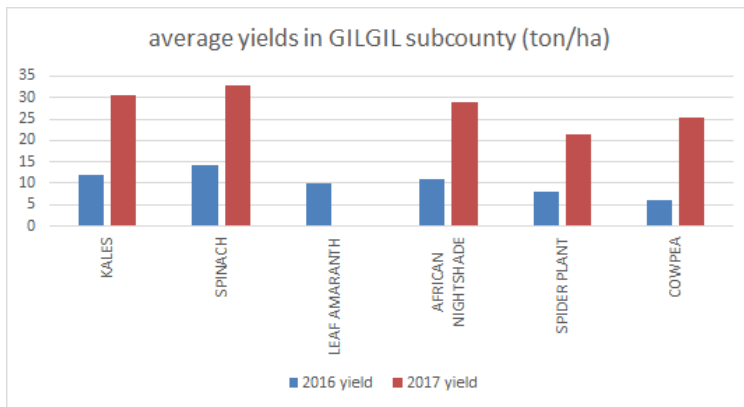


Figure 6: Yields of leafy vegetables in Gilgil subcounty (source: authors elaboration on data from Gilgil subcounty Agricultural Office).

The second point, higher price, is supported by Figure 8 which shows that the farmgate prices of the four IV considered are higher than those of exotic vegetables in all the markets considered (i.e. Kenya national, Nakuru county level and Gilgil subcounty level)

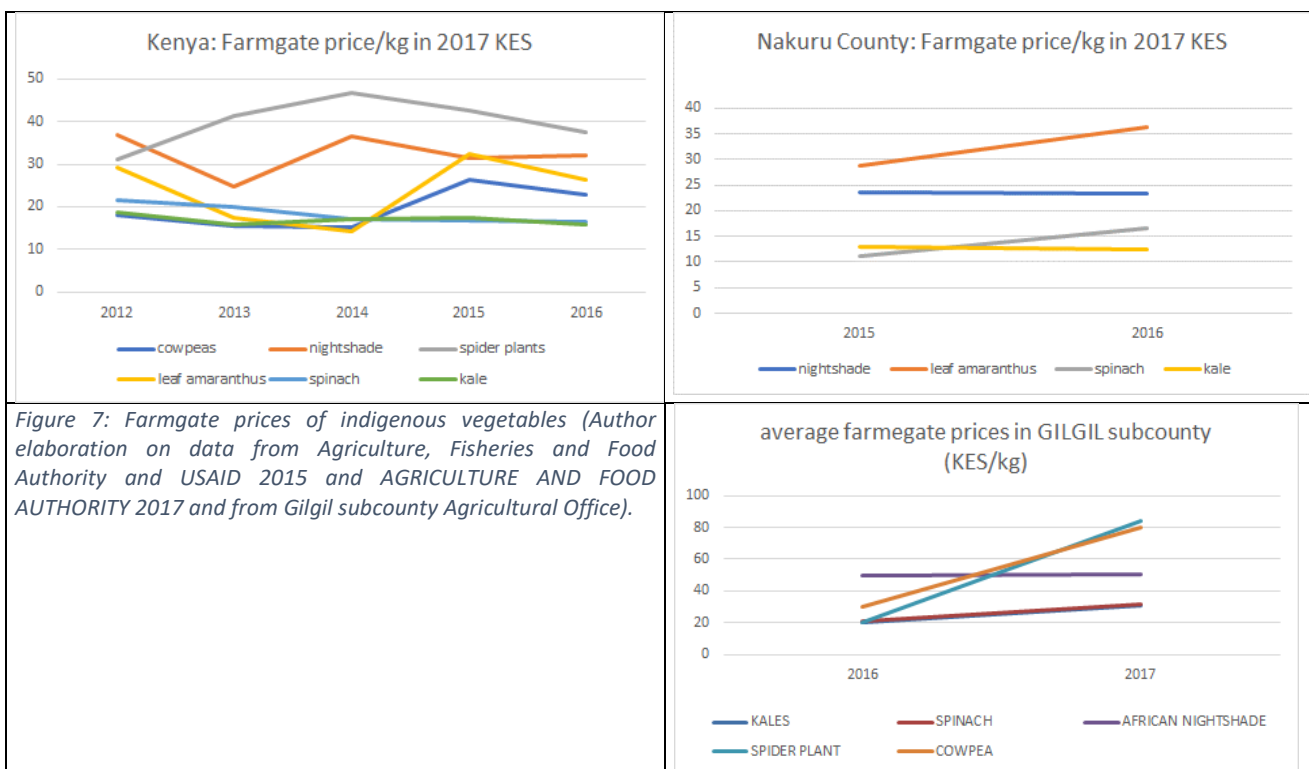


Figure 7: Farmgate prices of indigenous vegetables (Author elaboration on data from Agriculture, Fisheries and Food Authority and USAID 2015 and AGRICULTURE AND FOOD AUTHORITY 2017 and from Gilgil subcounty Agricultural Office).

A look at secondary data on farmgate prices and quantities (Figure 9) can also provide some support to the idea that higher prices for IV are here to stay, so that their production can be increased, and promoted, without negative effects on prices. Figure 9 shows the volume and price trends for all IV, at the national level and for Gilgil subcounty respectively. While volumes tend to increase for all the four IV considered, the corresponding prices do not seem to experience any decreasing trend and on the contrary, they tend to increase as well. This can be explained by the fact that, in the considered periods and markets, the increase in the produced and supplied volume was more than offset by the increase of the demand. Most actors met, in fact, reported demand constraints to be simply inexistent for IV, with rampant demand driving the growth of the market. This is a very important point when deciding to promote IV.<sup>29</sup>

<sup>29</sup> This of course, applies as a general rule and does not exclude that in particular times of the year and in specific markets oversupply can happen and important volumes of fresh product are wasted or sold at very low prices.



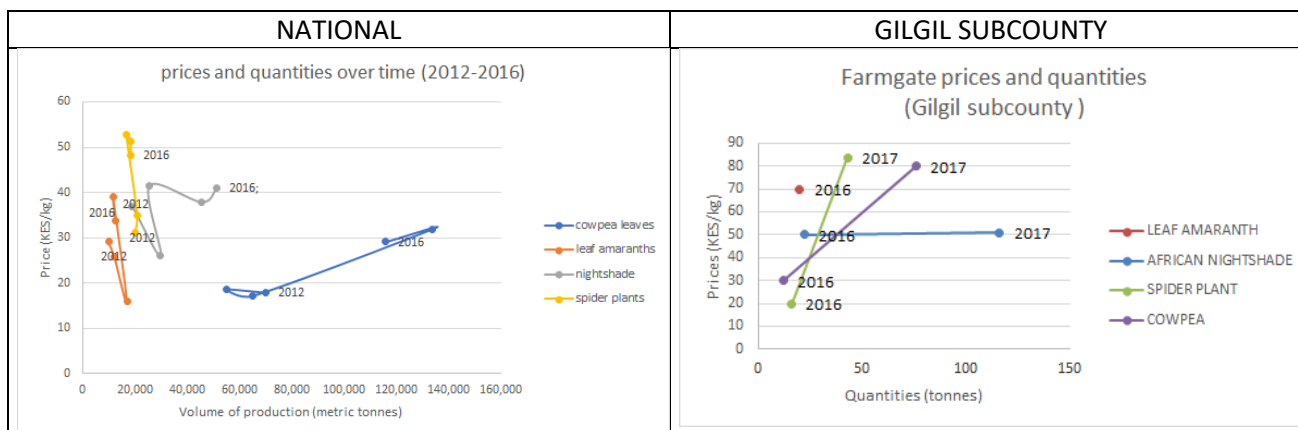


Figure 8: Trends in prices and quantities at the national level (right hand chart) and at the level of Gilgil subcounty (author elaboration based on data from Agriculture, Fisheries and Food Authority and USAID 2015; AGRICULTURE AND FOOD AUTHORITY 2017 and from Gilgil subcounty Agricultural Office).

Coming to retail prices, in September 2018 (a season when prices were reported to be at an average level), two interesting things were observed:

- there were no big differences between prices of traditional and prices of exotic vegetable in the supermarkets where prices were collected (Figure 10). The differences observed in farmgate prices seem to disappear along the value chain and are not transferred to the final customer. Still consumers perceive indigenous vegetables as more expensive due to the fact that they lose more volume during cooking so that comparatively bigger amounts must be purchased.
- There were no big differences between prices of traditional vegetable in the supermarkets and in the local open air markets. This is a counter-intuitive finding, whose explanation can be found in the inefficiencies and uncertainties of the values chains ending up in local markets. Supermarkets don't pay their supplier very high prices but they limit uncertainty with clear, yet unwritten, agreements. In line with Neven et al (2009) this is not the most important point in a value chain where the joint presence of uncertainty and perishability is a main constraint. Local markets do not enjoy a streamlined value chain and actors experience more risk and post-harvest losses, so that the final price is pushed up. The price of each kg actually sold has to contribute to the recovery of the kgs which are not sold and go lost.

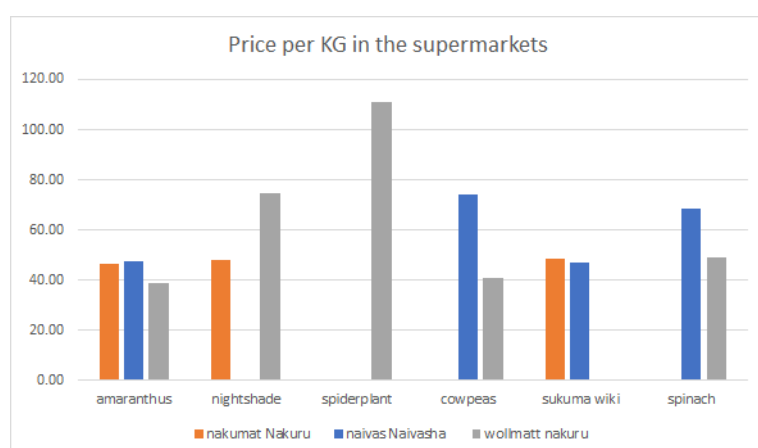


Figure 9: Prices of IV in Nakuru County supermarkets

Box 4: Prices as vehicles of information

It is very common, and also documented in the literature (Guarino 1997) to hear about bunches that are divided by half along the supply chains of indigenous vegetable. The story is that traders divide by two the bunches they get from farmers and sell each half at the same price they paid to the producer. The point that we want to stress here is that the focus for local people is on quantities rather than on prices. As a matter of fact, informers met in the markets seldom refer to prices per kg and, to describe price variability they do not refer to changes in prices for a constant quantity, i.e. a kg, or a standard bunch. They instead refer to changing quantities for a given price. The price, at least for the bunches of indigenous vegetables, is usually 10 KES and the quantity is the variable that is adjusted across seasons and periods to reflect relative scarcity of vegetables. This means that during the dry season, when only irrigated farms produce indigenous vegetables, the price of a bunch does remain 10 KES, but its dimension will be



Figure 10: Tomatoes sold at fixed prices for different numbers to account for dimension and differences in quality.

much smaller than during the rain-season. Conversely, in the afternoon, when the unsold production is at risk of depletion, the dimension of bunches and handful (another common measure prone to the same problems) increases. Of course, anyone mastering basic mathematics and technologies like scales and calculators can easily calculate the unit price corresponding to different bunches' dimensions. Nonetheless this system leaves rural people and small traders, without a reliable reference other than subjective estimations and memory. The prices are expected to convey market information and the price of a product is expected to change while the product and its quantity remain well constant, so that it is possible to make meaningful comparison. Given the lack of scales and the low use of the few available in the markets and at the farmgate, this system generates big uncertainty and information asymmetries. According to traders, farmers are increasingly using scales, thus improving their awareness and bargaining capacity, while in the wholesale markets, it is up to the buyer to decide whether to count bunches or to weight the produce, so that they perceive themselves to be in a weak position.

#### Box 5: Six stories of traders, farming traders and trading farmers

**Jane** is a woman in her 50s who has been trading traditional vegetables since 1996. She speaks Kiswahili and a local language. Her suppliers are among both irrigated and rain-fed farmers from Maji Moto - Diatomite, an area close to Gilgil. Around three times per week she walks 10 kms from her place in Gilgil to the farmers area. She fills two bags with vegetables and she calls a boda-boda taxi to go back with the bags. Once back in Gilgil she mostly sells door-to-door, in an affluent neighbourhood of the town, where she has a number of loyal customers. Jane, as most traders we met, uses a thumb-rule for setting prices: she doubles the buying price. Jane has very low costs, only the taxi motorbike and the barter tax (to enter municipal markets) when she sells excess vegetables in the local market, so that her margins are quite high and her average monthly income is above 600 usd (Kenyan per capita GDP was around 1500 usd per year in 2017). Nonetheless Jane's shelter clearly shows poor living standards. Moreover, when asked about the opportunity to re-invest her profits into her trading business to expand it and make it less demanding (i.e. using some means of transport instead of walking long distances), she explains that she is prioritizing investments into her sons (not daughters) education and into her own farm, far from Gilgil and managed by hired workers. Scaling up the vegetables trading in fact is very challenging, due to the lack of certain demand beyond the scale she deals with.

**Bernard** is the father of two young children, he is now in his early 30s and he speaks English. He is both a farmer and a trader. His plot, in Diatomite, is irrigated, like the ones of the farmers he buys from (there is a water scheme in the area). He uses his own motorbike to collect traditional vegetables from some 10 farmers, 3 of which only rely on him for selling their produce. Then his wife brings the bags with vegetables to four different hotels in Gilgil town. These hotels run small restaurants and do not target tourists, but local middle class. Even Bernard is making good business, but he doesn't see much opportunities for scaling it up. He is already dimensioned to satisfy the local demand he knows and, to find additional, reliable demand, he could only sell (i.e. send his wife to sell) in Nairobi wholesale markets, at night. But this requires some connections and the young age of children is also a limiting factor, at present. His real dream is instead to improve his farming business, with legal irrigation, or to open a shop to sell

cereals.

**Caroline** is younger than 30 years. She works in a micro-finance institution in Naivasha, but as most people in this area, she states that she is “also a farmer”. More noticeably, she is also a trader, and quite a successful one. A couple of times per month she collects 20 bags of indigenous vegetables and other vegetables from her farm in Diatomite and from her neighbours and bring them to Nairobi wholesale market of Marikiti, with a hired truck, at night. Also the farmers who supply her practice irrigation and she is not the only buyer for them, because she doesn't make regular purchases. She complements her income through this trade, but her project for the future are based on her formal employment and possibly on farm investments.

**Wirginia** is older than Jane and she runs quite a similar business. She walks at least twice a week to the farms where she purchases indigenous vegetables that she transports to Gilgil by boda-boda taxi. The main difference with Jane is that she work at Gilgil marketplace, selling her vegetables to consumers, or selling to other retailer in the markets. This seems to be less profitable, not for price differences as such, but for the higher uncertainty implied, so that the risk of unsold production turning to post-harvest losses is always high.

**Daniel** is around 30 and he owns more than 8 acres of irrigated land, cultivated, among others, with cowpeas and spider-plant, and he has 6 waged workers. He is not only a commercial farmer, but also a trader, because he purchases leafy vegetables also from 5 to 10 other farmers from the surroundings. The farms of his suppliers are smaller than his one, but still irrigated. For his trade, Daniel owns one truck, one pick-up and two motorbikes and he goes every night to the Nairobi market of Muthurwa. The main positive thing with Nairobi market is that demand is high throughout the year, but the problem is that, gathering products from all the regions of the country, it smooth down price seasonality of the different areas so that prices seldom become very high. For this reason, he doesn't consider such business promising.

**Grace** is a supplier of two supermarkets: Naivas Nakuru and Naivasha (for IV, black nightshade, only Nakuru). She is from Naivasha, she is in her late thirties and she speaks a good English. She had to apply as a supplier in Nairobi headquarters of the supermarket. Trade licence and PIN number from the Revenue Authority were required. Moreover, you have to bring samples of the product if you are a trader. If you are yourself a producer, you receive a field visit from Naivas staff. Both sample delivery and field visit are meant to assess your capacity to provide reliable quantities of product, but they don't check anything about chemical inputs or similar. Once registration is successful you can visit the shops and enter into a direct agreement with them. There is no contract for quantities and prices, but there is a mutual guarantee for twice a week delivery. Payments are delayed and only receipts are issued upon delivery. Quantities are decided from time to time and reference prices are set by Nairobi office, and they are checked and communicated to the shops through the internet. The trader has nonetheless some bargaining power in the periods when the supply is low. She regularly buys IV also from other farmers, both from Naivasha and from Gilgil to complement her produce, but she wishes to expand her production in the future, because she has higher mark-up on own production and complementary purchases have the main purpose to reach the required volumes.

## Policy recommendations

The recommendations take into account the considerations put forward in the introduction and concerning the problem of social and economic sustainability of food systems and the importance of leaving no one behind. This implies the attempt to improve the efficiency of the IV value chains but at the same time to preserve the social and economic structure of a territory which is already going through fast transformations. In many ways the poorest producers show many signs of fragility, most of all the small pieces of cultivable land and the difficulty in irrigation, to produce offseason. Therefore, the suggested interventions and policies are meant to orient and accompany the farmers in a soft way, precisely because they already experience the impact of strong economic and social changes. The same is true for many traders in particular those dedicated to local markets. We can describe these recommendations as an exercise of efficiency improvement with resilience, which implies a smooth modification in the existing production and marketing conditions.

The variety and diversification of the proposals is meant to capture the above preoccupation which follows also from the methodological awareness that sustainability cannot be captured by one or few policies. Most likely several velvet gloves are better than one strong fist to support social and economic sustainability. Regulation is itself an issue and a clear example of this. While the standardization of seeds

and that of food products respectively promoted by KEPHIS and AFA have great potential to boost trade and export, it is also very important that the domain of application of such stringent regulations is clearly defined in order to exempt small-holders production for self-consumption and for local markets<sup>30</sup>.

### Piloting protection of indigenous seeds through farmers' seeds systems

As discussed above Kenyan law is twofold about indigenous plants and farmers' seeds systems. On the one hand informal seed systems are considered a residual category which is going to disappear as modern seeds are developed and made available. On the other hand, it recognizes that traditional indigenous seeds need a separate consideration. However, it is not yet defined how protection of indigenous varieties could work. Promotion of IV production among farmers should include a pilot initiative, championed by relevant institutions, and designed to enjoy a derogation from the main rule preventing farmers from exchanging seeds. This pilot should contribute to assess the feasibility of a dual system, where farmers seed systems are not only allowed, or, as it is now, tolerated but even promoted, within the bounded domain of indigenous varieties.

### Promoting IV production among heterogeneous farmers: organic farming and IV watering

Recalling Bymolt and Delnoye (2012) in their study on Naivasha basin, it is worth to remembering that there are no "magic crops" and that promotion of crops will encounter risk adversity of farmers, which prevents them to invest on one single crop (or group or crops). It is important that promotion of IV emphasise their integration into household cropping (and coping) strategies, rather than substituting other crops and mechanisms. More particularly IV seem a good substitute of exotic vegetables.

According to all the local actors interviewed and to the trends in the prices at farmgate there is scope for increases in the quantities of indigenous vegetables produced. So far increases in quantities on the supply side did not translate into price decrease, probably because the demand for these vegetables is growing faster than supply. A careful monitoring of the local and central demand should nonetheless be regularly performed to detect supply gluts in advance.

The groups of farmers identified in Table 4 need different kind of support to improve their cropping practices. Sheahan and Barrett (2017) found that main constraint to agricultural productivity increase in Africa is not underutilization of agricultural inputs, but improper use of input and inputs' mix. This seem to be the case for all our groups of producers.

1. Group 3 (and 2 when relevant) needs awareness raising about the low need of chemical inputs and inorganic fertilizers, to improve environmental sustainability of IV farming, improve quality of the produce and its and marketability on organic farming markets, and increase farmers margins through cost reduction. This groups have an important potential for employment creation.
2. Group 1 Need to be supported to adopt better farming practices and more rational input use. Moreover, they could dramatically benefit from irrigation, which should be promoted with sustainable technologies like water harvesting. Ewbank et al. (2007) found that this can ensure quick cost recovery for traditional vegetables in Kiambu.

Water harvesting, when financially feasible and watering vegetables with water cans in kitchen gardens, with water from sources at walking distance or with basic roof collection systems are to be promoted. This of course is limited to very small acreage close to the household dwelling, but can easily ensure the labor and water intensity needed by vegetables crops. Irrigation would not only allow them to produce more, but

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<sup>30</sup> As a matter of facts, local trade in Kenya already enjoys the recognition of a special status, with access by sellers to municipal markets not limited to people with a trade licence but open to anyone paying a so called "barter tax".

also would allow them to exploit the seasonal prices fluctuations. The example of Sukuma wiki<sup>31</sup>, in Figure 12 shows the importance of price seasonality, particularly on local markets, while Nairobi market tends to smooth down price fluctuation of the different areas from which it gathers the vegetables, because of difference in seasonality.

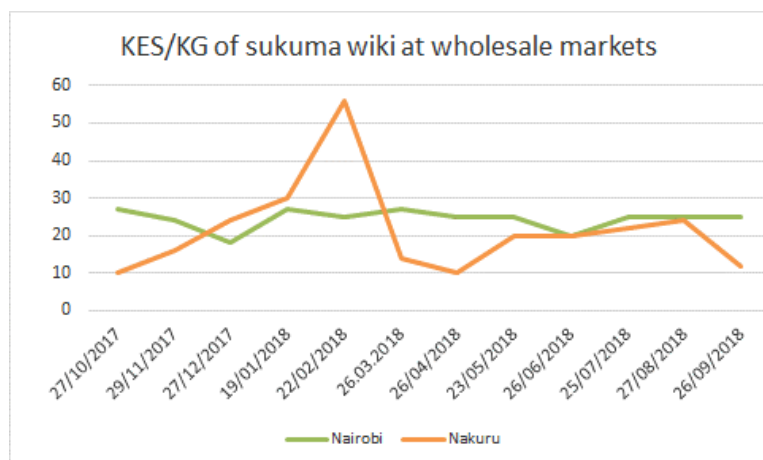


Figure 11: Price seasonality for sukuma wiki

### Labelling for quality

Improving the functioning of the IV value chains must take into account all the opportunities to add value to the production and marketing of IV. This can concern both the local and the more distant markets including export ones along short and long values chains.

The shorter distance to reach local informal markets may lead to improved quality, which is a characteristic that local consumers value and for which they seem to be willing to pay premium (Chelang'a, Obare and Kimenju 2013; Croft, Marshall and Weller 2014). In the case of local markets better communication and marketing system through help to improve information and sales opportunity this could be achieved with modest technical support.

Labelling IV could help to add value in the case of more distant markets, such as the capital city or supermarkets chains with centralized buying systems. This possibility requires some sort of association among producers, most likely with the need of some support from county and national agricultural support services. It is also necessary to identify the possible agency/organization which can help with a form of certification (Knaepen 2018). This should also address the traceability challenges of smallscale production identified above.

### Promoting value addition and contract farming

The issue of labelling links up with processing, and with drying IV. Dried leafy vegetables have a potential to reach high value markets (urban and export) and offer opportunities for agribusiness development. However, processing is unlikely to involve farmers or local SMEs, and calls for bigger investors. This can nonetheless ensure important benefits to farming households able to provide the raw product. Value addition for IV can address the problems of perishability ensuring higher demand for famers even in the

<sup>31</sup> Sukuma wiki is an exotic vegetable, but it is very common in Kenya and it is also used to calculate the national Consume Price Index so that data are largely available.

pick production season, when prices tend to be low. Moreover, contract farming can further reduce the risks bore by farmers and strengthen their capacity, through technical and financial assistance. KOF seems to be well positioned to engage both in IV processing and contract farming, as they are already processing outsourced leafy vegetables. The Kenyan Agricultural Sector Development Strategy 2009-2020 (Republic of Kenya 2010a, pp. xiv) envisages “divestiture in all state corporations dealing with production, processing and marketing that can be better done by the private sector”. Production for the market could be justified by the public benefits of procuring IV from smallholders, increasing their income, and of promoting valuable vegetables at once.

### Involving neglected underutilized traders

While agribusiness is now a keyword in the Africa development narrative, trade as such is seldom considered, despite many young people work in the trade of agricultural products. For IV value chains it was possible to observe that traders, buying at farmgate, play an important role providing farmers with a market outlet and, also, as vehicles of information. However, traders experience several constraints, due to poor road infrastructure and uncertainty about demand in their outlet markets. Moreover, leafy vegetables are so perishable that the value chain remains quite short, as too many steps would result in huge post-harvest losses and traders try to minimize demand risk. Barriers to entry in bigger businesses and to scale up are related to investment capacity and collusive practices by incumbent traders, but most of all, to the combination between perishability of product and demand uncertainty. Main strengths of formal outlets, like supermarkets, are related to the reduction of such uncertainty rather than to higher prices paid to suppliers. For traders who have no access to formal markets or to wholesale markets where demand is always high, vegetables are collected only when the outlet market is already identified, and in the quantity corresponding to that outlet, so that the trader goes straight to that market. Traders design their business model and operate it in such a way that, with their selected suppliers and buyers they enjoy some market power, but this is the only way to reduce uncertainty. For this reason, most of the traders encountered can hardly envisage a future where their business is scaled up and becomes more profitable. Instead of investing in their trading business they preferred to save their profits to invest in other sectors. In a context where remoteness of farmers and difficulties to reach them were reported as main constraints (for extension services, for contract farming, for traceability), middlemen traders have an unexploited potential as links with the farmers.

Supporting trader to enhance their role in the analysed value chains can encompass many interventions. Training and support to explore new markets, awareness raising about weights and measures, awareness on how to draft a simple contract (both with suppliers and with buyers), capacity to vehicle standards for production of vegetables to comply with quality standards (export/organic/related with labels) and to monitor them. Access to credit is also a main constraint experienced by informal traders. This kind of soft initiatives could greatly contribute to the role played by traders. This is also in line with the objectives of the National Agribusiness Strategy of creating “more structured and organized markets (Republic of Kenya 2012 p22) and of promoting “small traders associations (Republic of Kenya 2012 p29). Infrastructural interventions of course, in rural roads particularly remain a priority. In line with Croft et al. (2016) we didn’t find municipal regulations and, more generally tax collection and or any requirement or compliance resulting from Government intervention, to be important constraints for traders and for the development of the value chain.<sup>32</sup>

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<sup>32</sup> Relevant taxes are the so called ‘Cess’ (collected along the roads but only during day hours while traders are mostly active during night hours), and market entry taxes. Both are collected at the County level and rates are affordable for traders.

## Final remarks

The analysis confirmed that there is good potential for IVs' value chains development in Southern Nakuru County, both for local consumption and for urban markets. In this sense, there is no inherent contradiction between local and central urban market, and potentially even export markets. IVs value chains development can be oriented both towards the local food system and toward the external markets, that is into short and longer value chains, with the only limit to the length of the chain being perishability and lack of processing. Long value chain allow produce to reach wealthier markets and potentially to yield better returns to local producers and actors along the local part of the chain. Short chains development and improvement can more easily ensure that the food system remains diversified and that many small, even vulnerable, actors find their place in it. The point is not to choose long or short value chains, but to ensure that they bring benefits and do not harm local actors, and vulnerable actors particularly. IV value chains were found to involve heterogeneous actors. In production they range from small scale rainfed farming households alongside dynamic entrepreneurs, in consumption there is self-consumption alongside urban and potentially foreign markets. At all the stages of the value chain, different actors were found to need different interventions to streamline the value chain and size their potential. In most cases, there is no inherent trade-off between supporting one groups or another. Vulnerable farmers engaged in IVs production and the traders who links them to the markets can be targeted for social protection purposes, while more dynamic entrepreneurs, like commercial farmers and traders and even processing firms are targeted by business development initiatives.

Yet, it is important to recognize the multiple links and interactions. Vulnerable groups can benefit from the development of a dynamic rural sector, in terms of employment creation, and better integration into global value chains, for example through contract farming. It is nonetheless important to recognize that many poor farmers are likely to remain, at best, at the margins of the rural transformation envisaged. Vulnerable groups that base their livelihoods on local natural resources and land are weak counterparts in market transactions. The paper and its recommendations try to ensure that agribusiness development is both economically and socially sustainable and thus is part of an effort to move towards more sustainable consumption and production patterns as indicated by Sustainable Development Goal number 12. These considerations should help Southern Nakuru County to move towards a more inclusive society.

Leaving no one behind requires that it will be necessary to prevent dispossession and out-migration of young dispossessed farmers and farmers whose plot dimension is reaching productivity limits. Overall, it is important that modernization of agriculture draws a way out of poverty for vulnerable players, not a way to cut out the poor.

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## APPENDIX 1

The primary novelty of the 2013 Crops Act regarding seeds is the classification of crops as either scheduled or non-scheduled. Scheduled crops list can be amended by adding additional crops by the Minister for agriculture. The difference between scheduled and non-scheduled crops lies in the requirement for government authorities to assist the development and market promotion of each scheduled crop. Virtually, all food crops grown in Kenya, including our IVs, are listed as scheduled crops, which obliges the government to set seed quality standards. IVs are marked with bold.

The second list presented in this appendix is instead from the SPVA and presents seeds with breeding programs and compulsory certification, which is only the case for cowpeas so far.

### CROPS ACT 2013 FIRST SCHEDULE [Section 7, Act No. 7 of 2016, Sch.]

#### SCHEDULED CROPS

Part 1 — Crops with breeding program under compulsory certification	Finger millet.....Eleusine coracana (L.) Gaertn.
Sugarcane.....Saccharum spp.	Maize.....Zea mays L.
Tea.....Camellia spp.	Pearl millet.....Pennisetum (L.) R.Br.
Coffee.....Coffea spp.	Rice.....Oryza sativa L. (1)
Rhodes grass .....Chloris gayana	Sorghum.....Sorghum bicolor (L.) Moench.
Irish potatoes.....Solanum tuberosum L.	Wheat.....Triticum aestivum.
Cotton.....Gossypium spp.	Wheat (pasta).....Triticum monococcum L.
Sunflower .....Helianthus annuus L.	Part 2 — Crops with breeding program under voluntary certification
Soya beans .....Glycine max (L.) Merr.	Bananas.....Musa spp.
Beans.....Phaseolus vulgaris L.	French beans .....Phaseolus vulgaris L.
Barley.....Hordeum vulgare L.	

Silver leaf desmodium.....	Desmodium uncinatum	Flax .....	Linum usitatissimu L.
Lupin.....	Lupinus spp.	Sisal.....	Agave spp.
Lucerne.....	Medicago sativa L.	Beet.....	Beta vulgaris L.
Green leaf desmodium.....	Desmodium intorium (Miller).	Turnip.....	Brassica rapa L.
Setaria.....	Setaria spp.	Other flower species.....	Liliaceae, Umbilliferae, Roses, etc
Congo signal.....	Bracharia spp.	Blue stem grass .....	Andropogon spp.
Coloured guinea grass .....	Panicum coloratum	Buffel grass .....	Cenchrus ciliaris L.
Pyrethrum.....	Chrysanthemum spp.	Cock's foot.....	Dactylic glomerata.
Cassava.....	Manihot esculenta	Columbus grass.....	Sorghum alnum
Sweetpotato.....	Ipomeea batatas	Paspalum grass.....	Paspalum gayanus
Kenaf.....	Hibiscus cannabinus L.	Rye grass .....	Lolium spp.
Sesame.....	Sesamun indicum L.	Sudan.....	Sorghum sudanense.
Safflower.....	Carthamus tinctorius L.	Love grass.....	Eragrostis spp.
Ground nut.....	Arachis hypogaea L.	Bermuda grass.....	Cynodon dactylon.
Pigeon pea.....	Cajanus cajan.	Butterfly pen.....	Clitoria ternatea.
Dolichos bean .....	Dolichos lablab L.	Centrosema.....	Centrosema pubescens Benth.
<b>Cowpea.....</b>	<b>Vigna unguiculata (L.) Walp.</b>	Clover.....	Trifolium spp.
Chick peas.....	Cicer arietienum L.	Leucaena.....	Leucaena lencocephala.
Part 3 — Crops with no breeding program		Siratro.....	Macroptilium atropurpureum
Oats.....	Avena sativa L.	Stylosanthes.....	Stylosanthes guianensis
Rye.....	Secale cereale L.	<b>Amaranth.....</b>	<b>Amaranthus spp.</b>
Triticale.....	Tricosecale Wittm.	Artichoke.....	Cynara scolymus.
Broad beans.....	Vicia faba L.	Asparagus.....	Asparagus officinalis.
Cluster bean .....	Cyamopsis tetragonoloba.	Sugar beet .....	Beta vulgaris L.
Pea.....	Pisum sativum L.	Broccoli/cauliflower.....	Brassica oleracea var. botrytis L.
Common Vetch.....	Vicia sativa L.	Brussels sprouts .....	Brassica oleracea var. gemnifera
Castor bean.....	Ricinus communis L.	Cabbage .....	Brassica oleracea var. capitata L.
Jojoba.....	Simmondsia chinesis.	Canteloupe/ Muskmelon .....	Cucumis melo L.
Linseed .....	Linum unitatissimum L.	Carrot.....	Daucus carota L.
Oil seed rape.....	Brassica napus L.	Celery / Celeriac .....	Apium graveolens L.
		Chicory.....	Cichorium intybus L.
		Chinese cabbage.....	Brassica chinensis L.

Chirvil.....	Anthriscus cerefolium .	Pepper.....	Capsicum spp.
Collards / Kale.....	Brassica oleracea var ancephalaDC	Pumpkin/Squash/Courgette .....	Cucurbita pepo L.
Corriander.....	Coriandrum sativum	Radish .....	Raphanus sativus L.
Cucumber.....	Cucumis sativus L.	Rhubarb .....	Rheum rhaponticum L.
Dill.....	Arethum graveolens L.	Rutabaga.....	Brassica napus var. napobrassica L.
Eggplants.....	Solanum melongena L.	Spinach .....	Spinacea oleracea L.
Endive .....	Cichorium endivia L.	Swiss chard.....	Beta vulgaris.
Garden cress.....	Lespidium sativa L.	Tomato .....	Solanum lycopersicon.
Karella .....	Cucumis spp.	Turnip .....	Brassica rap L.
Kohlrabi .....	Brassica oleracea var. gongylodes.	Water cress .....	Nasturtium officinale Ribr.
Leek .....	Allium porrum L.	Water melon.....	Citrullus spp.
Lettuce .....	Lactuca sativa.	Coconut.....	Cocos nucifera.
Okra .....	Hibiscus esculentus L.	Cashewnut .....	
Onion.....	Allium cepa L.	<b>Indigenous Vegetables.....</b>	<b>(Blacknightshade, Spider plant, etc.).</b>
Parsley .....	Petroselinum crispum (Mill) Nym.	Guava.....	Psidium.
Parsnip .....	Pastinaca sativa L.	Fruit trees .....	(Mangoes, Avocado, Citrus, Pawpaw, etc.).
Pea.....	Pisum sativum L.	Miraa .....	catha edulis
Sensulato.			

[Rev. 2012] CAP. 326 *Seeds and Plant Varieties* [Subsidiary]  
SECOND SCHEDULE [Rule 10.]

SEED UNDER COMPULSORY CERTIFICATION

*Cereals Grasses*

Maize Setaria

Wheat Rhodes grass

Barley Sudan grass

Sorghum Congo signal

Millet Panicum spp.

Oats Columbus grass

Triticale *Pasture legumes*

*Pulses* Centro

Beans (dry) Stylo

Beans (Green podded) Desmodium

Peas Clover

Cow peas Lucerne

Pigeon peas Siratro

*Oil crops* Lupins

Sunflower *Root crops*

Oil-seed rape Irish potatoes

Linseed

Soya beans

Sesame