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Transforming Last Mile Seed Delivery: Case of High Iron Beans (HIBs) Niche Market Business Model in Western Kenya Study Report

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Feed the Future Consortium Partners in the Feed the Future Global Supporting Seed Systems for Development activity:

Contents

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ABBREVIATIONS AND ACRONYMS

ABC	Alliance of Bioversity International and CIAT
AfDB	Africa Development Bank
BHA	Bureau for Humanitarian Assistance
CGA	Cereal Growers association
CIAT	International Center for Tropical Agriculture
CRS	Catholic Relief Services
HIBs	High Iron Beans
GAC	Global Affairs Canada
ICT	Information Communication Technology
IDA	Iron Deficiency Anemia
IDD	Iron Deficiency Disorder
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Services
KNBS	Kenya National Bureau of Statistics
OAF	One Acre Fund
PABRA	Pan African Bean Research Alliance
PoS	Point of Sale
QGIS	Quantum Geographical Information System
RFS	Bureau for Resilience and Food Security
S34D	Feed the Future Global Supporting Seed Systems for Development activity
SSA	Sub-Saharan Africa
SDC	Swiss Agency for Development and Cooperation
TAAT	Technology for African Agricultural Transformation
USAID	United States Agency for International Development
VAD	Vitamin A Deficiency
WHO	World Health Organization

1. EXECUTIVE SUMMARY

The Kenya Agricultural and Livestock Research Organization (KALRO) in partnership with the Alliance of Bioversity International and CIAT (ABC) through the Pan Africa Bean Research Alliance (PABRA) released four micronutrient rich bean varieties in 2017. The iron and zinc rich varieties are Angaza, Metameta and Nyota, while Faida is zinc rich. These varieties were released to address prevailing micronutrient deficiencies, particularly among women of reproductive age and children under the age of five. For instance, iron deficiency among adolescent girls in refugee camps was estimated at 46%, while it was estimated at 21.1% prevalence among schoolgirls in western Kenya (Republic of Kenya, 2002). Efforts to disseminate these varieties by licensed seed companies is ongoing. Nyota has been licensed for commercialization to Bubayi Products Ltd (Bubayi), while Angaza, Faida and Metameta have been licensed to East Africa Seed Company Ltd. Three of these varieties (Angaza, Faida and Nyota) are currently being promoted for adoption across the country. However, these companies mainly rely on institutional markets (NGOs, county governments, etc.) for distribution, rather than selling directly to farmers.

As part of the S34D activity, the Alliance and CRS conceptualized the niche market business model with the objective of ensuring efficient and effective last mile delivery of the niche variety to farmers by linking Bubayi Products Ltd. and agrodealers to motorbike riders commonly known as *boda boda.* A variety is said to be 'niche' if the variety has: i) special attributes that address an identified problem (e.g. malnutrition) and is linked to breeding attributes (disease resistance, short cooking time, etc.) that are of urgent need among end users; ii) the process of regulatory approval and release for commercialization takes into consideration these special attributes and the variety is fast tracked due to need; and, iii) there is early on-boarding of the private sector for release and subsequent commercialization of the variety. ABC–PABRA and CRS developed and deployed the last mile point-of-sale (PoS) application, which is a mobile application that seeks to track the movement of the niche bean varieties (beginning with Nyota) from the seed producer (Bubayi Products Ltd), to the end-users (farmers). The PoS seeks to integrate use of the motorbike riders for last mile delivery of the niche variety. The PoS application[1] collects and analyzes information on the sale, purchase, dissemination, and performance of varieties—in this case, Nyota in western Kenya.

The Alliance and CRS in collaboration with other partners in Kenya including, KALRO, Kenya Plant Health Inspectorate Services (KEPHIS), and Bubayi Products Ltd, piloted the niche market model in three western Kenyan counties of Bungoma, Trans-Nzoia, and West Pokot in September-October 2019. The study aimed to: i) test the capacity of farmers to purchase the certified seed; ii) assess new varietal dissemination using geospatial data and near real-time analyses; iii) capture and understand factors affecting adoption of the niche varieties along the supply chain; and, iv) understand the prevailing regulatory framework affecting the use of *boda boda* in seed distribution.

August to September 2019 (short rains season) was the first agricultural season when Nyota seed was commercially sold from agrodealer shops. Overall, 298 farmers (40% women) were interviewed at the agrodealer shops as they bought bean seeds during the planting period. Results indicate that 123 farmers (41% of total interviewed) bought Nyota seeds (a total of 1,366 kg). Information was also collected from 14 agrodealer shops selling Nyota and Bubayi Products Ltd. – the producer and distributor of the Nyota seed. A follow-up customer feedback survey was conducted after harvest period in January and February 2020 among all the farmers who purchased Nyota.

The study recommends *boda boda* should be integrated in the last mile distribution of bean seeds and other agricultural inputs: using motorbike riders, there is great potential in improving availability, access and utilization of seed and non-seed technologies to smallholder farmers. This concept of 'uberization' will equip last mile agents with adaptive and absorptive capacities to enhance resilience among farmers, especially during

[1] The application is a digital data collection programme developed by CRS using Dimagi's CommCare and deployed over tablets. Data collectors were hired and trained using the tools before field collection efforts commenced.

crises times, such as the COVID-19 pandemic when they cannot access seed due to restricted travels. Further, with increased access to these climate smart, high yielding and micronutrient rich varieties, farmers will improve their productivity, incomes, nutrition and ultimately improve farmers' resilience. However, a feedback loop needs to be developed between the seed companies, agrodealers, researchers and farmers with the aim of understanding seed demand regimes to inform distribution and purchase decisions. Customer feedback shows satisfactory performance of Nyota. Additionally, farmers would like to have seeds in smaller packages and more information on agronomic practices. Finally, network analysis using geospatial data reveals that farmers do not always purchase their inputs from the nearest agrodealer. While further investigation on what informs the choice of the agrodealers from where farmers buy their seed would be necessary, it has implications for development partners on how to build agrodealer capacity at the last mile with business models and practices that sustainably meet farmers' needs. There is a need to widely test the niche market business model and PoS application with other companies to enable extensive application.

2. INTRODUCTION

2.1 Importance of the common bean in Kenya

With more than one million hectares under cultivation, common bean (*Phaseolus vulgaris* L.) is the second most important food crop (One Acre Fund, 2016) after maize in Kenya. Beans are produced by more than three million households and play an important role in sustaining livelihoods through provision of food security and income (Buruchara et al, 2011). Bean is an important component of smallholder farmers' production systems—beans are highly nutritious, widely adaptable and easy to grow, tolerant to shades, and they improve soil nutrients through nitrogen fixation (Buruchara et al, 2011). With a per capita bean consumption of 14 kg per year, beans are an important source of protein for many rural and urban households in Kenya (Katungi et al, 2010). Beans contribute significant proportions of minerals, vitamins and calories in human nutrition and over 70% of leguminous protein in the diets of Kenyan consumers (Celmeli et al, 2018). With a population of over 47 million people (KNBS, 2019), the country's food and nutrition security cannot be achieved without improving bean value chain activities.

Common bean has steadily evolved from being a smallholder subsistence crop (Katungi et al, 2009) to a market oriented and highly commercialized cash crop (Buruchara et al, 2011). This evolution has triggered expansion in bean production and commercialization. In Kenya, bean yields increased from 0.48 t/ha to 0.72 t/ha, while area cultivated increased by 32% from 897,032 ha to 1,180,784 ha - this resulted in a 97% increase in production from 428,796 t to 846,000 t (FAOSTAT, 2003 & 2017). Between 2014 and 2016 total bean exports from Kenya were estimated at 142,087 t with export value of US$ 119.6 million (FAOSTAT, 2014 & 2016).

2.2 Micronutrient deficiency and potential role of high-iron beans in Kenya

Malnutrition constitutes a major development constraint, affecting one in three people worldwide (Shikuku et al. 2019). It is a key contributor to infant mortality in Sub-Saharan Africa (SSA) (Hug et al. 2019) due to deficiency of micronutrients such as iron (Fe), zinc (Zn) and vitamin A (Wieser et al. 2013). Iron deficiency is one of the primary causes of anemia with serious health consequences to both women and children (WHO, 2011). Children with anemia experience irrevocable cognitive and developmental delays (Walter, 2003) and exhibit decreased productivity of labor force as adults (Blank et al., 2019). Maternal anemia increases the risk of pre-term delivery and low birth weight; iron-deficiency anemia underlies hundreds of thousands of maternal deaths and perinatal deaths each year, particularly in SSA.

In Kenya, malnutrition resulting from micronutrient deficiencies remains ubiquitous, particularly among vulnerable groups including women and children under the age of five (Jackiewicz et al. 2014). The Government of Kenya has developed the Food and Nutrition Security Policy—an overarching policy to address nutrition security in the country (Republic of Kenya, 2012). Utilization of HIBs provide a feasible and sustainable option to address malnutrition, including micronutrient-deficiency and its related health problems (Luna et al. 2020; Murray-Kolb, L.E, 2017 and Haas et al., 2016). The HIB varieties were developed using conventional plant breeding with a focus of improving the micronutrient contents of the staple food consumed by most Kenyans, especially in rural areas, and thus contributing to addressing malnutrition.

In 2017, KALRO released three HIB varieties: Angaza, Metameta and Nyota, as well as a zinc-rich variety (Faida), hereafter referred to as niche varieties. Angaza, Metameta and Faida have since been licensed to East African Seed Company Ltd and Nyota to Bubayi Products Ltd for commercialization. Three of these varieties—Angaza, Faida and Nyota—are currently being promoted across the country. East African Seed Company opted not to commercialize the Metameta variety because of the close resemblance with Faida in terms of their physical features, which presented marketing challenges. Figure 1 highlights key attributes of Angaza, Faida and Nyota.

Figure 1: Attributes of Angaza, Faida and Nyota niche varieties

ANGAZA	FAIDA	NYOTA
		
• Speckled sugar type, medium size and kidney shaped	• Red mottled/speckled type	• Brilliant red mottled grain
• Bush bean type	• A semi-climber (has tendrils)	•
• Has light pink flowers	• Has white flowers	• Has light pink flowers
• Flowers in 40-42 days	• Flowers in 45-46 days	• Flowers in 30-40 days
• Matures in 80-84 days	• Matures in 84-85 days	• Matures in 60-70 days
• Yields 1.4-2.5 t/ha (6-12 bags/acre)	• Yields 1.4-2 t/ha (6-9 bags/acre)	• Yields 1.4-2.2 t/ha (6-10 bags/acre)
• Sweet grains with low flatulence levels with high sucrose content		
• Tolerant to common bacterial blight (CBB), rust (*Uromyces sp.*), bean common mosaic virus (BCMV) and angular leaf spot (ALS)	• Tolerant to common bacterial blight, rust (*Uromyces sp.*), bean common mosaic virus (BCMV) and angular leaf spot (ALS).	• Drought tolerant suitable for arid and semi-arid lands (ASALs) and cold dry highlands
• Micro-nutrient rich with high grain iron content (97 ppm)		• High grain iron content (95 ppm)
• High zinc grain content (57ppm) and low phytic acid	• High grain zinc content (56 ppm) and low phytic acid	• High zinc grain content (39ppm) with low phytic acid
• Fast cooking compared to most beans	• Fast cooking compared to most beans	• Fast cooking compared to most beans
		• Good for making bean flour

Given the importance to address food and nutrition security in Kenya, as evident from the National Food and Nutrition Security Policy (Republic of Kenya, 2012), the niche market model under S34D is a timely application to address wider seed access of the HIBs using a market-led approach.

2.3 Bean seed systems in Kenya and existing bottlenecks

There are two broad categories of bean seed systems in Kenya – formal and informal systems. The formal seed delivery system entails a defined value chain (Rubyogo et al. 2010) that leads to certified seeds of released bean varieties. The value chain starts with plant breeding or a variety development program that includes a formal release and maintenance system. Guiding principles in the formal system are to maintain varietal identity and purity and to produce seed of optimal physical, physiological and sanitary quality. Certified seed marketing and distribution take place through a limited number of officially recognized seed outlets, usually for sale. The central premise of the formal system is that there is a clear distinction between seed and grain –

this distinction is unclear in the informal system (USAID, 2016). The informal seed systems mainly comprise of the use of farmer saved seed, seed exchange of among farming community and local grain market. This system plays a major role for the majority of small holders particularly for self-pollinated crops like beans (Rubyogo et al. 2007).

The formal bean seed system in Kenya is characterized by participation of both the public and private sector actors in the value chain (Munyi & Jonge, 2015). The public sector (KALRO and Universities) is mandated to undertake breeding research while the private sector manages the newly released bean varieties, multiplies seed and distributes it to farmers. The private sector participation in seed value chains in Kenya has been more vibrant for cereal staples such as maize than for legumes, despite the many registered legume seed merchants.

The overarching principle of the Seeds and Plant Varieties (Seeds) Regulations (Cap. 326) regarding seeds is the classification of crops as either scheduled or non-scheduled (Munyi & Jonge, 2015). The Regulations classify beans among scheduled crops. The scheduled crops are presumed to have breeding programs requiring compulsory certification. Therefore, production and commercialization of bean seed is legally vested in recognized institutions and seed companies or licensed seed dealers. Consequently, bean seed should be accessed by farmers only through the formal seed system. However, part of the challenge that renders bean seed business unattractive to the commercial seed industry is the self-pollinating nature and low seed multiplication ratio of most legumes, leading to market failure. Legumes produce fewer seeds per plant compared to cereals, thus slowing the multiplication process required to build up large quantities of seed. Unlike open-pollinated crops such as maize, farmers can also recycle the seed for self-pollinating crops like beans for up to three seasons without major drops in yields. Hence, the informal system supplies over 90% of seed requirement by smallholder farmers (Sperling & McGuire, 2010) – which confirms its dominance in bean seed supply.

Moreover, because there are no legal provisions supporting informal seed systems or alternative seed schemes like Quality Declared Seed systems, expanding the frontiers of formal seed system is necessary for bean systems. The major bottlenecks which limit formal bean seed system expansion are: (1) limited demand for the creation of new varieties; (2) reaching remote areas beyond areas surrounding agrodealers (generally around towns); (3) difficulties in accessing real time information about variety performance, seed availability and access to timely response to customers' demand; and, (4) institutional seed markets / subsidy programs distort the effective market though they are not reliable.

2.4 Research objectives

The objectives of the niche market pilot study were:

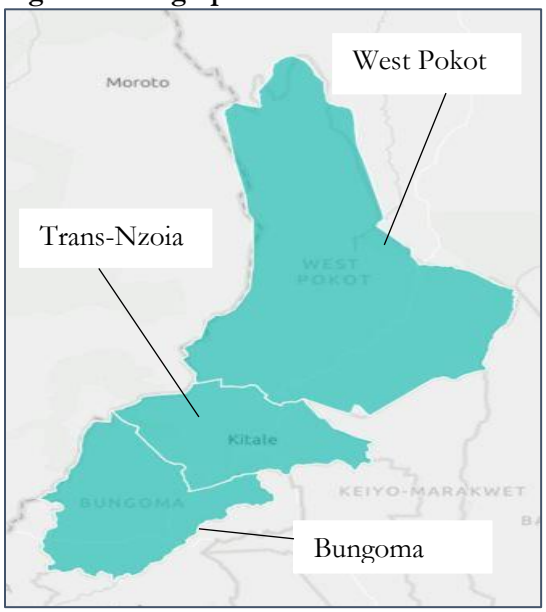
1. To test the capacity of farmers to purchase the certified seed and particularly HIBs
2. To assess new varietal dissemination using geospatial data and near real-time analyses.
3. To capture and understand factors affecting adoption of the niche varieties along the supply chain
4. To understand the prevailing regulatory framework affecting use of motorbike riders (*Boda boda*) in seed distribution.

3. METHODOLOGY

3.1 Study area

The niche market business model study was piloted in three counties of Bungoma, West Pokot and Trans-Nzoia (Figure 2) in western Kenya between September 25 and October 9, 2019. The three counties were selected based on Bubayi's network of agrodealer retail outlets. The counties are also important for bean production in Kenya.

Figure 2: Geographical Area of the PoS Pilot



3.2 Study design, participants and procedures

Demand creation prior to field-level data collection

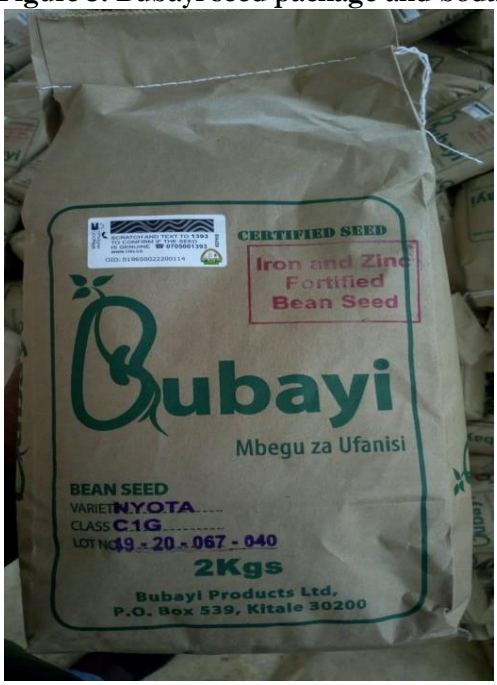
Through the support of the Technologies for African Agricultural Transformation (TAAT), an African Development Bank supported project led by the Alliance, awareness creation for Nyota, Faida and Angaza varieties was carried out in 10 counties in western Kenya. The Alliance in partnership with the Cereal Growers Association (CGA), a farmers' organization involved in production and marketing crops, carried out marketing in Kenya. Fifty-one on-farm demonstrations (demos) were set up spread across the 10 counties including Trans-Nzoia. CGA organized the field days, which brought together farmers, seed companies (including Bubayi Product Ltd), agrodealers and county government agriculture officials. During the field days there were a total of 3,719 participants (2,064 men and 1,655 women). In addition to the varieties' agronomic and consumer preferred traits, farmers and other field days' participants were briefed on the nutritional qualities of HIB varieties. These interactions provided opportunities for Bubayi Products Ltd to assess the farmers' seed demand.

Institutional Engagement

Bubayi Products Ltd, based in Kitale, Trans-Nzoia County of western Kenya, has an agrodealer network spread across a number of counties in the region. In addition to working with many agrodealers across the counties, farmers have been buying seed directly from Bubayi. The meetings between PABRA and Bubayi Products Ltd determined that agrodealer shops would be the best point for data collection. According to Bubayi, agrodealers would be more accountable for quality of data collection. If data collection on HIB occurred at the point of sale, then this would present an opportunity for the agrodealers to encourage seed sale of HIB varieties and for Bubayi to promote their brand.

Discussions were also held with the KEPHIS, the government agency which regulates seed business, to ensure that seeds are produced, packaged, labeled and distributed as provided for by Seeds and Plant Varieties Act Cap 326 of the Laws of Kenya. To address the legal requirement, Bubayi produced bags with single use certification labels that can be traced back to out-growers. These bags depict the variety name, class and lot number (Figure 3).

Figure 3. Bubayi seed package and *boda boda* delivering two bales of Nyota seed to farmers



Development of Data Collection Instruments and identification of key respondents

To capture information accurately, CommCare was used for the agrodealer registration and agrodealer survey, as well as the farmer (customer) registration and farmer survey. Microsoft Excel was used to collect information from Bubayi. The data collection instruments targeted the three main actors of the Point of Sale, Niche Market Business Model—farmers, agrodealers, and the seed company. A fourth questionnaire for *boda boda* riders was also created (which was later integrated into the agrodealer questionnaire).

The questionnaires (Annexes 1, 2, 3) were designed to answer questions about the Niche Market Business Model and PoS, such as who is buying what type of seed, what quantity, at what price, how often, and where. More data including contextual information, e.g., farmer profiles in a disaggregated manner, and information about agrodealer retail businesses were also captured. The instruments were uploaded into a CommCare data collection[2] application in tablets. Before administration of the questionnaires, the instruments were validated with PABRA and Bubayi Products Ltd. Before the deployment of the CommCare, the package was translated in English and training was conducted for the enumerators. Pretesting was also conducted and adjustments were made where necessary.

3.3 Data collection

Data was collected through in-person interviews with farmers at agrodealer shops, agrodealer managers, and management-level staff of Bubayi Products Ltd. The farmer interviews were conducted in two main phases. The first phase began in September and October 2019, during the planting season, and the second phase in February 2020, during or after the harvest season. In the second phase, phone interviews were conducted

[2] Dimagi's staff collaborated with CRS to troubleshoot any problems with the PoS application

with farmers that had purchased the niche Nyota variety, where the farmers shared information on HIB variety performance. Data collection during the first phase was done for 11 working days from September 25 to October 9 in three counties (Bungoma, Trans-Nzoia and West Pokot) where Bubayi Products Ltd has agrodealer agents and/or sub-agents. The third county (West Pokot) was integrated upon advice from Bubayi to accommodate agrodealers located within the county.

For this pilot exercise, data was collected from 1 seed company (Bubayi), 14 agrodealers (Annex 5), 298 farmers (213 men and 85 women) and two contracted motorbike riders. A total of 123 (90 men and 33 women) farmers bought 1,366 kg of Nyota. Twelve (12) enumerators were recruited for data collection and collected data for 11 days. Two enumerators collected data from two agrodealer shops each,[3] while the remaining enumerators each collected from one agrodealer shop. The questionnaires were loaded onto internet enabled tablets, usable offline.

Communication of preliminary findings with stakeholders

After the field surveys on sales, purchases, customer feedback, and variety performance information, the data collected was cleaned and quality assurance checks performed before proceeding with conducting data analytics and geospatial analysis and compiling summaries for narration of results. The findings were disseminated to key stakeholders at a workshop held in Eldoret, Kenya on February 26th, 2020[4] and their feedback collected for integration into this final PoS pilot report.

[3] Enumerator stationed in in Makutano, West Pokot, interviewed farmers at the Paves Agrovet headquarter branch and Paves Agrovet market branch, the latter only during market days. Enumerator stationed at Munyambu Farmers Pride, Kimilili town moved to a second shop (Wesamu Agrovet, Kiminini) when the Kimilili shop temporarily closed upon death of a close family member to the Director.

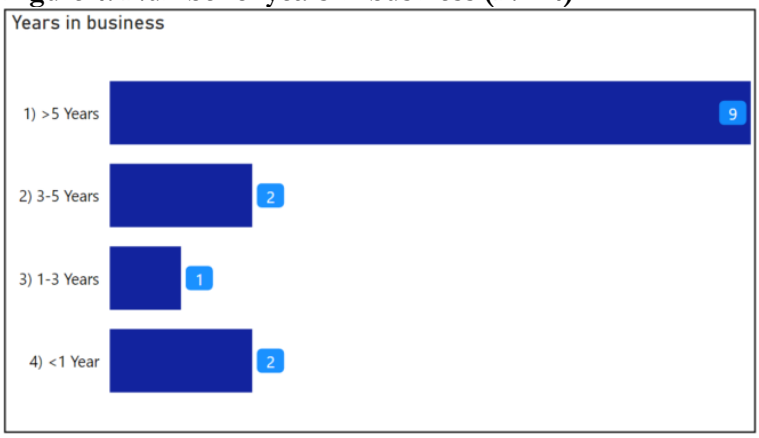
[4] More information on this workshop can be found in the dissemination report from March 2020

4. STUDY FINDINGS

4.1 Business profile of the agrodealers

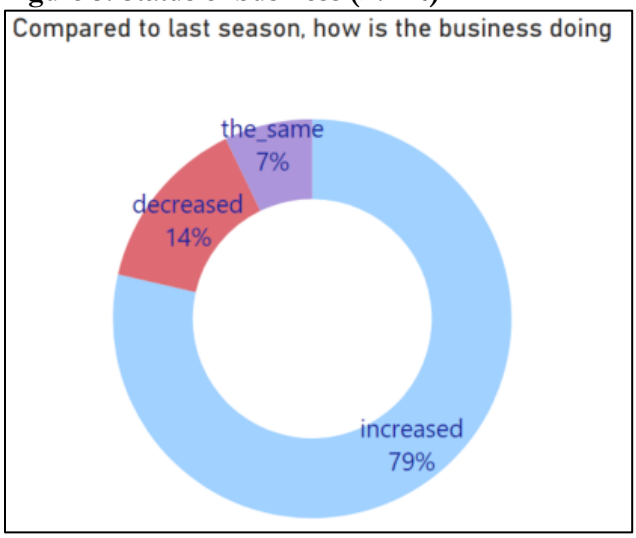
The study sought to describe the composition of the agrodealers, how long the businesses have been operating, their locations and how successful the businesses have been. Results indicate that the agrodealers selected included large wholesale shops and small retail outlets. Some of the shops were in large town centers and market areas while others were dispersed in smaller rural shopping centers. Of the 14 agrodealers registered with the PoS application, ten were male-operated and four female-operated. Nine out of the 14 agrodealers had been in business for more than five years while five had been in business for less than 5 years (Figure 4).

Figure 4: Number of years in business (N=14)



On the state of the business, the agrodealers were asked to give their opinion on the performance of their businesses during the ongoing agricultural season in comparison with the previous one. Eleven of the agrodealers stated that business had improved in the year of the pilot, while two (including one female owned business) stated that there had been a decrease in business and one stated that the business had remained the same (Figure 5). Several of agrodealers cited a rise in the popularity and demand for bean seed as a reason for increased business.

Figure 5: Status of business (N=14)



Regarding location, ten of the agrodealers were in Trans-Nzoia County, two in West Pokot County and two in Bungoma County. The majority of the agrodealers in Trans-Nzoia County were located in Kitale town and the smaller town of Kiminini located about 19 Km to the southwest of Kitale town along Kitale–Webuye road. Table 1 shows the location of the agrodealer shops, the volumes of purchases and the number of customers who bought the specified volumes of seed.

Table 1: Location and gender of a interviewed and volume of seeds they sold.

Agrodealer County	Agrodealer	Gender of owner	Number of farmers who purchased Nyota	Total Kg purchased	Sub-county locations of farmers who purchased Nyota
Bungoma	Munyambu Farmers Pride	Male	6	48	Kabuchai, Kimilili, Mt. Elgon, Webuye East
Bungoma	Maya Agrovet	Male	5	10	Kanduyi, Mt. Elgon
Bungoma	Nakewa Agrovet	Male	11	30	Webuye East, Webuye West
Trans-Nzoia	Joska Investment	Male	3	78	Kwanza
Trans-Nzoia	Skynet Agrovet	Male	17	84	Kiminini, Saboti
Trans-Nzoia	Wesam Agrovet	Male	2	30	Kiminini
Trans-Nzoia	Paves Vetagro Limited – Kitale	Male	22	176	Kimilili, Tongaren, Cherangany, Endebess, Kiminini, Kwanza, Saboti, Kapenguria
Trans-Nzoia	Kilimo Agrovet	Female	8	40	Kiminini, Kwanza, Saboti
Trans-Nzoia	Mazop Entreprises	Male	15	490	Tongaren, Webuye East, Cherangany, Kiminini, Kwanza, Kapenguria
Trans-Nzoia	Cenriva – Trans-Nzoia	Female	2	70	Kiminini
Trans-Nzoia	Itete Agrovet	Female	16	152	Cherangany, Kwanza, Saboti
Trans-Nzoia	Kimaran Agrovet	Female	7	98	Tongaren, Kiminini
West Pokot	Paves Vetagro Limited – West Pokot	Male	9	60	Kapenguria, Pokot South
TOTALS			**123**	**1,366**	

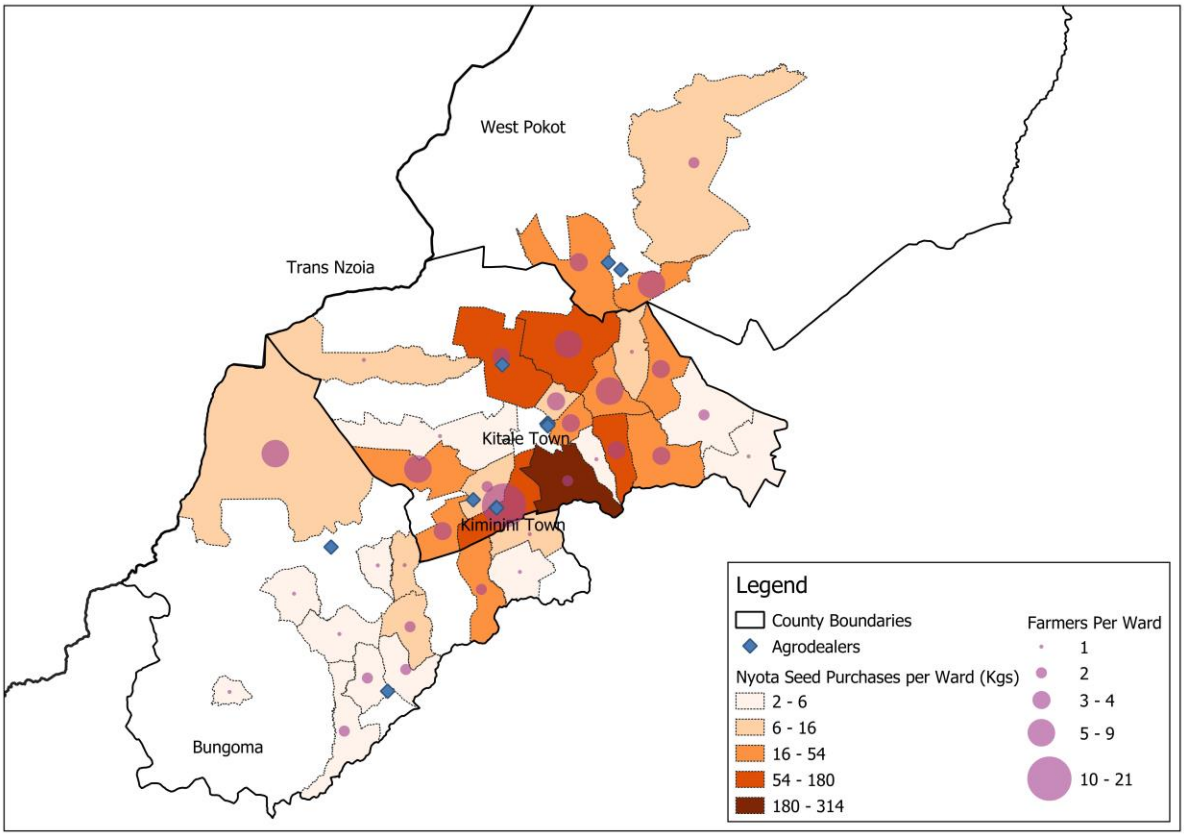
4.2 The profile of farmers who purchased Nyota seed

This section discusses the various aspects associated with the farmers who bought Nyota seed. These include their location across the three counties, ages and gender, risk preferences, source of information about Nyota, existing seed sources and use of motorbike riders for seed delivery.

Farmer distribution

The farmers who purchased Nyota seed were spread across many sub-counties in the three counties of Trans-Nzoia, Bungoma and West Pokot (Table 1). The majority of the farmers bought the seeds from major shopping centers located in Trans-Nzoia County. Figure 6 illustrates where Nyota customers are located and where the largest purchases were made.

Figure 6: Distribution of farmers who bought Nyota seed in Trans-Nzoia, Bungoma and West Pokot, Kenya (N=123)



The distribution of farmers who purchased Nyota seeds shows that the greatest number of customers came from the Kiminini sub-county (Table 2) where Kitale and Kimini towns are located and where the majority of agrodealer shops are located. Two farmers did not indicate their Sub-County names.

Table 2: Distribution of farmers per sub-county (N=119)

Sub-County	Number of farmers
Kiminini	34
Cherangany	21
Kwanza	16
Kapenguria	9
Saboti	8
Mt. Elgon	6
Webuye West	5
Tongaren	4
Webuye Eest	4
Kimilili	3
Pokot South	3
Budalangi	1
Endebess	1
Kabuchai	1
Kanduyi	1
Lugari	1
Marakwet West	1
	119

Gender and age of the farmers

Of the 123 farmers who bought Nyota, 90 were males and 33 were females (Figure 7). The age of buyers shows that a clear majority (92%) of Nyota purchases were made by customers aged 30 and above (Figure 8). Out of 90 male farmers, 86 were 30 years old and above. Of the 33 female buyers, 27 were 30 years old and above. On average, males purchased 11.57 kg of Nyota seed, and females purchased 9.85 kg. There were no observed differences in choice of agrodealer shops based on sex. In terms the median values, the seed purchased by gender for the males was 4 kg and the females 6 kg.

Figure 7: Buyers of Nyota, by gender (N=123)

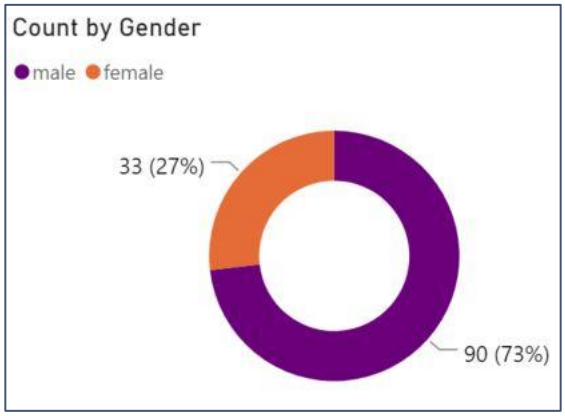
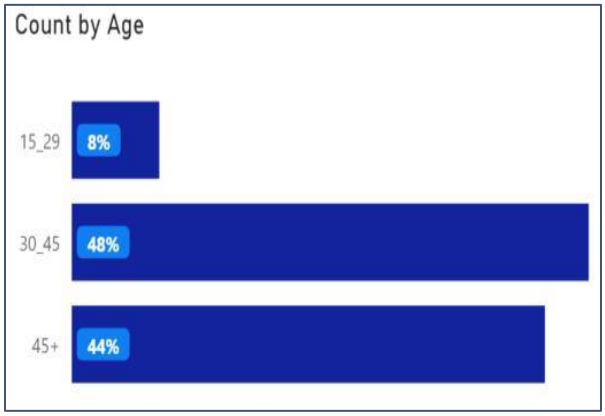


Figure 8: Buyers of Nyota, by age (N=123)



Land ownership and cultivation

During the PoS pilot, it was learned that many farmers might be leasing land for cultivation or other purposes. For this reason, the information on land leasing was captured along with land ownership details. Male farmers owned an average of 2.1 hectares, while female farmers' average land ownership was 1.5 hectares (Figure 9). On leasing, males leased an average of 3.2 hectares of land, while females leased an average of 2.2 hectares (Figure 10).

Figure 9: Average lands owned, by gender (N=116)

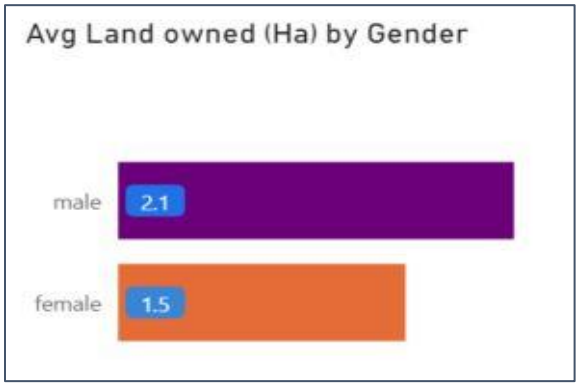
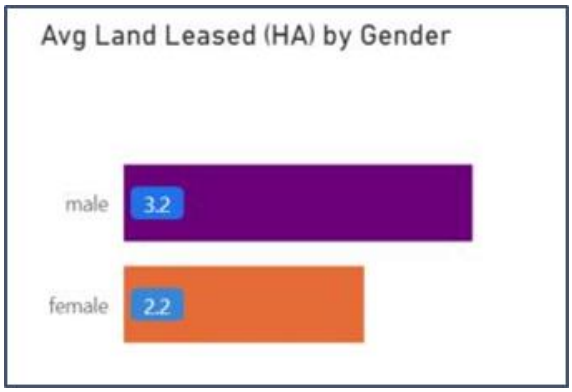
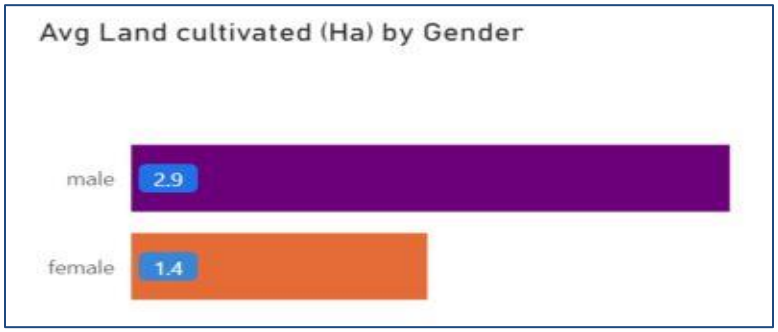


Figure 10: Average land leased by gender (N=41)



On average men owned and leased more land than women. Men also cultivated more land, an average of 2.9 ha compared to 1.4 ha for women (Figure 11). To calculate averages, seven farmers were excluded from calculations. These were farmers with extensive land holdings and leasing, (40 hectares or more).

Figure 11: Average land cultivated farmer disaggregated by gender (N=116)



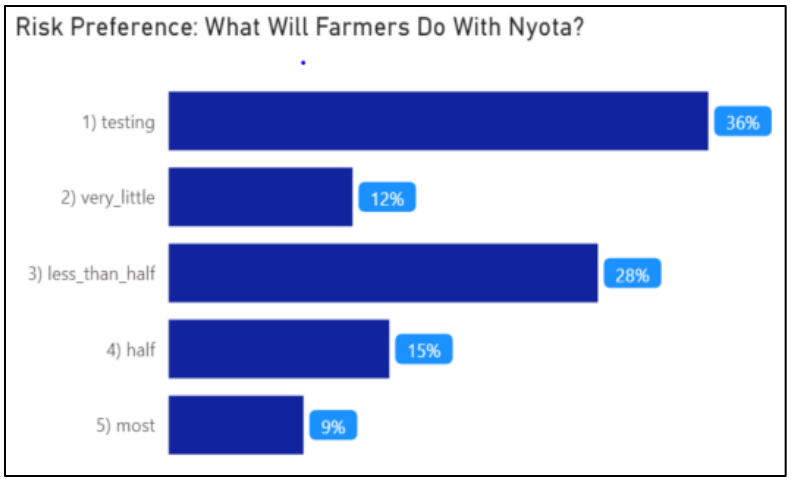
Risk preference

Farmers were also asked how much land they would plant with Nyota seed. The purpose was to understand risk in adopting new varieties, and if risk differed by the gender of a buyer. The farmers were given the following options: very little; less than half; half; most; testing. 'Testing' meant the farmer would be trying out the new variety for the first time and planting a small amount of seed.

These findings can be interpreted as the level of risk a farmer is willing to take in purchasing a new seed variety. About 36% of customers who purchased Nyota reported they would be 'testing,' indicating that at least a third of farmers would like to assume minimal risk when trying out a new variety. The next largest group (28%) said they would be using the new variety to cultivate less than half of their land (Figure 12), set aside for bean production. 15% said they would cultivate on half of the land set aside for bean production with Nyota, 12% 'very little', and 9% 'most.' With 24% of farmers saying they would cultivate Nyota on half

or more of their land, this is an indication that about a quarter of farmers who purchase a Nyota seed variety are willing to assume a fair amount of risk.

Figure 12: Nyota risk preference (N=123)



Analysis of the risk preference by gender showed that 42% (Figure 13) and 18% (Figure 14) for male and female farmers, respectively, bought the seed for 'testing.' Further, 36% of male farmers compared to 26% of female farmers said they would cultivate on 'less than half' of their land. Figures 13 and 14 show a side by side comparison of male vs female risk preference for the Nyota variety.

Figure 13: Nyota risk preference by male farmers – Male (N=90)

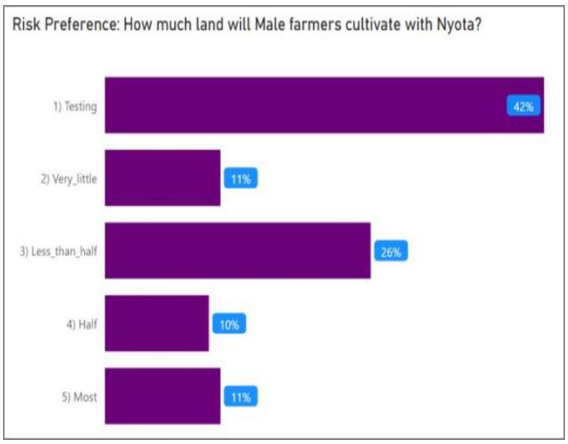
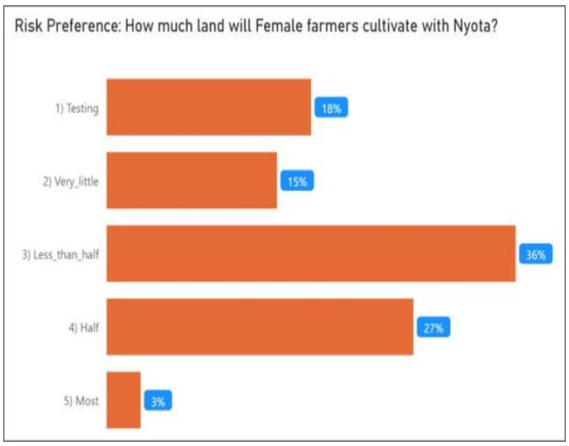


Figure 14: Nyota risk preference female farmers (N=33)



Reasons for buying Nyota variety

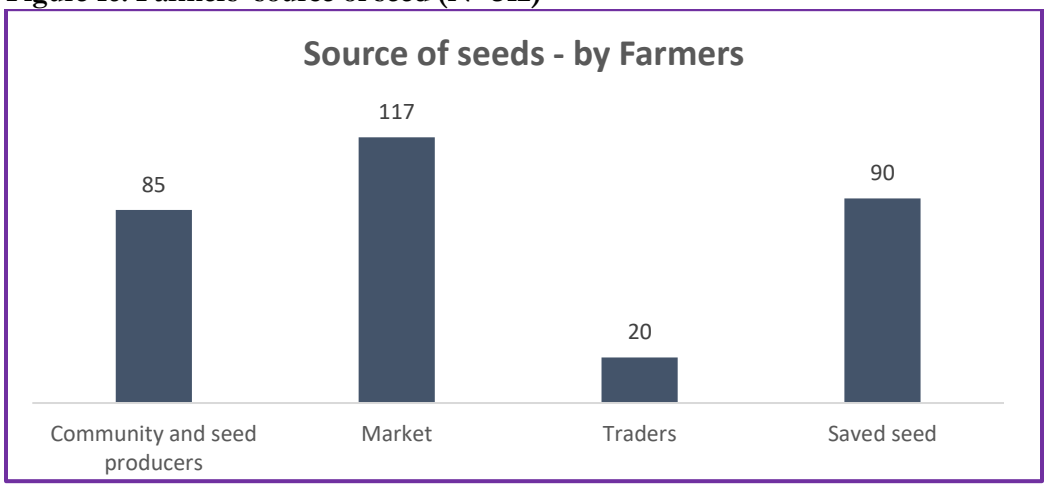
When asked why they decided to buy Nyota seed, majority of the farmers pointed to early maturity as the main reason for the choice followed by yields and testing this first time variety (Figure 15). This is closely related to what informs the risk preferences – yield and incomes and potentially livelihoods.

Figure 15: Reasons for buying Nyota Variety (N=123)

Sources of Seed

The PoS pilot collected information to understand where farmers sourced seeds (Figure 16). The information gathered on seed sourcing shows us that farmers source quality seeds for their preferred varieties from multiple sources (informal and formal). From the 298 farmers interviewed there were 312 responses to the questions, of which, 117 (about 38%) indicated that they sourced seeds from open air market, 90 (29%) used their own saved seed, 85 (27%) sourced from family members, neighbors, and known seed producers, while only 20 (6%) bought from agrodealers (traders).

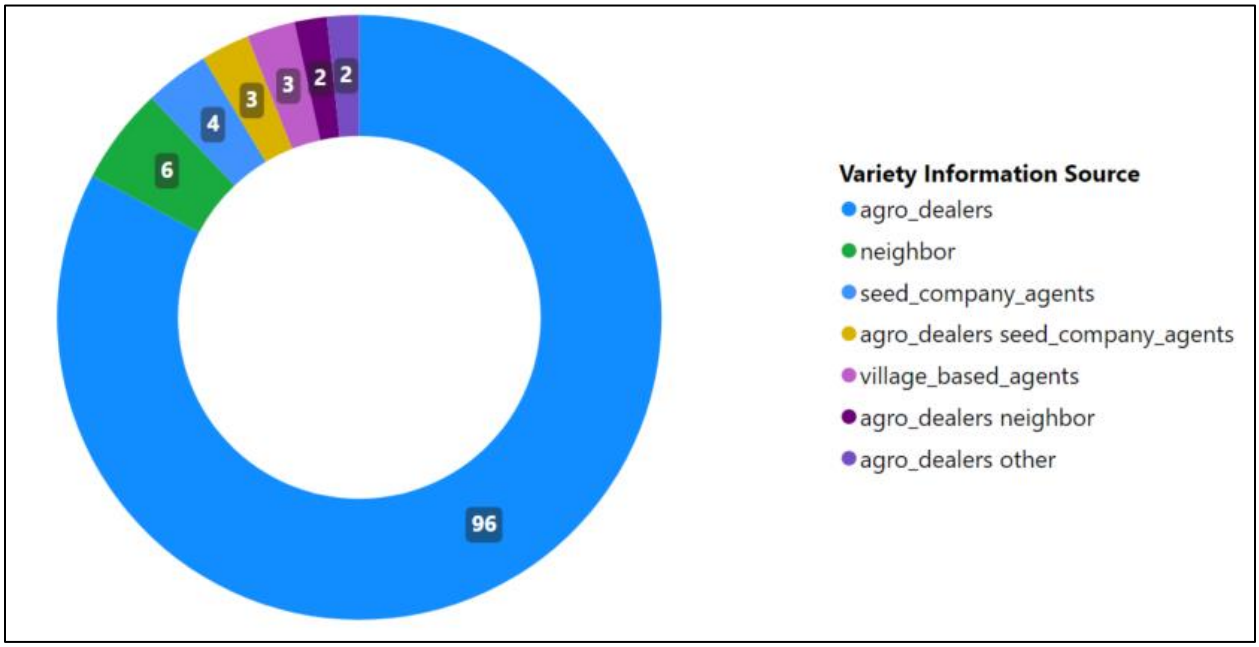
Figure 16: Farmers' source of seed (N=312)



Source of information about Nyota

Farmers were asked where they got information about Nyota. Majority of the farmers (83 percent) (Figure 17) got information from the agrodealer shop where they bought the seed. Other sources were the neighbors, seed company agents, village based agents among others. This can be explained by the fact that Nyota was reaching majority of the farmers for the first time during the pilot, and therefore the main source of information was the agrodealers shops and the data collectors stationed at the shops

Figure 17: Source of information about Nyota variety (N=116)



Motorbike riders

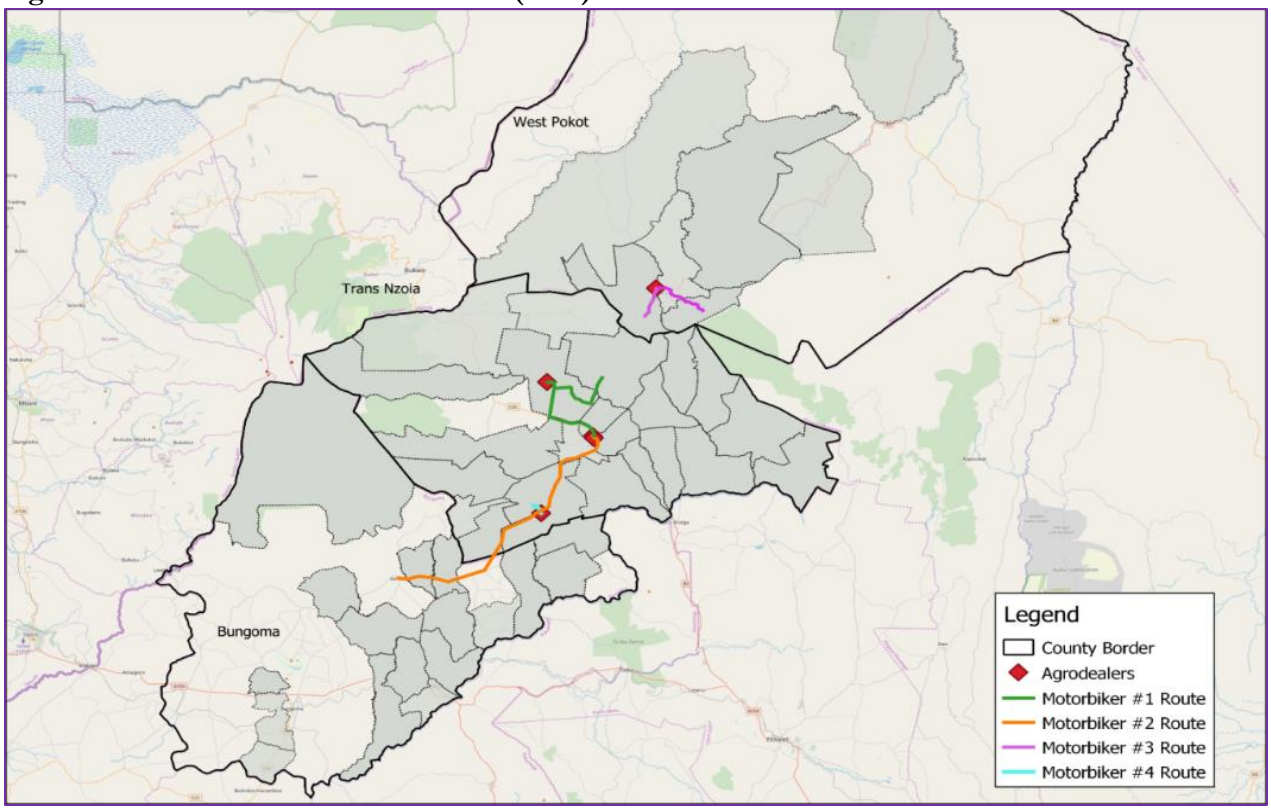
The PoS effort also examined the potential of non-traditional ways to disseminate niche variety seeds in the region. Motorbike riders (*boda boda*), are an emerging opportunity for wider bean variety dissemination. These motorbike riders are used by agrodealers to deliver farm inputs to customers around western Kenya. In the coming seasons the model will continue to gather information from agrodealers and motorbike riders to evaluate these delivery mechanisms as ways of disseminating more seed of niche varieties. To better understand the use of *boda boda* in delivering farm inputs for an agrodealer, two male riders linked to Mazop Enterprises, were interviewed on their experiences delivering farm inputs to farmers. Here is a short overview of one rider's story (Box 1).

Box 1: Boda boda riders venture in seed delivery

Two "boda boda" riders were interviewed during the PoS pilot. One of the riders is named Joseph and lives in Kitale. He is 27 years old and has been a boda boda rider for nearly 5 years. He says he has been making deliveries for the Mazop Enterprises (a local agrodealer) for one year. Joseph stated he makes about two deliveries per day and is paid per delivery either by the recipient farmer or by the agro dealer. Joseph identified a few challenges they encountered in their business, such as bad roads and long delivery distances of 30+ kilometers. Joseph indicated that he has enough knowledge to provide basic information and directions on how to use some of the agricultural products he delivers. If there is an issue he cannot handle that needs further expertise, Joseph will call his agrodealer supplier and ask for more information. By making deliveries for Mazop year-round, Joseph observed that being a boda boda rider has been a profitable venture.

To understand and assess the delivery network for the motorbike riders, a few motorbike riders were asked about their delivery routes. Figure 18 gives an indication of a typical delivery route for some motorbike riders in some parts of the counties where the pilot was conducted.

Figure 18: Some motorbike riders' routes (N=4)



Network analysis

For a deeper look at the geographic factors effecting the dissemination of the Nyota variety, a network analysis was done using QGIS (a free and open source geographic information system), to express the relationship between geo-locations of farmers and agrodealers. Figure 20 shows the location of agrodealers encircled by a 10 km buffer radius. The farmers within this 10 km radius are blue, with farmers outside this radius spotted green. The darker radius circles show where there are heavier clusters of agrodealers. Figure 20 shows this same analysis with differences highlighted between male and female farmers.

Figure 19: Farmers and agrodealers within 10 Km (For Famers N=123; For Agrodealers N=14)

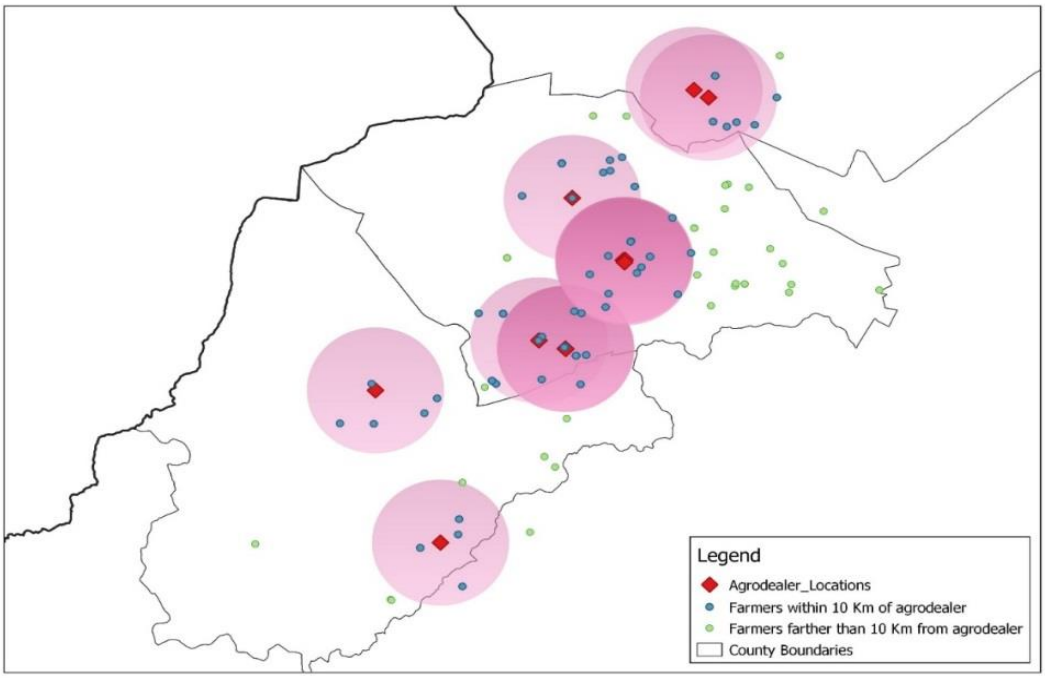


Figure 20: Male and Female Farmers and agrodealers within 10 Km

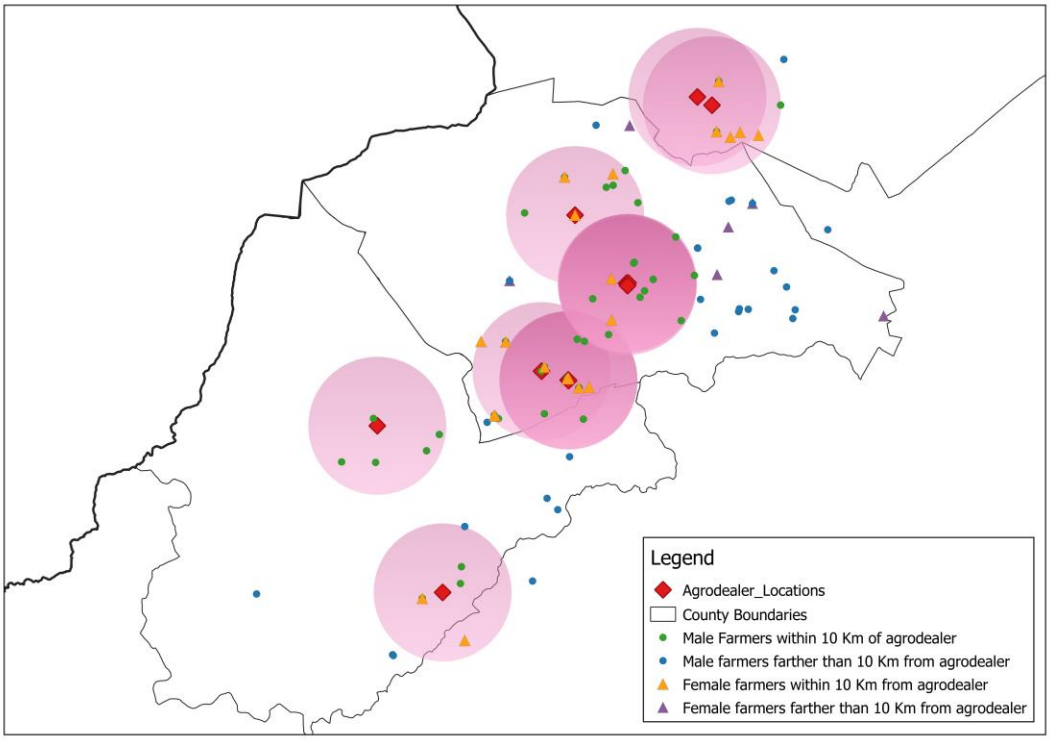


Figure 21 shows the location of the homes of Nyota seed buyers and their closest agrodealer. For comparison, Figure 23 shows the location of each farmer who purchased the Nyota seed.

Figure 21: Location of farmers vis a vis their closest agrodealers (N=123)

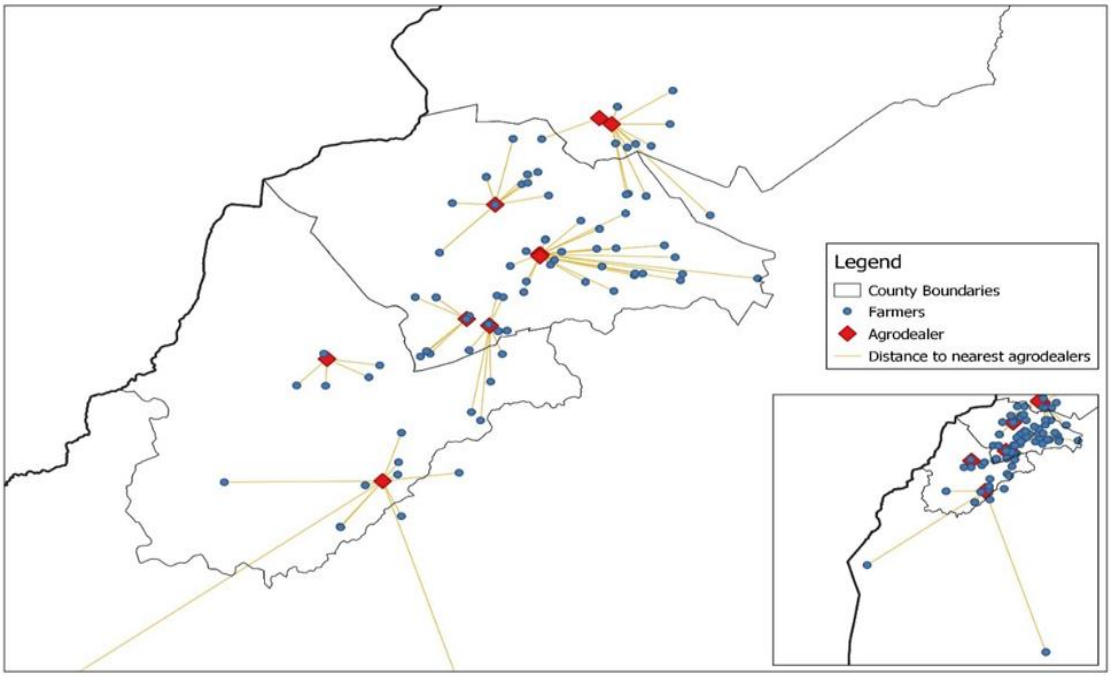


Figure 22: Location of Male and Female farmers vis a vis their closest agrodealers

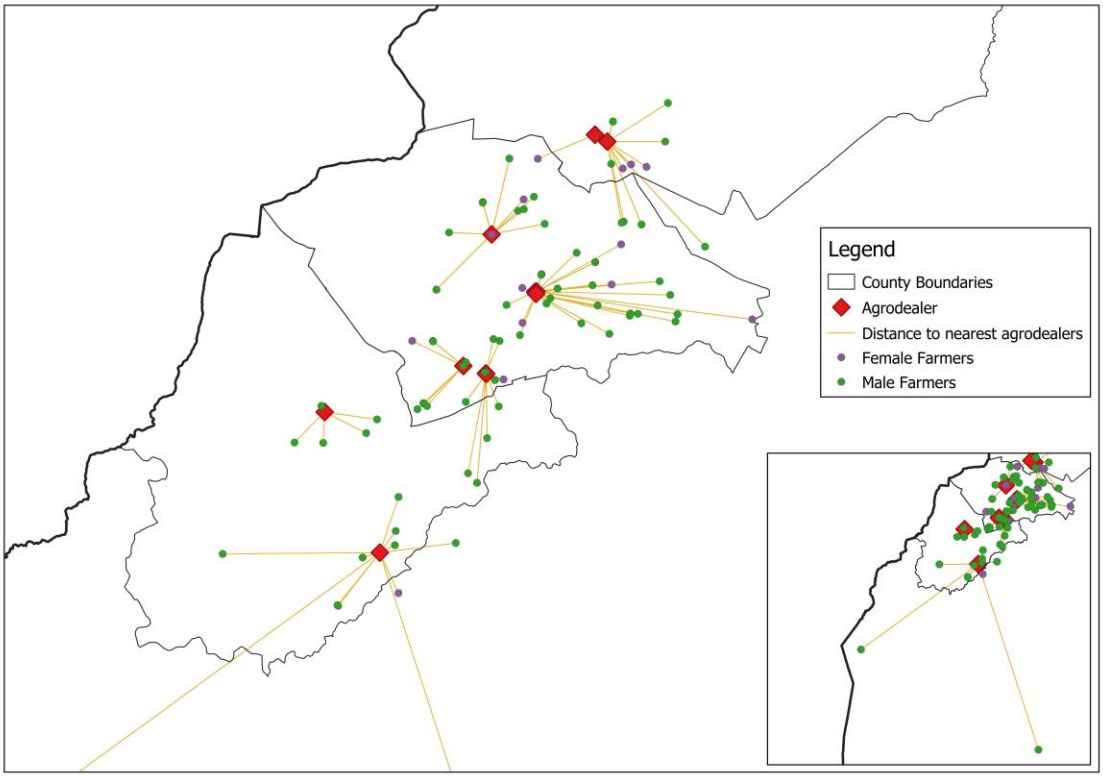


Figure 23: Nyota purchases by farmers and agrodealers

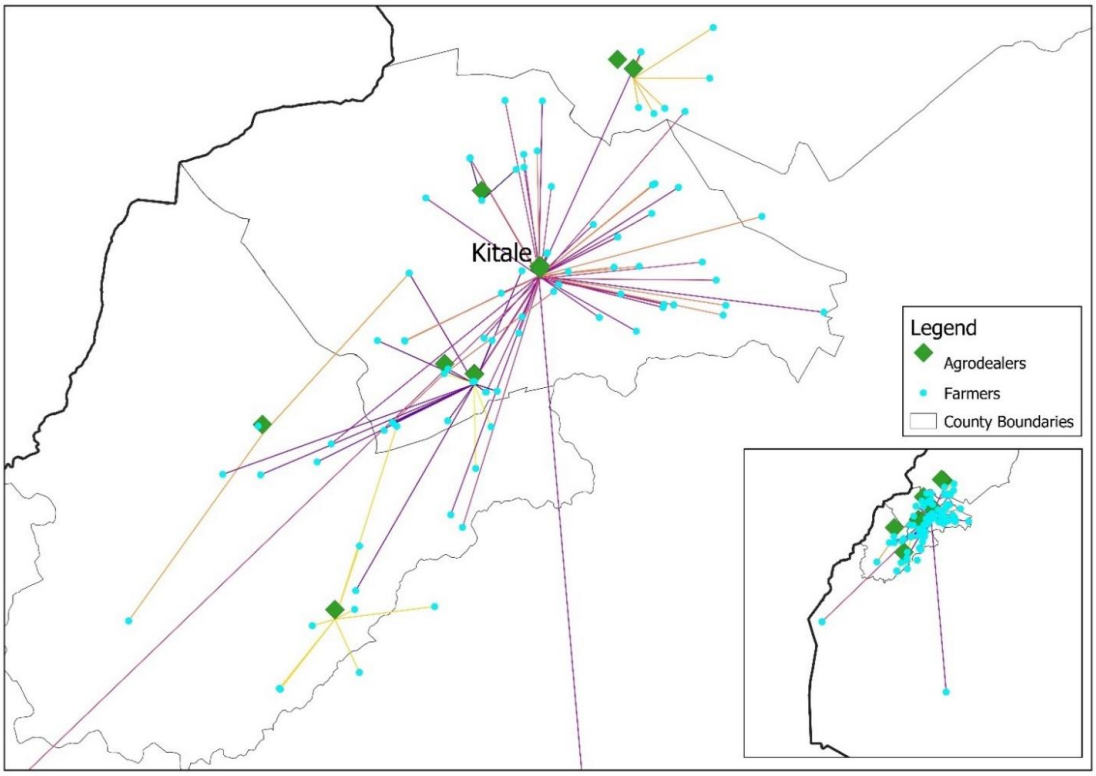
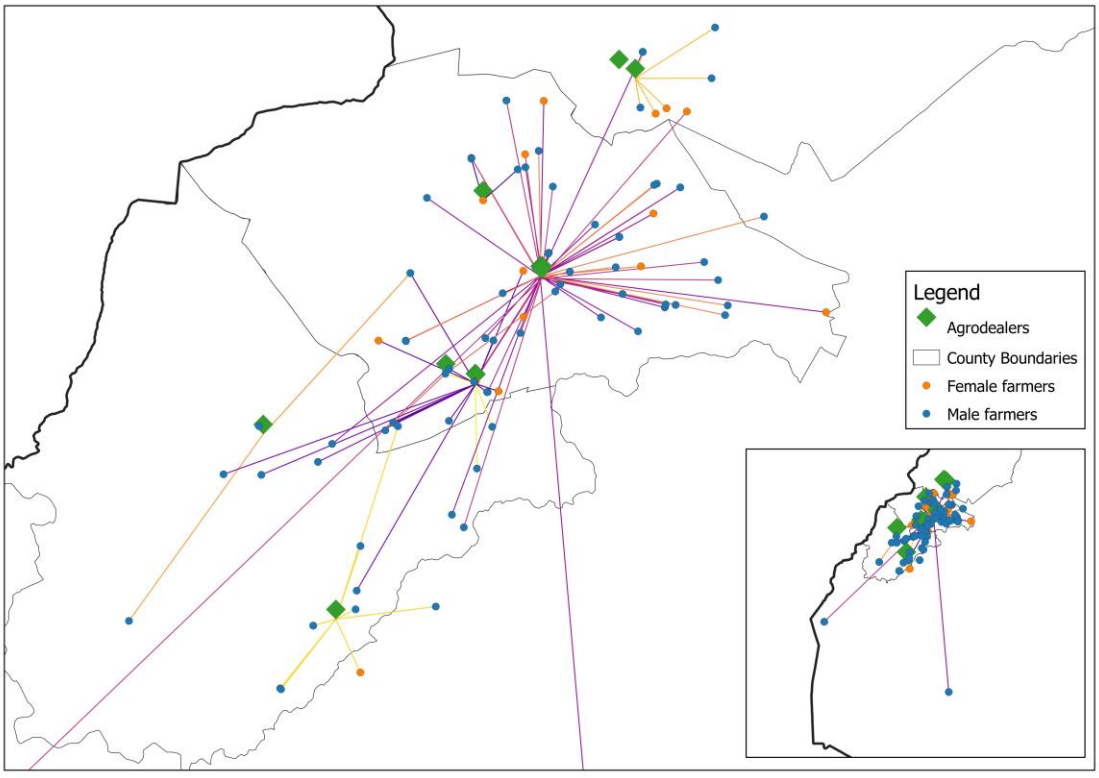


Figure 24: Nyota purchases by farmers and agrodealers, Male and Female



Comparing Figures 21 and 23 reveals that many farmers did not purchase Nyota seed from agrodealer shops ,nearest to them and which sold Nyota seed. Farmers will not necessarily make purchases on proximity alone for a variety of reasons. For instance, some farmers may have customer loyalty to particular agrodealers. Also, while an agrodealer can be geographically close to a farmer, they may not be in a town center or market where farmers frequent. This could be relevant when a farmer wants to visit bigger centers to make multiple item purchases on one visit. This finding has important implications for development partners as they build capacities of agrodealers at the last mile. To sustain their businesses at the last mile, it is important to understand how agrodealers can cater to farmers' needs, as proximity is not the only factor for growing a customer-base.

4.3 Customer feedback after harvest

In January and February 2020, telephone interviews were conducted with farmers (see Annex 6 for the survey instrument) who bought Nyota seed to gather feedback from them on varietal performance including maturity period, grain quality, utilization of harvested grain, preparation for next season, market performance and likelihood of repeat purchasing. 91 Farmers gave responses to these questions of which 67 were male and 24 were female. On maturity time, the majority of respondents (72%) said the variety matured in "about two months" (Figure 25). On the quality of the grain, 92% of respondents remarked that the quality of the variety was either excellent or good (Figure 26). On the amount of seed purchased, many respondents (68%) bought between 1 and 5 Kgs of Nyota seeds (Figure 27). The next largest purchasing group was 6 to 10 Kgs (12%).

Figure 25: Maturity time of Nyota (N=76)

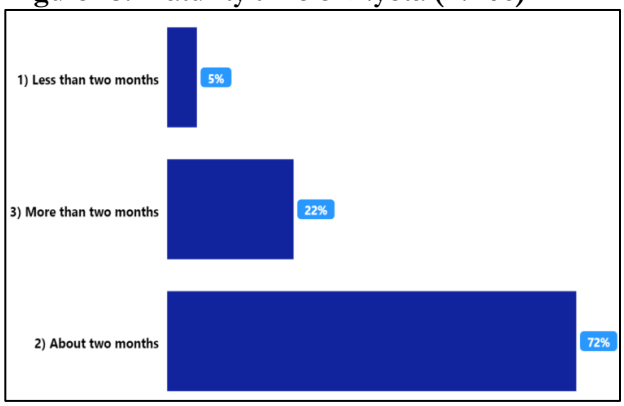


Figure 26: Quality of Nyota grain (N=91)

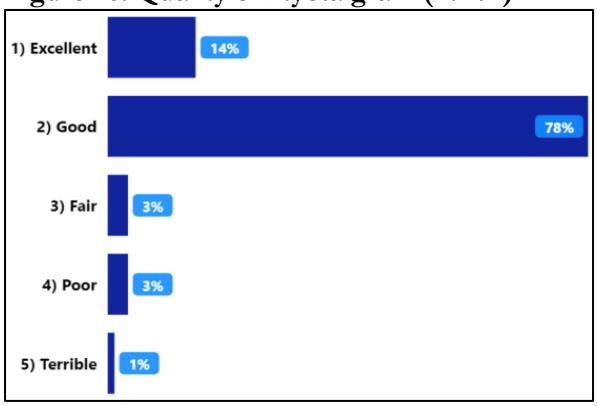
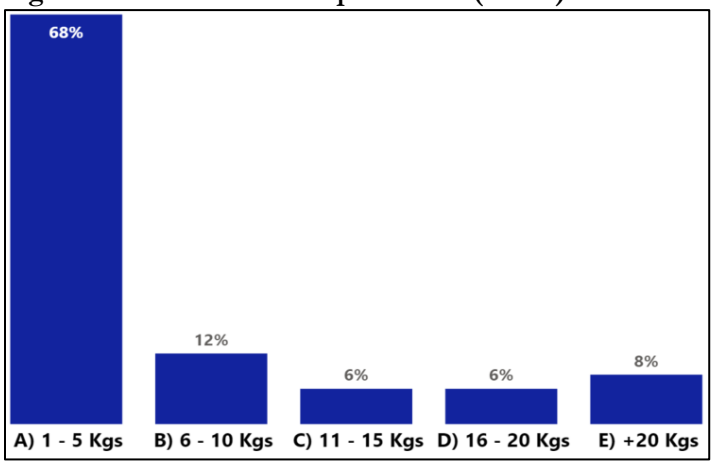


Figure 27: Amount of seed purchased (N=85)



For the 24 female farmers that responded to "Quality of Nyota grain", 87% (20) responded that the Nyota was "good" compared to 75% (51) of the male famers responding "good" for Nyota quality. Also, of the three farmers that responded that the Nyota quality was "poor", 2 of them were female farmers.

Figure 28: Seed purchased Males (N=64)

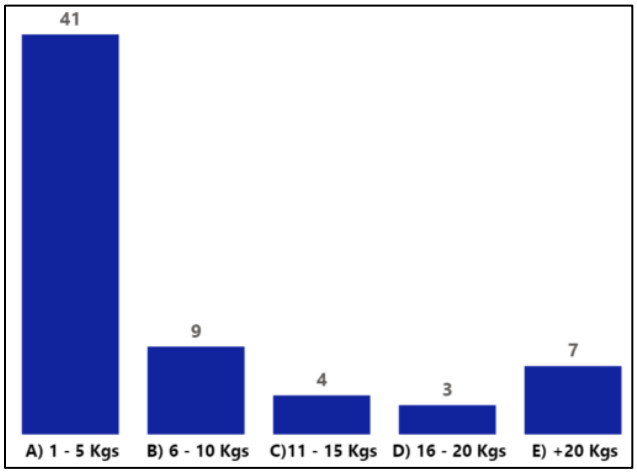
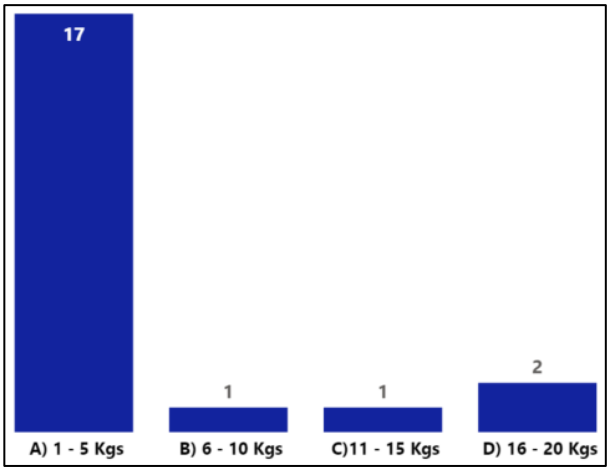


Figure 29: Seed purchased Females (N=21)



Farmers were asked what they did with the harvested Nyota grain. The farmers were given three options to pick from: save as seeds, consume as food, or sold as grain. Farmers could give multiple responses to this question. The majority of respondents (69 farmers) said they consumed the harvest as food; 41 farmers said they saved as seeds for next season; and, 36 farmers said they consumed some as food and saved the rest as seed for the next season. Only nine (9) farmers said that they would be selling it. Figures 30 & 31 show how these responses are broken down by gender.

Figure 30: Nyota grain – consumed as food, by gender (N=77)

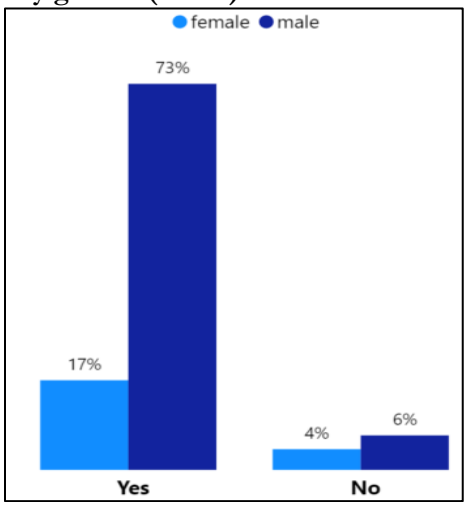
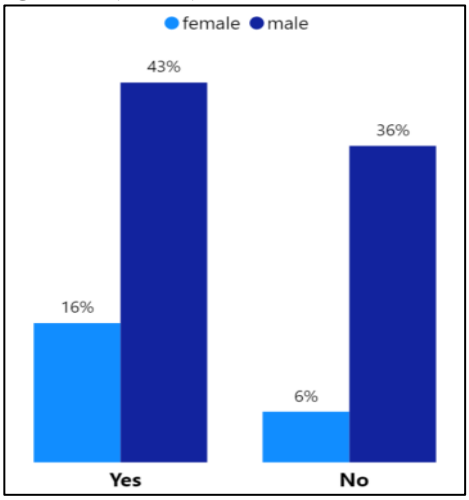


Figure 31: Nyota grain – saved as seed, by gender (N=70)



Farmers were asked whether and why they would buy Nyota seed the next season. Seventy-four percent (98 farmers) indicated that they would repurchase Nyota seed because of its good yield. Twenty-one percent (18 farmers) (Figure 32) said they would not buy Nyota the next season. The reasons advanced by male farmers included poor yields, unsuitability of the variety for the area especially during heavy and prolonged rains and availability of saved seed as the reasons for their decision. Reasons cited by female farmers for not buying Nyota seeds included poor harvest, but also the intention to harvest the seeds that have been planted. Of the farmers who said they would buy Nyota seed the following season, 74% cited high yields as the reason and 24% cited desire to try it again (Figure 33).

Figure 32: Percentage of farmers who will purchase Nyota seed next season (n=85)

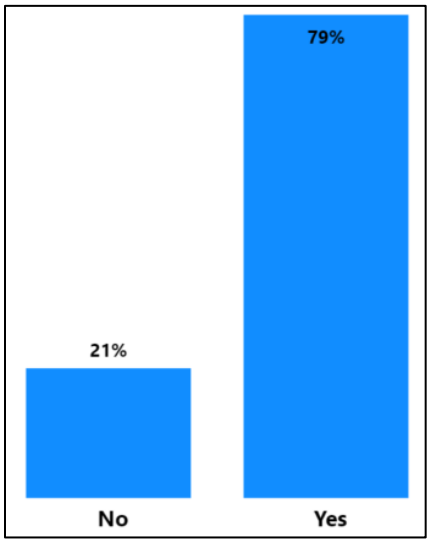
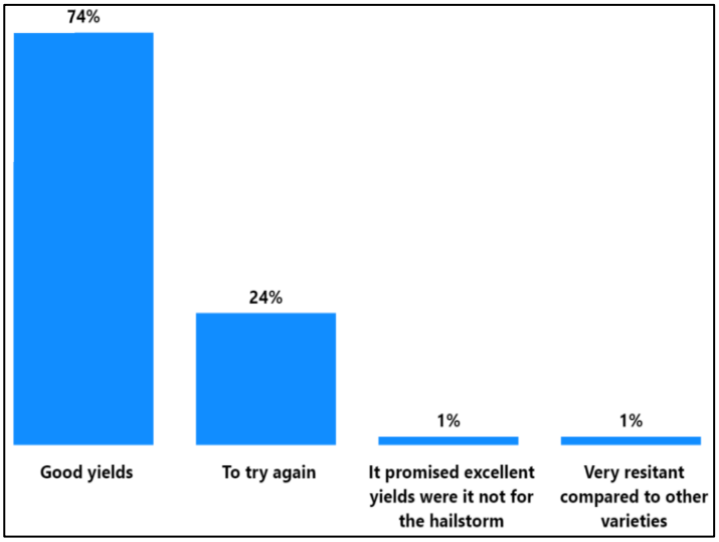


Figure 33: Reasons for repurchasing Nyota seed next season (N=68)



5. DISCUSSIONS AND CONCLUSIONS

This study highlights five results:

(1) It demonstrates that farmers are willing to purchase certified seed of new the bean variety and test it. However, the seed should be packed in a range of affordable pack sizes (Rubyogo et al.2019);
(2) After a season of observation, farmers are willing to invest and expand the areas under the new variety, which meets their needs e.g., climate smart/adapted particularly for short duration, high yielding, highly palatable and marketable. Further study would be required to establish the level of willingness to invest differentiated by gender.
(3) Testing the market of new variety requires a collaborative framework involving private public partnership that can pilot a niche product in the market.
(4) It introduced the concept of 'uberization' to deliver improved seed to the last mile. The study showed that motorbike riders can expand the reach of certified seed while increasing their business.
(5) Finally, it develops and deploys a low-cost digital application that tracks varietal dissemination at point-of-sale centers. Following up with farmers (registered at the PoS) for one complete agricultural cycle (planting to harvest) shows that adoption patterns of niche varieties may be affected by climate change, availability of quality seeds at the right time, availability of market for grain, cost of seeds, and distance from preferred agro-dealer shops.

Climate change adaptation and variability of rains are a concern to farmers. Many farmers have noted that they prefer Nyota because of its shorter maturity period, allowing them to produce a crop faster with erratic rainfall. This is a major adaptation measure among smallholders and directly contributes to building resilience within communities. Analysis of reasons for preference based on gender would be necessary in the subsequent pilot. A key issue farmers raised as they bought the seed was the access to better markets for HIB grain. Farmers wanted to know where they would sell the grain post-harvest. There is need for sustainable linkages between farmers, grain aggregators and off-takers.

Interviews with farmers indicated inadequate supply of certified seeds of preferred varieties such as KK8. At the same time, data shows farmers use multiple channels to source high-quality seeds, including markets. This signifies the role for both formal and informal seed systems. Building sustainable bridges between the two systems can offer pathways for farmers to avail quality seeds of their preferred varieties in sufficient amounts. Farmers found the cost of Nyota to be high, relative to alternative sources of seed (saved seed, local open-air markets, neighbors, etc.). Many farmers were willing to test the new variety on their fields. However, the minimum pack size was 2 kg and therefore the price tag was unaffordable. An acre of land requires 25-30 kg of seed. The 2 kg size pack corresponds approximately with 0.07 acre or 283 m^2. On responding to the need by farmers, Bubayi Products Ltd indicated that this is an issue the company will look at against other intervening factors like demand for seed, the economies of scale, the prevailing regulatory environment, and seed quality control among others.

Network analysis using geospatial data reveals farmers have loyalty or preference to certain agrodealer shops over others; hence, farmers do not always choose the nearest retail outlet. This is partly because of trust built over time, which is linked to the quality of inputs farmers receive from their preferred sources. This could also be attributed to the cost of farm inputs the farmer is able to negotiate with the preferred retail outlet management. These factors ultimately influence the distance farmers will travel to buy their seeds. Simply installing agrodealer shops in an area, for example around the cluster of farmers to the east of Kitale, in Trans-Nzoia County, may not be sufficient. Further research needs to be conducted to understand customer preferences for accessing certain retail outlets more than others.

Many farmers heard about Nyota for the first time when they were buying from their respective agrodealer shops. This may be explained by the limited number of awareness creation activities spearheaded by PABRA and its partners in the time leading up to the pilot. For this reason, during the feedback survey some farmers expressed the need for increased awareness creation and expanded distribution of Nyota. This could include

additional extension services, grain traders' demonstration days, and other marketing efforts within the geographical area of the pilot.

It is worth noting that the farmers and agrodealers were silent on whether the micronutrient richness (high-iron and zinc) could be a factor in the adoption of the new seed varieties. This could be attributed to the lack of awareness that the beans are iron and zinc rich, limited exposure with Ministry of Health institutions for awareness creation, and the newness of the variety among the farmers. This further emphasizes the need for increased awareness creation about the varieties and in partnership with several partners in the private sector (including seed companies and their agrodealer distributorship) and public sectors, like the Ministries of Health and Education, for greater interest, knowledge and impact.

Motorbike riders have become a common means of transport in rural Kenya. The pilot captures information on how *boda boda* riders can be engaged in the 'uberization' of improved agricultural inputs for last mile reach. However, currently there is no regulatory approval for use of motorbike riders for distribution of seed in Kenya. The pilot established that the riders are engaged by the agrodealers to deliver inputs on their behalf. In this regard, the key policy question is how to get regulatory approval and formalization of the use of motorbike riders for last mile delivery of seeds. Tied to this is the possibility of integration of ICT approaches with the motorbike riders for purposes of raising orders for seed and other farm inputs, enabling mobile payments, and delivering products in a timely fashion.

These innovative non-traditional avenues of delivery are likely to become the new normal in penetrating the last mile markets. Additionally, this could be a novel delivery method during emergencies such as COVID-19. A highly demanded variety like Nyota supported by efficient delivery models and timely feedback can enhance the resilience of seed systems. The Nyota variety enhances farmers' resilience (shortening hunger period and bridging cash period), while expanding business opportunities of seed suppliers both in coverage and portfolio diversification.

6. RECOMMENDATIONS

Demand creation among farmers, agrodealers, offtakers/aggregators and consumers is key to disseminating new varieties that are climate-smart, nutrition sensitive, and promote inclusive growth in the agricultural sector. Development partners and in-country stakeholders need to plan smartly and ahead of the planting season for effective impact. This study establishes and conforms to existing literature that farmers use multiple channels to procure quality seeds. Analysis in this report demonstrates that farmers are willing to risk and expand their investments in trying out new seed climate smart and consumer demanded varieties (e.g. Nyota) in their fields. However, to enable farmers to take those risks, seed companies must be willing to produce seeds and sell them in affordable packs (sometimes in smaller than 2 kg packs).

It is key to understand the economics for seed companies to sell seeds in small packs for a niche product. This is a gap in the current study and more information is needed to assess the threshold costs and benefits for seed companies to be incentivized to sell small packs for piloting. The need for formal partnerships between agrodealers and motorbike riders was raised by the riders. While this is contingent upon regulatory approval by KEPHIS, agrodealers may want to look for innovative ways of actualizing this need for enhanced delivery of HIB seeds and complementary technologies. This could be achieved by training of motorbike riders and branding of the riders' products, among other strategies. Further, agrodealer efficiency and impact could be enhanced by integrating ICT for raising of orders, making payments and sharing information. Development partners have identified capacity building models for agrodealers. Looking ahead, the same should be done for *boda boda.*

The current seed regulations require that the seed transporters be registered by KEPHIS. However, the regulations do not provide for official distribution of seeds by use of motorbike riders (*boda boda*). Informally though the farmers and agrodealers make use of *boda boda* for delivery of seeds and other farm inputs. Motorbike riders would want their business of seed and farm inputs delivery regularized. KEPHIS may therefore want to review this policy position with the view of formalizing the use of motorbike riders for last mile delivery of seeds. This could be done in consultation with agrodealers and seed companies and would most likely boost the use of certified seed of improved varieties and other agricultural technologies. This will also create job opportunities for the youth *boda boda* riders.

County governments in partnership with agrodealer companies should take the lead in implementing a tripod arrangement bringing together the Departments of Agriculture and Extension, Education and Health at the county level to improve productivity and consumption of HIB. Counties can take a lead in promoting the utilization of HIB through schools and health facilities for the antenatal and post-natal clinics working with Departments of Education and Health. Furthermore, the county governments can focus their awareness creation and nutrition trainings on women because women typically make decisions on food consumption at the household level. This will contribute to reduced malnutrition and improved household income and expand business opportunities for seed suppliers. At the same time, the Alliance/KARLO and county governments should expose traders to Nyota and other HIB to mainstream them in the bean grain market for wider access.

The study used a cost-effective approach to understand the varietal dissemination using data gathered at the point of sales. Development partners, funders, government and policy makers are interested in understanding dissemination and adoption of climate-smart improved seeds to build transformative capacity and resilience—especially at the last mile. Equally important is to learn how new varieties perform after the harvest period. The study engaged with farmers after the harvest period to understand implications for one full agricultural season. Going forward, it is recommended that development practitioners and partners build

such applications in their routines to understand new varietal dissemination and subsequent adoption patterns.

Oftentimes, certified seeds of farmer-preferred varieties are sold to institutions and not directly to farmers who want to buy from the agrodealer shops. For effective farmer seed demand, it is critical to support seed companies to expand their bean seed production and marketing. Farmers, agrodealers and extension agents need to be informed about Nyota's traits (short-duration, drought-tolerant, micro-nutrient richness) and its limitations, especially with regards to its vulnerability to diseases and pests during prolonged heavy rains.

There is a need to continue fine-tuning the PoS package to provide an online application, which links the farmers and seed suppliers as *uber applications* connects the taxis and commuters. Finally, to enhance the resilience of the bean seed systems it is critical to: (1) provide the correct varieties demanded by farmers; (2) work with diverse stakeholders, including non-conventional seed suppliers to reach more farmers; and, (3) access real-time information from end users to guide seed suppliers on demand and coverage.

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8. ANNEXES

Annex 1: Collection Instrument at the Customer (farmer) Level

Part 1: Customer Information

Questions	Options
1.1 What is your first name	
1.2 What is your last name	
1.3 What is your phone number	
1.4 Select gender of the customer	Male Female
1.5 Select the age category the customer falls in	15-29 30-45 45+
1.6 Are you the head of the household?	Yes No
1.7 How much land do you own in Acres?	
1.8 Do you lease land?	Yes No
1.9 How much land do you lease?	
1.10 How much land do you cultivate?	

Part 2: Location Information of the Customer where the seeds will be carried to

Questions	Options
2.1 In which county do you live?	
2.2 In which sub-county do you live?	
2.3 In which ward do you live?	
2.4 In which village do you live?	

Part 3: Stock and Sell Information for Bean varieties

Questions	**Options**
3.1 Please select the bean varieties customer has purchased:	Angaza (bio-fortified) Faida (bio-fortified) Nyota (bio-fortified) KK 8 Cal 194 (Rose coco) Red 16 (Wairimu) GLP 92 (Mwitemania) GLP 2 (Rose coco) GLP 1004 (Mwezi Moja) GLP 24 (Canadian wonder) GLP 1127 (New Mwezi Moja) Wairimu Dwarf
Follow questions will repeat for each variety selected	
3.2 How many 2 kg packs ____ variety packs did you buy?	
3.3 How many 5 kg packs ____ variety did you buy?	
3.4 What was the pack size of 1 bag of ____ in kg? (how many kg of seed are in 1 bag)	
3.5 Have you bought ____ variety before?	Yes No
3.6 Where did you get information about ____ variety?	Agro dealers Seed company agents Village based agents Farmer based organizations Other extension agents Neighbor Local markets Demonstration/field days Other
3.7 Please specify where	
3.8 How much of your land do you cultivate with ____ variety	Most of the land Half of the land Less than half of the land Very little I am testing
3.9 Did the agrodealer have enough seed of ____ for what you needed?	Yes No
3.10 Please specify why	

3.11 In addition to buying, do you also use your own saved seeds for ____ variety?	Yes No
3.12 How many kg ____ did you save?	
3.13 Why do you want to buy ____ variety?	
End of repeating question sets per variety	
3.14 In addition to agrodealers, where else do you source your seed from	Other farmers Family members Local seed producers Local Traders Local markets Other None/not applicable
3.15 Are there other bean varieties, not mentioned, that you grow with your own save seed	
3.16 Please specify the name of the variety	*Skip if customer doesn't know name*
3.17 What other crops do you grow that are important for you?	Banana Maize Potato Other None
3.18 Please specify other	
3.19 Do you have any other feedback for us?	

Annex 2: Collection Instrument at the Agrodealer Level

Part 1: Agrodealer Information

Questions	Options
1.1 What is your first name	
1.2 What is your last name	
1.3 Gender	Male Female
1.4 What is your phone number	
1.5 Age category	18 - 29 30 - 45 45 +

Part 2: Location Information of the Agrodealer where the data is collected.

Questions	Options
2.1 In which county does your shop reside?	
2.2 In which sub-county does your shop reside?	
2.3 In which ward does your shop reside?	
2.4 In which village do you reside?	
2.5 Is the agrodealer in a shopping complex?	Yes No
2.6 What is the name of the shopping complex?	

Part 3: Stock and Sell Information for Bean varieties

Questions	Options
3.1 Do you sell bio-fortified beans such Angaza, Faida, Nyota?	Yes No
3.2 Which bio-fortified bean varieties do you sell? (If "Yes")	Angaza Faida Nyota
3.3 Which non bio-fortified varieties do you sell?	KK 8 Cal 194 (Rose coco) Red 16 (Wairimu) GLP 92 (Mwitemania) GLP 2 (Rose coco) GLP 1004 (Mwezi moja) GLP 24 (Canadian wonder) GLP 1127 (New mwezi moja) Wairimu dwarf
Following questions will repeat for each variety selected	
3.4 What is the cost per 2kg pack of ____ in KSH?	
3.5 What is the cost per 5kg pack of ____ in KSH?	
3.6 When did you last receive stock of ____?	Date
3.7 How many kg stock did you receive of ____ variety?	
3.8 How many kg stock do you have of ____ variety right now?	

3.9 How often do you restock for ____ variety?	Daily Once a week More than once a week Bi-monthly Monthly Other
3.10 Do you have enough supply to meet demand of ____ variety?	Yes No Not applicable
3.11 Additional comments	
3.12 If no, how frequently did you turn customers away?	Daily Weekly Monthly
3.13 How many customers on average do you turn away?	
End of repeating question sets per variety	

Part 4: Business questions

Questions	
4.1 What is the most popular variety for female farmers?	Bean variety list drop down
4.2 **Why** is that variety popular with female farmers?	
4.3 What is the most popular variety for male farmers?	Bean variety list drop down
4.4 **Why** is that variety popular with male farmers?	
4.5 How long have you been in business?	Less than 1 year 1 - 3 years 3 - 5 years More than 5 years
4.6 Compared to last season, how is the business doing now?	Sales decreased Sales increased Sales remained the same
4.7 Do you know why sales has ____?	

Part 5: Motor Bike Questions

5.1 Do you use you motorbike riders to deliver seeds?	Yes No
5.2 How long have you been using motorbike riders for delivering seeds?	Less than 1 year 1 - 2 years More than 2 years
5.3 How many motorbike riders do you use to deliver seeds?	
5.4 How many motorbike riders are male?	
5.5 How many are female?	
5.6 What are their average ages?	18 - 29 30 - 45 45 +
5.7 How often do you give motorbike riders seeds to deliver	Daily Weekly

	Every two weeks Monthly
5.8 Which varieties do you deliver	Bean variety drop down list
5.9 Please tell me the routes of the motorbike riders. What are their delivery locations? County, sub-county, ward, villages.	Open ended question
5.10 How much seed do you give a motorbike rider each time? kgs	
5.11 Which other products do motorbike riders deliver to farmers alongside bean seeds?	
5.12 Do you have any other comments about using motorbikes to deliver seeds?	Comments

Part 6: Final Questions

6.1 Do you feel anything is constraining your business from growing?	Yes No
6.2 Do you know why this is so?	
6.3 Other comments:	

Annex 3: Collection Instrument for seed companies.

Part 1: Administrative Information

Name of the seed company
Location
Contact Information - Email
Contact Information - Phone
Contact Name
Position in the company

Part 2: Production and Market Information

Which varieties of bio-fortified beans do you produce?
Where do you source your early generation seeds for producing the certified seeds?
How much certified seeds did you produce for each variety? (Kg)
At present how much area is under cultivation for each of the varieties? (Hectares)
Is this the first time you are producing these varieties?
When did you start multiplying high iron bean varieties?
To whom do you sell the certified seeds? How much?
At what price do you sell them?

Do you have any annual target of sell? By variety.
How did you disseminate information about these varieties?
Comments: For example, what constraints do you face?
What is the volumes sold per season by variety? And is there unmet demand?
Do buyers place upfront orders for the season? If no, how does the company estimate demand to plan production?

Part 3: Varietal Information

Please list <u>at least 5 main</u> characteristic features (for each variety that you are selling) that you think are attractive to buyers. [Examples of features could be --- yield, height, color, smell, time it takes to grow etc.]

Variety name:
Varietal traits:
Expected performance (Yield)
Other comments:

Part 4: Hypotheses

What is your expectation from this niche market model with PABRA? Do you see any potential benefits and if so which ones?
What would you like to know that the PoS study can generate to help your business?
What does success look like for you?
Any constraints? What about capacity development?
Any opportunities?

Part 5: Yield

Additional comments:

Annex 4: The PoS List of Agrodealers

No	Agrodealer Name	County	Location
1	Cenriva Traders Ltd	Trans-Nzoia	Kitale Town
2	Itete Agrovet	Trans-Nzoia	Kitale Town
3	Joska Investment	Trans-Nzoia	Kobos
4	Kilimo Agrovet	Trans-Nzoia	Kitale Town
5	Kimaran Agrovet	Trans-Nzoia	Kiminini
6	Maya Agrovet	Bungoma	Mt. Elgon / Nomorio
7	Mazop Entreprises	Trans-Nzoia	Kitale Town
8	Munyambu Farmers Pride	Bungoma	Kimilili Town
9	Nakewa Agrovet	Bungoma	Webuye Town
10	Paves Vetagro Limited	Trans-Nzoia	Kitale Town
11	Paves Vetagro Limited	West Pokot	Makutano - Headquarters
12	Paves Vetagro Limited	West Pokot	Makutano - Market
13	Skynet Agrovet	Trans-Nzoia	Kiminini
14	Wesam Agrovet	Trans-Nzoia	Kimini Town

Annex 5: Farmer Feedback Questionnaire

Section A: Introduction

Good morning/ afternoon. My name is ……. and I work with CRS. You will recall that during the last planting season around September/ October 2019 you bought Nyota bean variety which was available for the first time from agrodealer shops in Kenya. CRS works in partnership with KALRO and Bubayi Seed Company. That's how we obtained your contact, and I request to ask you few questions regarding the new bean variety Nyota. The questions will take around ten minutes. As a farmer, your feedback on the Nyota bean seed is most valued, since this feedback will be shared with KALRO and Bubayi Seed Company for future planning and decision making. For these reasons, we request you to provide honest responses to the questions as much as you can. If you allow me then I will proceed with the questions. Can we?

Section B: Demographic Characteristics

1. First Name
2. Last Name
3. Gender
4. Age category
5. Phone number

Section C: Feedback Questions

1. How many kgs of seed did you purchase?
2. How was the quality of Nyota seed you purchased?
3. How much land area did you plant with the Nyota seed? [Very little, less than half, Half of the land, Most of the land]
4. How long did it take to mature?
5. What was your total harvest from the acreage you planted? (How many tins, debes, gorogoros, etc)
6. What did you do with your harvest? [Save as seeds for the next season - how many kgs?; Consume as food; Sold as grain
7. If sold as grain, to whom did you sell? [Community Members & Farmers; Traders and Aggregators; Retailers]
8. If sold as grain, at what price did you sell? [KSHs/Kg]
9. Will you purchase Nyota seeds next season? [Yes/No] If Yes, why? If No, why? If No, what variety will you buy?
10. Do you have any suggestions on how to improve Nyota?
11. Do you have any other comments?