Promoting the Adoption of Tissue Culture Banana through Increased Market Participation by Small Holder farmers in Kenya.

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ABSTRACT

The objective of the study was to evaluate the commercial drivers of tissue culture banana adoption by farmers in Kenya. While farmers adopt new technologies due to their inherent benefits, the adoption of the new Tissue Culture Banana which was high in the 1990s is no longer increasing and banana production has stagnated. This pattern has necessitated carrying out this study with a view to unravel the contribution of market participation of tissue culture banana farmers in Kenya. We adopted a descriptive document review on tissue culture banana with the aim of identifying potential policy options for improved uptake of tissue culture banana in Kenya. The results revealed that matching farmers perception towards TCB technology, its attributes and access to markets enhanced adoption. Most farmers adopting tissue culture bananas have small pieces of land, didi not earn much from the TCB produce yet the technology had a short payback period with higher returns. The study also found that farmer age contributed to yield stagnation, low market participation and hence low returns relative to the opportunity cost of other competing enterprises. The study concluded that improved adoption of bananas would be promoted through improved market participation for food access, use of credit and engaging the younger tech-savvy generation on the benefits of the technology for better incomes and improved livelihoods.

Keywords; Market, Banana, Adoption, Food Security, Technology.

INTRODUCTION

Food is a basic human need for a healthy productive nation. The availability of food in Kenya remains a dream for many people because Kenya is a food deficit country and relies on the market supply and rain fed production system to meet the local demand (Wambua, Omoke and Mutua, 2014). The main staple foods produced locally include maize, rice, wheat, Irish potatoes and banana among others. Banana is grown locally in Kenya for household consumption or food markets. The average annual output is over 1.8 million metric (Statistica 2024; FAO 2017). It supplies more than 25 % of the daily carbohydrate needs for people and is grown in over 150 countries (WHO 2023). The global output level was about 125 million tons in 2017, with India, the leading producer accounting for 25% of the total output (Filipenco, 2023: FAO, 2018). While Asia is the largest banana producing regions, Latin America and the Caribbean is the largest exporting region, responsible for approximately 80% of global exports (Voora , Larrea. and Bermudez; 2020).

Banana production in Kenya is under the purview of smallholder farmers, the majority of whom were peasant women producing about 4.5-10 tonnes per hectare annually (Masinde et al., 2012). The main producing areas are Kisii, Vihiga, Bungoma, Kakamega, Kericho in western Kenya and Murang'a Embu Nyeri and MeruIn central region. Banana production in these high potential areas is a major economic activity though production has been low. The total output in Kenya has not been able to bridge the national food deficit occasioned by the growing population, urbanization, unfavorable food production conditions, labor or supply chain disruptions due to changing climate macro and micro economic shocks (Bedasa & Deksisa, 2024; Crises, 2021).

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Increased adoption of Tissue culture banana (TCB) production is a potential game changer guaranteeing household food security and access. It offers diversity to the traditional staple foods whose production is equally low and does not meet the local demand. However, adoption rates are just roughly 7% in Kenya and even lower in Uganda and Burundi (Warinda et al., 2020). This is the puzzle that motivated this study to determine what strategies would enhance tissue culture production I Kenya.

METHODOLOGY

This is a document review study and drew data from studies that used mixed method approaches that combined surveys, focus group discussions (FGDs), key information interviews (KIIs) and and secondary data using well-designed validated tools. The study tools defined variables on a five-scale -Likert questions and open ended questions and used double hurdle model in 2023 amd 2022.. All the studies used surveys to collect data from the selected samples which varied depending on the sampling method.

The studies used a combination of cluster samples for FGDs and surveys to collect primary data collected that were validated through triangulation with survey data from members who did not participate in the FGDs. Other sources of data were subject matter specialists from State Department of Agriculture and key research organization Kenya Agricultural and Livestock Research Organization.

RESULTS AND DISCUSSION

Most studies revealed that farmers had a desire to improve banana productivity using TCB technologies. The desire to realize better production and high returns to TCB investments led to increased farmer participation during awareness training campaigns sessions. The participatory approach involving collaboration and consultation between researchers and farmers realized research products that suited that latters preferences. These observations are well aligned with the four theories of adoption namely Rogers's innovation diffusion theory, the Concerns-Based Adoption Model, the Technology Acceptance Model, and the United Theory of Acceptance and Use of Technology. Thuo, Nguluu and Kisangui (2017), Wanyama, Obare, Owuor G. and Wasilwa, (2013) and Omari, Muna, and Mburu, (2024) all reported a high level of adoption in their study samples. Omari et al, (2024) found out that proportion of farmers who desired to adopting Tissue culture banana was above about above 62.2 % for both adopters and non-adopters. This high preference was dependent among others on high average yield reported for TCB whose productivity was about ten tons of fruit per acre compared to five tons by native bananas. Tissue culture banana adoption and the resultant adoption patterns observed across various agricultural value chains where interventions involve new technologies follow the hypotheses embedded in adoption theories. Therefore aligning tissue culture technologies interventions for improved food access with social, individuals construct and their malleable perceptions of promoted adoption.

The double-hurdle regression model (Wanyama et al; 2013 and Haile et al; 2022) the main drivers of market participation were education level, farming experience, yield, market access, amount of credit received, and perception about the price significantly affect the market participation decision.

Adoption of Tissue culture banana technologies was catalysed by adopters education level, land size, experience and market access (Haile et al, 2022; Thuo el al,2017;, Masinde, et al, 2013, and Omari, et al , 2024). The theories of adoption portends that high TCB yields confers a positive attribute to increased adoption adoption patterns of the TCB technology translating to better returns hence meeting the objective of the small scale farmers Figure 1.In addition, the theories defined the apriori sign of theexogenouus variables.

High yielding TCB also matured faster, had higher bunch weight, and uniform development and growth characteristics. Tissue culture banana matures in 300 days unlike the other traditional varieties which take 400 days (Omari, et al, 2024). The net effect is higher returns on investment with a shorter payback period. As such, TCB venture is a suitable business venture for small holder farmers since it does not lock seed capital for long.

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The growth characteristics also make it easier for farmers to control field practices, enabling simultaneous harvesting, planning and operate an efficient TCB marketing activates (Otieno, 2023). Gabriela. (2015) corroborated these results and reported that the desire of local farmers to adopt a new technology is influenced by high production that must meet their consumption needs with the surplus being marketed. The marketable surplus provides income used to cover expenditures for enhanced food access and other household requirement (Kabra, 2001;Wanyama et al 2013). Where consumption of banana is low as the case of Murang'a county, low consumption of banana at household level left a high marketable surplus which translated to household income upon sale. In the local markets, ordinary bananas fetches between KSh 300 and KSh 800 a bunch, tissue culture bananas fetched between KSh 800 and KSh 1600. The crop has a uniform growth pattern that allows simultaneous harvesting, Further, the bundles are larger and heavier than traditional ones, which do not mature uniformly. TCB banana therefore made marketing easy and therefore supported the claim by farmers that the adoption of tissue culture banana significantly increased returns from market sales (Kabra,2001). This motivated farmers to participate in credit financing to improve their investment portfolio. Consequently, any efforts to boost household income from both agricultural and non-agricultural sources such as credit will spur the uptake of new technology, like tissue culture bananas.

Tissue culture banana technology not only transcends the benefits of the green revolution by providing high yielding genetically identical plantlets that were disease resistant (Erick et al., 2024; Thuo el al,2017; Masinde, et al, 2013, and Omari, et al , 2024.), but tha produce had a high market demand. Omari 2024 reported that On average, 57.5% of respondents, felt that the disease resistant tissue-culture bananas have a greater demand. This consists of 60.4% of non-adopters agreed and 72.2% of adopters ((Thuo el al,2017;,), Masinde, et al, 2013, and Omari, et al , 2024). This indicates that TCB is a low cost technology and could be favoured by commercial farmers who were targeting high returns. The low cost production technology therefore incentivized increased adoption (Akala et al., 2021). Therefore, The combined ability of farmers to use TCB technology to realize increased yields, high returns market at a low cost are critical cognitive elements that contribute to increased farmers adoption (Otieno 2024:Ţiţan, 2015).

The average farmer age who are land owners was over 61 years in 2025 (Haile et al, 2022; Thuo el al,2017;, Masinde, et al, 2013, and Omari, et al , 2024).While the elderly generation of farmers are risk averse, the younger technosavvy farmers are more likely to realize higher benefits since adoption increases with decline in age (Otieno, 2025). As such, younger farmers (Wanyama et al, 2013) were more incentive to work relative to older farmers (Haile et al, 2022). It demonstrates numerous advantages compared to traditional propagation strategies.

The identified interventions Financial Credit, Market Access, Marketable surplus and Training An increase in the level of intervention increased the likelihood of increasing yield and adoption simultaneously thereby achieving g the desired level of adoption and production.

CONCLUSION

The adoption of tissue culture technology should be encouraged because it increases farmer participation in the banana markets and it expands access food, generate revenue for the government and households through the sale of products, and create jobs for women and young people. With majority of aging farmers being risk averse, the success of future adoption patterns depend on developing a robust agricultural farmer extension system, facilitating younger farmers to access credit for enhanced farmer participation in tissue culture banana cultivation and value chain development. Emerging issues pose a danger to the productivity and sustainability of banana production.

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