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Socio-Economic factors affecting Maize Production in Kapseret Sub-County, Kenya

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Abstract

Maize is a major staple food crop in Kenya and an important source of food and income for smallholder farmers. However, maize production among smallholder farmers remains relatively low. This study examined the socioeconomic factors influencing maize production among smallholder farmers in Kapseret Sub-County, Uasin Gishu County, Kenya. Data were collected from 326 smallholder maize farmers through face-to-face interviews using a structured questionnaire. The data were analysed using a linear regression model to examine the relationship between selected socioeconomic factors and maize production. The results showed that land size, land preparation costs, amount of credit, on-farm income and extension services had statistically significant relationships with maize production. Land size had a positive and significant coefficient ($\beta = 0.153$, $p < 0.001$), while extension services also had a positive and significant coefficient ($\beta = 0.069$, $p = 0.001$). Amount of credit, on-farm income and land preparation costs were also positively and significantly associated with maize production. Gender and education level did not have statistically significant relationships with maize production. The regression model explained 82.9% of the variation in maize production and was statistically significant overall ($F = 133.748$, $p < 0.001$). The findings suggest that improving maize production requires greater access to productive land, affordable credit and effective extension services, while supporting farmers to manage production costs. Strengthening these areas could help smallholder farmers increase maize production and improve household livelihoods.

Keywords: *Uasin-Gishu, Kapseret, Maize, Consumption and Small holder*

Introduction

Maize is the most important staple crop in Kenya. It is what most families put on the table for consumption every day and it sits right at the heart of the country's food security. It is cultivated across diverse agro-ecological zones, with smallholder farmers accounting for the largest share of production. However, there is a problem in that harvests just aren't where they could be. Most fields yield less than two tons per hectare, even though with proper care and inputs, they could easily hit five or six. That is a pretty wide gap and it is not just about bad luck or weather. A mix of social, economic, and institutional hurdles keeps many farmers from hitting those higher yields.

Take a closer look at how farming works in Kenya and it will be evident that most farmers are working with less than five acres. These smallholder farmers are limited in accessing cash, unreliable infrastructure and they are pretty much at the mercy of the weather. Things like the size of land, how much money they make, whether they can get advice from agriculture experts, and if they can secure loans or credit all of those shapes what's possible for them. It matters for how quickly (or if) they can buy good seed, fertilizers, or chemicals, and whether they try new practices that could boost their yields. Studies have shown that financial constraints restrict the timely acquisition of certified seeds, fertilizers, and agrochemicals, while limited access to information reduces the adoption of climate-smart agricultural practices

Several determinants that affect smallholders' agricultural productivity have been identified by various recent studies in Sub-Saharan Africa. Wossen (2017) as well as Abate et al (2013), show that getting improved seed varieties or advice from extension officers makes a big difference to maize yields in Sub-Saharan Africa. Liverpool-Tasie's (2020) research says farmers do better when they have access to rural credit markets and can actually buy what they need, though not everyone can tap into these markets because getting loans isn't simple, they need collateral and face high transaction costs. Focusing on Kenya, Muyanga and Jayne (2008) found that guidance from extension services helps in adopting new technologies, but

Sheahan and Barrett (2017) Identified financial constraints as one of the major obstacles to the adoption and utilization of modern agricultural inputs. More t research like studies by Woomer (2023) and Burke (2024) shows that that when smallholders have better access to good inputs and use techniques like integrated soil fertility management, can substantially increase maize yields. Nevertheless, adoption among farmers remains relatively limited.

Although there is abundant evidence, several gaps persist regarding the interplay between socio-economic factors to affect agricultural production in various local contexts. This research seeks to fill this void by analysing the factors influencing maize production in Kapseret Sub-County, Uasin Gishu County, Kenya. It focuses on variables such as credit for inputs, land size, household income, access to extension services, and production costs, and how they each affect agricultural production. The study therefore seeks to provide empirical evidence that informs policy insights making smallholder farming more productive, resilient, and sustainable in Kenya. The average yield is less than 2 tonnes per hectare while the potential yield is about 5-6 tonnes per hectare. This discrepancy in the yield cannot be attributed only to the climatic and soil factors but is the result of multiple issues which include socio-economic and technological issues faced by small-scale farmers. An important factor influencing agricultural productivity is landholding size. Larger farms allow farmers to allocate acreage to better techniques like crop rotation and soil fertility management as well as take advantage of economies of scale and mechanization. Because farmers with bigger landholdings are better able to spend in inputs that increase productivity, studies have indicated favourable correlation between farm size and maize yield (Muyanga & Jayne, 2019). However, smallholders' capacity to reach ideal production levels in Kenya is still hampered by land fragmentation.

Access to financing is crucial in allowing farmers to purchase improved seeds, fertilizers and agrochemicals. According to Liverpool-Tasie et al. (2020), better access to rural financial services boosts input consumption and agricultural output. Similarly, Karlan et al. (2014) discovered that financing constraints considerably limit agricultural investment among smallholders. However, access to formal credit is still limited due to high transaction costs, collateral restrictions and underdeveloped rural financial markets.

As a result, many farmers rely on informal sources of funding, which are sometimes insufficient to finance agricultural intensification.

Household income affects farmers' ability to invest in agricultural production. Higher on-farm and off-farm incomes allow farmers to buy inputs, hire workers and implement new technologies. Sheahan and Barrett (2017) argue that cash limitations are a significant obstacle to input adoption in Sub-Saharan Africa. Farmers with consistent revenue streams are better able to manage risks and maintain productivity, but low-income households frequently choose immediate consumption over long-term agricultural investment.

Soil fertility remains a major constraint to maize production in Sub-Saharan Africa. Integrated Soil Fertility Management (ISFM), which mixes organic and inorganic fertilizer sources, is frequently touted as a long-term technique to improve soil productivity and crop yields. Empirical evidence suggests that ISFM techniques improve maize yields and help close yield gaps among smallholder farmers (Woomer et al., 2023; Burke et al., 2024). However, adoption of these approaches is still low because of high input prices, insufficient technical expertise and risk aversion among farmers, especially in resource-constrained regions.

Production costs really shape how productive farms can be. Things like getting the land ready, buying seeds and fertilizer and paying for labour all affect what farmers choose to use and how big they want their operations to be. If those costs get too high, farmers usually cut back on inputs, which means lower yields in the end. Research shows that when farmers get better access to affordable supplies and machinery, they can cut down production costs and work more efficiently (Sheahan & Barrett, 2017; Liverpool-Tasie et al., 2020). So, making good use of resources is key if smallholder farmers want to get the most out of their land.

A lot of research has looked at what affects maize productivity but not much has been said about how these factors actually work together in specific communities. Most studies zoom out to the regional or national level, so they tend to miss the local issues that really shape how much maize gets produced. This study aims to close that gap, focusing on how things like credit access, land size, household income, extension services and production costs all come together to impact maize yields in that area.

Methodology

Research Design

The study adopted a cross-sectional research design to examine the socioeconomic factors influencing maize production among smallholder maize farmers in Kapseret Sub-County, Uasin Gishu County, Kenya. A cross-sectional design was considered appropriate because data were collected from different farmers at one point in time, allowing the study to assess the relationship between maize production and selected socioeconomic factors.

Primary data were collected from smallholder maize farmers using a structured questionnaire administered through face-to-face interviews. The questionnaire collected information on farmers' demographic characteristics, farm size, land preparation costs, access to agricultural credit, on-farm income, and access to extension services.

Study Area

The study was conducted in Kapseret Sub-County of Uasin Gishu County, Kenya. Uasin Gishu County covers approximately 3,345.2 km² and is located in the North Rift region of Kenya. The county lies between approximately 34°50′ and 35°37′ East longitude and 0°03′ South and 0°55′ North latitude. According to the 2019 Kenya Population and Housing Census, the county had a population of approximately 1,163,186 people. The area receives an annual rainfall of approximately 624.9-1,560.4 mm, with rainfall generally occurring in two main peaks. Temperatures range from about 7°C to 29°C. These climatic conditions, together with the relatively fertile soils, support agricultural production, particularly maize production. Kapseret Sub-County was selected because maize is an important crop in the area and smallholder farmers depend on maize production for both household food and income. The sub-county comprises five wards: Kipkenyo, Ngeria, Megun, Simat/Kapseret, and Langas.

Target Population and Sample size

The target population comprised smallholder maize farmers in Kapseret Sub-County. The population was estimated at 1,738 farmers distributed across the five wards. The distribution of the target population was as follows in Table 1.

Table 1: Target Population and Final Sample Size

Ward	Target population	Proportion (%)	Final sample
Ngeria	418	24.05	78
Kipkenyo	413	23.76	77
Megun	417	24.00	78
Simat	301	17.32	57
Langas	190	10.93	36
Total	**1,738**	**100.00**	**326**

Source: Researchers, 2026

The study focused on smallholder maize farmers because they form an important part of maize production in the area and are among the farmers who access agricultural. Proportional stratified sampling technique was used for the research design. Each ward was considered a separate stratum to make sure that each farmer within each stratum is equally represented in the sampling process depending on their proportion in the population. Sample size was computed through the use of Yamane's (1967) formula, where margin of error was set at 5%, and resulted in 326 farmers. The Yamane's sampling formula is given as follows;

$$n = \frac{N}{1 + N(e)^2}$$

$$326 = \frac{1738}{1 + 1738(0.05)^2}$$

n = is the required sample size
N = is the total target population
e is the level of precision (margin of error)

Given a target population of 1,738 farmers and 5% margin of error using the Yamane method, 326 farmers will constitute a valid sample size.

Sampling Procedure

The researchers used multistage sampling technique to identify smallholder maize farmers to participate in the study. The researchers purposively chose Kapseret Sub-County as the study location owing to its significant role in maize production. Five wards in the sub-county were incorporated in the study to provide good geographical representation of the target population. This sample size was proportionally divided into five wards depending on the number of maize farmers in each ward. From each ward, simple random sampling technique was used to identify the individual farmers in the study.

Data Collection

Primary data were collected using structured questionnaires that were filled by the chosen small-holder farmers in Kapseret Sub-County. The questionnaire was designed to collect quantitative data related to the objectives of the study, which included maize production, amount of credit taken, size of land devoted to maize production, income from farm activities, availability of extension services, cost of preparing land and some socio-demographic characteristics of the respondents. The questionnaire was administered through face-to-face interview of the selected farmers to ensure that they understood the questions well and give complete answers. The questionnaire captured information on is presented in Table 2.

Table 2: Variables, description, level and measurements Units

Variable	Description	Level	Measurement
Maize production (output)	Total maize harvested by the household	Ratio	90 kg bags
Amount of credit	Total amount of credit accessed by the farmer	Ratio	Kenya Shillings (KES)
Land size	Total land allocated to maize production	Ratio	Acres
On-farm income	Income earned from farming activities	Ratio	Kenya Shillings (KES)
Access to extension services	Whether the farmer received extension services	Nominal (Dummy)	1 = Yes, 0 = No
Land preparation costs	Total cost incurred in land preparation	Ratio	Kenya Shillings (KES)
Socio-demographic characteristics	Farmer attributes (age, gender, education level, household size)	Mixed	Years, categories, number

Source: Researchers, 2026

Pilot Study

A pilot study was conducted among smallholder maize farmers from wards that were not included in the final sample. The purpose of the pilot study was to assess whether the questionnaire was clear, practical, and capable of collecting the information required to address the study objectives. The pilot focused on questions relating to agricultural input credit, maize production, extension services, and outreach activities. Feedback from the pilot study was used to revise and improve the questionnaire before the main data collection exercise.

Reliability Analysis

The reliability of the questionnaire was assessed using the test-retest method. The questionnaire was administered to 30 smallholder maize farmers participating in the pilot study and was administered again to the same respondents after a period of two weeks. The scores obtained from the two administrations were correlated using the Pearson correlation coefficient. The resulting correlation coefficient was $r = 0.86$, indicating a high level of consistency between the two administrations. The questionnaire was therefore considered sufficiently reliable for the main study.

Validity of the Research Instrument

Content validity was used to assess whether the questionnaire adequately covered the information required to address the study objectives. The questionnaire was reviewed by the researcher's supervisors, colleagues, and two lecturers from the Department of Economics. The reviewers assessed the relevance and clarity of the questions and provided suggestions for improvement. Their comments were incorporated into the questionnaire before it was administered to the study respondents.

Model Specification

Data collected were subjected to statistical analysis using regression method. Before the actual analyses were conducted, data were entered into the Statistical Package for the Social Sciences (SPSS) Software. Then data coding was done on the variables to enable further analysis. Afterward, the database was cleaned to remove any errors and inconsistencies. Furthermore, any data point that was found to be an outlier was eliminated since it could distort the result of the regression analysis. The cleaned dataset was subsequently subjected to SPSS analysis. The problems of non-normal distribution and heteroscedasticity were addressed using a logarithmic transformation of the dependent variable (maize production).

$$
\begin{aligned}
Maize\ production &= \beta_0 + \beta_1 landsize + \beta_2 Land\ prepation + \beta_3 Credit\ amount + \beta_4 On - farm\ Income \\
&+ \beta_5 Extension\ serv + \varepsilon
\end{aligned}
$$

Where:

β_0 = constant term

$\beta_1 - \beta_5$ =coefficents of the explanatory variables

$\varepsilon =$ error term

Results and Discussion

In this section, the descriptive statistics for the sampled small-scale maize growers and the major variables that have been studied is presented. The results provide an overview on the socioeconomic profile of the respondents and the major factors related to maize production in Kapseret subcounty while the last section provides regression results.

Descriptive Statistics

Descriptive statistics were employed in order to determine the social economic characteristics of the sample of smallholder maize farmers and the variables included in the regression model. Measures of central tendency and dispersion were used for continuous variables such as maize output, land area, loan amount, on-farm income, land preparation cost, age, educational attainment, and household size. Frequencies and percentages were used for categorical variables like gender and access to extension services. Results of the descriptive statistics is presented in Table 3 and 4.

Table 3: Descriptive Statistics for Continuous Variables

Variable	Observation (N)	Mean	Std. Deviation	Minimum	Maximum
Maize production (90-kg bags)	326	39.4	1.72	8.00	105.00
Land size (acres)	326	3.21	1.86	0.50	12.00
Credit amount (KES)	326	38,650.00	31,420.00	0.00	180,000.00
On-farm income (KES)	326	118,540.00	96,780.00	15,000.00	650,000.00
Land preparation cost (KES)	326	15,870.00	9,420.00	2,500.00	55,000.00
Age (years)	326	46.37	12.84	21.00	79.00
Education level/years of schooling	326	10.84	3.62	0.00	17.00
Household size (number)	326	5.21	2.34	1.00	13.00

Source: Researchers, 2026

The descriptive statistics of the continuous variables used in the study is presented in Table 3. The descriptive statistics presented above indicates that the mean maize production of the farmers is 39.84 bags of maize, with a standard deviation of 18.72 bags. This suggests a variation in the maize production levels among the farmers. The mean land size was 3.21 acres with a standard deviation of 1.86 acres, which suggests a variation in the land area used for maize production by the farmers. The mean access to credit by the sampled farmers is KES 38,650 while the mean income earned from farming activities by the farmers is KES 118,540. The mean cost incurred during land preparation is KES 15,870 while the mean age of the sampled farmers is 46.37 years. The mean level of education is 10.84 years while the mean household size is 6 persons.

Table 4: Descriptive Statistics for Categorical Variables

Variable	Category	Frequency	Percentage (%)
Gender	Male	204	62.6
	Female	122	37.4
Total		**326**	**100**
	Yes	221	67.8
	No	105	32.2
Total	No	**326**	**100.0**

Source: Researchers, 2026

Table 4 depicts the distribution of the respondents based on gender and access to extension services. It is evident from the Table 4 that the percentage of male farmers was 62.6%, and female farmers were 37.4%. This means that male farmers formed the majority of the sampled farmers. With regard to extension services, 67.8% of the sampled farmers had access to extension services, while 32.2% had no access to the service. This implies that a relatively high percentage of the farmers had access to extension services.

Table 5: Regression Analysis on the Factors Influencing Maize Production in Kapseret Subcounty

Maize production	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
Gender	-0.015	0.055	-0.28	0.782	-0.125	0.094	

Education	0.027	0.018	1.53	0.128	-0.008	0.063	
Land size	0.153	0.033	4.64	0.000	0.088	0.218	***
Land preparation	5.84e-06	2.02e-06	2.88	0.004	1.85e-06	9.83e-06	***
Credit amount	6.29e-06	2.15e-06	2.92	0.004	2.04e-06	0.000	***
On-Farm Income	9.52e-07	1.95e-07	4.89	0.000	5.68e-07	1.34e-06	***
Extension serv.	0.069	0.020	3.46	0.001	0.003	0.109	***
Constant	10.43	0.139	74.88	0.000	10.155	10.705	***

Mean dependent variable	11.651	SD dependent variable	0.756
R-squared	0.829	No. of Observation	326
F-test	133.748	Prob > F	0.000
Akaike crit. (AIC)	117.999	Bayesian crit. (BIC)	144.426

**** p<.01, ** p<.05, * p<.1*

Source: Researchers, 2026

In this case, the regression results from Table 5 show factors affecting maize production. The R-squared is at 0.829, meaning that 82.9% of the variation in maize production is explained by the variables in the model. This regression analysis shows joint significance (F-value = 133.748; p-value < 0.01), meaning that the model is appropriate.
Land size has a positive and highly significant impact on the level of maize production (β = 0.153, p < 0.01). The reason behind this is that large areas of land provide farmers with an opportunity to increase the scale of maize production, make better use of labor, equipment, and even mechanize the process of cultivation. In addition, larger sizes of the land area decrease the degree of fragmentation, which makes the process of farming more efficient. These findings corroborate with the previous research conducted by Abate et al. (2021) as well as by Muyanga & Jayne (2019).

Land preparation costs were found to be positively significant (β = 5.84e-06, p < 0.01). This result can be explained by the fact that land preparation plays a vital role in maize farming since it helps improve the structure of soil, its moisture-holding capacity, and enables early planting of crops. Land preparation costs often indicate the use of mechanized plowing or adequate labor, both of which improve efficiency. This finding is supported by recent evidence from Sheahan & Barrett (2017) and Liverpool-Tasie et al. (2020), who showed that investment in pre-planting activities significantly enhances crop productivity in African farming systems.

The level of credit accessed has a positive and significant effect on maize production (β = 6.29e-06, p < 0.01). The reason for this is that when credit is available, it helps farmers mitigate financial constraints in the sense that farmers can afford quality seeds, fertilizers, and agrochemicals. It also facilitates the process of hiring labor and mechanization services. The problem of insufficient funds is one of the common constraints faced by farmers in rural areas; thus, the availability of credit means that farmers increase maize production levels.
The findings are supported by recent studies by Adjognon et al. (2017) and Karlan et al. (2019) that credit in maize production enhances input usage and productivity.

On-farm income is another factor found to be statistically positive and significant (β = 9.52e-07, p < 0.01). This is attributed to reinvestment; farmers whose income from farming activities is high tend to invest the income received back into input acquisition and new technology adoption, as well as risk mitigation strategies like crop failures. On-farm income also enables the farmer to avoid using credit and make decisions at an appropriate time. Similar results are supported by Slavchevska et al. (2020).

On extension services, it exhibits a positive and significant coefficient (β = 0.069, p < 0.01). This is due to the provision of relevant knowledge on seed types, fertilizers, pest control, and climate considerations by extension services. Knowledge provision mitigates inefficiencies and encourages technology adoption, which in turn helps improve agricultural productivity. Similarly, recent works by Fabregas et al. (2019) and BenYishay & Mobarak (2019) show that agricultural extension services positively impact both the knowledge and technology adopted by farmers, resulting in increased crop yields.

Contrary to gender, it showed an insignificant value (β = -0.015, p = 0.782). From this, one can conclude that gender does not make much of an impact on the level of maize yield produced in this sample. One reason for that is the possibility of minimizing gender differences when controlling for the resources (land, credit, inputs) available to them. Recent studies like Kilic et al. (2015) confirm this, noting that productivity gaps by gender are mostly influenced by resource differences, not the skills of the farm operator.

Conclusion

This study looked at the socioeconomic factors impacting maize output among smallholder farmers in Kapseret Sub-County, Uasin Gishu County. The study found that access to input credit, land size, household income, extension services and land preparation costs are all important drivers of maize productivity. These data demonstrate that maize output is influenced by a variety of financial, informational, and resource-based restrictions, rather than a single factor.

The findings highlight the need of taking a comprehensive approach to solving productivity issues. While credit is essential for timely input procurement, it is most effective when combined with proper extension services, sufficient landholding, and household income stability. The regression model's high explanatory power ($R^2 = 0.829$) indicates that socio-economic variables have a significant influence in determining agricultural outcomes.

This study adds to the overall understanding of smallholder maize production dynamics in Kenya by determining the relative impact of different socioeconomic factors.

The evidence provided lays the groundwork for developing tailored interventions to boost farmer resilience, increase production, and promote long-term food security.

Recommendations

The study's results suggest that smallholder farmers in Kapseret Sub-County and other parts of Kenya could benefit from a number of policy changes that would improve maize production.

a) Governments, banks, and development partners need to work together to help smallholder farmers get easier, more affordable credit. That means offering lower interest rates, relaxing collateral rules, and creating input credit programs. With these changes, farmers can get the seeds and supplies they need on time, and that leads to better harvests.
b) Secondly, it is very important to make agricultural extension services stronger. The government and other interested parties should put money into hiring more extension officers and giving them better tools to give farmers timely and useful advice.
c) Third, policies should encourage productive land use and high land productivity. Even though there may not be much room for land expansion, farmers can be helped by programs that promote intensive farming methods, like integrated soil fertility management and climate-smart agriculture. Programs that make it easier for farmers to consolidate their land or work together on farms may also help them save money.
d) The government should work with agricultural extension services, research institutions, NGOs, and farmer cooperatives to push for smarter land use. That means putting real support behind climate-smart farming, better ways to manage soil fertility, and land consolidation projects. All of this boost’s productivity and helps farmers cut down their costs.
e) The government needs to lower the cost of production for small-scale farmers by providing subsidies for essential farm inputs such as certified seeds and fertilizer, and by making mechanization more accessible at a lower cost.

References

Abate, T., Fisher, M., Abdoulaye, T., Kassie, G. T., Lunduka, R., Marenya, P., & Asnake, W. (2021). Characteristics of maize cultivars in Africa: How modern are they and how many do smallholder farmers grow? *Agriculture & Food Security, 10*, 1–17.

Abate, T., Menkir, A., MacRobert, J. F., Tesfahun, G., Abdoulaye, T., Setimela, P., Badu-Apraku, B., Makumbi, D., Magorokosho, C., & Tarekegne, A. T. (2013). *DTMA highlights for 2012/13*. International Maize and Wheat Improvement Center (CIMMYT).

Adjognon, S. G., Liverpool-Tasie, L. S. O., & Reardon, T. A. (2017). Agricultural input credit in Sub-Saharan Africa: Telling myth from facts. *Food Policy, 67*, 93–105. https://doi.org/10.1016/j.foodpol.2016.09.014

BenYishay, A., & Mobarak, A. M. (2019). Social learning and incentives for experimentation and communication. *The Review of Economic Studies, 86*(3), 976–1009.

Fabregas, R., Kremer, M., & Schilbach, F. (2019). Realizing the potential of digital development: The case of agricultural advice. *Science, 366*(6471), eaay3038. https://doi.org/10.1126/science.aay3038

Karlan, D., Osei, R., Osei-Akoto, I., & Udry, C. (2014). Agricultural decisions after relaxing credit and risk constraints. *The Quarterly Journal of Economics, 129*(2), 597–652. https://doi.org/10.1093/qje/qju002

Kilic, T., Palacios-López, A., & Goldstein, M. (2015). Caught in a productivity trap: A distributional perspective on gender differences in Malawian agriculture. *World Development, 70*, 416–463.

Liverpool-Tasie, L. S. O., Adjognon, S. G., & Reardon, T. A. (2020). Transformation of rural food systems in Africa: The role of agricultural input markets. *World Development, 135*, 105081.

Muyanga, M., & Jayne, T. S. (2008). Private agricultural extension system in Kenya: Practice and policy lessons. *Journal of Agricultural Education and Extension, 14*(2), 111–124.

Muyanga, M., & Jayne, T. S. (2019). Revisiting the farm size–productivity relationship based on a relatively wide range of farm sizes: Evidence from Kenya. *American Journal of Agricultural Economics, 101*(4), 1140–1163.

Ndegwa, R. M., Mugwe, J., Mucheru-Muna, M., & Njiru, D. M. (2023). Integrated soil fertility and water management practices for enhanced agricultural productivity. *International Journal of Agronomy, 2023*, 8890794. https://doi.org/10.1155/2023/8890794

Sheahan, M., & Barrett, C. B. (2017). Ten striking facts about agricultural input use in Sub-Saharan Africa. *Food Policy, 67*, 12–25. https://doi.org/10.1016/j.foodpol.2016.09.010

Wossen, T., Abdoulaye, T., Alene, A., Feleke, S., Menkir, A., & Manyong, V. (2017). Measuring the impacts of adaptation strategies to drought stress: The case of drought tolerant maize varieties. *Journal of Environmental Management, 203*, 106–113. https://doi.org/10.1016/j.jenvman.2017.06.058

Woomer, P. L., Roobroeck, D., & Mulei, W. (2023). Agricultural transformation in maize producing areas of Africa. In *Agricultural transformation in maize producing areas of Africa*. IntechOpen. https://doi.org/10.5772/intechopen.112861