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Examining the Effects of Drought on Maize Production among Smallholder Farmers: A Case Study of Petauke District, Nyika Ward

[1] Edward Ngosa, [2] Taranhike Keresia

[1, 2] Department of Social Research, Information and Communications University, Lusaka, Zambia

Corresponding Author: **Edward Ngosa**

Abstract

Drought is increasingly becoming one of the most critical environmental challenges in Sub-Saharan Africa, including Zambia, affecting maize growth, reducing yields, and undermining food security. The general objective of the study was to examine how drought influences maize production among smallholder farmers. Specifically, the study aimed at examining the drought coping strategies adopted by smallholder farmers, determining the effectiveness of these strategies on maize production, and assessing the impact of drought on maize yields and household food security. The study utilized an exploratory case study design focusing on Nyika ward in Petauke District. The main research tool was a semi-structured questionnaire consisting of both open-ended and closed-ended question. Additionally, Chi-square tests were conducted to examine the relationship between drought coping strategies and maize production outcomes. Quantitative data was analyzed using STATA software, applying descriptive statistics such as frequencies, percentages, and means to highlight patterns and trends. The study examined drought adaptation strategies and their effectiveness among smallholder maize farmers in Petauke District. Irrigation (46%) and drought-resistant seed varieties (27%) were the most common strategies and maize insurance remained least common at 2%, though access to irrigation and resilient seed remained limited. Various drought copying strategies were practiced, with 70% reporting it as effective or very effective. Financial support was rarely accessible (8%). Chi-square analysis revealed a significant association between drought frequency and maize yield reduction ($p<0.001$), as well as between yield reduction and income loss ($p<0.001$). Strengthening drought resilience requires improving access to affordable drought-resistant seed, expanding small-scale irrigation, and enhancing extension services. Farmer training, peer learning, and timely weather information are vital for adoption of climate-smart practices. Expanding financial services, including microcredit and insurance, can help smallholders manage risks and recover from drought-related losses effectively.

Keywords: Effects of Drought on Maize Production, Small Holder Farmers, Petauke District

1. Introduction

1.1 Background

T.C, Christine. C, (2023). Between 1895 and 2010, on average, around 14 Percent of the United States was experiencing severe to extreme drought in any given year. The Dust Bowl era of the 1930s was the most notable drought event in the U.S. The three longest drought episodes occurred between July 1928 and May 1942, July 1949 and September 1957 (the 1950s drought), and June 1998 and December 2014. Each of these drought episodes covered 60 Percent or more of the contiguous United States at its peak and lasted 99 months or longer (NCEI; Heim 2017), and affected maize production up to 42.7%, yield loss due to extremely dry events more than 80%. (Zipper *et al*. 2016). This led to the following interventions such as increased water use efficiency by switching from flood to drip irrigation, which reduced water use about 20%. Other methods were expanding and consider water recycling infrastructures and storm water capture technologies. (Olivias Lal, 2023).

Historical experienced in Zambia showed that droughts had consistently disrupted maize production cycles, with notable instances in 1992, 2015, and 2019 resulted in national food insecurity and the need for external food assistance (Bwalya, 2025). Zambia had adopted several policy frameworks to address climate variability and promote agricultural resilience. These included the National Climate Change Response Strategy, National Agriculture Policy, and the Eighth National Development Plan (Zulu, 2022). While these policies acknowledged the risks posed by drought, implementation challenges such as

inadequate funding, limited technical capacity, and weak extension services constrained their effectiveness at the local level (Chisha, 2023). Recent developments in climate science and agricultural extension had introduced new tools such as seasonal climate forecasts, mobile-based advisory services, and conservation agriculture practices (Chikanwa, 2024). However, the extent to which smallholder farmers in Petauke District are adopting these innovations remains unclear. This study, therefore, aimed to examine the specific effects of drought on maize production in Petauke District, taking into account the socio-economic context, local farming practices, and available support mechanisms. The findings are expected to inform targeted interventions and policy reforms that can enhance the resilience of smallholder farmers to recurring droughts.

1.2 Statement of the Problem

Zambia experienced the driest agricultural season in more than forty years, which resulted in significant maize losses, leading to worsening poverty. Over 9 million people in 84 out of the 117 districts were affected. (Government Crop Assessment data, 2024). The 2023/2024 rainfall season was characterized by late onset and prolonged dry spells, affecting smallholder farmers with a total of 982,765 hectares out of 2,272,931 hectares of maize planted were destroyed by drought, which led to total maize failure, mostly in Central, Eastern, Southern and Western provinces of the country (ZMD, 2024). The drought impacted areas people where about 2.04 million, 58,000 people were estimated to be in Emergency (IPC Phase 4) and 1.9 million people in Crisis (IPC Phase 3). 67 of the 76 districts were hotspot. Therefore, this study was necessary to examine the current effects of drought on maize production, examine local coping mechanisms, and inform policy and programmatic responses.

1.3 Objectives of the Research Study

The general objective of this research is to examine the effects of drought on maize production among smallholder farmers. Specific objectives include the following: To examine the adaptation strategies employed by smallholder farmers in response to drought in maize farming. To determine effectiveness of drought coping strategies employed by small holder farmer's on maize production. To assess the effect of drought on maize yield and household food security among small holder farmer's.

1.4 Research Questions

1. What adaptation strategies are smallholder farmers using in response to drought in maize farming?
2. What is the effectiveness of drought coping strategies employed by small holder farmer's on maize production?
3. What's the effect of drought on maize yield and household food security among small holder farmer's on maize production?

1.5 Theoretical Framework

This study utilizes a multi-theoretical approach to examine the relationship between drought and maize productivity, the framework establishes a comprehensive understanding of the drought and agriculture productivity.

Under Ricardian theory on climate and agriculture productivity, provides evidence on the impact of climate change on agriculture, been a sector that's very susceptible to climate change and variability (Seo and Mendelsohn, 2007, Yongfu *et al*., 2013). Both laboratory experiments and field experiences affirm that agriculture yields the highest growth and production under specific climatic conditions (Mendelsohn & Dinar, 2009). Hence, any changes in the climate can impact farm yields. Moreover, crops can be indirectly affected by changes in the climate, for instance through the availability of water, expansion of weeds, and infestation of pests (Mendelsohn and Dinar, 2009, Molua, 2009) It's based on the idea that land values reflect the best long-term revenues a farmer can achieve. The model considers a number of factors, including: Climate, the Ricardian model uses climate variables to estimate the value of climate to agriculture; Ricardian model considers soil data as a factor in determining land values. Ricardian model includes adaptation choices farmers would make to adapt their operations to a changing climate. (Seo, S. Niggol Mendelsohn, Robert. 2008).

2. Literature Review

2.1 Adaptation strategies employed by smallholder farmers in response to drought in maize farming

Felipe. Z, Mónica. M.J.T, Cesar. S.E, (2021). In Chile Small scale agriculture was one of the fundamental sectors. An increased frequency and intensity of extreme weather events such has drought due to climate change suggested a higher weather risk for the future, with potential consequences for maize production. (7th Chilean National Agriculture and Forestry Census) Explored small scale farmers' cropland decisions had adaptation strategy to cope with droughts, by using remote sensing data to identify drought events. Farmers in dry land areas reduced high risk cropping activities after recent drought shocks by choosing crops with shorter growing periods, resistant crop varieties were one of the most important adaptation strategies in Chile. Furthermore, Freshwater for irrigation was most common strategy used by small holder famers for water conservation under climate change applied irrigation systems under pressure, such as drip irrigation on the maize farms, which has low tolerance to drought stress and waterlogging conditions. (Zuniga *et al*., 2021). Crop diversification was another important factor increased maize yield because it's a drought sensitive crop. Lastly agricultural insurance provided protection against losses from maize production risk by transferring the risk of loss from one entity to another in exchange for a premium, which prevented a large and possibly devastating loss to a farmer. (Nobuhle D. M and Makhura M.N., 2018). Samuel K. N. Dadzie (2023).

In Ghana drought had been manifesting in the central region through increasing temperature and decreasing rainfall amidst high variability. Maize farmers had experienced incidents of droughts that had a highly impacted negatively on their production and livelihoods in the Central region of Ghana. However, smallholder farmers developed different drought coping strategies that included, irrigation, crop insurance, and Adjustment in planting and/or harvesting times (Lolemtum *et al*., 2017).

Drought tolerant maize variety similar to Chile (Zuniga *et al*. 2021) was another strategy employed. Several drought tolerant maize varieties had been introduced and utilized in Ghana to combat the effects of drought. Crop diversification and intercropping are widely adopted strategies among smallholder farmers in Zambia and this reduced the risks

associated with drought and improve resilience in maize farming systems (Mihrete, 2025). Instead of relying solely on maize, which is highly vulnerable to water stress, farmers incorporate a variety of other crops that were more tolerant to drought or had shorter growing cycles. (Mpala, 2024). Additionally, rain water harvesting in regions where water resources were available or accessed, harvesting rainwater provided a way to capture and store water during the rainy season for use during dry periods, that was collected from rooftops, farm surfaces, or small catchment areas, directing it into storage facilities such as tanks, ponds, or reservoirs (Biswas, 2025). Another strategy was, Institutional support, such as subsidies for irrigation equipment, technical training, and community-based water management programs, can help overcome these barriers, when Governments and NGOs often promote rainwater harvesting through the construction of communal water tanks, terraces, and small dams that enhance water availability at the community level (Renwick, 2020). Lastly, access to climate information and agricultural extension services plays a crucial role in helping smallholder farmers adapt to drought conditions and improve maize production (Martey, 2020). Farmers increasingly rely on timely and accurate weather forecasts, advisory services, and training sessions to make informed decisions about crop management.

2.2 To evaluate effectiveness of drought coping strategies employed by small holder farmers on maize production

One potential impact of climate change was drought affecting small holder farmers on maize production in China, Zhang (2018). This risk was further exacerbated by climate change (Snidvongs *et al*., 2003; He & Zhang, 2005) as well as existing vulnerabilities. In order to counteract the effect of drought on maize production among small holder famers, farmers employed various droughts coping mechanism and increased maize yield. Firstly, Planting density and management employed as drought coping strategies increased China's maize production sufficiently and roughly doubled planting density and management, with estimated of 52% yield improvement through dense planting and soil improvement. Secondly, environmental factors improved maize production by 8.5% to 17%, that relied on complex interactions between genotypes, environmental factors (including climate and soil conditions), and agricultural management8. (Lower Niobrara, Tri-Basin, and Upper Big Blue) in Nebraska illustrates that climate trends and agronomic. However, irrigation served as an important means in counteracting the adverse effects of drought by alleviating heat and water stress on crops, maintaining soil moisture, and providing local cooling effects (IPCC, 2023). Irrigation improved maize production by nearly 4 times greater than the yield losses caused by climate change. Maize showed the largest yield increase from irrigation, particularly during critical growth stages and increased maize yields by up to 38 % (Nandan *et al*., 2021). Maize yield insurance was also among small holder farmers. government of China provided insurance on maize production to more than 60% in Jiangsu, 55% in Shandong, 20% in Sichuan, an as it insured farmers' welfare in enhancing resilience to drought as a coping strategy by protecting farmers from devastating losses, stabilizing household food security, and promoting investment in agriculture (Ke W, Journal of Integrative Agriculture, 2015). Franklin. S, and Emily. A (2019). In Uganda the effectiveness of drought coping strategies such as the adoption of drought-tolerant maize varieties on average maize yield, yield stability, risk exposure and resource use in rain fed among smallholder maize farmers was evaluated. The adoption of drought-tolerant maize varieties increased yield by 15% and reduced the probability of crop failure by 30%. Further showed that the adoption of these varieties increased investments in maize production at the extensive margin through maize area increased and to a more limited extent at the intensive margin through mechanization. (Hill *et al*., 2017). The yields were higher for DTMV and other improved varieties compared to local varieties. Adaptation had a positive impact on yield for adopters. It shows that the treatment effect for DTMV adopters was +0.96 which was equivalent to a 15.4% increase over the average yield. However, the yield of non-adopters reduced by 2%, if they had adopted DTMVs, had increased maize productivity by 18.9% compared to the 14% when DTMV yields are compared against other (non-DTMV) improved varieties. This compares reasonably to earlier estimates of a 25% yield advantage of improved maize varieties over local maize varieties in Africa (Smale and Jayne, 2003). Impacts of drought-tolerant maize production, adoption increased the area planted with maize by 0.29 ha, representing 59% increase.

In Zambia DTMV adoption as a drought coping strategies had increased maize yields by 23%, these results illustrated that Drought coping strategies on maize production can serve as productivity, as well as reducing yield variability and minimizing the risk of crop failure by 36%, Olaf. F, Franklin. S. (2019). However, Crop insurance was given to the farmers for protecting them against the loss of crops due to the occurrence of mainly natural disasters like drought, as It was a strategy used by farmers and maize producers to protect them against the unexpected loss of maize yield that lowers the revenues and profit margins (Sinha & Tripathi, 2016). On the other hand, Minimum tillage and crop rotation mitigated the adverse effects of climate variability, increasing maize productivity by 26%, respectively. Furthermore, the promotion of cost-effective technologies, such as simple irrigation systems, enhanced maize production to 21%. (Maureen M. 2024).

2.3 To assess the impact of drought on maize yield and household food security among small holder famers

In Argentina, the milder drought events generated relative losses of up to 6.2% in 2003/2004 and at least 1.3% in 2007/2008. A comparison of the relative losses of maize production among small holder farmers showed a different level of impact between the maize productions. Considering the highest severity event, the relative losses of maize production were 50.8%. (Food and Agriculture Organization 2020). Droughts in Argentina significantly impact maize production, ultimately affected household food security. Prolonged drought conditions, like those experienced in 2022-2023, lead to reduced maize yields, increased food prices due to reduced supply which led to higher maize prices, making it less affordable for consumer mostly vulnerable households, especially those reliant on maize for food security, were particularly affected by increased prices and reduced availability, and diminished access to food, particularly for vulnerable households, Farmers experienced financial losses due to reduced yields and forced to sell their maize at lower prices. Maize was a crucial staple food and a

major export for Argentina, making it particularly vulnerable to drought induced production losses. (EO Thomasz, 2024).

In Malawi, the 2024 El Niño season, that started in November 2023, caused dry conditions and below average rainfall across, (WHH, 2024). El Niño was accompanied by a strong Indian Ocean Dipole that enhanced the effects of El Niño from November 2023 until March 2024 that led Malawi to experience a delay in the onset of its customary rainy season. El Niño reduced farm production; disrupt food value chains yield by 22.5% due to maize yield loss that exceeded 30% on average resulting in high poverty rates. Determined that 4.4 million people constituting 22% of the nation's population, faced high acute food insecurity (IPC Phase 3 or above) between June 2023 and March 2024. During the height of the lean season in February and March 2024, approximately 2,460,000 individuals in the Southern Region equivalent to 29% of its populace required humanitarian aid. El Niño disproportionately impacts the southern region of Malawi RIAPA showed a reduction in maize production by 8.3% and 22.5% decline in total maize production among small holder farmers (IFPRI). Owing to the critical drought, that has led to crop production to decline (RIAPA) including maize production by 8.3% using the scenario of the average impact over 11 El Niño years, and a 20% in the scenario based on 7 El Niño years, on account of the forecasted El Niño conditions. Compromised household livelihoods, erode household consumption capacities by 3.4% using the and 6.7%, urban residents with higher loss in their consumption capacities than rural areas-5.3% - 12.2%, while rural resident experienced maize yield reduction of 2% - 2.6% reduction in their consumption capacities. The dietary diversification remained limited, and almost 60% of households in all districts. (FAO, 2024).

In Zambia, the lack of rainwater had destroyed one million hectares of maize (almost half the country's maize under cultivation) (UN RC Zambia/UNICEF 2024). Over six million people from farming households were at risk of acute food shortages and malnutrition. According to the latest IPC figures, over 23% of the population faced Crisis (IPC Phase 3) or worse food insecurity levels between October 2023 and March 2024 (IPC2023). As at 6 March, the need for urgent support, particularly for food and clean water, had increased (Oxfam 2024). Maize prices had risen by over 30% compared to the same period in 2024 and were nearly double the five-year average (FEWS NET 2024). The estimated national level household food expenditure required to meet basic food needs showed that, in May 2023, the average cost of a standard food basket was ZMW 1,257 (US 68.70), representing a 6.9% increase compared to the first quarter of 2023.

Poverty was another factor, over half of Zambia's population grapples with extreme poverty, living on less than USD 1.90 per day (CARE 2023, WFP 2023, WB, 2020). Poverty was particularly harsh in rural areas, where communities rely heavily on rain-fed agriculture for their livelihood. In 2022, the rural poverty rate was 78% (ZSA 2023).

2.4 Establishment of Research Gaps

Limited causal analysis of drought mitigation strategies: Most studies describe drought impacts and correlations but lack rigorous, quantitative assessments of how specific mitigation practices such as drought-tolerant maize adoption or irrigation directly affect yield outcomes and farmer resilience across diverse smallholder contexts. Neglect of peri-urban and urban smallholder farmers: Research predominantly focuses on rural smallholders, overlooking the vulnerabilities, adaptive capacities, and unique challenges faced by peri-urban and urban farming systems, which are expanding rapidly due to urbanization. Insufficient exploration of social inequalities in drought vulnerability: There is a lack of detailed investigation into how factors like gender, age, and social status intersect to influence farmers' drought exposure and ability to adopt adaptive measures. Inadequate analysis of climate information dissemination and accessibility: Few studies examine the effectiveness of communication channels for delivering climate forecasts and early warnings to farmers. Technological and infrastructural constraints in accessing climate data: Research rarely addresses how limited access to digital tools, internet connectivity, and mobile technology affects the uptake and utilization of climate services, particularly among marginalized groups such as women and low-income farmers. Weak evaluation of agricultural extension services' role in drought preparedness: There is limited evidence on how extension systems translate climate information into actionable advice or support farmers in adopting drought-resilient practices. Limited focus on long-term sustainability and scalability of drought adaptation interventions. Underrepresentation of farmer perspectives and indigenous knowledge: Few studies incorporate farmers' own experiences, knowledge, and preferences regarding drought risks and adaptation strategies, which can provide valuable insights for designing contextually relevant interventions.

3. Research Method

The current study adopted a cross-sectional Case study design, utilizing a quantitative approach to collect primary data. This design facilitated data collection at a single point in time, providing a snapshot of the variables under examination. By employing a quantitative methodology, the study gathered numerical data and applied statistical analysis techniques to identify patterns, draw conclusions, and explore relationships between variables.

3.1 Target Population

By definition, a population is defined as a collection of objects, events, or individuals sharing common characteristics that the researcher is interested in studying (Taherdoost, 2021). The target population for this study consisted of smallholder farmers in Nyika ward Petauke District.

3.2 Sample Size

A sample is a subset of a population that is used to represent the entire group (Hennink, 2022). The sample size for this study consisted of 70 respondents.

3.3 Sampling

The researcher will use Simple random sampling method in quantitative studies with survey instruments (Noor, S., Tajik, O. and Golzar, J., 2022). Is to be used, because it will allow for probability sampling in which the researcher will randomly select a subset of participants from a population. Each member of the population to have equal chance of being selected. Data will then be collected from as large a

percentage as possible of this random subset, and the rationale behind the use of simple sampling, is because this method will not involve the use of the researcher's knowledge of the population in terms of research goals.
Population 500 using manual method
↓ Assigned numbers from 1 to 300
↓ Prepared slips from 1 to 300 in a box
↓ Random draw by Picking 70 slips
↓ Sample selected (70 respondents)
The individuals who corresponded to those numbers were picked as sample.

3.4 Data Collection Methods
The main research tool used in the study was a semi-structured questionnaire consisting of both open-ended and closed-ended questions. Primary data was collected through structured surveys.

3.5 Data Analysis
Data entry and statistical analysis was done using STATA. Graphical presentation of descriptive statistics was done using Microsoft Excel 365. Chi-square was used for inferential statistics in order to determine the relationships between the variables. Thematic analysis will be used to analyse qualitative data.

4. Findings and Results
4.1 Characteristics of participants (Bio Data)
Figure 4.1.1 70 out of 70 respondents come from Nyika ward; hence the findings therefore reflect the situation, experiences, and perceptions of farmers only within this ward. While this ensures consistency and gives a clear picture of conditions in Nyika.

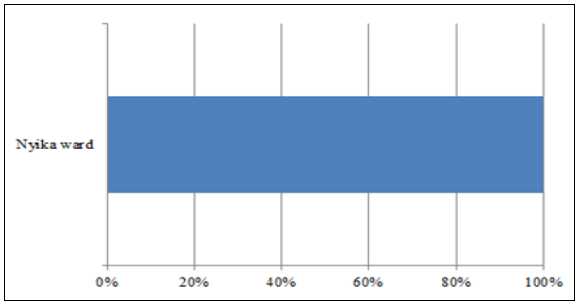

Fig 4.1.1

The results show that 59% of the respondents were female and 41% were male indicating that the majority of smallholder farmers in the study area are women; hence women play a more dominant role in maize production and household food security. It also highlights the importance of targeting women in agricultural interventions, capacity-building programs, and access to resources such as credit, inputs, and training.

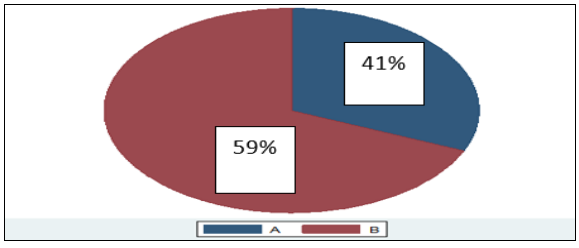

Fig 4.1.2: Gender

The majority of respondents (60%) were aged 18–30 years. This was followed by 20% aged 30–39 years, and 10% each in the 40–49 and above 50 years age groups.

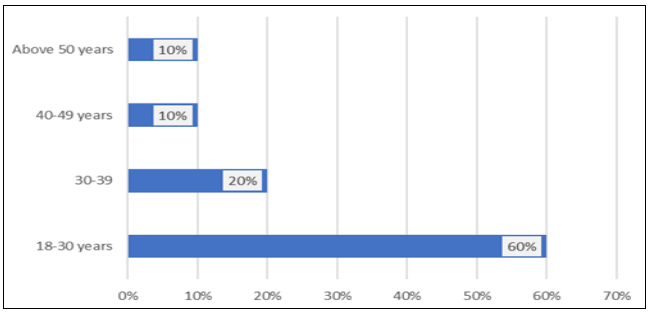

Fig 4.1.3: Participant's Age

Half of the respondents (50%) had attained a higher education diploma or certificate. 20% held a bachelor's degree, another 20% had a secondary school certificate, and 10% had completed only primary/basic school.

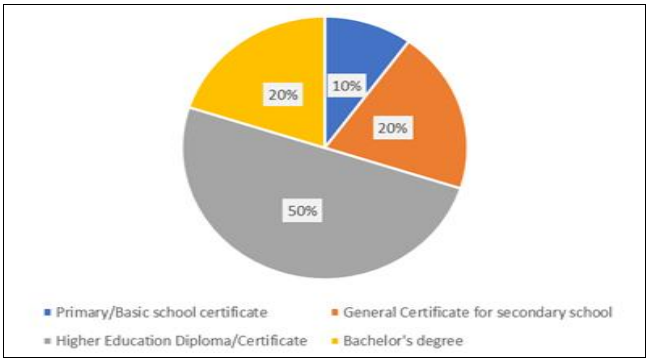

Fig 4.1.5: Education Background

4.2 Adaptation Strategies Adopted by Smallholder Farmers in Response to Drought
Out of 70 respondents the majority representing 25% had been in maize production as a small scale holder farmer for 5 years. This is followed by 21% for three years, 18% with 4 years, while 14% for 7 years, which is seconded by 13% for 8 years and lastly 4% for 10 and above years. This shows experience in maize farming and ability to deal with drought.

Fig 4.2.1: Years in maize production

Years in maize farming	Frequency	Percentage
2	4	3
3	15	21
4	12	18
5	18	25
6	8	13
7	10	14
10	3	4

Majority of farmers 23 (34%) out of 70 there field maize production was between 5-10 acres, followed by 18 above 15 acres (25%), while 15 with less than 5 acres (21%) and concluded with 14 between 10 to 15 (20%) acres. This structure shows good farming and implies that interventions such as drought coping strategies, improved seed varieties, and access to irrigation be tailored differently supporting smallholders for food security while enhancing productivity.

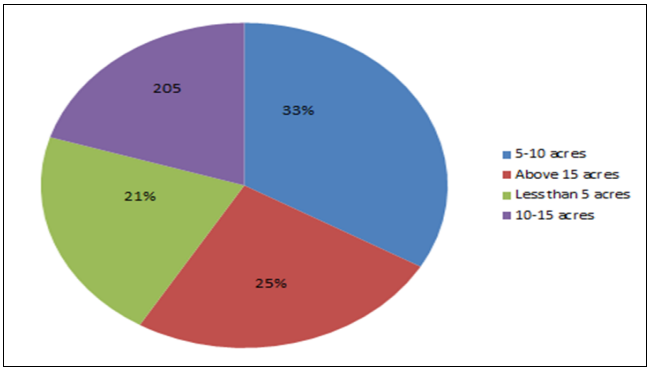

Fig 4.2.2: Size of maize farm

All respondent had experienced drought in the last five years, representing 100%.

The finding underscores that drought is not an isolated problem but a systemic threat to maize production and household food security. It also signals an urgent need for both short-term coping mechanisms and long-term policy interventions.

Fig 4.2.3: Drought experience in the last five years

The most commonly used method to cope with drought is irrigation, reported by 46% of respondents, followed by use of drought-resistant seed varieties (27%), shift farming season (19%), farming migration (6%), and Maize agriculture insurance (2%). This indicates that most respondents rely on irrigation and improved seed varieties as primary coping strategies.

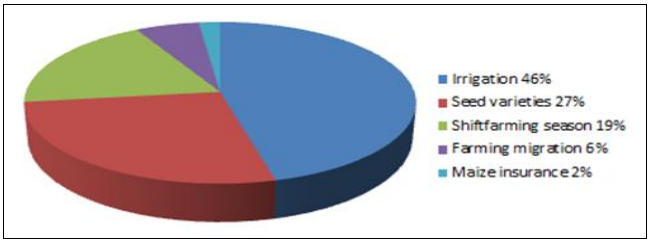

Fig 4.2.4: Drought copying strategies used

Respondents view information gaps (28%) and high input costs 23% as the most pressing constraints to coping with drought and improving farming, water shortage 19% and maize's vulnerability to drought are also significant, income 8% and land (9% ccess are issues but less widely reported compared to information and cost barriers.

This suggests interventions should focus first on improving drought information systems, reducing farming input costs (subsidies/alternatives), and enhancing water management, while also addressing crop resilience and income generation.

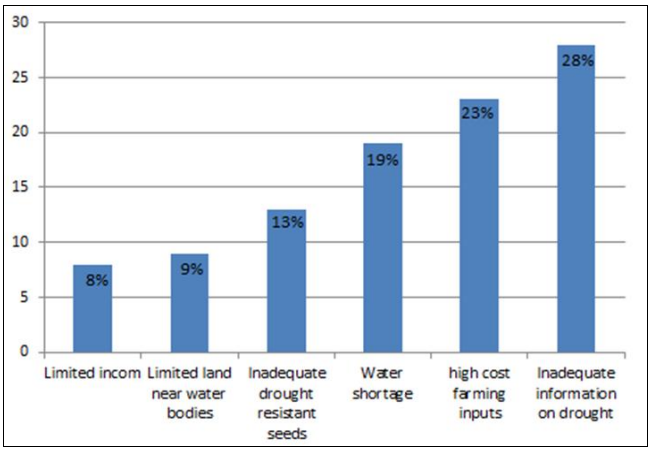

Fig 4.2.5: Challenges faced in the implementation of drought coping strategies

4.3 Effectiveness of drought coping strategies

The data shows that most respondents (49 out of 70, about 70%) rated the strategies as either fully (100%) or largely (75%) effective, which suggests that drought coping measures are generally successful in protecting maize production. However, a smaller portion (18 respondents, 26%) saw only moderate effectiveness (50%), and a very small minority (3 respondents, 4%) reported low effectiveness (25%).

This indicates that drought coping strategies are working well overall, but effectiveness is not uniform across all farmers.

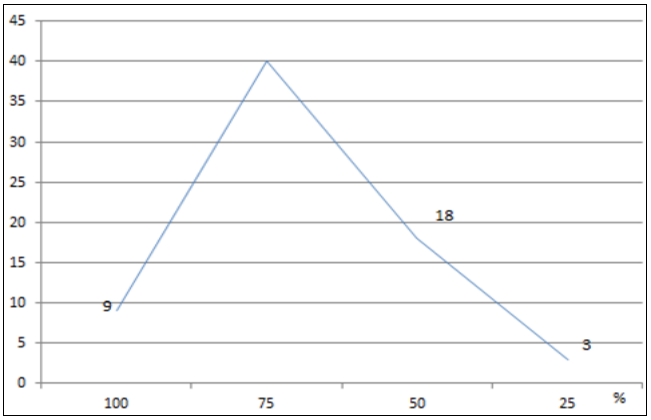

Fig 4.3.1: Extent to what drought copying strategies improved maize production

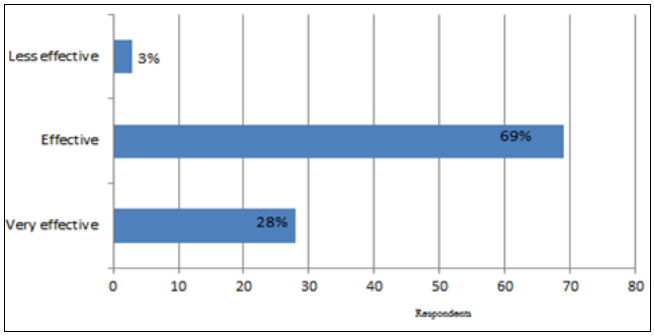

Fig 4.3.2: Effectiveness of various drought copying strategies on maize production

Most respondents (97%) perceive various drought coping strategies on maize production effective or very effective, which indicates that the strategies are generally working well in enhancing resilience and reducing the negative impacts of drought. However, small number found them less effective suggests that some gaps or limitations remain, and improvements or tailored support may be necessary to strengthen effectiveness for all farmers.

Traditional knowledge and practices remain highly valued and effective in coping with drought impacts on maize production, with overwhelming acceptance by the farming community 29% stating large extent. However, the presence of respondents reporting only medium (29%) or low extent (1%) highlights the need to integrate traditional knowledge with modern scientific innovations to strengthen resilience further.

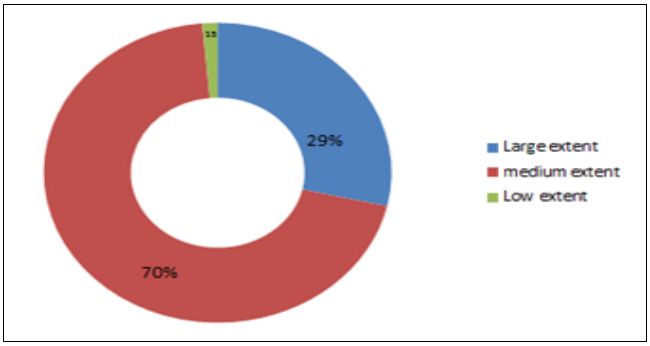

Fig 4.3.3: Effectiveness of traditional knowledge and practices such as irrigation, farming migration, early planting, intercropping, mulching, minimum tillage and crop rotation in enhancing maize production.

Government and Non-Governmental Organization interventions are generally perceived as moderately effective in enhancing drought coping strategies for maize production by 19 (27%) respondents. 42 (60%) who are the majority feel the interventions are moderately impactful, indicating gaps in coverage, sustainability, or effectiveness. The small percentage reporting low or no impact highlights that interventions are not reaching or benefiting all farmers equally in order to meet farmers' needs for drought resilience in maize production.

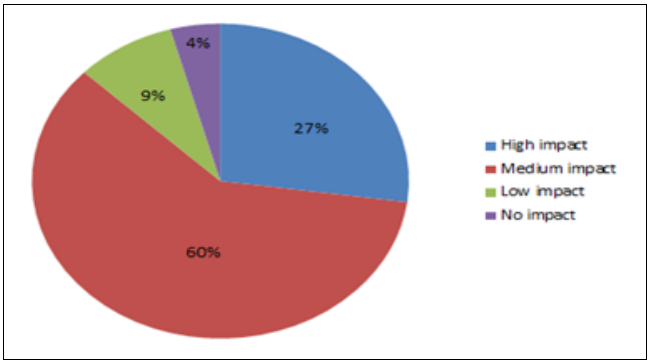

Fig 4.3.4: Impact of government and NGOs intervention on the effectiveness of drought copying strategies on maize production

42 out 70 Respondents strongly believe that information-based interventions (early warning systems) and financial risk protection (insurance) are the most effective policy approaches for improving drought coping strategies. Meanwhile, 28 respondents believe that structural and support measures such as government engagement, intensification of existing strategies, and water harvesting are also seen as important.

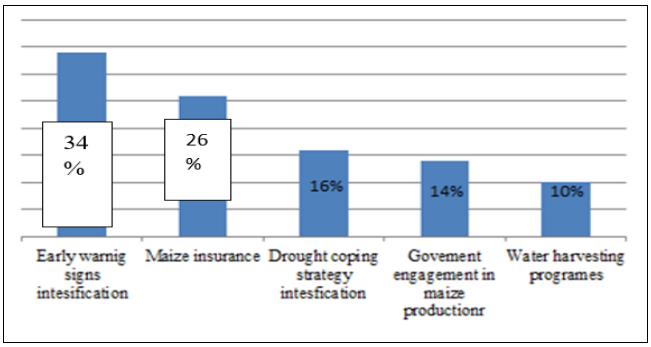

Fig 4.3.5: Policy intervention that can improve the effectiveness of drought copying strategies on maize production

4.4 Impact of drought on maize yield and household food security

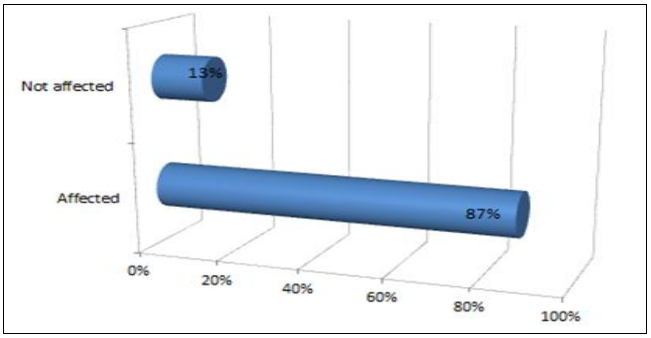

Fig 4.4.1: Local area affected by the impact of drought on maize yield and household food security

The findings showed that the majority of households (87%) were affected by the impact of drought on maize yield and food security, hence a major threat to both crop yield and household food security in the community, while only 13% indicated that they were not affected with better access to drought-resilient maize varieties, irrigation, diversified crops, or external support. This further, suggests that drought has had widespread and severe impact on maize production and food availability in the local area.

The findings showed that drought critically undermines maize yield, thereby worsening food insecurity for the majority of households from 43 respondents (61%), while only a small fraction remained food secure, likely due to better resilience measures.

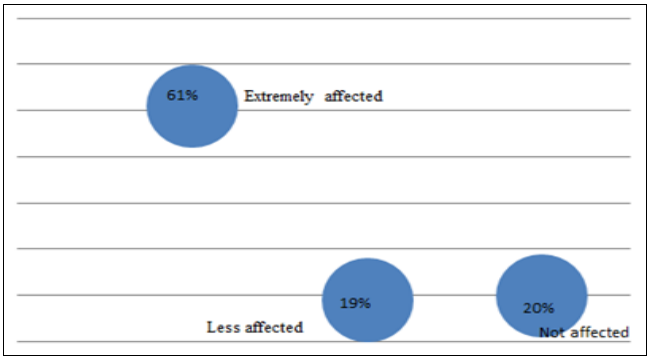

Fig 4.4.2: Extent to what drought on maize yield affected household food security.

The graph shows that drought severely undermines household and food security, with the most significant impact being increased poverty as indicated by 29 respondents. Secondary effects like social stress according to 13, health challenges, and even family breakdowns highlight that drought has both economic and social consequences, extending beyond food shortages to affect the overall stability and well-being of communities.

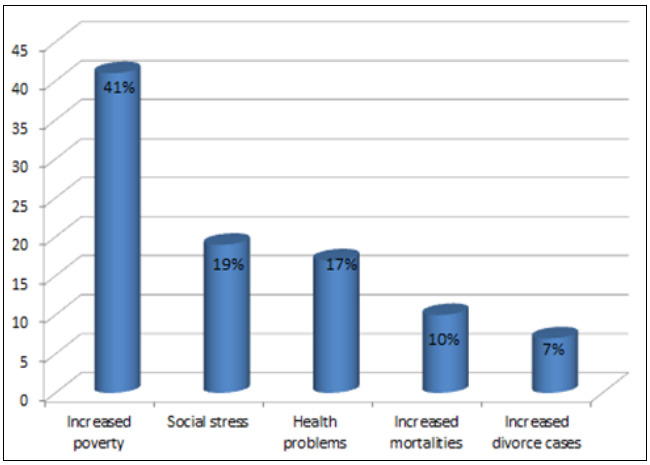

Fig 4.4.3: Social economic impact of drought on maize yield and household food security

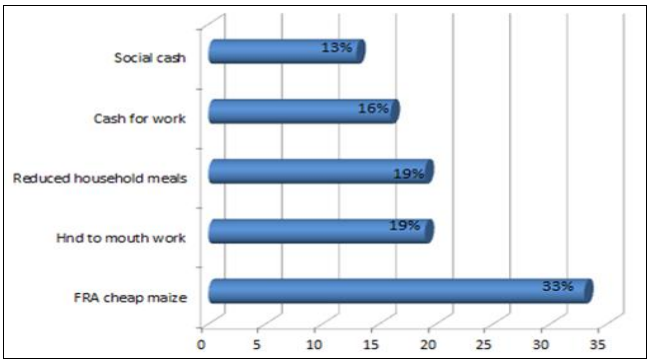

Fig 4.4.4: Short term solution to the effect of drought on maize yield on household food security

Data showed 33% affected households by drought on maize largely depended on government maize subsidies (FRA cheap maize) to cope with reduced maize yields. However, a significant portion resorted to coping strategies that compromise household welfare, such as cutting down meals or relying on hand to mouth labor. This highlights that while institutional interventions (like FRA maize and cash-for-work) played a huge role, while 13% depended on Social cash transfers, possibly due to limited coverage or accessibility of such welfare programs.

The long-term solutions to drought impacts on maize yield and household food security require a combination of preventive, production-enhancing, and protective measures. 34 out of 70 (35%) indicated that early input distribution to strengthen production readiness, while 24% (17) policies against maize smuggling and programs that boost local production ensure food availability by Increased maize production started by 21% respondents. At the same time, maize insurance provides resilience by safeguarding households from total loss during drought years.

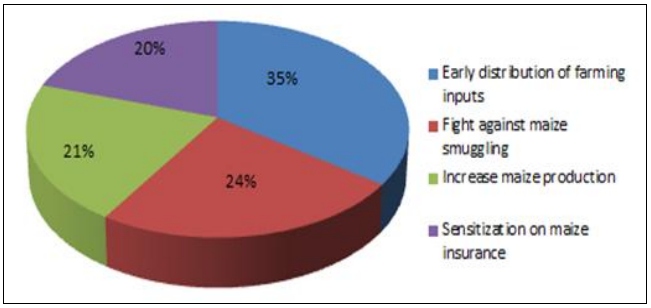

Fig 4.4.5: long term solution's on the impact of drought on maize yield and household food security.

4.5 Discussion of Study of Results

All of the people who took part came from Nyika ward, which is the main ward center in the peri urban part of Petauke District. By focusing on just one ward, we were able to get a detailed picture of how things really work in Zambian peri urban.

The majority of the samples (59%) were women, which is typical of agriculture sector in Zambia, especially maize farming. This is in line with national trends in human resources, with regards to population dominancy.

The study findings reveal that maize production in Nyika ward is dominated by relatively new entrants into maize farming on the basis that out of 70 respondents, the majority (25%) had only 5 years of experience in maize production. The second largest group (21%) had been in maize production for 3 years, followed closely by 18% with 4 years of experience.

23 out of 70, representing 34% cultivated maize on 5–10 acres of land. The second largest group (18 farmers, 25%) cultivated on above 15 acres, meanwhile, 15 farmers (21%) had less than 5 acres under maize. Lastly, 14 farmers (20%) cultivated 10–15 acres. this indicates that maize production in the area is characterized by land size diversity, ranging from very small to large-scale farming.

Drought experience revealed that all respondents (100%) had experienced drought in maize farming within the last five years in Nyika ward. This unanimous finding underscores the severity of drought, leaving no farming household unaffected.

Irrigation was the most widely used drought coping strategy at 46%, the second most common strategy was the use of drought-resistant seed varieties 27%, shifting the farming season at 19%, while farming migration 6%, only 2% used maize agriculture insurance as a coping mechanism.

Most pressing constraint to coping with drought and improving maize farming was information gaps with 28%, high input costs 23%, water shortage 19%, other constraints mentioned included limited land access near water bodies (9%) and low income (8%).

70% rated the drought coping strategies improved maize production to (100%) or largely (75%). A smaller proportion of respondents 26% rated the strategies as only moderately effective 50%.

70% acknowledged that traditional knowledge and practices as effective to a large extent, while 29% reported their effectiveness to a medium extent and only 1% to a low extent.

Government and non-governmental organization (NGO) interventions have had a mixed impact on enhancing drought coping strategies among maize farmers. A small proportion of respondents 27% rated the interventions as highly effective, while the majority 60% indicated that the interventions were only moderately impactful.

The study also showed that majority of respondents 34% identified early warning systems as the most effective intervention, secondly financial risk protection through maize insurance, drought coping intensification strategies 16%, meanwhile, government engagement in maize farming 14% and water harvesting programs 10%.

87% reported being affected suggests that drought not only reduces maize yields but also directly undermines household food availability, dietary diversity, and income security.

61% household food security indicated being extremely affected while 19% less affected, and 20% reported that they were not affected.

41% reported that drought induced declines in maize yield have led to increased poverty, social stress 19%, 17% households experienced health problems. 10% increased mortalities due to, malnutrition.

Short-term solutions to cope with the adverse effects of drought on maize yield and food security was Food Reserve Agency (FRA) maize, at 33% of periods, 19%, was hand-to-mouth, reducing meal frequency or portion sizes. Cash-for-work programs, by 16%, lastly, social cash transfers by 13%.

Lastly long term solutions that households and policymakers consider effective in enhancing resilience against drought impacts on maize yield and household food security, 35% was early input distribution, 24% combating maize smuggling, to stabilize local markets. Increased maize production, reported by 21%. Finally, maize insurance 20%.

5. Conclusion

The study findings reveal that drought significantly impacts maize production among smallholder farmers in Petauke District. A substantial proportion of farmers reported recurrent drought experiences over the past five years, with clear consequences for both the quantity and quality of maize yields. Moderate yield and quality reductions were common, and these translated into lower income from maize sales and reduced cultivated land due to water shortages. In turn, this affected food security and discouraged continued engagement in maize farming for many households. In response to drought, farmers employed several adaptation strategies, with irrigation and drought-resistant seed use being the most frequently cited. However, the use of drought-resistant maize varieties remained limited, and access to irrigation was not universal.

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