
CROP ATTRIBUTES, FARM DECISIONS CROP SPECIFIC POLICIES IN THE CONTEXT OF SUSTAINABILITY OF PRODUCTION IN ETHIOPIA

Mohammed Endris Harun¹, Belaineh Legesse²

*Corresponding author E-mail: mohzein1@yahoo.com

ARTICLE INFO

Original Article

Received: 17 October 2023

Accepted: 30 November 2023

doi:10.59267/ekoPolj23041009E

UDC 338.43.01:633.1/.8(63)

Keywords:

*pro-poor policy, tradeoff,
subsidy, agricultural policy.*

JEL: Q18, I38, D81

ABSTRACT

Ethiopia's government has created a number of policies and programs to address the urgent issue of rising food prices. Extension and regulation initiatives aiming at influencing the production and marketing are frequently used in conjunction with them. However, lack of indices on relative importance of individual crops results poor policy outcomes. Analyzing household decision dynamics and how household decisions respond to policies is crucial to reduce persistent complaints from recipients and avoid negative policy outcomes. For this study, data from 392 randomly chosen households of Kewot woreda was used. Sorghum found with higher calorie index per profit while mung bean was found higher profit index. Crop diversification found inefficient that arise from profitability differences and return to scale. Additionally multiple objectives could be met using tradeoffs among different crop benefits. This study also summarizes major findings from previous crop-related policies and linked them to specific crop characteristics. It is advised that policies be adjusted to reflect the value, character, and utility of crops.

Introduction

Both industrialized and developing nations have used agricultural policies to boost agricultural output, social welfare, and economic redistribution. Numerous agricultural policies are advised in a large body of literature in order to increase agricultural output and rural social welfare. Agriculture's economy is significantly impacted by agribusiness policies (Shikur, 2020). Developing nations use agricultural policy to keep

-
- 1 Mohammed Endris Harun, Lecturer, institution, Department of Economics, College of Business and Economics, Ambo University, Ambo, Ethiopia, Phone +251911751079, E-mail, mohzein1@yahoo.com, ORCID ID (<https://orcid.org/0000-0001-7590-0001>); Center for Rural Development, College of Development studies, Addis Ababa University, Addis Ababa, Ethiopia.
 - 2 Belaineh Legesse, associate professor, School of Agricultural Economics and Agribusiness, Haramaya University, P.O. Box 148, Haramaya, Ethiopia, Phone +251112362616, E-mail, belaineh.legesse@gmail.com, ORCID ID (<https://orcid.org/0000-0003-2526-7193>)

the cost of agricultural products below market rates, allowing consumers to buy food at reasonable prices. To enhance crop yield and social welfare, many Asian and Latin American countries have implemented various price support and stability measures. The price instability that has harmed output since the 1960s is routinely controlled in Asian nations through the deployment of price support policies. These techniques have sped up the implementation of advances from the Green Revolution that enhanced crop productivity (Hazell, 2010).

Numerous agricultural policies have been implemented by the Ethiopian government with the goals of boosting productivity, stabilizing food prices, and as effective interventions. Removal of tariffs on agricultural equipment as part of its agricultural export plans to boost output and productivity. While edible oil, sugar, and rice are exempt from both import tax and any other kind of tax charge when sold locally, wheat is not subject to import tax. When imported and sold domestically, spaghetti and macaroni are exempt from value-added tax (VAT). Additionally, GoE imports food products using public funding, such as wheat, sugar, rice, and cooking oils, to fill the local supply shortfall and stabilize the home market. These imported food products are sold at discounted prices by means of regional cooperative unions and consumer associations (MOFED, 2022). The government of Ethiopia is also making continuing and encouraging efforts to change the food system, including requiring the fortification of staple foods and establishing multi-sectoral nutrition projects. The Ethiopian government implemented a number of policy measures, including monetary, fiscal, and structural ones, to curb price increases, but inflation rates are still in the double digits.

No matter who may legally be the owner of such property inside the home, the household head in Ethiopia practically has ultimate control over decisions on the use and disposal of property. Despite the wide variety of cultures, religions, and patrimonial traditions that constitute Ethiopia, both within and between regions, this system is applicable throughout the whole nation (Torkelsson and Tassau, 2008). Due to the increasingly uncertain climatic circumstances and market prices for agricultural inputs and products, more research is needed to fully understand these pathways (Barrios et al., 2008). This is especially true when trying to find compromises and win-win scenarios for agriculture's numerous objectives, including soil protection, carbon sequestration, time and labor savings, yield, revenue, and nutrition (Remans et al., 2011). Understanding the decision-making process' patterns will speed up policy implementation and reduce the cost of supervision.

Ethiopia's external debt to GDP is increasing and forcing the nation to become one of the world's Heavily Indebted Poor Countries. Today, debt and economic policy are closely related. This could force the nation to reduce its support for agriculture, which in turn would require only supporting certain crops in a systematic manner. Finding crop-specific solutions and ranking crop kinds according to particular criteria could be helpful in this approach. Utilizing income diversification to manage risk rather than insurances costs a comparative advantage. In order to determine the relative importance of crops, this study will use productivity and dietary metrics, as well as trade-off usage

gaps in crop-related policy. Both diversifications are used to be solution for adaptations but losing efficiency for insurance covered and lack of long term investments.

Review of Related Literatures

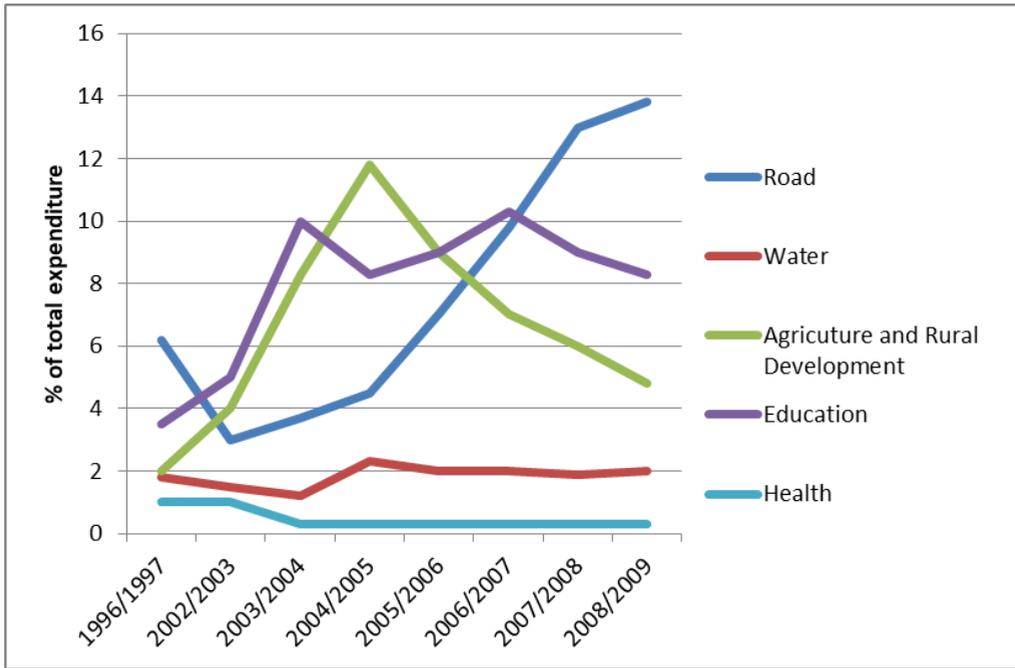
In the next ten years, it is expected that climate change will significantly influence the yields and distribution of staple food crops throughout Africa and elsewhere. Agriculture is thought to be the activity most at risk from climate change, according to some forecast reports (Raza, 2019). Climate change's possible effects could either improve or hinder crop-growing conditions in different regions. which could lead to changes in the types of crops grown in a particular area. According to FAO (2014), Ethiopia presented an agricultural development strategy that builds on the contributions of both corporate farmers and smallholder farmers in order to increase domestic food supplies. To eradicate hunger, it is planned to increase per person food production, especially cereal yields, by half, mostly by using more fertilizer. It's crucial to discover an effective crop selection and crop mix to lower production risk and increase production because the countries' diverse agro-climatic zones make the region conducive to cultivating a variety of crops (Ayal & Filho, 2017).

Governments and organizations working on development agree on the need to develop public policies that can facilitate agricultural transformation toward safeguarding food security and inclusive rural development in Africa. Increased employment and faster poverty reduction are two benefits of strong agricultural growth rates for the economic development of low-income countries. A dispersed spatial pattern of non-agricultural growth is produced by agricultural growth because it multiplies the employment benefits of the rural nonfarm sector (which includes small market towns) (Van Der Velde et al., 2007). To increase crop output without further depleting soil and water resources, farmland management must be improved.

Agricultural Policies of Ethiopia

Between the service, agricultural, and industrial sectors, there has been ongoing discussion about which should dominate Ethiopia's economy. In the past, the government has implemented the ADLI and GTP programs, with the main principles of agriculture led and reciprocal growth, respectively. Agriculture is among the main significant sectors in the recently launched ten-year economic growth plan of Ethiopia (GOE) (2021-2030). Over the following 10 years, the agriculture sector is anticipated to increase at a 6.2% annual rate (MoA, 2020). Public spending on sectors that benefit the poor has increased from 57% in 2004–2005 to 23% in 2016–17. The percentage of spending that has changed to be in favor of the poor and development is depicted in Fig. 1. In the coming years public investment in agriculture is expected to increase the new approached need to be adopted.

Figure 1. Trends in Pro-poor expenditure



Source: Adapted from von Brown et al. (2004)

The first Growth and Transformation Plan (GTP I), which was officially launched in 2006 E.C., included the Agricultural Transformation Agenda as a platform for addressing the most pressing systemic bottlenecks impeding the achievement of the government’s goals and targets for the agriculture sector.

Agricultural policies have been adopted by industrialized and developing countries to increase agricultural output and productivity, enhance social welfare, and redistribute wealth. The objectives of agricultural policies adopted by countries include achieving self-sufficiency, spreading income among economic players, assuring food supplies and reasonable prices for consumers. Industrial countries use agricultural policies to raise agricultural product prices above market prices, which transfers income from consumers to farmers, whereas developing countries use agricultural policies to lower agricultural product prices below market prices, giving consumers access to affordable food (Krueger et al., 1988). The welfare of rural households is influenced by agricultural assistance programs by developed nations (World Bank, 2003). Countries in Asia and Latin America have used various price support and stability measures to boost crop output and social welfare. Contrarily, several underdeveloped African nations relied on insufficient or nonexistent price support schemes to control the volatility of agricultural prices, which slowed productivity improvements and increased reliance on food imports. Low social welfare among producers is a result of the lack of price support measures in Africa (Demeke et al. 2012).

For the purpose of stabilizing domestic prices and promoting oilseed, plus, and coffee exports that may have a favorable influence on social welfare; the Ethiopian government has placed limits on the export of cereal products. The government has implemented export controls and tariffs on many agricultural commodities as part of its agricultural export policies. Following a drop in coffee prices on the world market, the tax on coffee exports was eliminated in 2002. To lower the cost of food for urban consumers, the government prohibited the export of important food grains. In an effort to lower domestic grain prices, teff, wheat, maize, and sorghum export bans were implemented in December 2006. A few agricultural inputs, including tractors, combine harvesters, insecticides, and herbicides, have been imported and made available to farmers by private businesses. Farmers' fertilizer distribution is handed to cooperatives as a monopoly (Habte et al. 2020).

Statement of the Problem

Since agriculture is a crucial sector for Ethiopia's economy, it must be transformed effectively if the nation is to meet its domestic food needs and improve economic performance. Ethiopia's population is expected to reach 145 million by 2030, according to World Bank (2022), necessitating the need for better decision-making procedures built on stronger institutional and human planning and execution capabilities. It forces the need for centralized agriculture and necessitates the employment of crop-specific distorting policies by the government. It is crucial to consider trade-offs between crops that might be cultivated in similar agro climatic zones as well as the advantages of each crop (Lencucha et al., 2020). Understanding the factors affecting crop choice and related issues is essential to making this policy effective in addressing the question of why good policies never come to pass as planned.

There are some pro-poor measures implemented by the Ethiopian government, however it is uncertain whether they will have the desired results. The various approaches must be assessed in order to create policies that bring about sustainable changes and comply with farmers. If effective, crop policy could have an impact on consumers and producers at the same time, affecting inflation and productivity, respectively. It may be claimed that as a result, how policy is handled in various circumstances will have a significant impact on how the country evolves in the future. In Ethiopia, various methods are used for various crops depending on their characteristics and economic significance. Among the frequent forms of intervention on which authors have opinions are subsidies and rules. The policy researches need to put more emphasis on how these limits and subsidies should be placed, to which crops and to what extent or how much. Therefore the objective of this study is to examine how farming decisions are made and interact with policies. The study is significant in Identification and estimation of calorie- revenue trade off help to uncover motivations in government attempts of redirecting farmers' crop choice.

Materials and methods

Data gathered through a questionnaire at the household level are used in the study. From March 2017 to March 2018, the survey was done as a part of a PhD thesis funded by Ambo University. 400 homes were included in the sample, however 8 were not used because of technical issues. A representative sample was chosen using a multi-stage sampling process. Purposeful selection of the Kewot woreda, which has a large number of smallholder farmers farming mung beans, was the first stage. Second, using a random sample technique, five woredas—Yelen, Shoarobit, Abay atir, Tere, and Kure Biret were chosen. The sample plan used Yamane’s (1996) estimating formula and was proportionate and representative. Numerous subjects were explored, such as household demographics, consumption habits, levels of spending, agriculture, livestock, production, and marketing. To create the variables used to gauge the degree of agricultural commercialization, the analysis used survey data.

Tradeoffs

Comparing calories produced by each crop form certain area

Comparing the profit per land allotted

Based on the two values crop usefulness index was computed.

Game theory approach to farm decision to policy link

Using the game theory rationality assumption, the decision-making of farmers was examined. The choice of that could be cultivated and its link with the strategic options A1, A2, A3,... And that will be presented in the form of a payment matrix. Table 1 will display this matrix.

Table 1. Pay of matrix of strategies

A	S			
	S ₁	S ₂	...	S _n
	P ₁	P ₂	...	P _n
A ₁	R ₁₁	R ₁₂	...	R _{1n}
A ₂	R ₂₁	R ₂₂	...	R _{2n}
⋮			⋮	⋮
A _m	R _{m1}	R _{m2}	...	R _{mn}

A = Set of strategic alternative A_i (for $i = 1, 2, \dots, m$)

S = Set of faced condition by S_j (for $i = 1, 2, \dots, n$)

R = Set of payoff R_{ij} by choosing strategic alternative A_i if facing S_j situation. P = Probability distribution of S

Source: Adapted from Adeoye (2012)

Making decisions about strategic alternatives involves deciding what crop will be planted. Assuming all farmers are rational and work to maximize their profits, the set of conditions they encounter includes risk and regulatory interventions. According to Adeoye et al. (2012), there are various characteristics to consider when utilizing game theory to determine the optimum strategic alternative for managing farming hazards.

Prior to establishing the risk management practices of horticulture farmers in accordance with the selection criteria, the measurement function must be built. According to Maximax standards, the farming industry is one that bears little risk. It shows that they are ready to take on any farming risks. The Maximin Criteria state that farmers are risk averse and would not be at all prepared to take this risk if anything terrible occurred or if they received the lowest price. The maxima criteria is a tactic for the optimistic person. The decision-maker will select the choice that, after accounting for all potential maximum rewards, will result in the best result. These constraints will produce results that are consistent with decision-makers that favor the greatest rewards and don't hesitate to take risks (Pazek, 2009).

Results

Women in farm decisions

Gender mainstreaming has increased gender engagement in non-agricultural activities (Dittoh, 2015). Their capacity to impact household decisions, particularly those pertaining to agriculture, received less attention ((Kinati & Mulema, 2016). This study aims to identify the role, level, and preferences of women's participation in agricultural decisions. Activities Women's participation in agricultural production and decision-making are influenced by social norms (Fernando, 2020). Effective decision-making on farms also requires consideration of the person making the decision. In addition to cooking and taking care of the household, women are observed to be involved in agricultural production activities.

Cleaning, seeding, and weeding are the particular tasks in which women are very engaged. Women are reported to be less involved in agricultural decision-making notwithstanding their involvement. For instance, as shown in table 10, 52% of respondents say they always consult their women while making farm decisions, whereas the other 48% only do so occasionally. According to 85% of respondents, women have a voice in deciding which crops are grown. This conclusion broadly agrees with those of Mulugeta and Amsalu (2014). Eighty percent of those who are hungry are women, and two thirds of them reside in climate change-prone regions.

Table 2. Women involvement in farm decisions

Variable	Category	Frequency	Percentage
Wife tell	Always	202	51.53
	Sometimes	184	46.94
	Never	6	1.53

Variable	Category	Frequency	Percentage
Role in crop choice	No	56	14.89
	Yes	320	85.11
Preference	Consumption		78
	Profit		22
Involvement in sales	High	176	44.5
	Low	216	55.1
Food purchase	Both	264	70.2
	Only women	112	29.8

Source: Own survey, (2018)

Table 2 shows that men (husbands) predominated in crop sales, with 55% of respondents rating the role of women in crop sales as low. Vegetables are even associated with low participation, which results in women having less liquidity than their male counterparts. Ednah et al. (2016) discovered similar outcomes when they discovered that females were losing control over income. Women's lack of financial resources affects their ability to bargain and changes their crop selection from one based on profit to one based on home consumption.

The results show that women's engagement in production decision-making is generally better than their marketing side. Even while it appears that women make decisions at the family level and in agricultural production operations, their influence in this area is negligible in comparison to that of men. Participants in both kebeles' agreed that the gender division of labor, which results in differences between husband and wife in the degree of decision-making authority, is a factor in the reasons for/restraints on women's participation in agricultural production decision-making. Even when husband and wife consult one another about their home and other matters, the husband typically makes the final choice. However, due to people's increased access to education, this trend is changing.

Productivity, calorie and revenue comparisons

It is feasible to assess trade-offs between two dimensions by figuring out how much of one dimension must be lost to make up for a change in the other when comparing the effect of these alterations on the rating. The two biggest tradeoffs are the calorie-revenue tradeoff and the risk-return tradeoff. Due to urbanization and population expansion, there is a decreasing amount of arable land; therefore, a quantitative approach to yield and other attributes will be crucial for optimal exploitation and future algorithm improvement.

Although each crop has a distinct function to play and set of traits, this study evaluates each crop's relevance based on its productivity, dietary advantages, and economic impact. One can evaluate the contributions of different crops to food security by creating index-based calorie contribution and revenue per hectare. This could guarantee that commercialization benefits both equity and efficiency: Germond (2013b) proposes a division between national and farm level interests, with the former focusing on feeding more people through crops on the same amount of land, which may be approximated by

calories per ha, and the latter, which might be represented as revenue per ha, optimizing revenue through crops. Instead than concentrating on trendy crops, this index will help to determine the type of food security actions.

Table 3. Calorie and revenue comparisons

Crop type	Productivity	Price per Q	Calorie per kg	Calorie per ha	Revenue per ha
Teff	14	2700	3660	62220	27000
Sorghum	25	1845	3390	91530	46125
Onion	90	2800	400	37200	644000
Mungbean	14	2506	3500	45500	35000

Source: Own computations, (2018)

The study discovered a trade-off between revenue and caloric content for the chosen crops. According to table 3, sorghum has the highest caloric content per hectare while mung beans have the lowest, even if onions yield more money than the other crops. Both the focus group discussion and the interview with development agents made it clear that while there is some lobbying on the part of development agents to influence crop choices, the most effective way to carry out such interventions would be through compensations. The index value was 0.3, which indicates that sorghum now provides 220 more calories while giving up 1 birr in revenue that onion growing could have produced. Farmers that choose to grow more caloric-dense crops will experience lower profitability from a food security perspective. If the government were to encourage sorghum farmers, either that revenue loss could be made up for or 200 more calories could be made affordable by subsidizing 1 Birr.

Investment

Looking on farmer's asset ownership only 6% of their asset is directly linked to agriculture. Even the richer farmers are found with no pump and modern farm equipment despite owning vehicles and other business firms. This will lead all agricultural investments are either forced or none and lead to long term investments on agriculture is expected only from government. Such lack of investments on agriculture could contribute to rural urban gap. Part of agricultural revenues should be forced to be reinvested on agriculture and in the area of production geographically.

The basic goal of commercializing agriculture is to increase farmer income. However, there are questions about how farmers are spending their extra income and their investments which are trading on non-agricultural commodities and transport vehicles. 60% of the farmers in this survey have investments, which are not primarily related to agriculture. Financial flow needs to be partially managed as a sector. Although agriculture should help other sectors flourish, in our country it has a propensity to become financially dry. Any legislation might ensure that even a tiny amount of the additional revenue stayed in the production region as well as in the sector, allowing

long-term agricultural investments like irrigation and soil management to be self-financing and better correlated with a balanced urbanization rate. Theoretically, production and conservation goals may be more effectively aligned if resource users were paid to protect environmental features (Anrew et al, 2023).

Discussions

Farmer-government Payoff

Table 4 lists the strategies available to farmers, along with the results of each strategy. In this instance, the government has made ensuring the availability of food a top priority, and farmers are viewed as rational producers looking to maximize their financial yields.

Table 4. Farmer payoff table

Farmer	No condition; No intervention	All farmers are expected to grow one crop highest revenue per ha	Mono cropping and specialization
	Condition; Risk	Market prediction (experience)	Multiple cropping
	Subsidy	Making revenue of all crops equal	Mono cropping

Source: Own (2018)

Agricultural subsidies are an important factor affecting farmers’ production decision-making behavior, and they are an effective incentive that significantly affects farmers’ green production behavior (FGPB) (Chen et al., 2017). On the one hand, agricultural subsidies can reduce the expected cost of farmers adopting green production technology and then increase the expected net income of farmers, thus promoting FGPB (Pietola, 2001). On the other hand, subsidies for means of production can reduce the real prices of polluting factors of production, which will make farmers increase their investment. Table 5 lists many strategies that the government could employ to strengthen crop choice. One popular strategy is the application of restrictions, which the Ethiopian government did when producing wheat, although farmers criticized this approach, and its viability is called into doubt. If farmers paid/subsidized the gap between what they would have earned if they had grown what they wanted and what they got from wheat, would provide better results.

Table 5. Government payoff table

Government	No intervention	Free market but distorted	Inflation and food insecurity
	Restrictions	Market prediction (experience)	Not sustainable and high supervision cost
	Subsidy	Cost and market distortion	Food security Food price stability

Source: Own (2018)

Policy alternatives

Here policy options that could be available are presented on table 6, where tradeoffs estimated in the previous sections can be efficiently exploited. This is only from the study area point of view for the national interest it is subject to inclusions and comparisons of all crops and all ecologies and productivities.

Crop related policies

The United Nations Food and Agriculture Organization (FAO) estimates that 828 million people, or 10% of the world's population, go to bed hungry each night, an increase of 46 million from the previous year. The future outlook for hunger suggests that it will continue, with more extreme weather events having a destructive impact. According to Ellis (1993), farm families work toward a number of objectives at once, such as ensuring a sufficient supply of food and other necessities for the family, as well as optimizing monetary gain. "Even if the price of food commodities increased globally, country-level price rises vary because different countries have distinct policies. (Tothova, 2023)

For instance, several nations use consumer subsidies to fix prices for consumers and protect them from market swings at the expense of the national budgets for a limited number of products. The resilience and capacity of nations to adapt to food shocks are weakened by cumulative global economic shocks, particularly sharp market disruptions and skyrocketing food prices. In several significant food crises, economic shocks have superseded conflict as the main cause of acute food shortages and malnutrition.

Table 6. Crop specific policy

Crop type	Advantage	Policy type	Policy Recommendation	Subsidize form
Sorghum	Higher calorie per area of production	Food security and income transfer	Subsidize	Inputs+ cash+ government purchase
Onion	High earning	-	No compensation	
Mung bean	High earning	Macro- economic stability	Subsidize	Subsidize insurance
Teff	High earning	-		

Source: Own (2018)

Farmers have adequate knowledge of their produce, but they have limited knowledge of integration, which is crucial. In this study, specific investment decisions made by the government for Ethiopian agriculture were examined, along with the beneficiaries of those initiatives. In addition, how the government uses institutions and regulations to sway farmer decisions in favor of its own interests, along with the resulting price and trade distortions, are all studied. Public spending must promote equitable resource allocation, lower inequality, and follow the correct transfer of resources.

Wheat

Recently with dream of being self-sufficient and a major wheat exporter in Africa, the government of Ethiopia is forcing farmers to grow wheat. No argument wheat could play important role in food self-sufficiency. The study found the approach associated with backlash with farmers (see Appendix D). Another complaint posed by Bale farmers was the restriction on to whom they sold their produce. Farmers were restricted from selling wheat in the open market and were forced to sell only to farmer cooperatives, which paid below the market price and costlier follow up (Yilma 2023). The sole crop that the Ethiopian government advises being subsidized as part of its pro-poor initiatives is wheat. Success are registered (see attachment B), which will assist in addressing inflation and preventing recurrent bread and floor subsidies. The government can stabilize the price of wheat by subsidizing production, or it can use contract farming to convert some of the safety net funds into in-kind transfers of wheat and support the establishment of food banks. It would make the choice separate by separating personal consumption from commerce.

Fertilizer subsidy

To help farmers with supply issues and price increases in the fertilizer market, the government is looking into loan options and subsidies. However, these subsidies are becoming burdensome because the government requested 21 billion birr for a one-year fertilizer subsidy (see Appendix D), which has a significant negative impact on the budget deficit and is also unsustainable. This study suggests fertilizer subsidies for only those crops that contribute more to food security, as measured by the crop usefulness index, in order to address this problem.

Table 7. Policy framework recommendations

Existing policy	Problems/what could be achieved	Recommended change
Safety net	Food security/inflation	Make ½ of it using in kind (from subsidized crop)
Fertilizer subsidy	Reduce government expenditure	Only for selected crop for subsidy
Crop choice manipulations	National plan and climate change adaptation	Compensate using revenue trade off from higher revenue crop in the same area
Agriculture investment	Enable to have Community financed irrigation schemes	More financial restrictions that could keep with in the sector
Insurance	Reduction of vulnerability	Make sure every productivity has insurance coverage
Farm clusters	Avoid conflicts and reduce cost of governance	Promote centralized specialization

Productive safety net

Social payments like school meals and safety nets are more crucial now than ever because of the crisis of food security and the increase of food prices. To ensure food security, the government might pay for half of it in kind. This enables the establishment of a food bank and the use of wheat subsidies rather than payments between the government and farmers.

Insurance subsidy

Since risk is the issue to be addressed, the government should change and subsidize insurances for other crops like mung bean and coffee because they are highly profitable. In this regard, the government is focusing on expanding insurances and creating an agricultural bank, which is great, but insurance may be subsidized at commercial banks until that time. Additionally, by making each production activity underinsured, this will assist farmers in concentrating on a particular activity rather than viewing income diversification as risk mitigation. There are insurance subsidies in many nations, but they vary greatly in terms of coverage, government engagement, subsidy level and rate, implementation standards, and institutional framework.

Conclusions

The government discovers an easier approach to accomplish its pro-poor goal by using agriculture policy. But for this to be in line with liberalization and sustainable, there must be clear crop purposes. Crop related policies are found implemented by the government of Ethiopia with the objective of securing higher productivity and achieving welfare. Those policies are not crop and area specific. The policies are found less sustainable because of farmer government links.

All crops do not deserve subsidy the one having higher contribution to food security should get subsidies. Profitable crops areas should finance their own improvement research and adaptation.

Availability of dietary important crops in the market enabled farmers to meet the family's need and focus on commercialization.

Farmers' investment decisions were not directly associated with agriculture which will affect long term investment in agriculture and aggravate rural urban balance. Women involvement in decisions in production and marketing activities had a wider difference.

Crop produced are found with different attributes which lead to trade off among this benefits. Both calorie-revenue and Risk-revenue tradeoffs existed. Mung bean found with the highest revenue and highest risk and sorghum found with higher calorie. Crops have been discovered with a range of attributes, and strategies for sustainability and lowering intervention costs could take advantage of these. Increased independence in agriculture should result from rising food prices.

For all crops grown in the nation, a crop usefulness index needs to be created. This would help efforts in boosting national calorie availability. Further research on the optimal crop for land allocation is required, and plans for non-agricultural investments must be coordinated with them.

Acknowledgements

The authors thank Ambo University for funding as part of a PhD study, which they recognize.

Conflict of interests

The authors declare no conflict of interest.

References

1. Adeoye, I. B., Yusuf, S. A., Balogun, O. O., & Alabuja, F. O. (2012). Application of game theory to horticultural crops in south-west Nigeria. *Journal of Agricultural and Biological Science*, 7(5), 372–375. <https://www.cabdirect.org/cabdirect/abstract/20123213203>
2. Ayal, D. Y., & Filho, W. L. (2017). Farmers' perceptions of climate variability and its adverse impacts on crop and livestock production in Ethiopia. *Journal of Arid Environments*, 140, 20–28. <https://doi.org/10.1016/j.jaridenv.2017.01.007>
3. Barrios, S., Bertinelli, L. and E. Strobl (2008). "Dry Times in Africa", CREDIT Working Paper, 03/07. <http://hdl.handle.net/11159/529984>
4. Chen, Y., Wen, X., Wang, B., and Nie, P. (2017): Agricultural pollution and regulation: How to subsidize agriculture? *Journal of Cleaner Production* 164, 258–264. <https://doi.org/10.1016/j.jclepro.2017.06.216>
5. Demeke, M., Dawe, D., Tefft, J. F., Ferede, T., & Bell, W. (2012). Stabilizing price incentives for staple grain producers in the context of broader agricultural policies: debates and country experiences. *RePEc: Research Papers in Economics*. <https://econpapers.repec.org/RePEc:ags:faoaes:288996>
6. Dittoh, S., Snyder, K. A., & Lefore, N. (2015): Gender policies and implementation in agriculture, natural resources and poverty reduction: case study of Ghana's Upper East Region. <https://doi.org/10.5337/2015.205>
7. Ednah Ngoma-Kasanda, Sichilima, Timothy, and Ikabongo Ikabongo. (2016). Gender and Decision Making in the Maize Sector. https://beamexchange.org/uploads/filer_public/67/70/677053c0-8171-4067-a55f-854ff476d189/gender_study_groundnuts_sector.pdf
8. Ellis Frankz. *Peasant Economics: Farm Households and Agrarian Development*. Wye Studies in Agricultural and Rural Development. New York: Cambridge University Press, 1988. 272 pp. https://www.academia.edu/25937108/Peasant_Economics_Farm_Households_and_Agrarian_Development_Frank_Ellis

9. Fernando, A. (2020): How Africa Is Promoting Agricultural Innovations and Technologies amidst the COVID-19 Pandemic. *Molecular Plant* 13(10), 1345–1346. <https://doi.org/10.1016/j.molp.2020.08.003>
10. Germond, C. (2013b): Preventing reform: farm interest groups and the common agricultural policy. In Palgrave Macmillan UK eBooks (pp. 106–128).
11. Habte, Z., Legesse, B., Haji, J., & Jaleta, M. (2020). Determinants of supply in the wheat value chain of Ethiopia. *Eastern Africa Social Science Research Review*, 36(1), 37–61. <https://doi.org/10.1353/eas.2020.0002>
12. Hazell P (2010) The Asian Green Revolution. In: Spielman DJ, Pandya-Lorch R (eds) Proven successes in agricultural development: a technical compendium to millions fed, an IFPRI 2020 Book. IFPRI, Washington D.C. The Asian Green Revolution (core.ac.uk) <https://doi.org/10.3390/agriculture12081191>
13. Kinati, W. W., & Mulema, A. (2015). Kinati, W. and Mulema, A.A. (2016): A gendered analysis of community profiles of target sites for small ruminant value chain interventions in Ethiopia. ICARDA/ILRI Project Report. Nairobi, Kenya: ILRI. ICARDA/ILRI Project Report. <https://cgspace.cgiar.org/handle/10568/79376>
14. Lencucha, R., Pal, N., Appau, A., Thow, A., & Drope, J. (2020). Government policy and agricultural production: a scoping review to inform research and policy on healthy agricultural commodities. *Globalization and Health*, 16(1). <https://doi.org/10.1186/s12992-020-0542-2>
15. MoFED (2022) Natural resources management directorates. Small-scale irrigation situation analysis and capacity needs assessment. MoFED, Addis Ababa
16. Mulugeta, M., & Amsalu, T. (2014): Gender, Participation and Decision Making Process in Farming Activities: the case of Yilman Densa District, Amhara Region, Ethiopia. *Journal of Economics and Sustainable Development* 5(1), 28–34. <https://iiste.org/Journals/index.php/JEDS/article/view/10273>
17. Pan, S., Di, C., Chandio, A. A., Sargani, G. R., & Zhang, H. (2022): Investigating the Impact of Grain Subsidy Policy on Farmers' Green Production Behavior: Recent Evidence from China. *Agriculture*, 12(8), 1191.
18. Pažek, K., & Rozman, Č. (2009). DECISION MAKING UNDER CONDITIONS OF UNCERTAINTY IN AGRICULTURE: A CASE STUDY OF OIL CROPS. DOAJ (DOAJ: Directory of Open Access Journals). <https://doaj.org/article/718ff40057ae49efb36e8c49b21de7d4>
19. Pietola, K. S. (2001): Farmer response to policies promoting organic farming technologies in Finland. *European Review of Agricultural Economics*, 28(1), 1–15. <https://doi.org/10.1093/erae/28.1.1>
20. Rashid, S., Assefa, M., & Ayele, G. (2007): Distortions to agricultural incentives in Ethiopia. RePEc: Research Papers in Economics. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2010/08/06/000333037_20100806002821/Rendered/PDF/560350NWP0ET0v16B01PUBLIC10Ethiopia.pdf

21. Raza, A., Razzaq, A., Mehmood, S. S., Zou, X., Zhang, X., Yan, L., & Xu, J. (2019a). Impact of Climate Change on Crops Adaptation and Strategies to Tackle Its Outcome: A Review. *Plants*, 8(2), 34. <https://doi.org/10.3390/plants8020034>
22. Remans, R., Flynn, D. F. B., DeClerck, F., Diru, W., Fanzo, J., Gaynor, K. M., Lambrecht, I., Mudiope, J., Mutuo, P. K., Nkhoma, P., Siriri, D., Sullivan, C., & Palm, C. (2011): Assessing nutritional diversity of cropping systems in African villages. *PLOS ONE*, 6(6), e21235. <https://doi.org/10.1371/journal.pone.0021235>
23. Shikur, Z. H. (2020): Agricultural policies, agricultural production and rural households' welfare in Ethiopia. *Journal of Economic Structures*, 9(1). <https://doi.org/10.1186/s40008-020-00228-y>
24. Torkelsson, Å., & Tassew, B. (2008): Quantifying women's and men's rural resource portfolios - empirical evidence from Western Shoa in Ethiopia. *The European Journal of Development Research*, 20(3), 462-481. <https://doi.org/10.1080/09578810802237623>
25. Van Der Velde, M., Green, S., Vanclooster, M., & Clothier, B. (2007). Sustainable development in small island developing states: Agricultural intensification, economic development, and freshwater resources management on the coral atoll of Tongatapu. *Ecological Economics*, 61(2-3), 456-468. <https://doi.org/10.1016/j.ecolecon.2006.03.017>
26. Welteji, D. (2018b): A critical review of rural development policy of Ethiopia: access, utilization and coverage. *Agriculture & Food Security*, 7(1). <https://doi.org/10.1186/s40066-018-0208-y>
27. World Bank (2022). *World Development Report 2008: Agriculture for Development*. Washington D.C.