

Research Application Summary

Profit efficiency analysis of onions production among smallholder farmers in Uganda: A review

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Abstract

Onion (*Allium cepa* L.) is one of the most consumed food ingredients globally, making it a crop with unique market opportunities in agribusiness. The objective of this review was to determine the main determinants of profit efficiency of onion production in Uganda. Onion is predominantly produced in the country by smallholder farmers, with a few medium to large scale production units. The main factors that affect profit efficiency of onion production among smallholder farmers include shortage of human labour, inadequate quality seeds, lack of sufficient supply of fertilizers, lack of irrigation facilities and insecticides, suboptimal farming experience, small land size, and low level of farmers' education. These factors are spatial, temporal and context specific; thus, necessitating that an empirical study be conducted in the Uganda setting. In addition, in spite of the fact that onion production in Uganda is done all year-round, its productivity has remained low with a national average yield of 5 t ha⁻¹ which is much lower than the global average of 19.7 t ha⁻¹.

Keywords: *Allium cepa*, Cobb-Douglas, irrigation, Uganda

Résumé

L'oignon (*Allium cepa* L.) est l'un des ingrédients alimentaires les plus consommés au monde, ce qui en fait une culture offrant des opportunités de marché uniques dans l'agrobusiness. L'objectif de cette étude était d'établir les principaux déterminants de la rentabilité de la production d'oignons en Ouganda. L'oignon est principalement produit dans le pays par de petits exploitants agricoles, avec quelques unités de production de moyenne et grande envergure. Les principaux facteurs qui affectent l'efficacité de la production d'oignons chez les petits exploitants sont le manque de main-d'œuvre, la qualité inadéquate des semences, l'insuffisance des engrais, le manque d'installations d'irrigation et d'insecticides, une expérience agricole sous-optimale, la petite taille des terres et le faible niveau d'éducation des agriculteurs. Ces facteurs sont spécifiques à l'espace, au temps et au contexte, ce qui nécessite la réalisation d'une étude empirique dans le contexte ougandais. En outre, malgré le fait que la production d'oignons en Ouganda se fait toute l'année, sa productivité est restée faible avec un rendement moyen national de 5 t ha⁻¹, ce qui est bien inférieur à la moyenne mondiale de 19,7 t ha⁻¹.

Mots clés : *Allium cepa*, Cobb-Douglas, irrigation, Ouganda

Introduction

Onion (*Allium Cepa* L.) is a cool-season biennial crop, which belong to the family Liliaceae (Boukary *et al.*, 2012). Onions is ranked fourth among the most consumed vegetables after tomato, cabbage and watermelon, with a global annual production of two million tonnes (Ddamulira *et al.*, 2019).

In Uganda, due to their dietary and commercial significance, onions are now grown in various agro-ecologies by urban and rural communities (Dijkxhoorn *et al.*, 2019). Despite its socioeconomic importance to the country, onion production remains low in Uganda (5 metric tonnes per ha), compared to the world average of 19.7 t ha⁻¹ (Ddamulira *et al.*, 2019). Thus the level of domestic production has failed to neutralize the increasing domestic and regional demand; a fact that has resulted in remarkable volumes of onions being imported from Tanzania to fill up the market gap (Dijkxhoorn *et al.*, 2019). Uganda imported up to 18000 metric tonnes of onions in 2018, excluding those smuggled across borders (Dijkxhoorn *et al.*, 2019). This volume of imported onions is very high despite Uganda having very favourable climate conditions for onion production. This is not helped by the fact that poor storage facilities in the country contribute immensely to onion yield losses during rainy seasons. This pushes onion farmers to sell their produce at giveaway prices, thus explaining the minimum return in onion production which have a negative effect on profit efficiency of onion farmers (Dijkxhoorn *et al.*, 2019). Bakhshoodeh and Shahnushi (2009) conceded that technological advancement, with the aim of increasing smallholder farmer efficiency, would be profitable only if farmers are sufficiently efficient in allocating their available resources. However, it remains unclear how the uptake of modern technologies has improved the productivity and profit efficiency of this crop. The objective of this review is to review existing knowledge on the main determinants of profit efficiency of onion production.

Theory of profit efficiency

Omotayo *et al.* (2021) refers to technical efficiency as the effectiveness with which farmers get the maximum possible output using a given level of input or set of inputs. Technically efficient farmers are those that operate on the production frontier which represents maximum output attainable from each input level such as capital, labour, seeds, etc. All feasible points below the frontier are considered technically inefficient points. When a farm is technically efficient it is usually also profit efficient. In other words, technical efficiency leads to profit efficiency (Ogunniyi, 2011). Yahaya *et al.* (2019) and Omotayo *et al.* (2021) described efficiency in three forms; namely technical efficiency, price or allocative efficiency and economic efficiency. Economic efficiency consists of technical efficiency and price or allocative efficiency. The capacity of a firm to produce the maximum possible output using a given set of inputs and technology is referred to as technical efficiency; while the capacity of a firm to remain on the same production possibility curve by using the least-cost combination of inputs and available technology is called allocative efficiency (Lebailly, 2020). Profit efficiency in terms of onion production describes the level of efficiency of farmers against the best profit efficient farmer on the production possibility curve (Lebailly, 2020).

Related empirical studies

Many recent studies have been conducted to assess the factors that influence the level of onion production. Haque *et al.* (2011) adopted the use of gross margin analysis to examine the profitability and efficiency of onion production in some districts of Bangladesh. Their

findings revealed that gross margin and net return were Tk. 85308 and 79487 per hectare, respectively (Tk = Bangladesh currency). The benefit cost ratio was found to be 1.85. Inputs like human labour, seedling, manures, urea, TSP, irrigation, and insecticide had positive effects on the yield of onion. Using a Cobb-Douglas production function, human labour, TSP, insecticides and seed had a positive effect on profit efficiency and significant co-efficient (Haque *et al.*, 2011). An increase of 1% in seedling, TSP, insecticides and human labour holding other factors constant led to an increase of onion yield by 0.01, .005, .002 and 0.01%, respectively. However, in the same study, MP, manures and urea had a negative and significant co-efficient on profit efficiency due to the fact that the soils of the study area contained already the ingredients contained in those inputs. Khan (2015) conducted a research in Pakistan, and found out that the technical efficiency of farmers varied from 0.7478 to 0.9851. Gamma (γ) was estimated at 0.93, the production of onions varied as a result of inefficiency factors. In the same study, the Stochastic frontier production function and technical inefficiency model revealed that the production elasticity estimation for the irrigation variable of onion growers rose above the set value that's to say higher (0.7080). The variables for urea, FYM (Farm Yard Manure), irrigation, and pesticides were positive and statistically significant according to an asymptotic t-test. Production elasticity for urea (0.0186), FYM (0.1171), irrigation (0.7080), and pesticides (0.1213) were important in terms of contribution towards higher onion yield. The same author concluded that the efficiency of onions productions can be improved through better use of urea, FYM, irrigation, pesticides, and also through improved hybrid technology, by providing either formal or informal education. These are factors that influence the efficiency of farmers. Technical efficiency determines profit efficiency and so it can be said that the farmers in the study area are also profit efficient. Gindi *et al.*(2019) examined the profitability and technical efficiency of onion production in Nigeria. The result indicated that onion production was profitable and the mean profit efficiency obtained was 83.6%, indicating that there was a 16.4% opportunity for improving efficiency in 2019. In addition, the outcome showed that farmers' efficiency can be improved according to the farmers' educational level, years of farming experience, by the use of new farming techniques which are the factors that positively influence profit efficiency.

Factors affecting onion profit efficiency

Previous research has revealed onion profit efficiency to be affected by farm size, chemicals, seed, labour, farmers' education, family size and onion farming experience.

An increase in the size of land cultivated for onion production may increase output of the commodity, other factors held constant (Baree, 2012). However, Abdulkadir (2015) in his study in Ethiopia observed that land size had a negative effect on onion yield and was inversely related to the technical and profit efficiency of onion production, signifying the theory of inverse relationship between land size and productivity in production of onions.

Optimal use of fertilizers and other agrochemical such as herbicides have also been found to increase output of onion (Adeoye, 2016). This is expected because low soil fertility reduces productivity and vice versa; while heavy weed infestation is responsible for high yield losses. The use of herbicides has been found to contribute significantly to yield benefits in Nigeria (Gindi *et al.*, 2019).

Increase in output of onion production also depends on the quality and quantity of seeds used. Ddamulira *et al.* (2019) conducted a peri urban study in Uganda to ascertain the need for farmers to adopt high yielding and well-adapted onion varieties to achieve potential yields and profit efficiency and better incomes. Improved onion varieties were superior in economic yields to the local cultivars. Therefore, emphasis should be put on improving the genotype of the local onion cultivars to enable farmers attain economic efficiency in onion production. Seed quality mostly influences onion production implying that farmers should observe seed quality as a major determinant the level of profitability of crop production (Lebailly, 2020). Such salient information is still unavailable in the onion production systems of Uganda.

Optimized labour for technical and profit efficiency is important in the production process of any crop including onions (Adeoye, 2016). An increase in labour used leads to increase in onion output, although in some cases it can lead to reduction in the revenue generated by farmers, if not properly managed. The existence of imperfect labour market has also been found to cause smallholder farmer households to majorly rely on family labour, in which larger family sizes were found to provide a ready source of cheap family labour (Gindi *et al.*, 2019).

Education level of farmers is another factor that affects the profit efficiency of onion production. An increase in the level of education of farmers was found to have positive influence on profit efficiency (Gindi *et al.*, 2019). Education has also been found to influence technological dissemination, adoption of new innovations, and understanding of factor and product markets which are all paramount in influencing profit efficiency (Gindi *et al.*, 2019). Similarly, education of farmers in Kenya showed that farmers who were exposed to agricultural seminars, trainings and extension had access to technical knowledge and information on agriculture, increasing their profit efficiency (Bakhshoodeh and Shahnushi, 2009).

As for family size, studies in Nigeria showed that smallholder farmers strived to make efficient use of their available resources, and would endeavor to minimize the usage of paid labour, due to scarcity of resources at hand (Tanko *et al.*, 2012). Many family members help to offset field labour requirements at peak times during cultivation (Berhan, 2015).

Cumulative experience in onion production was also found to be significant on the profit efficiency of onion production (Gindi *et al.*, 2019). Experience in the production of onions gives a substitutional measure of managerial and technical knowledge. It has been found that the more years farmers spend growing onions, the more experienced they became (Berhan, 2015) and the more the efficient their profit was. Gindi *et al.* (2019) also ascertained that previous experience aids farmers to set genuine time and cost targets bearing in mind production risks and challenges. This agrees with the findings of Abdulkadir (2015) in Ethiopia, who established that experience had a positive and significant effect on farmers' technical efficiency in production, and therefore, a corresponding effect on their profit efficiency.

Conclusion and recommendations

From literature, the main factors that affect profit efficiency in onion production among smallholder farmers include farm year experience, better use of urea and pesticides, farmyard manure, farmers' educational level and the use of improved technologies. Profit efficiency studies in Uganda are hard to come by despite the heavy involvement of farmers in onion production. It is recommended that researchers in Uganda should explore studies in the area of profit efficiency of onion production and its determinants. There is also the need for adequate dissemination and utilization of improved technologies such as improved onion varieties, chemical and fertilizer use.

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