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Chapter

Factors Affecting Efficiency of Vegetable Production in Nigeria: A Review

Iyabo Bosede Adeoye

Abstract

Vegetables are important for maintenance of good health; their production and marketing are veritable sources of employment and livelihood. To promote vegetables' contribution to the above, there is a need for sustainable and efficient production process. The paper reviewed production, socioeconomic factors, and constraint affecting efficiency of production of three important vegetables (tomato, pepper, and onion). The review showed that socioeconomic factors found to increase technical efficiency in vegetable production were educational level, extension contact, and household size. Influence of farmer age on technical efficiency was inconclusive due to varied opinions. Increase in farm size, quantity of seed, amount of fertilizer, and agrochemical were found to have positive influence on output. Majority of the literature reviewed opined that increase in quantity of labour raises productivity; however, it must be utilized efficiently. The mean technical efficiency of the vegetables varied from the southern to the northern part of the country. The cross cutting constraints in vegetables production are pest and diseases, inadequate storage facilities, and high cost of improved inputs. The study recommends increase awareness and sensitization on optimum levels of resource use for increased productivity and appropriate intervention to constraints in the value chain.

Keywords: vegetables, productivity, socioeconomic factors, production inputs, Nigeria

1. Introduction

Vegetable is one of the important sources of vitamins and minerals [1] and dietary fiber [2] and are essential in prevention of diseases [3]. Vegetable production is of great economic importance in the agricultural sector [4]. Its value chain can provide income and reduces poverty and unemployment [1]. Vegetable production has the potential to increase food security and create employment [5]. Smallholders' farmers made up large number of vegetable producers in Nigeria [6].

Insufficient intake of fruit and vegetables is estimated to cause around 14% of gastrointestinal cancer deaths, about 11% of ischemic heart disease deaths and about 9% of stroke deaths [7]. The World Health Organization recommended consumption of 400 g of fruits and vegetables daily to maintain good health. Vegetables production is profitable, and the actors will require adequate knowledge, capital, and new methods [8].

Tomato, pepper, and onion are important vegetables in the global economy due to their high consumption [1]. Tomato is one of the foremost, essential vegetables in Nigeria [9], virtually consumed by every tribe [10], and grown all over Nigeria [11]. Tomato stands out as one of the important vegetables considering the scale of production and level of consumption [12]. It is beneficial for the maintenance of good health and disease prevention [13]. Tomato production presents an opportunity for increasing rural incomes particularly among peri-urban smallholder farmers due to the high demand in urban centers [14]. Farmers are willing to cultivate tomato more than any other vegetable because of its high demand, multiple harvests produced [15]. Tomato is produced across Nigeria and smallholder farmers cultivating between 0.5 and 4 hectares of land account for 90% of production [16]. Tomato is mainly produced by resource poor small farmers with small farm holdings and they are responsible for the tomato consumed in the nation [17].

Tomato production is profitable in Nigeria, and average profit of tomato production under irrigation was N128,750 ($ = N350) in Kogi and Benue State [18], while the rate of naira on naira invested on tomato production in Kano was 1.5 indicating profitability of the enterprise [19].

Pepper is a rich source of vitamins A, C, and E [20]. It is a high value crop [21] and has economic significance in the world market. It has potentials to generate foreign exchange and can be utilized in confectionary, medicinal, and culinary purpose [22]. Pepper production is an important source of foreign exchange and its exportation in Nigeria has been reported to be lucrative [23]. The northern part of Nigeria is the major areas of production [20, 22], and it is mostly produced by smallholder farmers [24].

Onion is an important vegetable and is of commercial importance throughout the world [25]. Onion production in Nigeria is profitable with rate of returns on investment of 91.89 and 119.78% in Sokoto and Kebbi state [26]. Onion consumption and demand is throughout the year [27]. Onion is used as spice, vegetable, salad, and dressing [28]. The production of onion can improve economic status and welfare of farmers [29]. In Nigeria, bulk of onion is produced under irrigation in the Northern states [30].

Despite the importance of vegetable in the daily diet and the competitive and comparative advantage the country has in the production, vegetable production is fluctuating [6]. For instance, the average yield of tomato is far below the potential of the crop. For instance, the average yield of about of 6 tones is much lower than 7 tones and 6.48 tones reported for Tanzania and Uganda, respectively [31]. Agricultural production can be sustained through efficient resource use [32]. Efficiency is the ability to produce maximum output from the least input combination during the production process [33, 34]. Efficiency is crucial in resource saving [35]. Factors influencing efficiency of farmers can be categorized into agent and structural facts [36]. Agents' factors are educational level, age, and social capital, while structural factors include farm size, fertility, and among other [37].

Analyzing efficiency levels provides understanding of constituent of efficiency system and strategies to improve efficiency [38]. It is worthy of note that efficient utilization of resources leads to improvement in production [38]. Improvement in technical efficiency of farmers will lead to better yield, food security, and better standards of living [39].

A series of studies have been carried out to assess and compiled factors affecting agricultural productivity and its drivers in Nigeria, which include [40–44]. They have focused on commodities such as rice, maize, and tuber crops. None of the aforementioned studies, however, has compiled factors affecting efficiency of vegetable production in Nigeria. This paper intends to identify and collate factors affecting efficiency of vegetable production in Nigeria.

2. Methodology

The study made use of literature on efficiency of vegetable production in Nigeria from. Studies from the different geopolitical zones of Nigeria were collected and reviewed to identify the production inputs and socioeconomic factors reported to have influence on vegetable production in the country. Primary data and stochastic frontier production model were employed by majority of the reviewed literature.

2.1 Factors affecting efficiency of tomato production

2.1.1 Age

Age is one of the important determinants of agricultural production because age of farmers may affect adoption of agricultural innovations. Older farmers were more technically efficient compared to younger farmers in tomato production at Kwara and Adamawa states, Nigeria [45, 46]. Contrarily, an increase in farmer's age was found to increase technical inefficiency in tomato production in Benue State [11]. In other countries in Africa, older farmers are more technically efficient than their younger counterparts in Cameroon and Swaziland [39, 47]. They attributed this to their respective years of experience in the production of the commodity. Succinctly, the impact of age on technical efficiency of tomato production is inconclusive due to the various outcomes of the impact on tomato production.

2.1.2 Education

Number of years spent in school was found to be positively and significantly related to the output of tomato farmers [11, 48]. Educated households were exposed to information and able to manage farm production better [49]. The higher the level of education, the more enlightened a farmer becomes in adopting new innovation with its multiplier effect on increased output. According to [39] in Cameroon, on tomato production, higher level of education of farmers results in increasing technical efficiency of farmers. This is justifiable as new techniques, and innovations are introduced daily especially with the presence of research institutions. Households that are educated will adopt such novel techniques and technologies and increase their technical efficiency. Presumably due to their enhanced ability to acquire technical knowledge, which makes them move close to the frontier output. Since most authors confirmed positive effect of education on technical efficiency, the factor can be adjudged to improve productivity.

2.1.3 Household size

Household size had a positive and significant effect on technical efficiency of tomato production in Oyo state [50]. This indicates that efficiency increases with increase in household size. Increase in household size improved tomato production in Benue and Adamawa States [11, 46]. Households with large family size may serve as a readily available source of labor. Thus, it can be inferred that household members may be a ready source of labor in farming activities.

2.1.4 Extension contact

Increase in extension contact increases the output from tomato production [48]. This is expected as extension agents have been known for their role in smallholder

production. According to a study in Cameroon on tomato production, the nearer a farmer is to an extension agent, the higher will be his technical efficiency [39]. The extension provides latest information on production techniques, provision of information on improved seeds, and provision of agronomic knowledge. The farmer can avail himself of all the above to boast his productivity and technical efficiency.

2.1.5 Farm size

An increase in the hectares of farm land put into tomato production will lead to an increase in the output of tomato [10, 48]. Increase in farm size will lead to increased output of tomato and that land is a very important factor in tomato production [11, 31, 46, 51]. Additionally, in Cameroon, increase in area put into tomato production leads to increase in yield of the commodity [39]. Thus, increase in area of land put into tomato production may lead to increase in output of tomato.

2.1.6 Labor

Increase in the quantity of labor had been found to increase the output of tomato in Benue and Kano State, Nigeria [10, 48]. Furthermore, increase in the labor lead to improvement in tomato output in Kaduna and Kwara states [31, 45]. Thus, adequate number of labor at the appropriate time may lead to increase in the output of tomato. Although care must be taken not to over use labor, thus optimum level must be adhered to in order not to lead to reduction in the returns due to overutilization of the input.

2.1.7 Seed quantity

A unit increases in the level of seed lead to increase in tomato output [31]. Increase in seed quantity was found to lead to increase in tomato output [10, 11, 22, 31, 51]. Increase in quantity of seed positively influences tomato output in Cameroon [39]. A 1% increase in seed under tomato production will raise the output of tomato production; thus, seed is a very important factor of production [46].

2.1.8 Chemical (such as fertilizer and insecticides)

An increase in the level of chemical and organic fertilizer will lead to increase in tomato output [31]. Increase in pesticides use will lead to increased output of tomato [11]. Increase in the quantity of herbicide and fertilizer lead to increase in tomato output [51].

Increase in the quantity of fertilizer lead to improvement in tomato output [10, 11, 31] This is expected because nonfertile soil will not support good growth and development of the commodity. It is very important to note that optimum level of the above resources must be utilized. This is very important in relation to herbicides, pesticides, and fertilizer because when they are overused, they may have adverse effect on the health of the consumers.

2.2 Factors affecting efficiency of pepper production

2.2.1 Age

Increase in age of farmers increases technical inefficiency indicating that older farmers are less efficient in pepper production [20, 52]. This may be due to the fact that older farmers may not be agile to search for new information that may lead to

improvement in pepper production. Older farmers were also found to be technically inefficient in pepper production in Ethiopia [53]. Additionally, increase in the number of years of farmer's experience reduces technical inefficiency [52, 54]. This may indicate that experience gathered over time in the production of the commodity may be put into use to improve practices in the production. This showed that there are various opinions on the effect of age on technical efficiency of pepper farmers.

2.2.2 Household size

In a study on pepper production in Ogun state, increase in household size may lead to increase in efficiency of pepper production [20]. This may be due to increase in number of individuals that may assist in farm operations.

2.2.3 Extension contact and member of cooperative society

Increase in extension contact was also found to increase technical efficiency [20, 53]. This may be attributable to the fact that extension agent will be able to build capacity of producers on improved method of production and disseminate information on improved practices to the farmers. The reviewed literature also indicated that being a member of cooperative society may lead to increase in efficiency in pepper production [54]. This may be due to the fact that the members of the society will be able to pull resource together and share knowledge that may lead to increase in productivity.

2.2.4 Education

Education was also found to have positive effect on efficiency of pepper farmers [20, 52, 54]. Educated farmers will be able to adopt innovations in production which may be necessary to improve yield. In Ethiopia, farmers that were educated were more technically efficient in pepper production compared to those with no education [53].

2.2.5 Farm size, seed quantity, and fertilizer

Increase in farm size was found to lead to increase in quantity of pepper produced [52–54]. Additionally, seed quantity was found to increase quantity of output. Thus, increase in the quantity of seed [55] may lead to increase in efficiency and output of pepper. Increase in quantity of fertilizer was found to increase output of pepper [52, 55]. This is expected because nonfertile soil may lead to low productivity.

2.2.6 Labor

Increase in the quantity of labor will lead to increase in output of pepper [55]. This may be due to the fact that pepper production may be labor intensive but over utilization of the resources should be prevented in order not to lead to decline in output.

2.3 Factors affecting efficiency of onion production

2.3.1 Farm size

Increase in the size of land put into onion production may increase output of the commodity [30, 56]. Thus, output may be increased by putting more land into

production. It was also discovered that putting more land into onion production may increase output of the commodity in Ethiopia [57].

2.3.2 Chemicals

Increase in the quantity of fertilizer and agrochemical such as herbicides was also found to increase output of onion [30, 57]. This is expected because low soil fertility will reduce productivity.

2.3.3 Labor

Increase in labor lead to increase in onion output [56]. Labor quantity must be optimum in order not to lead to reduction in the output of onion [30].

2.3.4 Education

Increase in education level of farmers was found to have positive influence on technical efficiency, thus increase in education level may bring about increase in the efficiency of farmers [30]. Educated farmers may be able to carry out the practices in order to improve the output of the commodity. Increase in farming experience, household size, and extension contact was also found to increase technical efficiency [30] (**Table 1**).

Commodity	Factors	Study area	Authors	Effect of factor on productivity
Tomato	Age/farming experience	Northcentral (Benue state)	Abur [11]	Factor has inconclusive effect on productivity
		Northcentral (Kwara)	Adenuga et al. [45]	
		Northeast (Adamawa)	Zalkuw et al. [46]	
	Education	Northcentral	Abur [11]	Factor increases productivity
			Ibitoye et al. [48]	
		Cameroon	Tabe-Ojong and Molua [39]	
	Extension contact	Northcentral	Ibitoye et al. [48]	Factor increases productivity
		Cameroon	Tabe-Ojong and Molua [39]	
	Household size	Northcentral	Abur [11]	Factor increases productivity
		Southwest	Ogunniyi and Oladejo [50]	
		Northeast (Adamawa)	Zalkuw et al. [46]	
	Access to Credit	Northcentral	Adenuga et al. [5]	Factor increases productivity
	Farm size	Northeast	Tijjani et al. [51]	Factor increases productivity

Commodity	Factors	Study area	Authors	Effect of factor on productivity
		Northcentral	Abur [11]	
		Northcentral	Ibitoye et al. [48]	
			Saleh et al. [10]	
		Northwest	Umar and Abdulkadir [31]	
		Northeast (Adamawa)	Zalkuw et al. [46]	
		North central	Adenuga et al. [45]	
	Seed quantity	Northeast	Tijjani et al. [51]	Factor increases productivity
		Northcentral	Abur [11]	
			Saleh et al. [10]	
		Northwest	Umar and Abdulkadir [31]	
		Northeast (Adamawa)	Zalkuw et al. [46]	
		Northcentral	Adenuga et al. [45]	
	Labour	Northcentral	Abur [11]	Factor increases productivity
		Northwest	Umar and Abdulkadir [31]	
		Northcentral	Adenuga et al. [45]	
	Chemicals such as herbicide and fertilizers	Northeast	Tijjani et al. [51]	Factor increases productivity
		Northcentral	Abur [11]	
			Saleh et al. [10]	
		Northwest	Umar and Abdulkadir [31]	
		Northcentral	Adenuga et al. [45]	
Pepper	Age/farming experience	Southwest	Dipeolu and Akinbode [20]	Factor effect on productivity inconclusive
		Southeast	Ugwu [52]	
		Northwest	Mohammed [54]	
		Northwest	Adeoye et al. [55]	
	Household size	Southwest	Dipeolu and Akinbode [20]	Factor increases productivity
		Southeast	Ugwu [52]	
	Extension contact	Southwest	Dipeolu and Akinbode [20]	Factor increases productivity

Commodity	Factors	Study area	Authors	Effect of factor on productivity
		Northwest	Mohammed [54]	
	Education	Southeast	Ugwu [52]	Factor increases productivity
		Northwest	Mohammed [54]	
	Farm size	Southeast	Ugwu [52]	Factor increases productivity
		Northwest	Mohammed [54]	
	Seed quantity	Northwest	Mohammed [54]	Factor increases productivity
		Northwest	Adeoye et al. [22]	
	Fertilizer	Northwest	Adeoye et al. [22]	Factor increases productivity
	Labor	Northwest	Adeoye et al. [22]	Factor increases productivity but must be utilized efficiently.
		Southeast	Ugwu [52]	
Onion	Farm size	Northwest	Ojo et al. [30]	Factor increases productivity
		Northeast	Grema and Gashua [56]	
	Fertilizer	Northwest	Ojo et al. [30]	Factor increases productivity
		Northeast	Grema and Gashua [56]	
	Labor	Northwest	Ojo et al. [30]	Factor effect on productivity inconclusive
		Northeast	Grema and Gashua [56]	
	Education	Northwest	Ojo et al. [30]	Factor increases productivity
	Extension contact	Northwest	Ojo et al. [30]	Factor increases productivity
	Household size	Northwest	Ojo et al. [30]	Factor increases productivity

Table 1.
Summary of factors affecting efficiency of vegetable production.

3. Mean technical efficiency of vegetable production

Mean technical efficiency of tomato production in Benue state was 0.59 [11], Kwara 0.78 [45], and Adamawa (0.68) [46]. The mean technical efficiency of pepper production in Enugu state was 0.70 [52] indicating that there is still capacity to improve on the present efficiency level. The technical efficiency of pepper of 0.90

Commodity	Location	Author	Mean technical efficiency
Tomato	Northcentral	Abur [11]	0.59
	Northcentral	Adenuga et al. [45]	0.78
	Northeast	Zalkuw et al. [46]	0.68
Pepper	Southeast	Ugwu [52]	0.70
	Northwest	Mohammed [54]	0.90
Onion	North	Ojo et al. [30]	0.95
	Northcentral	Ibrahim and Omotesho [58]	0.92

Table 2.
Summary of mean technical efficiency of vegetables.

was obtained in Kaduna state [54]. Mean technical efficiency of onion according in the northern state of Nigeria was 0.947 [30]. Mean technical efficiency of 0.92 was obtained for onion in north central Nigeria [58] (**Table 2**).

4. Constraints to vegetable production

The major constraints to tomato production are pest and diseases [9, 10, 19]. Major constraints in pepper production were price fluctuation, activities of middlemen, and high cost of inputs such as fertilizer, labor, and seeds [54]. Other problems were pests and diseases infestation in the field. The producers may experience price fluctuation most especially in the peak period of production especially when there are no processing facilities. Activities of middlemen may disrupt income that may be realized by the farmers in the production process.

Constraints in onion production include high cost of production input, lack of storage facilities, limited access to improved seeds, pests, and diseases, and lack of effective extension services [56].

5. Conclusion and recommendations

The review revealed that educational status, household size, and extension contact are important factors influencing producers' efficiency in tomato production. Production inputs such as seed and chemicals such as fertilizers are critical to increased yield of tomato. Although increase in the quantity of labor may raise productivity, it must however be utilized efficiently. The study recommends sensitization and increased awareness on optimum level of resource use for increased tomato production in order to improve contribution of the commodity to economic empowerment.

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