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Factors affecting vegetable production

Sustainable vegetable production is crucial for maintaining good health, generating employment, and promoting livelihoods. This review examines socioeconomic factors, production constraints, and technical efficiency in the cultivation of three important vegetables - tomato, pepper, and onion. Findings indicate that educational level, extension contact, and household size positively influence technical efficiency, while farm size, seed quantity, fertilizer application, and agrochemical use have a positive impact on output. The study also highlights the importance of utilizing labor efficiently to increase productivity. Mean technical efficiency varies across regions in Nigeria, with pests, diseases, inadequate storage facilities, and high input costs being significant constraints. Recommendations include increasing awareness about optimal resource utilization and addressing value chain limitations. Vegetable production has significant economic potential in Nigeria, with pepper being a high-value crop generating foreign exchange and having multiple uses in confectionary, medicinal, and culinary purposes. The northern region, dominated by smallholder farmers, is a major area of production. Onion production is also profitable, with returns on investment rates exceeding 90%. However, despite the importance of vegetables in daily diets, Nigerian vegetable production has been fluctuating, with average yields often lower than potential levels compared to other countries. Efficient resource use is crucial for sustained agricultural production, and factors influencing efficiency can be categorized into agent and structural elements. These include educational level, age, social capital, farm size, fertility, and others. Analyzing efficiency levels provides insights into the constituent parts of the efficiency system and strategies for improvement. This paper aims to identify and collate factors affecting vegetable production efficiency in Nigeria by reviewing existing literature from various geopolitical zones and employing primary data and stochastic frontier analysis. Given text here farmers' experience and education are key factors that influence their adoption of agricultural innovations. Research has shown that older farmers tend to be more technically efficient than their younger counterparts, possibly due to their years of experience in production. In contrast, a higher level of education has been found to positively impact technical efficiency, allowing farmers to adopt new innovations and technologies, which in turn increases their output. Additionally, households with larger family sizes have been found to increase tomato production, as they can provide an abundance of labor for farming activities. Furthermore, extension agents have also played a crucial role in increasing technical efficiency by providing farmers with the latest information on production techniques, improved seeds, and agronomic knowledge. Finally, an increase in farm size has led to increased output of tomatoes, highlighting the importance of land as a key factor in tomato production. Boosting labor availability in Kaduna and Kwara states led to a significant rise in tomato output. It's clear that having the right number of workers at the correct time can greatly impact production levels. However, it's equally crucial not to overextend labor resources, as this could lead to decreased returns due to inefficient use of inputs. Interestingly, research suggests that increasing seed availability correlates with higher tomato yields [31]. In fact, a 1% increase in seed usage can result in a notable boost in output. The importance of quality seeds is further emphasized by studies from Cameroon and other regions, where increased seed quantity directly translates to improved tomato production [39]. The application of chemical and organic fertilizers has also been shown to positively impact tomato yields [31]. Furthermore, the judicious use of pesticides can lead to increased output levels [11]. It's worth noting that optimal levels of these resources must be utilized to avoid adverse effects on consumer health. In contrast, older farmers have been found to exhibit reduced efficiency in pepper production due to decreased agility and access to new information [20, 52]. However, accumulating experience over time can actually improve technical skills and reduce inefficiency [52, 54]. Studies have also highlighted the importance of household size and extension contact in enhancing efficiency. Increased household size may lead to more individuals available for farm operations, while greater extension contact can facilitate capacity-building and dissemination of improved practices among farmers [20, 53]. Membership in cooperative societies has also been linked to increased efficiency in pepper production due to shared knowledge and resource mobilization [54]. Education is another critical factor, as informed farmers are better equipped to adopt innovations that enhance productivity [20, 52, 54]. In fact, a study in Ethiopia found that educated farmers demonstrated higher technical efficiency in pepper production compared to their less-educated counterparts [53]. Notably, increasing farm size was also found to lead to increased quantities of pepper production. Increased quantity of seed, fertilizer, labor, and land put into onion production has been found to increase output. Similarly, increase in the size of land put into pepper production may lead to an increase in efficiency and output. The study also suggests that educated farmers can improve their technical efficiency, leading to increased productivity. Summary of factors affecting vegetable production efficiency in Nigeria, indicating room for improvement on current technical efficiency levels, with mean efficiencies ranging from 0.59 to 0.947 depending on the region and commodity, such as tomatoes (0.59-0.78), peppers (0.70-0.90), and onions (0.95). Major constraints in vegetable production include pests and diseases for tomatoes and price fluctuation, middlemen activities, high input costs for peppers, high cost of inputs, limited access to improved seeds, and lack of extension services for onions. Factors influencing efficiency include education, household size, extension contact, seed quantity, fertilizers, and labor utilization efficiently. Factors affecting the productivity and profitability of vegetable production were investigated in various studies across different regions. Xaba and Masuku (2013) examined factors influencing vegetable farming efficiency in Swaziland, while Stoeva (2012) analyzed the impact of various factors on vegetable farming efficiency in Bulgaria. Additionally, Smith and Eyzayurre (2007) discussed the role of African leafy vegetables in the World Health Organization's global fruit and vegetable initiative. In terms of resource use efficiency, Ogunbo et al. (2015) investigated the technical efficiency of pepper production under tropical conditions, while WHO (2020) promoted fruit and vegetable consumption around the world. Dias (2010) provided an overview of the world importance, marketing, and trading of vegetables, whereas Aboki et al. (2014) studied the resource use efficiency of irrigated tomato production in northern Taraba state, Nigeria. Saleh et al. (2016) analyzed the resource use efficiency in tomato production in a semi-arid zone of Nigeria, while Abur (2014) assessed the impact of irrigated tomato farming on the resource productivity of farmers in Vandeikya local government area of Benue state. Adejobi et al. (2011) highlighted weight and measurement issues in retail marketing of fresh tomatoes in Osun state. Usman and Bakari (2013) evaluated the profitability of dry season tomato production in Fufore local government area of Adamawa state, Nigeria, whereas Takesure (2017) investigated factors influencing commercialization of smallholder tomato production in Domboshava, Goromonzi district in Zimbabwe. Hanadi et al. (2018) conducted a value chain analysis for tomato production and marketing in Khartoum state, Sudan. Sahel Newsletter (2017) published an overview of the Tomato Value Chain in Nigeria, while Adenegan and Adeoye (2011) analyzed price trends of tomatoes in rural and urban retail markets of Oyo state. Ayoola (2014) compared the performance of tomato under irrigation and rainfed systems in selected local government areas of Kogi and Benue state, Nigeria. Katanga et al. (2018) conducted an economic analysis of tomato production in Fagge local government, Kano state, Nigeria, whereas Dipeolu and Akinbode (no date available) analyzed the impact of various factors on the productivity and profitability of vegetable production. Agricultural productivity in Nigeria: An analysis of pepper production and its associated efficiencies. Small-scale farmers' resource utilization and technical efficiency in Africa: A review of studies on tomato production. Research highlights the significance of environmental factors for Kenya's smallholder food crop farmers (Environment, Development and Sustainability, 2014). Other studies have assessed the technical efficiency of open-field tomato production in Kiambu County, Kenya (Jomo Kenyatta University Journal, 2016), and compared it with semi-urban farms in Cameroon (Journal of Management and Sustainability, 2007). Additionally, there are analyses of resource use efficiency for dairy pastoralists in Adamawa state, Nigeria (University of Ibadan, 2006), irrigation systems in Kwara state, Nigeria (Department of Agricultural Economics, University of Ibadan, 2002), upland rice production in Ogun State, Nigeria (Department of Agricultural Economics, University of Ibadan, 2004), and a comparative study of traditional and improved rice variety farmers in Nigeria (African Journal of Economic Policy, 2006). Furthermore, research has been conducted on the efficiency of broiler firms in Ibadan area of Oyo state Nigeria (Tropical Animal Science Journal, 2003) and dry season tomato production in selected areas in Kwara state, Nigeria (Agris On-line Papers in Economics and Informatics, 2013). Moreover, studies have analyzed technical efficiencies of tomato production in Adamawa state, Nigeria (International Journal of Agriculture Environment & Biotechnology, 2014), smallholder vegetable farmers with and without credit access in Swaziland and the case of Hhohho region (International Journal of Sustainable Agricultural Research, 2015), resource use efficiency in tomato production in Kogi state, Nigeria (Asian Journal of Agricultural Extension, Economics & Sociology, 2015), off-farm income and technical efficiency of smallholder farmers in Ethiopia (SLU Master thesis, 2014), technical efficiency of tomato production in Oyo state, Nigeria (Agricultural Science Research Journal, 2011), resource-use efficiency in tomato production in Jere, Borno state, Nigeria (Journal of Biology, Agriculture and Healthcare, 2018), and technical efficiency in the production of Nsukka yellow pepper among rural farmers in Enugu North, agricultural zone, Enugu state, Nigeria (University of Nigeria Master thesis, 2010). Lastly, a study was conducted on technical efficiency of red pepper production and its determinants among smallholder farmers (unspecified source, not dated). Journal articles published in various international journals discussing climate change impacts on vegetable production, crop management, and agricultural practices. Given article text here