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Efficiency of Homestead Gardens Farmers in Eastern Cape Province, South Africa (Pathway to Food Security)

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ABSTRACT

Background and Objective: Household food security is a global concern of which South Africa is not left out. Despite government spending on food security projects most of the rural households in the Eastern Cape are not food secure. This paper sought to examine the socioeconomic characteristics and the Technical Efficiency of homestead food farmers in South Africa (Eastern Cape Province) with a view to knowing the relevance of homestead gardens and their contributions to the food security drive. **Materials and Methods:** Two villages (Tyefu and Qamata) were purposively chosen and 60 households were randomly picked resulting in 120 homestead gardeners that were interviewed. Descriptive statistics, food security index and Stochastic Frontier Analysis were used to analyze the demographic features, food security and technical efficiency of these homestead gardeners, respectively. **Results:** It was discovered that 90% of these homestead gardens were not in use again, where they were in operations they were being operated by old women (Makhulu). As 92% of these farmers are of the age range 65-70 years. Maize, spinach, lettuce and other forms of vegetables were the dominant plants in these villages. As 68.14% of the respondents were food insecure while only 31.86% of them were food secure. The productivity of these gardeners is low but efficient in resource use. **Conclusion:** The importance of homestead food gardening in ensuring food security cannot be overlooked, hence, the call on the government to rebrand and promote homestead gardening as a pathway to the food security movement in the province.

KEYWORDS

Drive, efficiency, food security, food security index, homestead gardens, stochastic frontier analysis

INTRODUCTION

There are many definitions of the word food security. It is the fundamentals of any community's health, The World Health Organization[1], "When people do not have adequate physical, social or economic access

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to food" as stated above, it is considered, food insecurity[2]. The World Food Summit came from a conference in 1996 and declared that a state of being food secure is when everyone has constant access to enough food that is safe, nutritious and sufficient for an active and healthy life. Food insecurity was divided into four categories by Sinyolo *et al*.[3] in their study at national, regional, community and household levels. On the contrary, South Africa's situation is a country that is food secured at the macroeconomic level whereas highly food insecure at the microeconomic level[4]. According to WHO[1], a nation can meet its population's food needs while maintaining the lowest per capita nutritional requirements when it does so.

In South Africa, part of the betterment planning and settlement policies adopted by the apartheid government is the homestead food gardens. This policy assisted the former homeland settlers to be self-dependent and food secure[5]. This pattern of farming has a number of distinguishing features that confirm its performance and the characteristics of those who earn their livelihood from farming[6]. Most of these farmers operate on very small land, they are known to use obsolete tools and their harvests are predominantly for subsistence[7]. Most of the early settlers in the Eastern Cape Province are called the Bantus, they are agro-pastorals in nature. They built their gardens around any available natural resources such as or mostly water. They engaged in livestock rearing and crop production mainly for home consumption. Most of the farming works were done collectively by the villagers, thereby reducing the farm input costs. To date, the farmers in the Eastern Cape Province are versatile in the natural way of reading the climatic conditions and other farming predictions and forecasts.

A community is said to be food-secured when the residents have access to sustainable, safe, adequate and culturally accepted nutritional standard food system which maximizes self-esteem in the community. The variables such as location, culture, health status availability of natural resources, income and the educational level of the dwellers in a community are often used in defining the food security state of a community[3]. Household food security occurs when there is access to adequate and quality food for all the members of the household[4]. The prevalent hunger and malnutrition in South Africa are not caused by the non-availability of food but rather by inadequate access to foodstuff by certain groups of people in rural communities. The most vulnerable group of people to food insecurity is women and children[8]. The production and supply of food are some of the variables used in the determination of food availability and expected utility. Income is also used in determining access to food and food utilization is measured by the nutritional level of the food, the health status of the people and the care given to these villagers[9].

Homestead gardeners are the farmers who till the pieces of land around their houses or homes, they are predominantly subsistence in nature[10]. According to Muzangwa *et al*.[11], homestead gardeners have a lot of features that range from production objective which is basically for home consumption, the economic role of their production is supplementary, the tools of operation are purely simple, local and traditional in nature and the farming input costs are relatively cheap. They rely mostly on family labor and have limited access to financial assistance. They lack storage facilities for their perishable farm produce. Also getting farming input is a bit tough[12]. Among the crops that are produced by the homestead gardeners are tomatoes, cabbage, lettuce, maize and sorghum. The cost of maintaining the homestead garden such as watering, application of fertilizer, disease and pest control is so simple which encouraged the settlers to grow vegetables and plants of high value[13]. Homestead gardens are more efficient and cost-effective to run than distance farms. Although homestead food gardeners use conservation methods of agriculture, outputs are very low but consistent more meaningful sources of food were recorded when it was fully in place in the former homelands[14]. Farmers should be encouraged to use their homestead farming experience and other available skills to produce more harvest[15].

According to Slamet *et al*.[15], household food security is achievable through the development of the agricultural sector. The designing of effective programs that will have positive impacts on improving the already existing agricultural practices is important[16]. This will help in increasing the productivity of the

smallholder farmers in the rural communities of South Africa and could serve as a driver of change in households and their nutritional status[17] during this period, households are more food secure. There are lots of committed farmers who work in their gardens on a regular basis. Although the harvest was very small the resource use was efficient with the civilization, most of the young people were leaving the rural area to look for white-collar jobs thereby reducing the number of people participating in homestead food gardening. Therefore, this study examined the socioeconomic characteristics and the Technical Efficiency (TE) of homestead food farmers in South Africa (Eastern Cape Province, ECP).

MATERIALS AND METHODS

This study was conducted in ECP of South Africa in the year 2017/2018 growing season. The province, one of South Africa's nine provinces, has shared borders with the Western Cape, the Free State, KwaZulu-Natal and Lesotho in the North[18]. In this region, there are 39 municipalities, 37 of which are local municipalities and two are metropolitan municipalities. The province is the homeland of the Xhosa people of South Africa. According to Statistics South Africa, the region is home to 6,562,053 of South Africa's 51,770,560 inhabitants. Statistics show that the rural population makes up approximately 60% of the total population[19].

The demographic characteristics of ECP revealed a high prevalence of poverty, illiteracy and unemployment, as well as a dearth of basic commodities and inadequate infrastructure. There has been a continuous decline in the contribution of agriculture to the Gross Domestic Product (GDP) of the area[18-20]. Two stages (purposive and random) sampling techniques were used to select 120 respondents for this study which were drawn from four different locations namely, Tyefu and Qamata Villages in the Chris Hani District of Eastern Cape Province and administered questionnaire. Information about the state of the communities was successfully gathered as a result of meetings with stakeholders and community members. Following the conference, two villages, all located in the Chris Hani District, were chosen to serve as the research hub for this work. Data were gathered by a research team with the help of community authorities and cooperation from extension officers. A random selection technique was adopted. A total of 60 households were interviewed in each of these villages. In all, sample sizes of 120 smallholder households were interviewed for the study.

Analytical technique

Descriptive statistics: Descriptive statistics such as frequencies and percentages were used to describe the socio-economic features of the sampled households in the study area.

Food Security Index: Measuring food security of the homestead gardener Food Security Index (FSI) will be used. For this study, the Food Security Indicator (Index) used by Ohajianya *et al.*[21] was utilized. The Food Security Index (FSI) calculates the average household food expenditure in monetary terms, including both cash and farm produce consumption. If a household spends at least two-thirds of the average food spending of the sampled households, it is said to be food secure, otherwise, it is said to be food insecure. As a result, the FSI is expressed as Ohajianya *et al.*[21]:

$$F_i = \frac{\text{Per capita food expenditure for the ith households}}{2/3 \text{ mean per capita food expenditure in all households}}$$

Where:

F_i = Food security index

When:

$F_i \geq 1$ = Food secure ith household

$F_i \leq 1$ = Food insecure ith household

Stochastic Frontier Analysis (SFA): The technical efficiency of homestead food gardeners was estimated using SFA. The results of this analysis were used to predict the resource use efficiency of these homestead food gardeners. The result was used to make investment recommendations for the most effective and sustainable gardens. Battese and Coelli[22] and Ogundari and Ojoo[23] explained that an estimation of a specific company's technical efficiency was made using a Stochastic Production Frontier, which is defined as:

$$Y = f(X_i, \beta) + I$$

$$I = V - U$$

The stochastic frontier analysis provides an estimate of the technical efficiency levels. Following's[24] flexible log-linear Cobb-Douglas production function was employed in this study to calculate the stochastic frontier production function.

The stochastic frontier production function analysis: The Cobb-Douglass frontier production function is used in this study to define the stochastic frontier production function. The definition of the Cobb-Douglass stochastic frontier model is[24]:

$$Y_i = \beta_o + \beta_{1lnX1} + \beta_{2lnX2} + \beta_{3lnX3} + \beta_{4lnX4} + \beta_{5lnX5} + V_i - U_i$$

Where:

ln = Natural Logarithm
Y_i = Output from homestead garden (kg)
X_1 = Seeds (kg)
X_2 = Fertilizer (kg)
X_3 = Pesticides (Liters)
X_4 = Herbicides (Liters)
X_5 = HCI (Liters)
V_i = Error term (random)
U_i = Error term (non-random or technical inefficiency effect)
β_0 = Intercept
β_1-β_5 = Coefficients of regression

Inefficiency model is represented thus:

$$U_i = \delta_0 + \delta_1 S_1 + \delta_2 S_2 + \delta_3 S_3 + \delta_4 S_4 + \delta_5 S_5 + e_i$$

Where:

U_i = Inefficiency effects of the ith farm
S_1 = Sex
S_2 = Marital status
S_3 = Age in years
S_4 = Years of education
S_5 = Numbers of extension visit
δ_1-δ_5 = Estimated parameters
e_i = Error term

Statistical analysis: Descriptive Statistics and Stochastic Frontier Analysis were used in this study and the results were taken at 1, 5 and 10% levels of significance.

RESULTS AND DISCUSSION

Socio-economic characteristics of respondent: The result in Table 1 showed clearly that 90.0% of the respondents were females and 10.0% were males. It is an indication, that more females engage in homestead food gardening than the male counterparts and accounted for the reason for low productivity in the study areas. The result conforms with the study carried out by Adekunle[16]. In addition, 35.8% of the total responses are between the ages of 61 and 70, followed by 6.6% between the ages of 31 and 40, 21.6% between the ages of 41 and 50, 20.8% between the ages of 51 and 60, 14.4% between the ages of 71 and 80, 0.80% between the ages of 81 and 90. The implication of this distribution is that most of the people engaging in homestead food gardening are old people. That is why productivity is low. This result agreed with the study carried out by Meyer and Nishimwe-Niyimbanira[25] who asserted that as women get older they tend to participate in agriculture. Moreover, about 35.8% of households have between 3-6 members in the house, 48.3 of the households have between 7-10 people which is the largest proportion and 15.9% of the households have between 11-15 members. This result is in line with the study carried out by Musotsi *et al*.[26], that households with large numbers of people do participate in farming because they will have laborers to work on the farm. The distribution of the household by primary occupation showed that 75% of the household is majorly in farming, followed by 11.8%, the artisans and

Table 1: Socioeconomic characteristics of the respondents

	Frequency	Percentage
Gender		
Male	12	10.0
Female	108	90.0
Age		
31-40	08	6.6
41-50	26	21.6
51-60	25	20.8
61-70	43	35.8
71-80	17	14.4
81-90	01	0.8
Household size		
3-6	43	35.8
7-10	58	48.3
11-15	19	15.9
Distribution of the household by pastoral		
Sheep	40	33.3
Goat	9	7.5
Chicken	55	45.8
Cow	9	7.5
Not specified	7	5.9
Primary occupation		
Family	90	75.0
Teaching	8	6.6
Civil servant	4	3.3
Artisans/apprentices	14	11.8
Not specified	4	3.3
Crop types		
Cabbage	61	50.8
Lettuce	5	4.2
Carrot	10	8.4
Maize	5	4.2
Spinach	20	16.8
Butternut	19	15.6
Distribution of the households with the crop		
Consumption	80	66.7
As gift	30	25
Sales	10	8.3

Field survey, 2017

Table 2: Stochastic frontier (half-normal distributions)

Variable	Parameters	Coefficient	SE	Z	p-value
Stochastic frontier					
Intercept_	β_0	127.55	4362.11	0.03	0.980
Seeds	β_1	29.89	3.96	7.55	0.000***
Fertilizer	β_2	5.73	1.31	4.37	0.000***
Pesticides	β_3	-34.10	80.19	-0.43	0.670
Herbicides	β_4	81.77	37.15	2.20	0.030**
HCI	β_5	1106.06	200.83	5.51	0.000***
Inefficiency model					
Sex		175.09	163.03	1.07	0.28
Marital status		51.62	161.60	0.32	0.75
Age		-10.93	6.71	-1.63	0.10
Education		23.42	19.43	1.21	0.23
Extension visit		-1.86	3.79	-0.49	0.62
Variance parameter					
Sigma_v		637.0.1	43.34		
Sigma_u		0.08	5410.25		
Sigma2		405784.9	55222.77		
Lambda		0.00	5410.66		
Log-likelihood		-850.58			
Wald chi2		532.46			
Mean technical efficiency		0.001			

** and ***represent 1, 5 and 10% levels of significance, SE: Standard error, Z: Z value and estimated standard error

6.6% engaging in teaching. As 3.3% did not signify their occupational status while the remaining 3.3% are civil servants. It showed that a larger percentage of the households sampled are majorly into farming. This result is in agreement with the study carried out by Mehrara and Mehrara[27] that a household's primary occupation is the one in which they spend at least 75% of their time and get the majority of their income. The result showed that 50.8% of the household plant cabbage, which is the plant with the highest percentage, Spinach is the next most planted vegetable with a distribution of 16.8% of the households and Butternut has 15.6% on the distribution chart, lettuce and maize have the same 4.2% and carrot is distributed at 8.4%. This result is in support of the outcome of the study carried out by Adekunle[16]. However, 66.7% of the households consumed their produce. As 25% agreed that sometimes they use it as gifts to their neighbor or visitors while 8.3% said they sell it to any intending buyer which is a very rare instance. This is in conformity with Muzangwa *et al.*[11], who said the sole aim of homestead gardens is purely for home consumption. Finally, about 45.8% of the households are into poultry keeping alongside the cultivation of land. As 33.3% had sheep in their homes and 7.5% of the households kept cows and goats. As 5.9% of the household did not specify the type of animal they keep and lastly. This confirmed the description of the Bantus in the Eastern Cape as an agro-pastoral group by Perry[20].

Food security: The results of the food security status revealed that 68.14% of the respondents were food insecure while only 31.86% of them were food secure.

Technical efficiency result of homestead food gardeners: The result of parameters obtained from the Stochastic Production Function is presented in Table 2. Due to the assumption that the data used in the model have a half-normal distribution, the coefficients (β's) reported in this Table represent the elasticities of the various inputs utilized in household gardens[28]. Seed, fertilizer, herbicides and HCI were all important and positive factors in the Table, indicating that their use was profitable. As a result, an increase in these inputs will eventually lead to an increase in farmers' yield. This result is in agreement with the findings of Akintayo and Rahji[2] that a unit increase in this input will eventually lead to a rise in the gardeners' output because the seed is a positive and significant component. In addition, the result also confirms the findings of Geta *et al.*[29] and Adio and Olaoye[30] where they found a strong and positive correlation between higher fertilizer application rates by farmers and higher production rates. This suggests that increasing the

amount of seed, fertilizer and pesticide used would considerably enhance yield for homestead gardeners. In terms of yield, pesticides showed a favorable link, but it was minor. This can mean that gardeners are using this variable less than they should be because it responds more to output. This result disagrees with the findings of Mehrara and Baghbanpour[27] which indicated a significant and positive impact of the usage of pesticides on maize production. With the average estimate of technical efficiency to be 100%, the predicted technical efficiencies in the study area vary greatly among the homestead food gardeners. This reveals that in this region farmers use their available production factors more effectively. Sex, marital status and age, which were socio-demographic factors that belonged to the inefficiency model, on the other hand, were all beneficial factors but inconsequential to the production of homestead gardeners.

This study clearly exposed the danger of neglecting the settlement plan and the dependence policy of the apartheid as enshrouded in the homestead food garden in the former homeland. Thus, for the food security agenda for all South Africans to be ensured since it is still an incubation period, this concept of homestead gardening plays a long way.

This study was only carried out in the Eastern Cape Province (ECP) of South Africa. The sample size can be expanded for further study.

CONCLUSION

The study discovered that the homestead food gardeners are very efficient in the use of the available few farming input resources at their disposal. This study exposed the danger of neglecting the settlement plan and the dependence policy of the apartheid as enshrouded in the homestead food garden in the former homeland leading to food insecurity. The study, therefore, recommends that there should be a guild in the high school to incorporate the teaching of homestead food gardening in the teaching curriculum.

SIGNIFICANCE STATEMENT

This study derived its purpose from the fact that household food security is achievable through the development of the agricultural sector and that the art of homestead food gardening has faded away. The result of the food security status revealed that 68.14% of the respondents were food insecure while only 31.86% of them were food secure and that seed, fertilizer, herbicides and HCI were all important and positive factors and their use was profitable and probably improving the food security status. As a result, the availability of these inputs will eventually lead to an increase in farmers' yield. The predicted technical efficiencies in the study area vary greatly among the homestead food gardeners.

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