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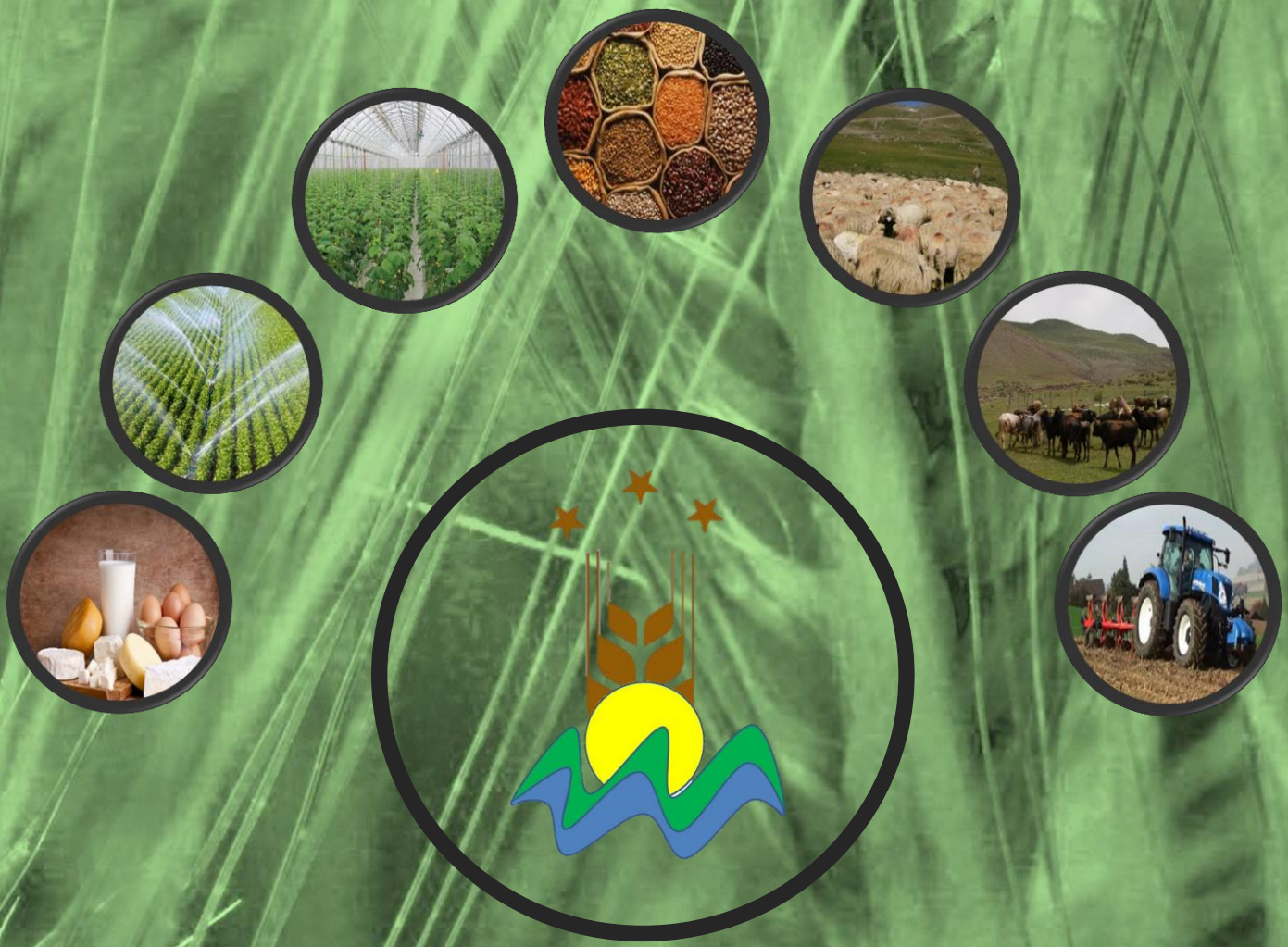

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Research Article
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SEASONALITY OF EGG DEMAND, PRODUCTION, AND SUPPLY IN GREATER PORT HARCOURT CITY, NIGERIA

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Abstract: Seasonality in smallholder chicken egg production, demand and supply in Greater Port Harcourt City (GPHC) was studied using exploratory research to build theory. Six wholesalers, six retailers, three intercity traders, six institutional consumers, and the Chairman, Poultry Association of Nigeria, Rivers State, were interviewed one-on-one using a checklist. Focus Group Discussion with eight egg producers was carried out to obtain insight on seasonal influences on the egg chain. Quantitative data was analyzed using Microsoft Excel while qualitative data was analyzed using thematic analysis. Results indicate that egg production in GPHC is grossly inadequate to meet the demand, thus, encouraging influx of eggs into GPHC from other parts of Nigeria. Egg production, demand and supply in GPHC is influenced by school calendar, Christmas and end of year/new year vacations. Also, smallholder egg production is poorly planned, causing seasonal scarcity and glut. To eliminate seasonal scarcity and glut, capture the full benefits of the high demand periods for stakeholders especially smallholders, extension workers and egg producing entrepreneurs need to emphasize planned production and cost minimization strategies to increase local production and supply competitively priced eggs throughout the year.

Keywords: Calendar, Glut, Scarcity, Vacation, Intercity trade

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1. Introduction

Egg production traditionally follows seasonal cycles (FAO, 2003). Seasonal variation is a major non-genetic factor affecting performance of laying birds as well as marketing and profitability of egg business particularly in the tropics (Schulte-Drüggelte and Thiele, 2013; Oguntunji et al., 2015).

Seasonal variation in egg production is significant in Nigeria's sub-humid zones (Malau-Aduli et al., 2003). High ambient temperature moderated by variation in climatic seasons causes heat stress on poultry. This adversely affects and varies the performance of hens, thereby, reducing egg production, fertility, and hatchability. Example, higher egg production was recorded in wet season (April-September) compared to dry season (October-March) in parts of Nigeria (Guobadia, 1997; Oguntunji et al., 2015).

When production, influenced by climatic season, supports high production in a declining or steady demand, glut results. But, lower production induced by unfavorable climatic season and rising demand causes scarcity. In Ejigbo, Nigeria, seasonal glut could last for four months (March-June) with 6 months' post-glut recovery period. To survive the glut, farmers employ strategies such as sales of live birds, disposal of stale eggs, sales of eggs at prices lower than marginal cost by offering them at high discount rate and credit sales (Bolu and Aremu, 2007). However, modern commercial layers have the genetic potential to maintain high egg production throughout the climatic seasons of the year (Schulte-Drüggelte and Thiele, 2013).

Though gains have been made in reducing the effect of climate-induced seasonality on egg production by layers, the impact of climate and man-made seasons on the demand and marketability of eggs is still a serious problem.

The main aim of egg marketing is to secure a more even supply of eggs over the year at relatively stable prices (FAO, 2003). However, this is not always the case due to seasonality influences, especially in poorly organized markets and weakly coordinated value chains. For instance, though the egg business was lucrative, it was still affected by seasonality in demand in parts of Southwestern Nigeria (Adedeji et al., 2014). Also, a wide seasonal variation in the price of eggs due to change in demand and supply at different times of the year was observed elsewhere in Nigeria (Omar et al., 2013). The overall impact of seasonality on egg production, supply, marketing, and demand include poor food security, unfair business practices by those capable of exploiting the situation to their advantage, and erosion of incomes for the vulnerable groups in the egg chains, such as

smallholders.

To resolve these problems, there is need to analyze effects of seasons on egg production, supply and demand. This type of analysis looks beyond averages of the market to gaining a better understanding of the monthly, seasonal, or holiday business cycles of eggs. Seasonality analysis is important because periods of high demand often bring new opportunities and a premium price as the market expands. Also, seasonality might offer counter-cyclical opportunities to move goods elsewhere where local production is lower. The seasonal opportunities so revealed could be used to improve performance of egg supply chain and target investment (USAID, 2008).

Seasonality of egg production, demand and supply in Port Harcourt has not been paid serious attention, thus, limiting the use of the data for interventions that could improve the egg supply chain in the study area. This study, therefore assessed the effects of seasons on the demand, production and supply of eggs by commercial smallholder egg producers in Port Harcourt to generate actionable insights for egg market development interventions and investment decision-making for egg producers in the study area and elsewhere.

2. Materials and Methods

2.1. Description of Study Area

Greater Port Harcourt City (see Figure 1) has eight Local Government Areas (Harcourt City, Obio/Akpor, Ikwerre, Etche, Oyigbo, Eleme, Okrika and Ogu/Bolo) and is located in Rivers State, Nigeria. Port Harcourt is the fourth largest city in Nigeria. It covers 1900 km2 area with over 2 million people (Ede et al., 2011). Transportation within and outside the area is by rail, road, air and water. In addition, Port Harcourt is the center of oil and gas business in Nigeria.

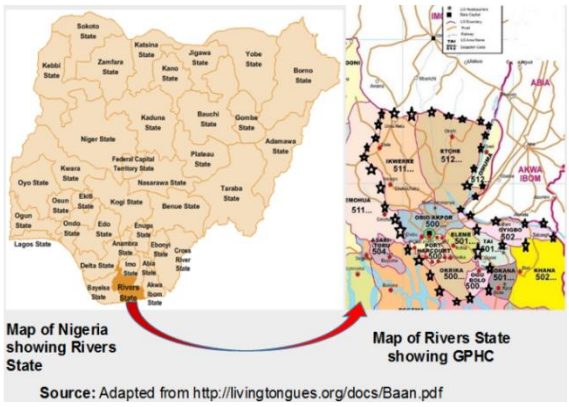

Figure 1. Maps of Nigeria and Rivers State showing Port Harcourt.

2.2. Target Population

The sample was obtained from population of commercial egg producers located in Greater Port Harcourt in Rivers State. Using scale of production based on the number layers owned by the farmer, we classed the commercial egg producers to three: (i) 10,000 layers or more (large-scale), (ii) 2,500-9,999 layers (medium-scale), and (iii) less than 2,500 layers (smallholder or small-scale). The research sample was obtained from class (iii) or small-scale egg producers.

2.3. Operationalization of Variables

1) Commercial smallholder egg production systems refers to egg producing farms or egg producers that have a maximum of 2, 500 layers and the eggs so produced are mainly for sale.
2) Driving distance refers to the distance covered (in kilometers) in moving eggs produced elsewhere in Nigeria to Greater Port Harcourt City for sale.
3) Driving time means the time used to transport the eggs from other parts of Nigeria to Greater Port Harcourt City
4) Seasonality refers to any predictable pattern in egg demand, production and supply that recurs every calendar year.
5) Geographical flow of eggs refers to movement of eggs through any means of transportation to Greater Port Harcourt City.
6) Cost of eggs refers to the variable costs of eggs from the farm gate in other parts of the country to Greater Port Harcourt City. It includes farm gate price of eggs, transportation and handling charges and other costs along the way to Greater Port City.

2.4. Data collection and Analysis

Desk study was first carried out to gather information on background of study area, study concepts, and present state of knowledge in the research area.

Desk study was followed by a survey using semi-structured questionnaire. Three local government areas (LGAs) of the eight in GPHC were purposively selected for the survey because from observation and enquiries they probably have the largest concentration of poultry farmers. These LGAs included Obio-Akpor, Oyigbo and Etche. Forty-seven commercial smallholder egg producers rearing not more than 2,500 birds were identified and used for the survey. Of this number, 17 were from Obio-Akpor and 15 each from others. Obio-Akpor had 17 because it has the largest population of egg producers based on enquiries from Poultry Association of Nigeria, Rivers State chapter. The snowballing sampling technique was used to sample the farmers. This was because no register of farmers (hence, no sampling frame) could be obtained from government or other agencies, hence, subjects were difficult to come by. The farmers were administered questionnaires and personally guided to fill-in the answers. After an interview, the interviewee was asked for leads to other farmers having 2, 500 birds and below. Input sellers were also helpful in recruiting subjects. All forty-seven questionnaires (100% response rate) were filled and returned.

Following the survey, focus group discussion (FGD) was used to collect data that gave deeper insight on issues that arose from the survey and that needed further

probing. Open-ended questions from a checklist were used for FGD. Eight egg farmers (4 females and 4 males) were purposively selected, considering gender inclusion and spread across the LGAs.

Quantitative data was analyzed using descriptive statistics (mean, median and mode) and simple percentage in Statistical Package for Social Sciences (SPSS) version 24. Data from the FGD were analyzed using matrices and thematic analysis and simple percentage. Results were presented in graphs and seasonality diagram.

2.5. Limitations of the Study

There was no sampling frame because Greater Port Harcourt City Authority does not have a database of egg producers from which we could have drawn the sample. This means the findings may not be generalized to commercial smallholder egg producers outside the study area.

2.6. Definition of concepts

There is no agreement in literature on the definition of smallholder poultry farming in Nigeria, especially, as it concerns 'flock size'. Hence, in this research, we classed flock size as: industrial/large-scale (≥10,000 layers), medium-scale (2,500-9,999 layers) and small-scale (<2,500 layers). The term 'smallholder' as used in this study, therefore, include small and medium-scale egg producing farms (i.e. ≤10,000 layers).

2.7. Research Strategy

This was an exploratory and theory-building research. The aim was to study to understand and explain rather than identify causal patterns and regularities. Preliminary desk study was carried out to identify stakeholders and have an overview of the case. Full desk study was done during literature review phase. This was followed by triangulated one-on-one in-depth interviews with 22 stakeholders (Table 1) in three Local Government Areas (Obio-Akpor, Oyigbo and Etche) of the eight that constitute Greater Port Harcourt City.

Table 1. Stakeholders interviewed

S/N	Stakeholder	Type	No.
1	Wholesalers	Hawking wholesaler	3
-	-	Sedentary wholesaler	3
2	Retailers	Supermarket	3
-	-	Small street shop	3
3	Institutional consumers	Boarding school	3
-	-	Fast food chain	3
4	Trader	Intercity trader	3
5	*PAN Chairman	-	1
	Total		22

*PAN = Poultry Association of Nigeria, is an association of poultry farmers formed to protect interest of the farmers.

The three were picked because they have the highest concentration of poultry farmers.

After the stakeholder interviews, focus group discussions were conducted with eight purposively selected farmers (3 females and 5 males) considering gender and spread across the Local Government Areas. The focus group discussion engendered deeper insight on issues that came up during in-depth interviews with other stakeholders. Distances and driving time between Greater Port Harcourt City and other cities were generated from online Google maps. Quantitative data was analyzed using Microsoft Excel to generate averages. Thematic analysis was used to analyze qualitative data. Results are presented in map, charts and seasonality calendar. The Nigerian currency, the Naira (₦) was used for the calculations involving money. As at the time the study was carried out, one US Dollar (1$) was equivalent to ₦ 355.

2.8. Ethical Consideration

Approval was granted by the Research Ethics Committee of University of Port Harcourt for the survey and FGD questionnaires. The consent of respondents and participants were sought before commencement of the research. Assurance of confidentiality for information obtained were given and observed throughout the research.

3. Results

3.1. Geographical Flow of Eggs into Greater Port Harcourt City

The flow of eggs into GPHC is shown (Figure 2). Interview with intercity traders and wholesalers indicate that eggs were brought into GPHC from farms in Lagos, Kwara, Oyo, Osun, Ogun, Enugu, Anambra and Imo states. The Poultry Association of Nigeria, Rivers State Chairman asserted that about 60% of the eggs marketed in GPHC come from other Nigerian cities.

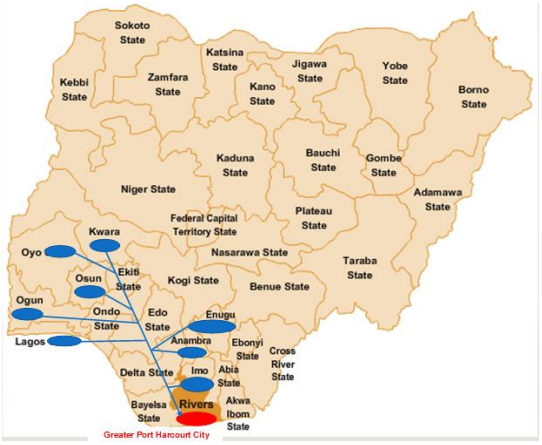

Figure 2. Geographical flow of eggs into Greater Port Harcourt City.

3.2. Driving Distances

Figure 3 presents driving distances by road to the study area. Lagos, Ilorin and Ibadan cities are 619, 655 and 626 kilometers to GPHC, respectively. Also, Enugu, Onitsha, Owerri and Port Harcourt suburbs are 226, 206, 108 and 16 kilometers to GPHC center, respectively.

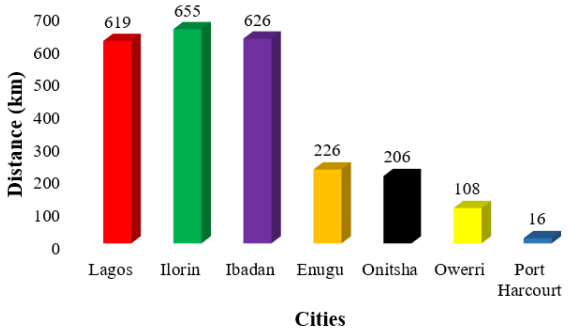

Figure 3. Driving distances from other cities to Port Harcourt.

3.3. Driving Time

The driving times by road to Greater Port Harcourt City center from other cities are presented (Figure 4). Lagos and Ibadan take 8 hours while Ilorin is 9 hours. Enugu and Onitsha take 3 hours each while Owerri and Port Harcourt suburbs take 2 and 0.5 hours each, respectively.

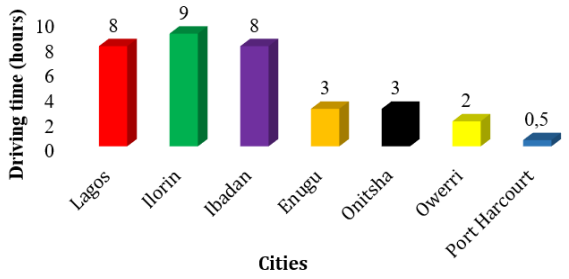

Figure 4. Driving times from other cities to Port Harcourt.

3.4. Cost of Eggs

Transport cost, cost price (farm gate) and total cost per crate of bringing eggs from other cities to GPHC are shown (Figure 5). The transport costs were ₦60 (Lagos), ₦65 (Ilorin), ₦63 (Ibadan), ₦30 (Enugu), ₦29 (Onitsha), ₦21 (Owerri) and ₦4 (Port Harcourt suburb). The farmgate cost of a crate of egg at the different cities were N650 (Lagos, Ilorin and Ibadan), ₦680 (Enugu, Onitsha and Owerri) and ₦750 (Port Harcourt environs). In sum, the total costs were ₦710 (Lagos), ₦715 (Ilorin), ₦713 (Ibadan), ₦715 (Enugu), ₦709 (Onitsha), ₦701 (Owerri), and ₦754 (Port Harcourt environs).

3.5. Seasonality of Egg Production, Demand and Supply

Information from focus group discussion with farmers and in-depth interviews with other stakeholders were used to construct a seasonality calendar showing patterns of climatic season, egg production, demand and supply in Greater Port Harcourt City as shown (Figure 6).

LD1: Low demand season I. It is the first week of January. Most people that travel for Christmas, end-of-the-year, New Year and schools' vacation are not yet back. Demand is low.

HD1: High demand season I. It begins from second week of January to fourth week of March. Most people are back from vacation. Schools have resumed for Second Term. Households buy eggs to prepare food for their children as they go to school. Demand is high.

LP: Low-production season. There is high atmospheric temperature which is not good for productivity of layers. Begins from the first week of January to end of April. Mass culling of old layers in December to target the huge demand for poultry meat at Christmas, end-of-year and New Year festivities without planning for pullets that would start laying by January the following year. Industrial farms exploit this gap by planning their production. There is egg scarcity at this period, increasing the prices by 6-13%.

LD2: Low-demand season II. Begins from second week to third week of April. Schools have vacated for the Second Term. Demand is low.

HD2: High-demand season II. Begins from fourth week of April to third week of July. Schools are in session for the Third Term. Demand is high.

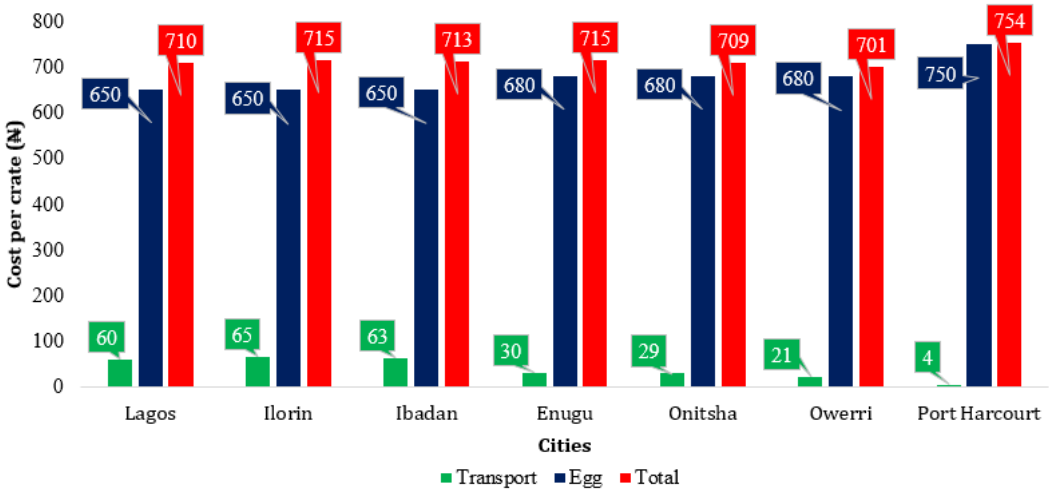

Figure 5. Cost of eggs brought from other cities to Greater Port Harcourt City.

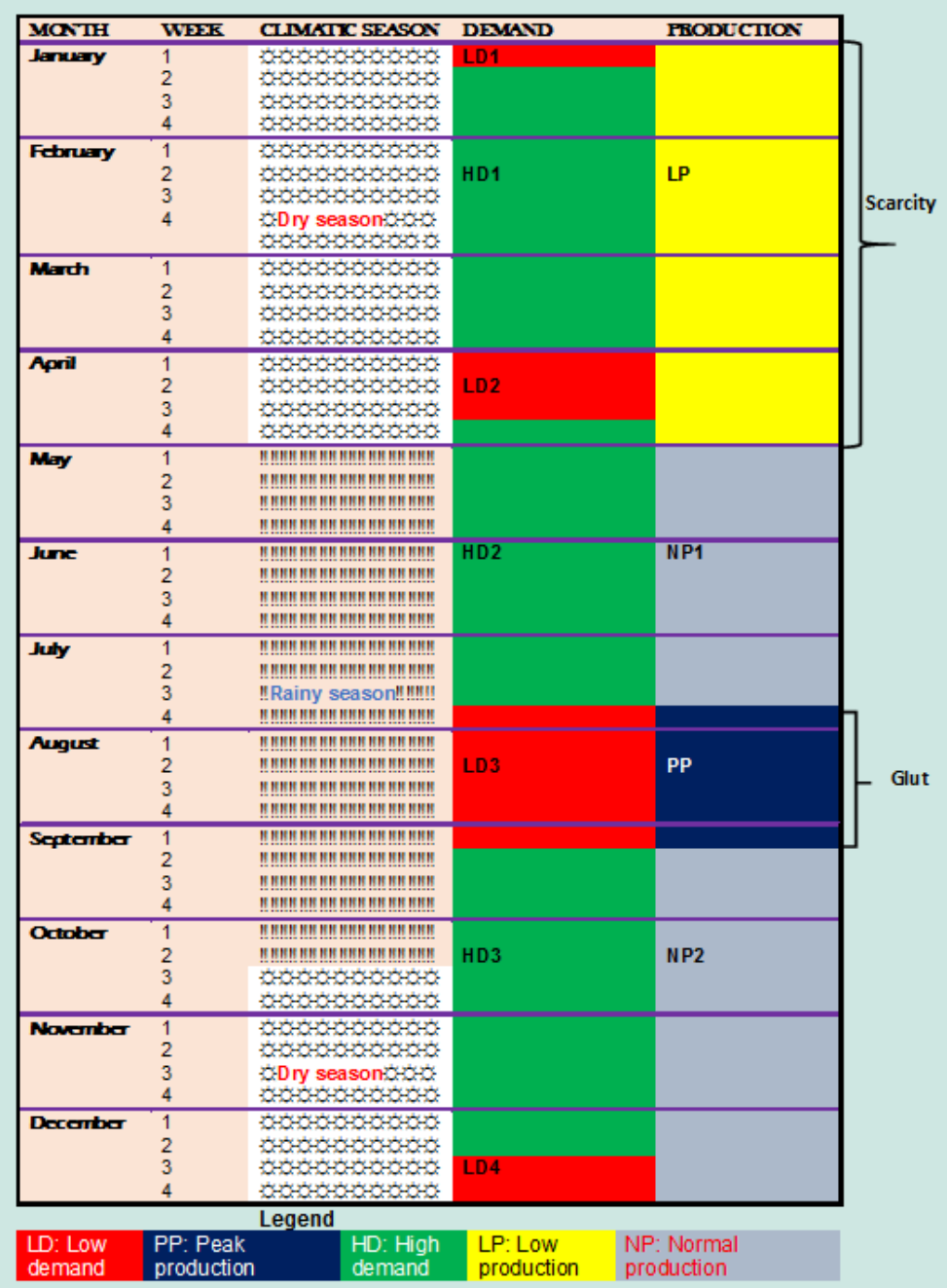

Figure 6. Seasonality of egg production, demand and supply in Greater Port Harcourt City.

NP1: Normalized production season I. Pullets stocked between January and February have started laying. Local production in GPHC has started picking up and fully normalizes by the end of this phase. Begins from the fourth week of May to the third week of July. Also, atmospheric temperature is reducing as rains have started fully. Weather is cool and good for layers' productivity. Production is normal.

LD3: Low-demand season III. Begins from the fourth week of July till the first week of September. Schools are on long vacation for the Third Term. Demand is low.

PP: Peak production. Starts from the fourth week of July to the first week of September. All the farms that stocked earlier in the year have started producing. Weather is cool and good for layers' productivity. Glut is observed in the chain by the middlemen bringing in many eggs from other cities without considering that local production has peaked.

HD3: High-demand season III. Begins from second week of September to the second week of December. Schools have resumed for the First Term. Demand is high.

NP2: Normalized production season II. Begins in the second week of September and ends by the last week of December. Weather is cool and good for layers' productivity. Influx of eggs from outside GPHC has been adjusted to the peak local production.

LD4: Low-demand season IV. Begins in the third week of December till early January of the following year. People have started travelling out of city for Christmas, end-of-the year and New year vacations. Demand is low.

4. Discussion

The flow of eggs into Greater Port Harcourt City (GPHC) from as far as Lagos, Ilorin, Ibadan, Onitsha and Enugu indicates the dynamism of the Nigerian egg market as encouraged by open market economy, free movement of goods across the country and weak geographical barriers of entry from one state to another, within the country. It also confirms the PAN chairman's position that 60% of eggs in GPHC come from outside GPHC and further shows where they come from. Inter-city traders are acting as a transmission belt, moving eggs from surplus to deficit regions to fill the gap created by insufficient local production (Clapp, 2015).

Cities like Lagos, Ibadan and Ilorin are more than 600 kilometers from GPHC while Enugu and Imo are above 100 kilometers away. When the risks of bad roads and high cost of transport (Tunde and Adeniyi, 2012; Mohammed et al., 2013) in the country are factored in, it indicates that for the inter-city traders to still prefer procuring eggs from these far-flung cities, local egg production in GPHC is either inadequate to satisfy the local demand or local prices are far higher than cities where the eggs originate or both. This situation likely offers a better margin. This is supported by the traders' complain during interviews that they are unable to procure enough local supply.

The driving time by road to Greater Port Harcourt City center from other cities (Figure 3) shows Ilorin to be the longest (9 hours) followed by Lagos and Ibadan (8 hours), Enugu and Onitsha (3 hours), Owerri (2 hours) and Port Harcourt suburbs (0.5 hours). The time spent on the road reflects the distance, state of the road, traffic situation and the state of the vehicle. In this analysis, only the distance is considered. If the bad state of Nigerian roads and thick traffic situation (Tunde and Adeniyi, 2012) are added, then the time could be higher because interviews with intercity traders indicate they spend about 12 hours on the road to GPHC from Ilorin, Ibadan and Lagos. The low local production in GPHC, cheaper farm gate prices in those other cities, higher market prices in GPHC and resultant higher margins could be the reason why these traders go so far in search of eggs.

Transport cost, cost price (farm gate) and total cost per crate of bringing eggs from other cities to GPHC (Figure 4) indicate that Ilorin had the highest transport cost per crate (N65) followed by Ibadan (N63), Lagos (N60), Enugu (N30), Onitsha (N29), Owerri (N21) and Port Harcourt environs (N4). The closer the city to GPHC, the lower the transport cost. This is normal as transport cost is charged per distance (Tunde and Adeniyi, 2012). Transportation between production and consumption areas is expensive, difficult to organize and risks heavy losses. Seasonal changes in the prices of eggs mainly reflect variations in production (FAO, 2003).

The farm gate cost was similar (N650) for Lagos, Ilorin and Ibadan, N680 for Enugu, Onitsha and Owerri and N750 for Port Harcourt environs. The farm gate price increased as the cities got closer to GPHC. This could be due to cost of production (cost of feed, labour, day-old-chicks, transportation and medication) which is cheaper elsewhere than GPHC. Most producers of poultry inputs are located in the Southwest (Ibadan, Abeokuta Lagos) which has the most developed poultry industry in Nigeria and feed ingredients are cheaper in the North where Ilorin is located (Akinwumi et al., 2010). Also, Onitsha and Enugu are closer to the North where feed ingredients are cheaper. The intercity egg trade is encouraged by the lower farm gate price of eggs in those other cities and lower costs of moving them to GPHC.

The total landing cost for a crate of egg varied widely among the cities under examination: Ilorin and Enugu (₦715), Ibadan (₦713), Lagos (₦710), Onitsha (₦709), Owerri (₦701) and Port Harcourt environs (₦754). Eggs purchased from farms within GPHC were the most expensive followed by those from Ilorin and Enugu, Ibandan, Lagos and Onitsha in that order. Though the lowest was from Owerri, interviews with stakeholders reveal that consistent availability and in required quantities was a setback that necessitates them going as far as Ilorin, Lagos, Ibadan, Onitsha and Enugu to source for eggs. Availability affects the demand for food products (Dixie, 2005).

Seasonality analysis in value chains helps to identify seasonal opportunities for chain improvement and investment (USAID, 2008). From Figure 5, in GPHC, egg production by hens increase in the rainy season when the weather is cool and temperature is within the comfort zone of the birds but reduce during the dry season when the weather is hot causing heat stress. This agrees with several literatures that demonstrated the significant influence of high ambient temperature, prevalent in the dry season, on the lowering of egg production by commercial layers in humid southern Nigeria (Guobadia, 1997; Malau-Aduli et al., 2003; Oguntunji et al., 2015). Therefore, there is opportunity for introduction of season management practices with proper planning to ensure exploitation of rainy and dry season for the benefit of the birds and farmer by reducing the effect of high humidity and ambient temperature on production (Guobadia, 1997).

Also, interviews and FGD findings indicate that mass culling of old layers, by smallholder farmers in December, without restocking pullets that will start laying by January of the new year, causes egg scarcity throughout the first half of the new year leading to a 13% increase in price. Thereafter, egg glut occurs at the middle of the year when unrestrained influx of eggs from other cities combines with peak local production. Production, however, normalizes between May-July and September-December. This agrees with literature as there was a wide seasonal price variation of egg in the selected markets due to change in demand and supply at different times of the year in India (Omar et al., 2013) and climatic seasons influence egg consumption (Karthikeyan and Nedunchezhian, 2014).

The demand for eggs increase when schools are in

session and decreases when they are on holidays. Also, Christmas, end-of-the-year and New Year vacations reduce demand for eggs. In Nigeria, this agrees with literature but reports from India indicate that festival seasons (New year and Christmas) increase demand for eggs, thus, helping rise in prices during the months of November and December (Karthikeyan and Nedunchezhian, 2014). Differences could be due to whether eggs are used for the festivals in question. In India, the eggs are used for the celebration but in Greater Port Harcourt City the low demand is due to reduction in town population as people migrate from GPHC to their villages thus reducing the demand for eggs. In addition, in GPHC, chicken, beef and other types of meat and not eggs are used to celebrate the festivals.

In all these, opportunities exist for planning of production by smallholders. The main aim is to secure a more even supply of eggs over the year at relatively stable prices (FAO, 2003). Therefore, producers can vary their production schedules to maximize their income from egg, reduce costs, considering seasonal price cycles, preferences of middlemen and specific customer demands. Optimal replacement schedule calls for keeping the current flock in production if its weekly contribution margin exceeds the expected average weekly contribution margin of a new flock but not ignoring seasonal variation in monthly egg income (Schulte-Drüggelte and Thiele, 2013). Another opportunity may be through vertical integration mechanisms e.g. contract farming, which narrows seasonal variation in production and prices of poultry eggs (Gillespie, 1998).

5. Conclusion

The study examined seasonality in the smallholder egg value chain in Greater Port Harcourt City using exploratory research. It is concluded that egg production in the study area is poorly planned and inadequate to satisfy demand, hence, causing seasonal scarcity and glut, with attendant influx of eggs from other parts of Nigeria. Egg value chain is significantly influenced by school calendar, Christmas and New Year vacations. To eliminate seasonal scarcity and glut, capture the full benefits of the chain for smallholders, egg extension workers and entrepreneurs need to focus on strategies that will plan production, minimize cost to increase supply of competitively priced eggs throughout the year in GPHC.

Author Contributions

JNI; conceived the research idea, planned, gathered, analyzed and interpreted the data and wrote the manuscript. JM; supervised the research, validated the research instruments and methods, structured the paper and corrected the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

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ORGANIC LARGE CARDAMOM FARMING IN LONGLENG DISTRICT: PROMOTING GROWTH WITH POVERTY REDUCTION

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Abstract: Longleng, the smallest and poorest district of Nagaland, situated in the North-Eastern region bordering towards Myanmar is gradually becoming the hub of large cardamom (AmomumsubulatumRoxb)production.At the present time, large cardamomcultivation has become one of the foundation economies and farmers were motivated for cultivation of large cardamom by various governmental agency like Agriculture Technology Management Agency, Horticulture department, Agriculture department and Krishi Vigyan Kendra and they are shifting their focus from growing paddy to large cardamom as the aforesaid agencies provide proper training and ad rem suggestions to the farmers.Most of the farmers living in the region are following traditional methods for cultivation, which are eco-friendly, less expensive due to utilization of local resources, knowledge and labour. Research survey was conducted in Yongam, Nian, Yongnyah and Pongo village in 2017-18. A total of 80 respondents i.e., large cardamom growers were selected using stratified random sampling technique. Additionally, two local traders were interviewed to know various details regarding marketing of large cardamom. The paper investigates the size of landholding, production, productivity, cost and net return. The result shows higher BCR for large acres of areas as 1.25, 1.96, 3.13 and 3.33. Cobb-Douglas production function exhibits diminishing return to scale. To analyze the efficiency of organic large cardamom farming, SWOT analysis was carried out. The study pointed out that the cardamom farming could be a highly profitable and market-oriented enterprise in Longleng. It also points out the problems faced by the cardamom growers and finally suggests policy implication.

Keywords: Land holding, Production, Productivity, Benefit cost ratio (BCR), Cobb-Douglas production function

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1. Introduction

Agriculture and allied sector plays significant role in the socio-economic development of the state (Gavian et al., 2002; Griffin, 1974; Mellor et al., 2006; Ahluwalia, 1978; Hazell et al., 1991; Lewis, 1954).This sector is a major contributor to the state economy as well as providing livelihood to more than 71.14 per cent of the working population (Census, 2011). However, the mountainous topography and uneven terrain breaking into small lowland and valley area is encumbrance to a large scale production for commercial purpose. The three types of traditional farming systems in practice are Jhum, terrace rice cultivation and wet rice cultivation (Ninan, 1992; Rasul and Thapa, 2003; Saxena et al., 2007; Jeeva et al., 2005; Singh and Singh, 2017; Tiwari, 2003; Unai, 2005; Toky and Ramakrishnan, 1981). Despite of all these obstacles, farmers have significantly moved on to adopt system such as integrated approaches, organic and dry land farming. Some farmers have gone forward to grow commercial crops such as tea, rubber, kholar, ginger, cardamom, oilseeds, black pepper, pluses and tuber crops (Archer et al., 2008; Vision 2025, 2012). In the course of time the predominance of chemical intensive farming has resulted in a near stagnant level of productivity of many of the economically important crops and the indiscriminate use of chemical fertilizers and pesticides has eventually emerged as a potential source of danger not only to the sustainability of the environment but also to the safe food requirement of our population (Devi, 2010; Crissman et al., 1994; Ajayi, 2002; Antle and Pingali, 1994; Jeyaretnam, 1990: Saju et al., 2011). As a result of loss of agro-ecosystem vitality and productivity, the cost of cultivation has escalated and this led most of the small and marginal farmers to shift away from raising food crops to cash crops in order to sustain their economic viability of agriculture (Finnis, 2006). This scenario can be predominantly observed in states like Nagaland, Sikkim and Mizoram where there is an ideal climate for high value low volume crops prevails. This situation made it inevitable to think beyond the unsustainable agricultural practices of the country and slowly, a number of alternative eco-friendly farming practices have evolved from different parts of the country. While analyzing all the developments from different parts of the world, organic agriculture seems to have an edge in the adoption process among the farming community of Nagaland and the success of organic farming is predicted by the availability of eco-friendly method capable to sustain agricultural productivity,

increase market potential and maintain economic viability (Kuotsuo et al., 2014; Chandra, 2005). Furthermore, organic agriculture can be more clearly defined compared to sustainable agriculture and takes its reference point in environmental protection. Moreover, organic agriculture is the most advanced and best developed approach to environment friendly farming, and certification bodies provide well-defined norms for organic agriculture in relation to certification (Singh, 1978; Awasthe et al., 2011; Das, 2007). Large cardamom (AmomumsubulatumRoxb) is the most important perennial cash crop in the Eastern Himalayan region (Sharma et al., 2000). Farming of large cardamom appeared to offer sustainable economic guarantees for the farmers, with a stable demand, and hence a lucrative price level for the farm works (Sharma et al., 2009: Gupta, 1983; Gupta et al., 2012; Rao et al., 1993; Partap et al., 2014). Further, while considering the contribution of these organic products. It is generally assumed that the option of organic farming is a practice leading to agricultural development. It is one of the highly priced and expensive spices and rightly called as the 'green gold'. Till early seventies India was the main producer and exporter of this commodity. Now Guatemala has emerged as world's largest producer, offering stiff competition to Indian cardamom in the international market. Since the ancient time India is an organic produce exporting country. So, export of organic agricultural produce, especially which of low volume high price commodities like spices have an impact on India's economic future (Gills, 2012).

India ranks 33rd in terms of total land under organic cultivation and 88th in terms of the ratio of agricultural land under organic crops to total farming area. Kerala is the leading state in the production of organic spices. The cultivated land under certification is around 2.8 million hectare (2007-08). This includes 1 million hectare under cultivation and the rest is under forest area (APEDA, 2011). Sikkim, which has been declared India's first organic farming state, grown large cardamom over 17,000 hectare and produces 4000 tonnes annually, Sikkim share 90 per cent of the country's organic production. Exports of large cardamom in 2015-16 (April-March) were at 600 tonnes, down 10 per cent from 665 tonnes a year ago. However, large cardamom exports are higher than India's export target of 500 tonnes for 2015-16 (Indian Agriculture Report, 2015-16). The total area covered under cardamom in the state during 2014-15 was 3,153 hectare and its production was 1,378 metric ton and its productivity was 437metric ton (Statistical Handbook, 2016). In Longleng district as per the VISION 2025 prosperity through Agriculture Food for All, the Phonli Self Help Group of the village solely works for large cardamom. The area covered by the large cardamom in Longleng is 75 hectare. Its productivity per hectare is 0.3 metric ton and production is 22.5 metric ton (Kendra, 2017). In terms of productivity, almost all spices improved except cardamom.

The objectives of the present study was to investigate the land ownership pattern and management systems, examine cost components of the large cardamom growers and to analyze the production, productivity, cost and net returns.

2. Material and Methods

2.1. Historical Background of the Birth of Nagaland

The state of Nagaland is a long, narrow strip of hills in north-eastern India, generally paralleling the south taking the state of Manipur as the south base, it is bordered by the state of Arunachal Pradesh to the north, Assam to the west and the Sagaing Region of Myanmar to the east, lies between 25°60 and 27°40 latitude north of equator and between the longitudinal lines 93°20'E and 95°15'E (Figure 1 and 2).

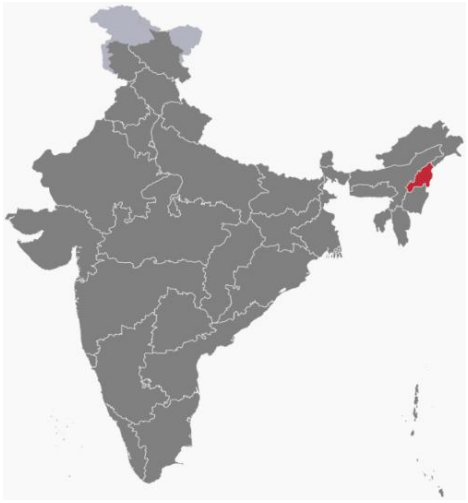

Figure 1. Map of India.

It has an area of 16,579 sq. kms, making it one of the smallest states of India. The topography of Nagaland is much dissected, full of hill ranges, which split into a broad chaos of spurs and ridges. It is one of the twenty five hot spots of the world with respect to its biological diversity, and hence can be termed as the state of true mega bio-diversity (Census, 2011). The potential of this state in terms of the sheer variety of agro and horticultural produce including fiber, tea, rubber, coffee, pineapple, orange etc. is also immense.

In spite of this inherent potential, the state has not developed and there exist high level of poverty in rural sector of Longleng (Jamir and Ezung, 2017a; Jamir, 2019). The state also lacks basic social and physical infrastructure development in terms of networking with the rest of the country (Ezung and Jamir, 2018). The current practice of agriculture is largely unsustainable owing to the traditional Jhum/Shifting cultivation cycle mode of operation. Though some dynamic initiatives by government and non-governmental organization are in action to mitigate the detrimental effects of Jhum cultivation, a lot still needs to be done on various fronts including efforts on checking deforestation, control of

wild fire, conservation of biodiversity, proper water harvesting, use of non-conventional energy sources etc (Ramakrishnan, 1992).

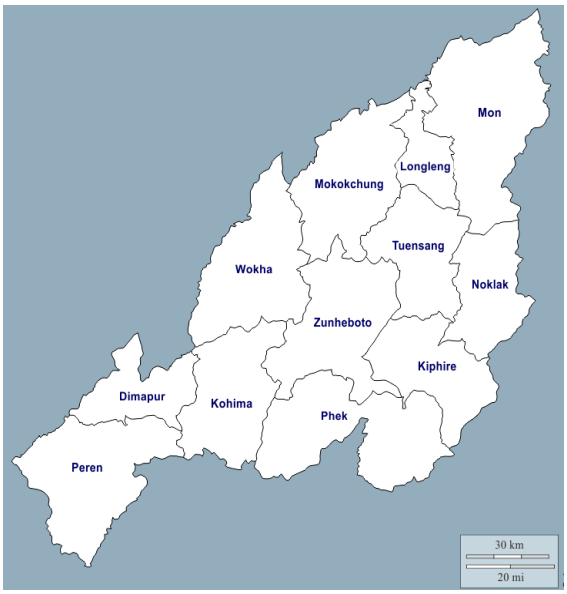

Figure 2. Map of Nagaland (indicating Longleng).

2.2. Study Area

Longleng, smallest district of Nagaland, situated in the eastern region bordering towards Myanmar, lies between 94°E-95°E longitude and 26°N27°N latitude of the equator, the district is mountainous with an area of 562 Sq.km. The home of the Phom Nagas is the tenth district of Nagaland. As per 2011, Longleng had a population of 50,484 of which males and females were 26,502 and 23,982 respectively. Longleng has an average literacy rate of 72.17 per cent lower than national average of 79.55 per cent (Census of Longleng, 2011). The proposed study has designed to cover the Yongam, Nian, Yongnyah and Pongo village. The above villages were selected for the study because these villages are the largest producer of large cardamom in the district (Figure 3, 4, 5, 6).

2.3. Sample and Sampling Technique

A list of large cardamom-growing farmers from each village was prepared separately, which was provided by Department of Agriculture, Longleng. A total of eighty (80) respondents i.e., large cardamom growers were selected using stratified random sampling technique to study production economics and marketing of large cardamom (Cochran, 1963; Deming, 1960). The data collected relate to the agricultural year from 2017-18. Additionally, two local traders were interviewed to know various details regarding marketing of large cardamom. To measure the poverty level more over 10 per cent of the total household from each village was interviewed.

Figure 3. Yongam.

Figure 4. Nian.

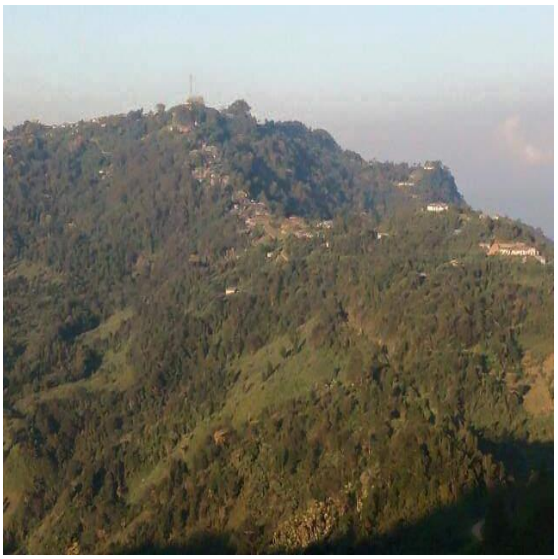

Figure 5. Yongnyah.

Figure 6. Pongo.

2.4. Research Instruments and Design

Data collection was done through personal interviews. Primary methods were used to collect data, shared experiences, observation and find out the real problems mostly faced by the larger cardamom grower which were collected through questionnaire, key informant interview and focus group discussion (Ackoff, 1961; Bailey, 1978; Bowley, 1937). The target groups were asked a series of open and close-ended questions. All three such as structured, semi structured and unstructured questions were included in the interview schedule. Key informant interviews (KIIs) were carried out with leader farmers, traders and other concerned stakeholders to assess additional information about large cardamom production and trade (Berdie, 1974). Two focus group discussions (FGDs) were held with the people of similar interest for triangulation of obtained data through schedule interview. KII and FGDs were helpful for SWOT analysis. Secondary information was collected from journal articles and departmental reports of government of Nagaland.

2.5. Data Analysis

Information collected from the field survey was coded and tabulated on Statistical Package for Social Science version (SPSS) 20 and Microsoft Excel. The data were collected from four size classes, viz., below 1 acre, 1-2 acres, 2-4 and 4 and above. Benefit cost analysis was estimated using the total cost of production of large cardamom and gross return from large cardamom production. The total cost of production was calculated by summing the variable cost and fixed cost items incurred in the production process. The collected data were analyze using Benefit-Cost Ratio (BCR) and Cobb-Douglas production function model.

The consequent step in poverty analysis is the identification of rural poverty line that distinguishes the poor from non-poor. The National Sample Survey Organization (NSSO), Government of India, set the poverty line for rural areas based on the monthly per-capita consumption expenditure (MPCE) incurred by a household on domestic consumption (Planning Commission, 2014). The NSSO estimated a poverty line of Rs 972 for rural areas during 2011-12 and Rs. 1229.83 for Nagaland during the same period. The sample survey report estimates of monthly per-capita consumption expenditure came out to be Rs 1350.23 and Rs. 1832.44 for rural area during 2013 and 2017. In comparison to Nagaland MPCE at 2011-2012 prices, the field survey on MPCE is higher mainly due to the price inflation of essential food and non-food items and also increase in income of the people due to various government sponsored programs. The report of the expert group maintains that the household consumer expenditure is more reliable than income and hence more suitable for measuring poverty. Thus, MPCE was used as a proxy for the actual income while determining poverty (Ezung, 2011).

2.6. Measurement of Cost-Benefit using Benefit-Cost Ratio Method

2.6.1. Mathematical expression for BCR:

$$BCR = \frac{Discount\ Benefit}{Discounted\ Cost}$$

Total cost of production and gross return from cardamom were used to analyze the benefit cost ratio (Gitting, 1984). Therefore, the BCR ratio was calculated using the following formula:

BCR=Gross return/total cost where, gross return was calculated from the income of sold product. The total cost of production was calculated by summing the variable cost and fixed cost items incurred in the production process.

Cost=Expenses incurred for agronomic operation in terms of labour, farm machinery and inputs costs such as seed, fertilizers, irrigation, pesticides etc.

2.6.2. Return to scale using Cobb-Douglas production function model

Cobb-Douglas production function = $Y=AL^{\beta}K^{\alpha}$

Y=Total production (the real value of all goods produced in a year)

L=Labour inputs, K=Capital inputs, A=Total factor productivity

α and β are the output elasticity of capital and labour (Cobb and Douglas, 1928).

2.7. Measurement of Poverty

2.7.1. Head count ratio

This measures give the proportion of the total population deemed to be (i.e., those below poverty line).

The Head Count Ratio (H) if then

$$H = \frac{q}{n}$$

2.8. Ethical Consideration

The information regarding the study such as nature of the study, nature of the intervention and the procedure followed in the study - invasive or noninvasive - was also obtained and followed.

3. Socio-Economic and Demographic Information of the Study Area

3.1. Gender distribution of population and sex of the respondents

The field survey report shows that out of total 80 household samples, 88.75 per cent households were male headed and remaining 11.25 per cent household heads were female. It indicated that males are dominating female in resource ownership and decision making power at household level and male are more involved in large cardamom farming than female in all the four sample villages. They have more skill knowledge about large cardamom and actively involved in the economic activities of large cardamom cultivation than female.

3.2. Occupational Distribution

It is observed from the field survey data that the occupational distribution in the total workforce is still tilted towards primary activities more than 95.67 per cent of workforce is concentrated in agriculture activities. However, a striking feature of the trend is that there is a sharp decline in the size of self-cultivators and at the same there is a bulging agricultural labour category. It was found that farming is their main source of income and especially large cardamom farming fulfilled their needs and desire.

3.3. Education Status of Respondent of Sampled Household

Education directly helps in the expansion of knowledge and skill among the individual (which comprises of both male and female) particularly in rural sector of the Longleng. The individual, who are educated and acquire adequate knowledge, skill and training will be able to improve their wages and hence lead to elimination of poverty, therefore, higher education, lower the poverty level. The direct impact of education and poverty is through increase in wage level (Jamir and Ezung, 2017b). Education status is categorized into six categories: illiterate, literate, primary level, secondary level, higher secondary and degree and above. From the survey, education status of majority of the respondents was up to primary level (67.20 per cent) followed by secondary level (29.80 per cent) Higher secondary education status of respondent was 3 per cent). It predicted that the majority of the large cardamom farmers are less educated and lack basic soft skill training.

4. Results and Discussion

4.1. Land Holding Pattern

The land ownership and management systems of the Phom Nagas are unique and different from the rest of the country, where local customary laws govern the land. In Longleng the problem of fragmentation of land holdings is not an issue on account of the peculiar pattern of land-ownership, tenure and use prevalent in the region (Christoph, 1982). Due to the unique ownership and management system of the Phom Nagas, there is little or no alienation of the people from their land and resources and therefore, even farmers, despite their poor economic condition can be considered resource-rich (Bezbaruah, 2007). Comparatively low population pressure, high regeneration rate of natural resources, community-based natural resource management initiatives and projects like the watershed programmes and bio diversity reserves have all further created opportunities for other economic activities to take place and contribute to the overall development of the district (Goswami, 2002; Jamir, and Lianchawii, 2013; Bathari, 2008). The total area covered under the study comes to about 123 acres; only 80 growers are selected for this study. It constitutes twenty four marginal, forty six small and eight medium and two large growers in selected large cardamom growing areas of Yongam, Nian, Yongnyah and Pongo. Table 1 indicates that in the sample of 80 large cardamom growers out of which 21.6 acres of land is covered by farm size below 1 acre which comprises of 17.50 per cent, 70 acres of land is covered by farm size 1-2 acres which comprises of 56.72 per cent, 22.8 acres of land is covered by farm size 2-4 acres which comprises of 18.47 per cent and finally 9 acres of land is covered by farm size 4-6 acres which comprise of 7.29 per cent. The result showed that the average land under large cardamom cultivation was 1.54 acre ranging from 0.85 to 4.5 acre. Unirrigated land occupied total large cardamom cultivated area.

Table 1. Size of land holding of the large cardamom growers

Farm size	No. of Sample	Own land	Rental land	Total	Percentage
0-1 acre	24	21.6	-	21.6	17.70
1-2 Acres	46	70.0	-	70.0	56.32
2-4 Acres	08	22.8	-	22.8	18.57
4 and above	02	9.00	-	9.00	7.41
Total	80	123.4	00.0	123.4	100

4.2. Production and Productivity

According to the Horticulture Department, Government of Nagaland, the total area under large cardamom in Nagaland during 2010-11 was 3180 hectare but further increased to 4208 hectare in 2016-17. Production area is the actual area that provides an agronomic yield on a yearly basis. During the same year the areas under large cardamom cultivation in Longleng was 50 hectare and increase to 234 hectare. Total production of cardamom in Nagaland has during 2010-11 was 15 metric ton and increased to 74 metric ton in 2016-17(Statistical Handbook 2011, 2018). As a consequence of long dry

spells and disease infestations during 2018-2019, the production area and yield decreased each year (Chattopadhyay and Bhowmick, 1965; Biswas et.al., 1988; Sharma et.al., 2001). Revitalization strategies were then initiated by improving the management of the farms such as use of manures before flowering and after harvesting, uprooting infected plants, and manual management of pests and diseases followed by application of bio-pesticides (Karibasappa, 1987b: Karibasappa, 1987a; John, 1984; Biswas et.al., 1986). Farmers planted cardamom in new fields, leaving the old plantations fallow, while the Nagaland Government Horticulture provided them with incentives for reviving large cardamom.

Table 2. Area, production and productivity of large cardamom growers

Farm Size	Area	Production	Productivity
0-1 acre	22	480.0	21.81
1-2 acres	70	3420	48.85
2-4 acres	23	1150	50.00
4 and above	09	465.0	51.66
Total	123	5515	44.83

Production and productivity (in kg)

From Table 2 reveals that the farm size between 1-2 acres shows the highest production with 3420 kg and the lowest was found in the farm size 4 and above with 465 kg. The farm size 4 and above shows the highest productivity with 51.66 kg. and the lowest was found in the farm size 0-1 acre with 21.81 kg. The total area as a whole is 123 acres and total production is 5515 kg and productivity is 44.83 kg. The average production fand productivity of cardamom were 0.54 MT/acre and 0.04 MT/acre respectively in the study area which was lower than the national productivity of cardamom (1.67 MT/acre) and productivity of large cardamom (0.07 MT/acre). In recent years, productivity of large cardamom in Longleng decreases, because the large cardamom farmers did not apply recommended amount of manure and fertilizer to the cardamom orchard which degrade fertile soil (Gudade et. al., 2013). In addition, the incidence of cardamom stem borer, rhizome rot, viral diseases such as Chirkey (Mosaic streak) and Foorkey (Bushy dwarf) also seems to have effect on yielding. Besides this, climate change, poor management of cultivation area, unavailability of suitable variety according to the altitude etc. are other reasons behind the decline of large cardamom production (Annamalai et.al 1988). Due to all above reasons of lower production and efficiency, growers in Longleng are destroying the cardamom orchard and reestablishing the orchard of cardamom.

From the above table 3 it is evident from the analysis that cardamom cultivation requires three major costs such as labour, seedling and drying cost, farm size below one labour cost is Rs. 130000, imputed value of labour is Rs. 612000, seedling cost Rs. 71000 and drying cost is Rs. 8,000. For farm size 1-2 acres labour cost is Rs. 828000 imputed value of labour is Rs.736000, seedling cost Rs. 552000 and drying cost is Rs. 18000. For farm size 2-4 acres labour cost is Rs. 256000, imputed value of labour is Rs.128400, seedling cost Rs. 74000 and drying cost is Rs. 4, 000. Size 4 and above labour cost is Rs 64, 000, imputed value of labour is Rs.5200, seedling cost Rs. 34000 and drying cost is Rs 1400. It has been found that in all the farm size labour cost is highest. Till now cost in other components is negative. From the above table 4 it was observed that farm size below 1 (one) acre the total cost is 270200.

Return comes out to be 608000 and the Net Return is 337800. Farm size 1-2 acres the total cost is 1471600, Return is 4340000 and the Net Return comes out to be 2894400. Farm size 2-4 acres total cost come out to be 344800, Return is 1520000 and the Net Return is 1081200. Lastly farm size 4 and above total cost is 106000, Return is 480000 and the Net Return is 354000. The farm size below one acre receive 14 per cent of the total income, farm size 1-2 acres receive 124 per cent of total income, farm size 2-4 acres receive 46 per cent of the total income and farm size 4 and above receive 16 per cent of the total income. It is the most important factor in the cultivation of agricultural crops, which influences the profitability of the produce and also the input use efficiency of the farmers.

Figure 7. Large cardamom plantation under 50% shade in Yongam

Table 3. Cost components large cardamom growers (Cost in Rs)

Cost components	Below 1 Acre	1-2 Acres	2-4 Acres	4 and above
Hired labour	130000	828000	256000	64000
Imputed value of family labour	61200	73600	12800	5200
Seedling	71000	552000	74000	34000
Manure and fertilizers	-	-	-	-
Plant protection	-	-	-	-
Mulching, Shading, tying				
Drying of cardamom using firewood	8000	18000	4000	2800
Interest on working capital	-	-	-	-
Total	270200	1471600	346800	106000

Table 4. Cost, return, net return, percentage of income and benefit cost ratio of large cardamom growers

Farm size	Cost	Return	Net return	Percentage of Income	BCR
0-1 Acre	270200	608000	337800	14	1.25
1-2 Acres	1471600	4340000	2894400	124	1.96
2-4 Acres	344800	1520000	1081200	46	3.13
4 and above	106000	480000	354000	16	3.33
Total	2192600	6948000	4667400	200	2.12

Cultivation of large cardamom includes various types of cost, since it uses various kinds of inputs in terms of labour, seedling, cardamom plantings, equipment, firewood etc. It is evident from the analysis of Benefit Cost Ratio (BCR) that all categories of the farmers enjoyed some profit since BCR varied from 1.25 to 3.33. The farmers of large farm size enjoyed the highest profit as per acre, cost is comparatively low than the farmers of small farm size. Benefit and cost ratio (BCR) were used to analyse whether the large cardamom enterprise was profitable or not. Any enterprise/producing unit with BCR ratio less than 1 are not feasible since they are not profit yielding. However, BCR ratio greater than 1 denotes feasible enterprise/producing unit that could be sustained or making profit. So, overall BCR was estimated in the study area, which was found greater than unity (2.12). This showed that the large cardamom enterprise is profitable in Longleng district. The details on benefit cost analysis of large cardamom in the study area presented (refer Table 4 and Figure 8).

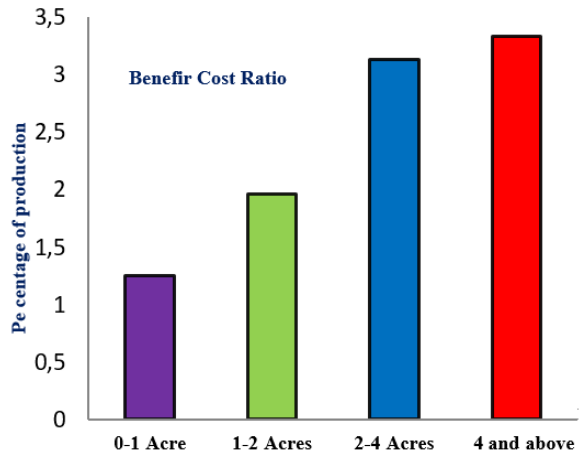

Figure 8. Percentage of production and BCR.

The Cobb-Douglas production function show that if labour increases by 10 per cent, output increases by 6.93 per cent, whereas if capital invested on raw material and transport cost (Seedling and firewood cost) increases by 10 per cent output increases by 1.71 per cent (Table 5). Since the coefficients value of labour and capital cost is less than 1 it exhibits diminishing return to scale and the Cobb-Douglas production function is not statistically significant. Thus, the null hypothesis which states that production function operates under increasing return to scale is rejected.

4.3. Agriculture and Poverty reduction: A nexus

Longleng is primarily agrarian economy. People are dependent on agriculture for their living and also agriculture has a large share to the economy (Jamir, 2020). Growth in agriculture also provides a larger supply of food and contributes to lower food prices, and benefits both rural and urban poor. In recent times agriculture played an important role in the process of economic development in the region. It not only helps in earning income within the sector but also promote growth in other sectors.

Thus, helps in reducing poverty by generating employment and income to the poor people who are not educated and also have low skills and training, as well as supporting the growth of non-agricultural employment in rural sector (Datt and Ravallion, 1998; Dercon, 2009; Ravallion and Datt, 1996). In Longleng, most of the farmers engaged in agriculture are either small or medium sized. Also, the majority of poor people depend on this sector for their subsistence. So, the GDP growth from agriculture benefits mostly the poor section of the population and it supports the rural economy. The estimated head count ratio shows that Yongam village has the highest percentage of fall i.e., 14.30 per cent in poverty rate, while Nian village exhibits the lowest percentage of fall in poverty with 4.58 per cent during the last five years (Table 6).

Table 5. Cobb-Douglas production function of large cardamom growers

Observation	Coefficients	Standard Error	t-Stat	P-value
Intercept	2.90419	5.191384	0.5594	0.6752
Labour cost	0.69365	1.445103	0.48	0.4151
Capital cost	0.17144	1.304045	0.1314	0.9167

*Labour cost includes payment made to labour

**Capital cost includes investment made on seeding and firewood

Table 6. Estimated poverty through monthly per-capita consumption expenditure

Village	HCR 2013	HCR 2017	Percentage decline
Yongam	35.22	20.92	14.3
Nian	74.45	69.87	4.58
Yongnyah	54.77	46.84	7.93
Pongo	48.87	38.31	10.56

Table 7. SWOT analysis for key informant interviews and focus group discussions

Strengths	**Weakness**
Favourable climatic and geographical condition for large cardamom farming. Organic farming for cultivation resulting in a maintenance of rich soil nutrients especially carbon. Large cardamom is a high value cash crop having higher export potential. Cardamom farming is labor intensive. So, it generates the employment and income. Thus, helps in raising the standard of living and helps in reducing poverty and inequality.	Traditional cultivation of large cardamom. Low level of productivity due to lack of use of fertilizers. Price variation in international market. Lack of improved smokeless dryer. Dependency on a Chinese market for the export of large cardamom. Cheat by traders in market places.
Opportunities	**Threats**
There is an increased scope to expand under cultivation to increase production Large Cardamom growers show motivation towards organic cardamom cultivation. Farmers are much involved to the organic cardamom production. Traditional way of processing of large cardamom couldn't produce quality of cardamom. Therefore, there is possibility of adoption improved technology like smokeless dryer.	There is an uncertainty on price fixation in the domestic and international market Fatal diseases and pests are reappeared. No consumption of large cardamom in the district as a result there is no market demand for the products Decline an amount of nitrogen, phosphorous and potassium in soil

5. Conclusion

The total area under cultivation of large cardamom during 2017-18 is 123 acres and the total production is 5515 kg and average yield per is 44.43 kg. The finding show that the total cost of all the farm size is Rs 2192600 and the total return is found to be Rs 6948000 net return is Rs 4667400. The overall Benefit-Cost Ratio (BCR) is found to be 2.12 and show higher BCR for large acres of area and vice versa. The result show that the Cobb-Douglas production function exhibits diminishing return to scale. The finding show that out of four major cost, highest is the labor cost, followed by seedling cost, imputed value of family labor, it is also found that other cost such as manure, plant protection, mulching, shading, maintain and depreciation cost is negative. It was also found that most of the large cardamom growers is facing several problems in its efforts for increasing production most important of which is the limited scope for extensive cultivation, prevalence of diseases i.e., Foorkey and Chirkey, cultivation based on traditional methods, lack of processing facility, un remunerative prices, lack of credit, inadequate government investment, existence of middlemen, lack of market knowledge about price and finally the most important, is the increasing cost of production. Innovative technological and methodological practices of organic cardamom farmers which have increased the yield may be popularized for adoption among the farmers and also conviction about organic farming as better alternative for sustainable development need to be generated among farmers. Though there are many institutions and agencies working towards promotion of organic cardamom cultivation a synergetic approach need to be adopted. Co-operative farming and marketing need to be introduce to help the farmers to acquire agricultural inputs at reasonable cost and to reduce the number of

intermediaries who causes disadvantageous price spread. Nowadays, large cardamom farming is gaining momentum for income and employment generation and improving the livelihood of the farming community in the district. Thus, apart from all the mention problems large cardamom farming is gaining momentum for income, employment generation and improving the livelihood of the farming community in the district. So, the government agencies should come forward and provide proper training and ad rem suggestions to the farmers so as to promote organic cultivation of large cardamom among farmers so as to enable them to enhance their earning capacity among the farmers.

Author Contributions

All tasks have been performed by single author.

Conflict of Interest

The author declared that there is no conflict of interest.

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CORRELATION AND PATH ANALYSIS FOR YIELD AND RELATED TRAITS IN UPLAND RICE (*Oryza sativa L.*) VARIETIES

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Abstract: The study was carried out on twenty varieties of upland rice (oryza sativa L.) to find out the correlation and path co-efficient values among the grain yield and its' components. Genotypic and phenotypic coefficients of variation ranged from 6.44 (days to maturity) to 30.47% (yield per plant) and 6.51 (days to maturity) to 30.67% (yield per plant), respectively. High genotypic and phenotypic coefficients of variation with low magnitude of differences between the two were observed for days to maturity, yield per plant and number of filled grains per panicle. Highly significant (P<0.01) and positive phenotypic and genotypic correlations were observed between grain yield with yield per plant, number of filled grains per panicle, biomass yield in the range between 0.55 to 0.78. The highest positive and significant genotypic direct effects on grain yield were exerted by plant height, harvest index, days to maturity and biomass yield, suggesting higher chance of improving yield of upland rice through indirect selection of these traits. Grain yield was significantly and positively associated with yield per plant, number of filled grain panicle-1, and number of fertile tillers per plant and harvest index.

Keywords: Correlation coefficient, Path coefficient, Component traits, Varieties

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1. Introduction

Rice is a self-pollinated cereal crop belonging to the family Gramineae under the order Cyperales and class monocotyledon having chromosome number 2n=24 (Hossian et al., 2015). The genus Oryza is known to consist of two cultivated species i.e., Asian rice (O. sativa, 2n=24=AA) and African rice (O. glaberrima, 2n=24=AA) and 23 wild species (2n=24, 48) (Singh et al., 2015).

In Ethiopia, rice development of modern cultivars for the past nearly two decades concentrated towards high yielding plant type: short stature, erect leaves, high tillering, sturdy stems, early maturing and fertilizer responsive.

Genotypic coefficient of variation (GCV) measures the variability of any trait. The extent of the environmental influence on any trait is indicated by the magnitude of the differences between the genotypic and phenotypic coefficients of variation (Allard, 2000).

Correlation coefficient measures the relationship between two characters and does not indicate relative importance of each factor. The degree of correlation among the characters is an important factor especially in economic and complex character as yield (Cyprien and Kumar, 2011). The selection for one trait results in progress for all characters that are positively correlated and retrogress for traits that are negatively correlated.

Path coefficient analysis measures the direct influence of one variable upon the other, and permits separation of correlation coefficients into components of direct and indirect effects. Partitioning of total correlation into direct and indirect effects provide actual information on contribution of characters and thus form the basis for selection to improve the yield (Mohsin et al., 2009). It is used in plant breeding programs to determine the nature of the relationships between yield and yield components that are useful as selection criteria to improve the crop yield. If the cause and effect relationship is well defined, it is possible to present the whole system of variables in the form of a diagram, known as path-diagram (Ekka et al., 2011).

Grain yield is a complex trait, which is influenced by many independent traits and its improvement is essentially linked with deep understanding of interrelationship between them. Studies on the correlation of traits and their relative direct and indirect effect on yield are important, as they are helpful in selecting desirable traits.

2. Material and Methods

2.1. Description of the Study Area

The study was undertaken at Fogera national rice research and training center, Ethiopia. Average altitude

of Fogera ranges from 1750 to 2500 meters above sea level (m.a.s.l.) with an average rain fall of 1284 millimeter and temperature ranging from 11.5 °C to 27.9 °C. The experimental site is located at 11°58'N latitude, 37°41'E longitude and at an elevation of 1810 m.a.s.l. Based on ten years' average meteorological data, the annual rainfall is 1300 mm and mean annual minimum and maximum temperatures are, 11.5° C and 27.9°C, respectively. The soil type is Vertisol with pH of 5.90.

2.2. Experimental Materials

Experimental materials were 20 upland rice varieties released by different research centers in different years. Eight of the varieties were NERICA (New Rice for Africa) types initially developed for upland ecosystem by Africa Rice. NERICA varieties were developed by interspecific hybridization of *Oryza glaberrima* and *Oryza sativa* (Samado et al., 2008). The description of the varieties is as shown in Table 1.

Table 1. List of upland rice varieties used for the study (MoANR, 2016)

No	Variety	Pedigree	Year of release
1	Pawe-1	M-55	1998
2	Kokit	IRAT-209	2000
3	Suprica-1	WAB 450	2006
4	NERICA3	WAB 450-IB-P-2B-HB	2006
5	NERICA4	WAB 450-IB-P-9/1	2006
6	NERICA2	WAB 450-1-1-P31-1-HB	2007
7	Getachew	AD-01	2007
8	Andassa	AD-012	2007
9	Tana	AD-048	2007
10	NERICA14	WAB 880-1-32-1-2-P1-HB	2010
11	Kallafo-1	FOFIFA-3737	2010
12	NERICA6	WAB 450-IBP-160-HB	2011
13	NERICA15	WAB 881-10-37-18-3-P1-HB	2011
14	Hidasse	WAB 515-B-16A1-2	2012
15	Chewaqa	YIN lu 20	2013
16	NERICA10	WAB 450-11-1-1-P41-HB	2013
17	NERICA12	WAB 880-1-38-20-17-P1-HB	2013
18	Adet	WAB 450-1-B-P-462-HB	2014
19	NERICA13	WAB 880-1-38-20-28-P1-HB	2014
20	Fogera-1	ART15-7-16-30-2-B-B	2016

2.3. Experimental Design and Management

A field experiment was conducted using 20 released upland rice varieties at Fogera national rice research and training center during 2017 main cropping season. Randomized complete block design with three replications in 14m x 39.5m total area was used. Each experimental plot had a total area of $6m^2$ (1.5m x 4m) and six rows at 0.25m interval while the distance between plots and between blocks were 0.5m and 1m, respectively. Seeds have been sown in rows with manual drilling at a rate of 60kg ha^{-1}. Fertilizer application was at a rate of 60.5 kg NPS and 125 kg urea per hectare. All NPS have been applied during planting while urea application was in three splits at planting, tillering and at panicle initiation stages.

2.4. Data Collection

Observation and data recording for the traits under study were based on the standard evaluation system for rice (IRRI, 2013). The data were collected from ten randomly selected plants of each plot for traits treated on plant-basis like plant height (cm), panicle length (cm), number of panicles per plant, number of total grains per panicle, number of filled-grains per panicle, number of fertile tillers per plant, yield per plant (gm). However, days to heading, days to maturity, grain-filling period, thousand-seed weight (gm), biological yield (t ha^{-1}) and grain yield (t ha^{-1}) were taken on plot-basis; the four central rows were considered. Grain yield was adjusted at 14% moisture level.

2.5. Statistical Analysis

Correlation coefficient analysis was done using Statistical Analysis System (SAS) version 9.4 Computer software program following SAS statement (syntax) for randomized complete block design (SAS, 2013). Path coefficient analysis was done using excel.

3. Results and Discussion

3.1. Genotypic and Phenotypic Coefficients of Variation

The genotypic coefficient of variation ranged from 6.442% for days to maturity to 30.471% for yield per plant; and phenotypic coefficient of variation ranged from 6.505% for maturity date to 30.671% for yield per plant. Maximum values of genotypic coefficient of variation were recorded for yield per plant (30.471%) followed by biological yield (22.387%), number of filled grains per panicle (19.561 %) and grain filling period (19.01). Better value of phenotypic coefficient of variation were recorded for yield per plant followed by

biological yield, number of filled grain per panicle, grain filling period, grain yield and harvest index with values of 30.671%, 22.805 %, 19.612%, 19.219%,19.185%, and 19.134%, respectively, in the study.

The magnitude of phenotypic coefficient of variation (PCV) is higher than the genotypic coefficient of variation (GCV) for all 16 traits. This indicates that apparent variation for the characters was not only due to genotypes but also due to influence of wide range of genotypic and environmental variance observed in all studied traits. This result is related with the findings of other similar works (Allard, 2000; Idris et al., 2012, Mulugeta Seyoum et al., 2012). However, magnitude of differences between GCV and PCV for most of the traits were low indicating that these traits were less influenced by environmental factors and the phenotypic expression of these traits are controlled more by the genetic factors.

3.2. Correlations Analysis of Quantitative Traits

A positive value of correlation (r) shows that the changes of two variables are in the same direction; high values of one variable are associated with high values of other and vice versa. Genotypic and phenotypic correlation coefficients of all possible combinations for traits under study are presented in Table 2. In most of the cases the genotypic correlation coefficient were higher than the corresponding phenotypic correlation coefficient indicating strong inherent relation between the traits but suppressing effect of the environment, which modified the phenotypic expression of these characters by reducing phenotypic coefficient values (Ekka et al., 2011).

Table 2. Genotypic correlation coefficient (rg) (below diagonal) and phenotypic correlation coefficient (rp) (upper diagonal) of 16 traits of 20 released upland rice varieties

Variable	DH	DM	GFP	PH	PL	CL	FL	NSP	NGP	NFGP	NFTP	TSW	YP	BY	GY	HI
DH		0.54**	-0.53**	0.47**	-0.32*	0.55**	-0.04	0.07	-0.05	-0.02	-0.05	0.42**	0.03	0.54**	0.01	-0.51**
DM	0.55*		0.43**	0.27*	-0.20	0.32*	0.10	0.20	0.49**	0.42**	0.33*	0.40**	0.47**	0.57**	0.30*	-0.38**
GFP	-0.54*	0.41		-0.23	0.14	-0.27*	0.14	0.13	0.54**	0.44**	0.38**	-0.05	0.44**	-0.01	0.28*	0.17
PH	0.47*	0.27	-0.25		0.43**	0.99**	-0.11	0.18	0.26*	0.26*	0.01	0.00	0.28*	0.50**	0.39**	-0.18
PL	-0.35	-0.23	0.15	0.44*		0.31*	0.14	0.23	0.24	0.20	-0.06	-0.41**	0.16	0.02	0.37**	0.33**
CL	0.56*	0.32	-0.28	0.99**	0.32*		-0.16	0.13	0.22*	0.23	0.02	0.08	0.26*	0.54**	0.36**	-0.25
FL	-0.04	0.09	0.15	-0.14	0.09	-0.19		0.48**	0.39**	0.36**	-0.02	0.00	0.28*	-0.14	0.07	0.27*
NSP	0.06	0.27	0.21	0.15	0.20	0.10	0.57**		0.45**	0.43**	0.00	-0.08	0.34**	0.15	0.17	-0.02
NGP	-0.05	0.50*	0.55*	0.25	0.25	0.22	0.42	0.53*		0.95**	0.48**	-0.18	0.81**	0.25*	0.55**	0.21
NFGP	-0.02	0.43	0.45*	0.26	0.21	0.23	0.40	0.50*	0.95**		0.49**	-0.05	0.88**	0.34**	0.64**	0.18
NFTP	-0.05	0.36	0.42	0.00	-0.09	0.02	-0.09	-0.06	0.53*	0.55*		0.05	0.56**	0.29*	0.50**	0.07
TSW	0.44	0.41	-0.07	-0.01	-0.51*	0.08	-0.08	-0.15	-0.19	-0.06	0.03		0.16	0.39**	0.04	-0.40**
YP	0.03	0.47*	0.44*	0.27*	0.15	0.26	0.28*	0.39	0.82**	0.89**	0.61**	0.15		0.39**	0.77**	0.27*
BY	0.57**	0.58**	-0.03	0.52*	-0.04	0.56**	-0.24	0.11	0.26	0.36	0.30	0.37	0.38		0.57**	-0.57**
GY	0.01	0.29	0.28	0.40	0.35	0.37	-0.03	0.15	0.58**	0.67**	0.56*	-0.02	0.78**	0.55*		0.31*
HI	-0.53*	-0.40	0.17	-0.20	0.38	-0.27	0.30*	0.00	0.22	0.19	0.10	-0.43	0.29	-0.59**	0.30	

(*, **) at 5 % and 1% probability level respectively, ns= non-significant.

DH=days to heading, DM=days to maturity, GFP=grain filling period, H=plant height, PL= panicle length, CL= culm length, FL= flag leaf length, NFTP=number of productive tillers per plant, NSP=number of spike per panicle, NGP=Number of grains per panicle, NFGP= number of fertile grain per panicle, TSW= thousand seed weight, YP= yield per plant, BY= biomass yield, GY= grain yield and HI=harvest index.

In general the magnitude of genotypic correlations (r_g) is higher than those of phenotypic correlations (r_p) except number of spikelet per plant which is (r_p) greater than (r_g) for days to heading and culm length. This revealed that association among characters is under genetic control. When value of r_p is greater than r_g, it shows apparent association of two traits is not only due to genes but also due to favorable influence of environment. By contrast, if value of r is zero or insignificant, this shows that the two traits are independent (Akhtar et al., 2011). Thus from the study, yield per plant correlated positively with all studied characters both at genotypic and phenotypic level. Yield per plant also correlated significantly with all studied characters both at genotypic and phenotypic level except days to heading, panicle length, culm length and thousand seed weight at phenotypic level and days to heading and panicle length at genotypic level was non-significant.

Days to heading had highly significant positive association at genotypic and at phenotypic levels (r_g=0.57**, r_p=0.54**) with biomass yield and significantly negative associated with harvest index at genotypic and phenotypic level (r_g=-0.53*, r_p =-0.51**). Therefore days to heading increase with increase in biomass production whereas decrease with increase in harvest index.

Days to Maturity showed significant positive association at phenotypic level with number of grain per panicle (r_p=0.49*) and grain yield per hectare (r_p=0.30*). Highly positive association with number of filled grain per

panicle (r_p=0.42**), yield per plant (r_p=0.47**), biomass yield (r_g=0.58**, r_p=0.57**). This finding is in agreement with the findings of Chandra et al. (2006) and Aditya and Bhartiya (2013) reported Days to maturity was found to be significantly positively correlated with grains per panicle and fertile grains per panicle. Hairmansis et al. (2010) reported days to maturity and 1000-grain weight had negligible effect on grain yield. Days to maturity negative significant associated with harvest index at phenotypic level (r_p=-38**).

The correlation between plant height and grain yield per hectare was positive at genotypic and significantly correlated at phenotypic level (r_g=0.4, r_p=0.39**) which indicates that an increase in plant height leads to an increase grain yield. Similar results have been found (Sabesan et al., 2009; Kashif et al., 2013). However, Hairmansis et al. (2010) reported negative correlation of plant height and grain yield. Plant height had negative significant association with grain-filling period, culm length and harvest index at phenotypic level. However it was positive significant associated with yield per plant and biological yield at both correlation types.

The correlation between number of productive tillers per plant and grain yield per hectare was positive and significant at both genotypic and phenotypic levels (r_g=0.56*, r_p=0.50**). Number of productive tillers per plant was positive and significant associated with number of total grain per panicle (r_g=0.53*, r_p=0.48**), number of filled grain per panicle (r_g=0.55*, r_p=0.49**) and yield per plant (r_g=0.61**, r_p=0.56**) both at genotypic level and phenotypic level. It was positively correlated with biomass yield (r_g=0.30, r_p=0.29*) which is similar to the report of Rasheed et al. (2002). Surek and Beser (2003) and Ratna et al. (2015) study reveals grain yield significantly correlated with its component characters like the number of productive tillers.

Number of spikelet per panicle was in positive relationship at genotypic level (r_g=0.15) and at phenotypic level (r_p=0.17) with grain yield per hectare. It had a significant and positive correlation with yield per plant and flag leaf length at genotypic level. At genotypic level it was significantly correlated with total numbers of grains per panicle and filled grains per panicle and phenotypically it was highly and positively associated with these traits. Zhang and Kokubun (2004) observed number of spikelet per m2 significantly correlated with grain yield.

Number of filled grains per panicle had positive and highly significant association with grain yield per hectare at genotypic level (r_g=0.67**), and at phenotypic level (r_p=0.64**). It had highly significant positive relationship with yield per plant at genotypic (0.89**) and phenotypic (0.88**) levels. The perusal of both the correlation coefficient results suggested that number of filled grains per panicle should be given prime importance regarding its contribution to yield. These results suggest that selections should be based on number of filled grains per panicle for developing new high yielding upland rice varieties. These results are substantiated with those of Madhavilatha et al. (2005) and Elsadig and Abdalla, (2013).

Thousand-seed weight showed negative and non-significant association at genotypic and phenotypic levels (r_g=-0.02, r_p=0.04) with grain yield per hectare. This result is in contradicted with a number of works in rice (Madhavilatha et al., 2005).

Biomass yield was in positive and significant relationship at both phenotypic and genotypic levels with grain yield per hectare (r_g=0.55*, r_p=0.57**). These results are supported by the findings of Chowdhry et al. (1991). In the present study, it was highly and positively correlated with days to heading, days to maturity, culm length and plant height at both genotypic and phenotypic levels.

Harvest Index had positive at genotypic level and significantly positive relationship at phenotypic level with grain yield per hectare (r_g=0.30, r_p=0.31*). These results are supported by the findings of Chowdhry et al. (1991) and Zhang and Kokubun (2004). In this study harvest index was negatively correlated with days to heading, days to maturity, spike length and thousand-seed weight at genotypic level, and the result is supported by the findings of Moghaddam et al. (1997).

The study of correlation suggests that plant height, number of productive tillers per plant, yield per plant, harvest index and biomass yield were the most important characters which possessed highly positive association with grain yield per plant. From the study, positive and significant correlation of characters with grain yield and yield per plant both at genotypic and phenotypic levels, suggests that yield would increase with increase of those characters and vice versa. Therefore, these traits could be used as indirect selection criteria for grain yield improvement.

3.3. Path Coefficient Analysis

Estimates of path coefficients, direct and indirect effects of yield contributing characters on grain yield per hectare using genotypic correlation, which showed significant association with grain yield, were presented in Table 3 and phenotypic relations were given in Table 4. Maximum positive direct effect on grain yield per hectare was exerted by plant height (3.60) followed by harvest index (1.03). This means that increase in these traits may directly contribute to increased grain yield. Pandey et al. (2012) identified harvest index as one of the major direct contributors towards yield. On the other hand, traits like culm length (-3.23), days to heading (-1.03), total number of grains per panicle (-0.75), grain filling period (-0.68) showed negative direct effect on grain yield. Since the direct effect were negative, so the direct selection for these traits to improve yield will be undesirable.

Biomass yield had positive indirect effect on grain yield through thousand seed weight, panicle length, flag leaf length, number of fertile tillers per plant, number of filled grain per panicle, days to maturity and plant height.

Negative direct effect in case of yield per plant on grain yield was estimated by displaying a value of -0.27 on

grain yield and in addition to this yield per plant positively affected grain yield indirectly through harvest index (0.29), plant height (0.97), date of maturity (0.47), number of filled grain per panicle (0.63) and biomass yield (0.38).

Biomass yield, days to maturity, number of fertile grains per panicle, number of fertile tillers per plant, number of spike per panicle and thousand-seed weight showed positive direct effect on grain yield by displaying a value of 0.99, 1.01, 0.71, 0.22, 0.12, and 0.04, respectively. Dramatic increase in the grain yield of major world cereal crops is due mainly to increases in the harvest index and to a lesser extent the biological yield (Acquaah, 2007). In this study plant height, days to maturity, harvest index and biomass yield showed high genotypic correlation and positively significant direct effect on grain yield. Thus, plant breeder should practice selection through those most favorable traits for future upland rice yield improvement programs.

On the basis of estimates of path coefficients, it could be suggested that plant height, harvest index and biological yield are the main contributors to grain yield in the present investigation. Selection for these characters will possibly improve other component characters thereby improving grain yield. Therefore, these traits can be used as selection indices in grain yield improvement in upland rice. The result agrees with Pandey et al. (2012).

The residual effect in path analysis determines how best the independent variables account for the variability of the dependent variable, grain yield per plant (Singh and Chaudhary, 1985). To this end, the genotypic and phenotypic residual effect in the present study were 0.0208 and 0.0691 showing that 97.9 % and 93.7% of the variability in grain yield was explained by the component factors. This result was related with the findings of Allard (2000), who reported residual effects 0.065. But when the amount of residual effect is high it indicates that in addition to the studied characters, there are also other factors to justify grain yield changes (El-Mohsen et al., 2012).

Table 3. Estimate of direct (diagonal) and indirect (off diagonal) effects at genotypic correlation coefficient

Variable	DH	DM	GFP	PH	PL	CL	FL	NSP	NGP	NFGP	NFTP	TSW	YP	BY	HI
DH	-1.03	0.55	0.37	1.70	0.17	-1.80	0.01	0.01	0.04	-0.01	-0.01	0.02	-0.01	0.56	-0.55
DM	-0.56	1.01	-0.28	0.96	0.11	-1.04	-0.01	0.03	-0.37	0.31	0.08	0.02	-0.13	0.58	-0.42
GFP	0.56	0.42	-0.68	-0.89	-0.07	0.91	-0.02	0.02	-0.42	0.32	0.09	0.00	-0.12	-0.03	0.18
PH	-0.49	0.27	0.17	3.60	-0.22	-3.20	0.02	0.02	-0.19	0.19	0.00	0.00	-0.07	0.51	-0.21
PL	0.36	-0.24	-0.10	1.60	-0.49	-1.03	-0.01	0.02	-0.18	0.15	-0.02	-0.02	-0.04	-0.04	0.39
CL	-0.57	0.33	0.19	3.56	-0.16	-3.23	0.02	0.01	-0.16	0.17	0.00	0.00	-0.07	0.56	-0.28
FL	0.04	0.09	-0.09	-0.51	-0.05	0.60	-0.12	0.07	-0.32	0.29	-0.02	0.00	-0.07	-0.24	0.31
NSP	-0.06	0.28	-0.14	0.53	-0.10	-0.34	-0.07	0.12	-0.40	0.36	-0.01	-0.01	-0.11	0.10	0.00
NGP	0.05	0.50	-0.38	0.92	-0.12	-0.70	-0.05	0.06	-0.75	0.67	0.12	-0.01	-0.22	0.25	0.23
NFGP	0.02	0.44	-0.31	0.95	-0.10	-0.75	-0.05	0.06	-0.71	0.71	0.12	0.00	-0.24	0.35	0.20
NFTP	0.06	0.37	-0.29	0.01	0.04	-0.07	0.01	-0.01	-0.40	0.39	0.22	0.00	-0.17	0.30	0.10
TSW	-0.45	0.41	0.05	-0.03	0.25	-0.26	0.01	-0.02	0.15	-0.04	0.01	0.04	-0.04	0.37	-0.44
YP	-0.03	0.47	-0.30	0.97	-0.07	-0.83	-0.03	0.05	-0.62	0.63	0.13	0.01	-0.27	0.38	0.29
BY	-0.58	0.59	0.02	1.87	0.02	-1.82	0.03	0.01	-0.19	0.25	0.07	0.01	-0.10	0.99	-0.61
HI	0.55	-0.41	-0.12	-0.72	-0.18	0.89	-0.04	0.00	-0.17	0.13	0.02	-0.02	-0.08	-0.59	1.03

Residual effect= 0.0208.

Table 4. Estimate of direct (diagonal) and indirect (off diagonal) effects at phenotypic correlation coefficient

Variable	DH	DM	GFP	PH	PL	CL	FL	NSP	NGP	NFGP	NFTP	TSW	YP	BY	HI
DH	-11.28	5.44	5.29	-0.07	-0.01	0.15	0.00	0.00	0.02	-0.01	-0.01	-0.01	0.00	0.53	-0.44
DM	-6.05	10.13	-4.23	-0.04	-0.01	0.09	0.00	0.01	-0.21	0.20	0.04	-0.01	-0.03	0.55	-0.33
GFP	6.02	4.32	-9.90	0.04	0.00	-0.07	0.00	0.01	-0.24	0.20	0.04	0.00	-0.03	-0.01	0.15
PH	-5.28	2.70	2.32	-0.15	0.01	0.27	0.00	0.01	-0.11	0.12	0.00	0.00	-0.02	0.49	-0.16
PL	3.56	-2.01	-1.38	-0.06	0.03	0.08	0.00	0.01	-0.11	0.09	-0.01	0.01	-0.01	0.02	0.29
CL	-6.21	3.22	2.69	-0.15	0.01	0.27	0.00	0.01	-0.10	0.11	0.00	0.00	-0.02	0.52	-0.22
FL	0.48	0.99	-1.42	0.02	0.00	-0.04	-0.03	0.02	-0.17	0.17	0.00	0.00	-0.02	-0.13	0.23
NSP	-0.75	2.07	-1.32	-0.03	0.01	0.03	-0.01	0.04	-0.20	0.20	0.00	0.00	-0.02	0.15	-0.01
NGP	0.56	4.93	-5.35	-0.04	0.01	0.06	-0.01	0.02	-0.44	0.44	0.05	0.00	-0.05	0.25	0.18
NFGP	0.20	4.30	-4.40	-0.04	0.01	0.06	-0.01	0.02	-0.42	0.46	0.05	0.00	-0.05	0.33	0.15
NFTP	0.60	3.31	-3.81	0.00	0.00	0.01	0.00	0.00	-0.21	0.23	0.11	0.00	-0.03	0.28	0.06
TSW	-4.72	4.11	0.41	0.00	-0.01	0.02	0.00	0.00	0.08	-0.02	0.01	-0.02	-0.01	0.38	-0.34
YP	-0.32	4.73	-4.33	-0.04	0.00	0.07	-0.01	0.01	-0.36	0.40	0.06	0.00	-0.06	0.38	0.24
BY	-6.11	5.78	0.08	-0.08	0.00	0.15	0.00	0.01	-0.11	0.16	0.03	-0.01	-0.02	0.97	-0.49
HI	5.78	-3.84	-1.68	0.03	0.01	-0.07	-0.01	0.00	-0.09	0.08	0.01	0.01	-0.02	-0.56	0.86

Residual effect= 0.0691.

4. Conclusion

High genotypic and phenotypic coefficient of variations with low magnitude of differences were observed for yield per plant, plant height, grain filling period, grain yield ha-1 and harvest index indicated that these traits were less influenced by environmental factors. The phenotypic expression of these traits are controlled more of by the genetic factors. The highest positive and significant genotypic direct effects on grain yield were exerted by plant height, harvest index, days to maturity and biomass yield. The results suggested the higher chance of improving yield through indirect selection of these traits.

Improved grain yield in the modern varieties appeared to be associated more with the production of a higher grain yield than with higher partitioning efficiency to the biomass yield. It can be considered that changes in number of productive tillers per plant, grain yield panicle^{-1}, number of filled grain panicle-1, harvest index and grain yield per plant had contributed to the changes in grain yield breeding of upland rice in Ethiopia

The positive and significant correlation of plant height, number of productive tillers per plant, yield per plant and biological yield traits with grain yield suggests that yield have increased with increase of those characters.

Author Contributions

BZ; initiated the research idea, developed, organized, analyzed and interpreted the data and wrote the manuscript. FW; supervised the research, suggested the research methods, structured the paper and edited the manuscript.

Conflict of Interest

The authors declared that there is no conflict of interest.

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GOAT BREEDING IN IRAN: SITUATIONS, PROBLEMS AND APPROACHES

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Abstract: Goat and sheep breeding observe all together by rural and nomadic people as a traditional work for their livelihood and income earning in many arid and semi-arid regions of Iran. Goats traditionally had a strong influence on the socio-economic life of human populations, especially in rural and less favored regions of the world. In these regions this livestock constitutes an important source of proteins by converting different natural resources of lower quality. Due to their high tolerance to heat stress goats can be survive and produce in the most marginal regions of the world. On the other hand goats when are managed well contribute on the preservation of the ecosystems and can be used as an ecological tool for controlling the noxious weeds, reducing the incidences of wildfire, improving the rangelands and wild life habitat. Goats are raised principally for their meat, milk, fibre and skin. Goat farming can be very suited to production with other livestock such as sheep and cattle on low-quality grazing land. The impact of this breed on the carpet and meat industries in the areas where it is farmed is large which make it attractive to study to attempt to understand and potentially improve production and production efficiency. The aim of this article was to study the present situation and the trends of goat production and rearing as an essential tool for sustainable livelihood of rural and nomadic people in arid and semi-arid regions, with emphasizing on the cashmere-producing goats in South Khorasan province, east of Iran.

Keywords: Goats, Breeding structure, Raeini, Cashmere, South Khorasan, Iran

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1. Introduction

12,000 year old paintings of goats have been found on the walls of caves in Europe. Goats were the first animals domesticated by human in 10,000 B.C. (McKenzie-Jakes, 2007).

Goats were the first animals to be used for milk by humans. There are over 210 breeds of goats in the world. There are approximately 450 million goats around the world (McKenzie-Jakes, 2007).

In the developing countries, goats make a very valuable contribution, especially to the poor in the rural areas. The importance of this valuable genetic resource is underestimated and its extent of contribution to the livelihood of the poor is inadequately understood. They are often neglected in comparison with cattle and sheep. Part of this attitude towards them can probably be due to a recognition of their capability, rather any prejudice against them, as it is believed that goats are intelligent, independent, agile, and tolerant to many diseases and parasites and can look after themselves much better than other livestock species (Abdel Aziz, 2010).

The geographical and ecological conditions of Iran are well-suited to small ruminant production. The relatively low cost of sheep and goat farming (local breeds – well adapted to their environment plus extensive free communal grazing areas) and the increasing demand for expensive organic products in domestic and regional export markets encourages nomads to shift to organic production livestock production (Ansari-Renani, 2016).

Goats traditionally had a strong influence on the socio-economic life of human populations, especially in rural and less favored regions of the world. In these regions this livestock constitutes an important source of proteins by converting different natural resources of lower quality (Skapetas and Bampidis, 2016).

Due to their high tolerance to heat stress goats can be survive and produce in the most marginal regions of the world. On the other hand goats when are managed well contribute on the preservation of the ecosystems and can be used as an ecological tool for controlling the noxious weeds, reducing the incidences of wildfire, improving the rangelands and wild life habitat (Skapetas and Bampidis, 2016).

Goats are remarkably agile and will climb trees to browse. As with other herbivores, the number of animals that a goat farmer can raise and sustain is dependent on the quality of the pasture. However, since goats will eat vegetation that most other domesticated livestock decline, they will subsist even on very poor land. Therefore, goat herds remain an important asset in regions with sparse and low quality vegetation (FAO, 2013).

Nowadays goats and sheep face serious environmental challenges (degradation of rangelands, competition for

land use, less water availability etc.). On the other hand climatic changes creates additional difficulties on the small ruminant farming. Thus the needs of policy on more research, organization and extension are increased (Skapetas and Bampidis, 2016).

Agricultural sector accounts for about 1/3 of the Iranian GDP and 1/4 of the country workforce. More than 90% of the Iranian food requirements are produced in the country. Animal agriculture covers over 40% of the agricultural activities. More than 57% of the available animal units in the country are sheep and goats. Iranian goat and sheep industry is characterized by owned by small farmers, based on extensive grazing, highly influenced by the environmental variables, its increment rate is declining in comparison with the past decades because of urbanizations industrialization and low income. Iranian goats are not grouped well according to their products importance. More than 20 breed of goats have been recognized in Iran but the two typical breeds are Marghoz and Raeni goats which produce attractive and expensive mohair and kashmir fiber (Mueller et al., 2015).

The overall reproduction performances of Iranian sheep and goats are lower than the exotic pure breeds. It seems the variability in environmental patterns such as low rainfall and feed shortage, uncertainty in farmers' income and market conditions will be the most important factors in pushing the compulsory transition in Iranian sheep and goat industry. This transition may have critical effects on the animal-based food security mainly red meat. Therefore, more attention is required from the government and non-governmental organizations for handling this trend to the well-managed right direction (Abdel Aziz, 2010).

Similar to sheep, goats are kept for producing different products including, meat, milk, fiber, hide, etc. The two main breeds are known for their Mohair and Kashmir production. Hide or skin marketing mainly of small ruminants is an open and real ongoing market throughout the year in all Iranian cities. Nearly all of the produced skins are exported (Valizadeh, 2008).

Goats and sheep breeding all together in many rural areas of Iran. During author visiting from very disadvantaged villages near city of Sarbisheh, close to Afghanistan borders, with 295 km distance to city of Birjand, center of South Khorasan province, and east of Iran. Their main employment are rearing of goats, sheeps and chicken, plus carpet weaving in their peasantry and traditional houses (Figure 1).

2. Material and Methods

In this study, Information were collected through face-to-face interviews with the rural and nomadic people that their main employment are rearing of goats and sheep or one of his/her household members that author could access to them in Iran. Statistical unit is an agricultural holding with livestock units' activity, which at least has two heads of small livestock (sheep and goats). The information is collected by interview in case of availability of the holders of goats and sheep, otherwise, by interview with the local informants. Also the data of goat number, goat milk, meat and raw skins etc. in the different continents and countries were taken from the FAO data base, Jihad Agriculture Organization of Iran, National Bureau Statistics of Iran etc. These data are processed statistically and analyzed further in order to arrive in appropriate conclusions. Also author utilized scientific journals and sites, his experiences, observations, interviews, pictures etc. that gathered them during two decade work and visiting rural and nomadic regions in various parts of Iran, specially in main locations of research namely South Khorasan province, east of Iran and Chaharmahal and Bakhtiari Province and its situation in south west of Iran (Figure 2).

Figure 1. Goats and sheep breeding all together in many rural areas of Iran (Pictures by author. Autumn, 2017).

Figure 2. Map of main locations of research namely South Khorasan province, east of Iran (A) and Chaharmahal and Bakhtiari Province in south west of Iran (B).

2.1. Worldwide Trends and Orientation of Raising Goats

The general trends of goat production systems are increasing size of farms, while reducing their number, decreasing pastoral practices in the milk production,

enlarging the stocks of major milk producing breeds and increasing the number of projects for the conservation of local breeds (Chetroiu, et al., 2014).

Currently worldwide, raising goats sector tends to become increasingly important for the national economies, being even a factor of economic development, particularly for rural areas. In all countries, due to accelerated increasing of human population number, resorts to more efficient exploitation of animal resources, applying more efficient technologies for breeding and exploitation of zootechnical interest animals. Competitiveness and profitability of goat milk on the world market are closely linked with seasonal production, livestock and productivity.

Over two thirds of the goats are grown in tropical and subtropical areas of the world, but yields from these are much lower compared to that of goats in temperate regions. This is due to poor feeding conditions and exploitation of less productive breeds (Chetroiu, et al., 2014).

2.2. Fibre Production from Goats

Cashmere is the fine, undercoat fibre (down) of cashmere goats. Cashmere is a luxury fibre regarded as one of the softest and warmest animal fibre principally used for clothing. Main producing countries of cashmere are China and Mongolia (60-70%) and Iran and Afghanistan (20-30%) (Ansari-Renani et al., 2013).

Being expensive, cashmere necessarily have a market which is limited to wealthy consumers who buy luxury goods not only for its intrinsic qualities of appearance, softness, warmth, handle and comfort but also simply because they are rare and expensive.

Of the 25 million goats in Iran, 5 millions are cashmere producing and the remaining goats produce small quantities of cashmere. Exact quantity of cashmere production and export of Iran is not known but it can be estimated that 5 million cashmere goats produce about 2000 tons of cashmere annually. This quantity of cashmere is exported either as raw undehaired (70%) or processed (30%).

More than 90% of the Iranian cashmere is produced by Raeini and Birjandi goats in Kerman and South Khorasan provinces respectively (Ansari-Renani et al., 2013).

In South Asia, cashmere is called "pashmina" (from Persian pashmina, "fine wool"). In the 18th and early 19th centuries, Kashmir (then called Cashmere by the British), had a thriving industry producing shawls from goat-hair imported from Tibet and Tartary through Ladakh. The shawls were introduced into Western Europe when the General in Chief of the French campaign in Egypt (1799–1802) sent one to Paris. Since these shawls were produced in the upper Kashmir and Ladakh region, the wool came to be known as "cashmere".

The quality of Iranian cashmere being long and highly curved ranks third after China and Mongolia. At present no price differential is paid to the producers for fine cashmere, as a major portion of cashmere is exported with some added value through processing (Ansari-Renani et al., 2013).

A major portion of cashmere is exported without any added value through processing. As a result of the marketing system, Iranian producers do not achieve good prices and have little incentive to produce better quality cashmere (Ansari-Renani, 2018).

2.3. Housing and Stocking Rate within Nomad Pastoralists in Southern Iran

Tethering of livestock is prohibited in organic farming. Basically, there was no tethering of any kind of livestock among nomads. When nomad livestock returned from grazing, adult and young animals were penned separately near the tent in circular-shaped pens made up of wood, fenced overnight and milked in the morning before being taken out for grazing (Ansari-Renani, 2016).

In organic farming, it is obligatory that ruminants should graze on pastures ('free-range') and not fed in stables as long as the animal, weather and pasture conditions are suitable. If grazing is not possible, a permanently accessible open-air run is obligatory. Free-moving stables with permanent access to open-air runs are the principle of ruminant keeping. Only with permanent summer pasture grazing is an outdoor run not necessary, as long as the animals are not tethered.

The nomad livestock were not fed in stables or in restricted areas, but moved and grazed freely in extensive open grazing areas. Nomad families used the northern highland rangelands in spring and summer for grazing and migrated to the warmer southern Persian Gulf provinces in autumn and winter (Figure 3).

Figure 3. Nomadic goat raising.

The nomadic pastoralists had no fixed homesteads and covered great distances with their livestock following pasture availability throughout the seasons. The transhumant pastoralists followed a regular seasonal movement between set areas. Their movement was vertical where pastures at high altitudes are used in summer and pastures in the lowlands are used in winter or horizontal in the surroundings. Consequently, the livestock density (stocking rate) in Baft varied throughout the year, with the highest number of livestock and people in summer (Ansari-Renani, 2016). Establishing a wind water pump for producing new, safe, cheap and renewable energy resources and extracting

groundwater resources for goat and sheep herds of nomad people, for improving their life conditions plus watershed management and pasture planting activities by CSP (International project of Carbon Sequestration) near cities of Sarbisheh and Nehbandan in South Khorasan Province- East of Iran (By CSP. 2009 to 2012) (Figure 4).

Figure 4. Establishing a wind water pump.

3. Results and Discussion

Agricultural sector accounts for about 1/3 of the Iranian GDP and 1/4 of the country workforce. More than 90% of the Iranian food requirements are produced in the country. Animal agriculture covers over 40% of the agricultural activities. More than 57% of the available animal units in the country are sheep and goats (Bureau statistics of Iran, 2019).

Goats and sheep form the most important group of ruminants in Iran mainly in rural areas. More than 57% of the available animal units in the country are sheep and goats. Most of the sheep and goats keepers which are mainly small farmers regard this enterprise as a complementary enterprise to plants culture or horticulture (Valizadeh, 2008).

In developing countries, much of the milk produced by goats is for family consumption, but goat milk can also be further processed into a variety of marketable products. Marketing of goat milk and its products is still in its infancy. So far, there have been no marketing efforts attempted on a broad scale (Abdel Aziz, 2010).

The development of a professional marketing system is part of the challenge to benefit from the fact that many people consuming dairy products prefer products from goats (Abdel Aziz, 2010).

The potential of goats for sustainable supply of milk and meat for human consumption is unquestioned, and their contribution to improved nutrition of rural people is likely to increase. At the same time, goat cheese consumption is likely to increase also in developed countries. This is attributed to the image of goat cheese being a product of natural farm conditions compared with milk and milk products from high yielding dairy cattle in large industrial farms. Regarding goat meat, rising living standards in some parts of the world and the migration of people preferring goat meat to the developed countries, have increased the demand for goat meat in these areas (Abdel Aziz, 2010).

Government programs to support goat farming should focus on research and education in the areas of breed improvement, farm management, control of infectious diseases, milk collection, processing and marketing (Abdel Aziz, 2010).

In developed parts of the world goats are considered, usually, as specialty or exotic livestock, whereas in the developing countries, especially those in South - East Asia and Africa goats constitute the major source of meat production (Ivanovic et al 2016).

Goat meat is a good source of proteins and also has health benefits when is consumed in appropriate portions. In comparison of beef, has similar protein, lower fat, higher calcium, magnesium, potassium, similar iron and lower B12 and folate contents. On the other hand goat meat contains low amount of saturated fatty acids and cholesterol and it is a healthier alternative compared to other types of red meat (Ivanovic et al 2016).

Goat meat contains low amounts of saturated fatty acids and cholesterol. It is considered to be a healthier alternative to other types of red meat.

Leather from goat skin is used for bags, boots, gloves and other products that requires soft hide. Traditionally has been a preferable material for leather bookbinding. Untanned goat skins are used in different countries as containers for water, kefir, wine etc. High quality goat skins are provided from Black Bengal breed in Bangladesh.

On average every sheep or goat keeper has 38 and 25 heads of animals respectively.

Iranian sheep and goat industry is characterized by:

1) Owned by small farmers
2) Based on extensive grazing
3) Highly influenced by the environmental variables (rain fall, weather, feed supply, drought etc)
4) Economic variability due to uncertainty in feed availability, weather, rainfall, market, export and import animal products mainly food materials.
5) Its number or increment rate is declining in comparison with the past decades (because of urbanizations industrialization, low income, etc).
6) Genetic structure and physiological characters of the most Iranian sheep and goats are not clear.
7) No comprehensive standard investigation had been carried out on distinguishing different breeds of these animals. What is known as breed of sheep or goat is based on the apparent physical conformation and.

8) All of the Iranian sheep breeds, except one (Zel breed) are fat-tail types.
9) Although Iranian sheep and goats are grouped according to their main product, but generally they are kept for providing different products or sources of income including meat, milk, fiber and hide.
10) These small ruminants are resistant to high level of inorganic minerals in feeds and forages.
11) Iranian sheep and goat live and produce over a remarkable wide range of environments from the desert type dry and warm climate to the mountainous cold zones.
12) Iranian sheep and goats appear in different color from white to the completely black and many classes between.
13) Iranian sheep produce mainly coarse fiber which is suitable for Iranian carpet industry.
14) Most of Iranian breeds are high–set animals which is a suitable character for grazing over the rocky and mountainous areas. (Valizadeh, 2008).

The main obstacles of Iranian agriculture which affects its animal agriculture as well as other agricultural disciplines can be out lined as follows:

A. Desertification
B. Deforestation
C. Water shortage
D. Erosion
E. Low efficiency and out-put
F. Mostly illiterate small farmers (Valizadeh, 2008).

Goats, especially dairy ones, are an ideal species for poverty reduction and economic development for the poor in developing countries. Several reasons make goats particularly attractive for poverty reduction and improvement of family food security and livelihood of the poor in developing countries:

1) Goats are easily acquired by the poor as they require modest starting capital.
2) They can easily be tended by the weak, women or children.
3) They provide people by valuable nutrients.
4) Many people cannot drink cow milk as they are allergic to it. Several studies indicated that people with cow's milk allergy could tolerate goat's milk.
5) The growing demand for goat meat presents an opportunity for goat fattening (Abdel Aziz, 2010).

During the research in a nomadic region – as a main source of overgrazing and destruction and pressure to pastures by their goats and sheep herds etc.- in lake Choghakhor near (7 km) city of Boldaji and near lake Choghakhor, Chaharmahal and Bakhtiari Province, south west of Iran. Plus changing pasture lands toward agricultural lands during three past decades in mountains and field of this lake by nomadic and rural people (Figure 5-6).

Figure 5. Destruction and pressure on pastures.

Figure 6. Pasture for goat and sheep raising together (August 2, 2013).

During research in Gol village (50 km distance from Birjand, centre of South Khorasan province). As observe in these field research pictures, small and peasantry farmers raising goats and sheep all together in their rural homes plus horticulture, farming etc. (Figure 7).

Figure 7. Goat raising in Gol village (Spring 2015).

Visiting of author from Jihad- Agriculture Organization near the city of Sarbisheh and its Cashmere Goat Breeding Research Station that is located in the 15 km distance to city of Sarbisheh, - and near boundary regions with Afghanistan - 90 km east of Brjand, center of South Khorasan Province, east of Iran. This Cashmere Goat Breeding Research Station established in 1998 and presently has 182 mature cashmere goats for research goals and preserving and breeding them (Figure 8).

Figure 8. Sample view of Cashmere Goat Breeding Research Station (By author, autumn 2019).

4. Conclusion

In the nomadic system of sheep and goat production, one objective was to achieve animals' wellbeing through animal welfare-oriented husbandry and appropriate use. Curtailing freedom of movement, sensory deprivation and unsocial ways of husbandry; not allowing any contact with animals of the same species, or forcing too close a contact were not permitted in the nomadic farming system (Ansari-Renani, 2016).

Husbandry management practices, transport and slaughtering, management of livestock among nomads was a social process, and they did their utmost for the wellbeing of their animal and to avoid animal cruelty of any kind. In the nomadic system, there were no tail ducking, dehorning and tethering.

A country rich in indigenous animal genetic resources like Iran is very much suitable for adopting this farming system. Moreover, the nomadic farming system with well-diversified livestock populations in terms of species and breeds is ideal for organic livestock production.

Although the nomadic type of livestock keeping provides an excellent and 'green' alternative to industrial production, nomad pastoralists need to overcome some challenges and harness strengths and opportunities, while developing their capacity in terms of knowledge, skills, infrastructure, animal feeding, hygiene, sanitation, disease control and assured certified supply chain required for organic livestock production.

Nomad farmers need to be oriented and educated about the organic standards and how to overcome the risks they might face in adoption of organic livestock standards. The livestock advisors should be trained and skilled in providing services in livestock management and permitted therapies in organic rearing systems. Research on the locally adaptable management and disease-preventive measures needs to be emphasized by the government and organic-promoting agencies as well as NGOs.

The potential needs to be recognized of Iranian nomad farmers to meet the requirements of organic livestock product demand, not only locally but also globally in the near future.

Organic livestock production can be encouraged through research and development efforts, including establishment of model organic livestock farms, processing units, traceability tools and capacity-building measures (Ansari-Renani, 2016).

Goat farming systems are diverse, both intensive and semi-intensive and extensive, reflecting the ability of these animals to adapt to a wide range of environmental conditions. A simplified description of the different operating systems, based on eco-regional criteria, shows that both loose housing - feeding with forage crops or on cultivated pastures and grazing meadows, or on areas that are not part of the agriculture circuit are practiced (Chetroiu, et al., 2014).

The geographical and ecological conditions of Iran are well-suited to small ruminant production. The relatively low cost of sheep and goat farming (local breeds – well adapted to their environment plus extensive free communal grazing areas) and the increasing demand for expensive organic products in domestic and regional export markets encourages nomads to shift to organic production Livestock organic production (Ansari-Renani, 2016).

The severe damage that goats have caused in some regions is usually associated with high stocking density and mismanagement. Heavy goat damage is usually localized (Abdel Aziz, 2010).

Goats have a good appetite for and the ability to utilize effectively many trees and shrubs not available or not palatable to sheep and cattle. Therefore, they can be more damaging to perennial vegetation and soil stability. This is greatly realized during drought in arid zones, as goats have a reputation for being good survivors. Clearly, goats require careful management to avoid irreversible damage to the vegetation (Abdel Aziz, 2010).

Socioeconomic and political stability, availability of veterinary services, and adequate infrastructure and logistic supports are essential for implementing effective control programs. Inadequate infrastructure in most of developing countries is one of the major elements that conflict with effective implementation of building herd immunity (Mirzaie et al., 2015).

There are still the great deal that are not well understood concerning the different aspects of sheep and goat husbandry, interactions between industrialization, urbanization and the trends of small ruminants production in Iran. This fact is well known that Iranian sheep and goat population will be decreased and changed dramatically with respect to their systems, locations,

herd sizes and specialization in the future but at the same time the price of their products mainly meat will be increased. It seems the variability in environmental patterns such as low rainfall and feed shortage, uncertainty in farmers' income and market conditions will be the most important factors in pushing the compulsory transition in Iranian sheep and goat industry. This transition may have critical effects on the animal based food security mainly red meat from small ruminants which is popular for Iranian consumers. Therefore, more attention is required from the government and non-governmental organizations for handling this trend to the well-managed right direction (Valizadeh, 2008).

On average, 50% of sheep and goat population are kept under nomadic and semi-nomadic system and the remaining 50% are managed under composite system. Traditional shepherding and displacement of livestock by nomads is common countrywide. Nomads displace their herds between different provinces and within a particular province (Ansari-Renani et al., 2013).

Iran is one of the main producers and exporters of cashmere in the world, third after China and Mongolia. Of the 25 million goats in Iran 5 million are cashmere producing goats. Nomads play an important role in sheep and goats production mainly because they keep 58.5% of sheep and 39.7% of goat population of Iran. Approximately 70% of goats in Iran are of mixed breeds and their crosses, which are mainly kept for meat production, while other types are known for their cashmere (Raeini, Birjandi, Abadeh and Nadoushan), mohair (Markhoz), milk (Najdi) and meat (Tali, Adani and Native black) production (Ansari-Renani et al., 2013).

More than 90% of Iranian cashmere is produced in the eastern part of the country mainly by two breeds of goat namely Raeini in Kerman and Birjandi (Baluchi) in South Khorasan provinces. However Raeini goats mainly kept by nomad farmers is the most important cashmere producing breed both in terms of population and volume of cashmere produced (Ansari-Renani et al., 2013).

Converting extensive, range-based nomadic system to organic production could become economically attractive, if price premiums could be captured for organic meat and livestock products. Development of business models will definitely attract commercial interests and ensure that vulnerable nomadic communities receive attractive returns for their untapped treasure of organic principles. Systematic studies need to validate the animal husbandry practices of nomads with respect to organic certification, so that revision or improvement can be made wherever necessary. In this way, organic livestock products will have considerable potential for high-value niche markets (Ansari-Renani, 2016).

Also, following facts must be considered for goat milk, meat and raw skin production:

Goats continues to play a significant role in the human nutrition. Their number is increasing more rapidly in comparison with the sheep, especially in the less developed parts of the world, indicating an increased role of this livestock in food production.

In the developing countries of the world, during the period 2000-2019 goat milk production was increased significantly.

The same thing can be said and for the goat meat and raw skin production.

Author Contributions

All tasks have been done by single author.

Conflict of Interest

The author declared that there is no conflict of interest.

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ANALYSIS OF YAM MARKETING IN NGWA ROAD MARKET, ABIA STATE, NIGERIA

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Abstract: This project analyzed yam marketing in Ahiaohuru, Aba, Abia State, Nigeria. The research employed random sampling technique to select 80 yam marketers in the study area. Results from socio economic characteristics of the respondents' shows that total of 62.5% of the yam marketers were males; while the other 37.5% were females. Total revenue accruable from yam sales by the 80 randomly selected marketers was N620,793.12; while the total cost items was N680,293.25. The net profit gave a negative value of – N59,500.12. This shows that the yam marketer's expenses exceed their revenue. Similarly, 69.36% of the cost items went to the purchase of yams which was a major variable cost. The respondents' sex, marital status, source of start-up capital and total sales obtained were the significant variables influencing income from yam marketing in the study area. Lack of capital, high cost of labour, poor storage facilities, perishability of yam, high cost of transportation and unfavourable market prices were the notable constraints limiting efficiency of yam marketing in the study area. Since yam marketing in the study area was not profitable, measures should be taken to reduce associated cost of marketing. In this regard, the government and other organizations should extend a hand of fellowship to yam marketers by fostering grants and single digit loans.

Keywords: Yam marketing, Market structure, Cost and returns, Determinants of income, Nigeria

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1. Introduction

Half of the people in developing countries like Nigeria live in rural areas; globally, >2.1 billion persons live on less than $2 U.S. dollars a day (Chinaka and Emereole, 2013). Majority of these people are considered poor and depends on agriculture either directly or indirectly for their livelihoods (World Bank, 2007). The 2007 World Bank Development Report stresses the important role agriculture and even yam (*Dioscorea esculetum*) plays in curbing hunger and food insecurity in Nigeria. Agriculture generates an average of 29% of the Gross Domestic Products (GDP) and employs >65% of her labour force in Nigeria (Dimelu et al., 2009).

Root and tuber crops comprise crops covering several genera. They are staple food crops; being the source of daily carbohydrate intake for the large populace of the World. They refer to any growing plant that store edible materials in subterranean root, corm or tuber (Oke, 1990). Yam is a member of this important class of food. Yam is an important food crop especially in the yam zones of West Africa, comprising Cameroon, Nigeria, Benin, Togo, Ghana and Cote d' Ivoire. This zone produces more than 90% of the total World production which was estimated at about 20 – 25 million tons per year (Babaleye, 2003). Nigeria is the main producer of yam in the World with about 71% of the World output, followed by Ghana, Cote d' Ivoire, Benin and Togo (FAO, 2002).

Medicinally, yam tubers are used for various traditional medicines in China, Korea and Japan (United States Department of Agriculture-USDA, 2012). In addition to its importance in diet, it is prominent in traditional festivals, marriages, burials and indeed in almost all social, cultural, religious and economic gathering (Omojola, 2014). Marketing is defined as the process of satisfying human needs by bringing products and services to people in the proper form and at a proper time and place. Marketing has economic value because it gives form, time and place utility to products and services. Agricultural marketing is one of the important branches of marketing that deals with the exchange of agricultural goods. Agricultural marketing comprises all the activities from production to consumption (such as harvesting, grading, packaging, storing, price fixation, selling and buying) (Tiku et al., 2015).

Yam remains a major staple food in Nigeria, contributing immensely to rural economies (Kalu and Erhabor, 1992). It is therefore important to take a critical look into the marketing of this important produce in Ahiaohuru, Aba, Abia State, Nigeria. In view of the foregoing; this study was conducted.

2. Materials and Methods

2.1. Description of the Study Area

The study was carried out in Aba, Abia State, Nigeria. Abia State is one of the five states that make up the Southeast geopolitical zone of Nigeria. Abia state is approximately within Latitudes 4°, 41/ and 6°, 14/ North of the Equator and Longitudes 7°, 10/ and 8° East of the Greenwich meridian. The state has 17 Local Government Areas (LGA) that were divided along three agricultural zones namely Ohafia, Umuahia, and Aba (Nwaru and Iheke, 2010). The state is involved in arable crop production such as cassava, yam, rice, maize and sweet potatoes.

2.2. Sampling Technique and Size

The study employed multistage purposive sampling technique. In the first stage, Ngwa Road Market (Ahiaohuru) was deliberately selected because of the presence of higher number of yam marketers. The second stage involved the random selection of 80 yam Marketers in Ngwa Road Market (Ahiaohuru) Aba, Abia State, Nigeria.

2.3. Analytical Techniques

Socio-economic characteristics of the yam marketers as well as their market structure were analyzed with the application of descriptive statistics such as frequency tables, percentages and mean. Cost and returns involved in yam marketing was analyzed with the application of budgetary technique involving profitability function and rate of returns. Income obtained from yam marketing was evaluated with the use of multiple regression model. On the other hand, constraints to yam marketing in the study area were analyzed with the use of Likert scale.

2.4. Model Specifications

Cost and returns associated with yam marketing in the study area was analyzed with the application of budgetary technique involving model on profitability and rate of returns on investment. The rate of returns from was determined with the application of Gross Margin (GM) analysis while the profitability level was determined using Net Profit (NP) function.

$GM = TR - TVC$ ……(1)
$NFI = GM\text{-}TFC$ or $TR\text{-}TC$ ……(2)
$NROI = NFI/TC$ ……(3)

Where;
GM= gross margin, TR= total revenue, TVC= total variable cost, NFI= net farm income, TFC= total fixed cost, TC= total cost, NROI= net return on investment.

The income from yam marketers in Ngwa Road Market (Ahiaohuru) Aba was analyzed with the use of multiple regression analysis.

$Y = f(X_1, X_2, \ldots\ldots X_8, X_9, \mu)$ ……(4)
$Y = b_0 + b_1X_1 + b_2X_2 + \ldots\ldots + b_8X_8 + b_9X_9 + \mu$ ……(5)
Where;
Y= income from yam marketing, X_1= sex, X_2= age (years), X_3= marital status, X_4= household size, X_5= marketing experience, X_6 = source of finance, X_7 = educational level (years spent in schooling) of marketers, X_8= sales of yam, X_9= number of items sold, μ= stochastic error term, X_1-X_9= defined in the implicit form, b_1-b_9= regression coefficients of variables X1-X5, b_0= constant term

Constraints to yam marketing were analyzed with the use of Likert scale. In the use of the Likert scale, the researcher considered the mean score of 2.5 to be accepted while any constraints below 2.5 were rejected. The score of 2.5 was calculated using the weightings attached to the response options of;

Strongly Agree (SA), = 4
Agreed (A) = 3
Disagree (DA) = 2
Strongly Disagree (SD) = 1
Hence, $\frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$

2.5. Ethical Consideration

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to. The experimental procedures were approved by the Michael Okpara Univeristy of Agriculture, University Research Ethics Review Committee, Umudike, Nigeria.

3. Results and Discussion

3.1. Socio – Economic Characteristics of Yam Marketers in Aba, Abia State

The result of the analysis of the socio economic characteristics of the yam marketers in the study area were presented in Table 1 and 2; and the discussion follows suite. Table 1 shows the gender, age, marital status, educational level and household size of the randomly selected yam marketers in Ahiaohuru, Aba, Abia State, Nigeria. From Table 1, it was observed that a total of 62.5% of the yam marketers were males; while the other 37.5% were females. The result shows that greater percent of the yam marketers in the study area were males. This result conforms to the findings of Audu (2009) who noted that the productivity and marketing skills of men tends to be higher than that of the women. This may be connected to the laborious nature of yam marketing which most females cannot contend with. Omojola (2014) noted that the marketing of yam is an energy demanding activities which require men who are naturally endowed with abundant physical strength necessary for such jobs.

Age distribution of the sampled yam marketers' shows that 10% were equaled to or less than 25 years; 33.75%, 37.5% and 12.5% were within the age brackets of 26-35 years, 36-45 years and 46-55 years respectively. Furthermore, 3.75% and 2.5% of the yam marketers in the study area were within 56-65 years and greater than 66 years respectively. The mean age of the marketers was 36.92 (approximately 37 years).

Table 1. Distribution of respondents' according to gender, age, marital status, educational level and household size*

	Category	Frequency	Percentage (%)
Gender	Male	50	62.50
	Female	30	37.50
Total		80	100
Age (Years)	≤ 25	8	10.00
	26-35	27	33.75
	36-45	30	37.50
	46-55	10	12.50
	56-65	3	3.75
Mean: 36.92	66 and above	2	2.50
Total		80	100
Marital Status	Single	21	26.25
	Married	55	68.75
	Divorced	1	1.25
	Widowed	3	3.75
Total		80	100
Educational Level	Primary	10	12.50
	Secondary	42	52.50
	NCE	2	2.50
	OND	8	10.00
	HND	7	8.75
	University degree	11	13.75
Total		80	100
Household Size	≤ 4	39	48.75
(Number of persons)	5-9	35	43.75
	10-14	3	3.75
	15-19	1	1.25
	20-24	1	1.25
Mean: 5.42	25 and above	1	1.25
Total		80	100

*Field survey data, 2018

The result posits that majority (37.5%) of the yam marketers were within the age bracket of 36-45 years. This has a lot of implication as majority of the marketers were in their active and productive age. From Table 1, it was also observed that 26.25% and 68.75% of the yam marketers in Ahiaohuru, Aba, Abia state were single and married respectively; while divorced and widowed constituted 1.25% and 3.75% respectively. The result infers that greater percent of the yam marketers were married.

The educational distribution of the marketers shows that 12.5% had completed their primary school education, 52.5% had completed their secondary school education while 2.5%, 10% and 8.75% had NCE (National Certificate of Education), OND (Ordinary National Diploma) and HND (Higher National Diploma) respectively. Only 13.75% of the sampled respondents had university degree. The result concludes that majority of the yam marketers in the study area had Senior School Certificate of Education (SSCE). This surmises that mainstream (75%) of the marketers had basic education.

Analysis of household size of the respondents shows that 48.75%, 43.75% and 3.75% of the yam marketers had less than 4 persons, 5-9 persons and 10-14 persons in their household respectively. The mean household size of the respondents was 5.42 (roughly 6) persons. The result shows that greater percentage of the yam marketers in the study area had less than 4 persons in their household. The implication of this result is that larger household size could provide additional family labour required for marketing and other related operations.

Table 2 shows additional socio economic characteristics of the yam marketers. About 67.5% of the marketers had less than 10 years of marketing experience. A total of 27.5% and 2.5% had between 11-20 years and 21-30 years of experience in yam marketing; while 1.25% had more than 31 years of marketing experience. The average marketing experience of the yam sellers was 9.78 years.

The average income accruable from yam marketing in the study area was N237,172. Preponderance of the marketers makes ≤ N50,000 on a monthly basis. About 63.75%, 20% and 6.25% of the marketers obtains financial assistance through personal savings, friends/relatives and cooperative society respectively. This indicates that mainstream of the yam marketers in Ahiaohuru, Aba, Abia state source their capital from personal savings or equity.

3.2. Market Structure of Yam in Aba, Abia State, Nigeria

The market structure of the respondents comprises

information on the types of crops marketed, information on price fixation, data on respondents marketing status, source of marketing information and level of marketing information among other descriptive variables.

Table 2. Distribution of respondents' according to years of experience, average income, source of finance and religion*

	Category	Frequency	Percentage (%)
Years of Experience in yam	≤ 10	54	67.50
marketing	11-20	22	27.50
	21-30	2	2.50
	31-40	1	1.25
Mean: 9.78	41 and above	1	1.25
Total		80	100
Income Accruable from Yam	≤ 50,000	26	32.50
Marketing in Nigerian Naira	50,001-150,000	13	16.25
(₦)	150,001-250,000	18	22.50
	250,001-350,000	4	5.00
(@ ₦365.73 to $1.00)	350,001-450,000	5	6.25
	450,001-550,000	6	7.50
Mean: ₦237,172.50	550,001 and above	8	10.00
Total		80	100
Source of Finance	Personal Savings	51	63.75
	Friends/Relatives	16	20.00
	Cooperatives	5	6.25
	Microfinance banks	2	2.50
	Commercial Banks	5	6.25
	Others	1	1.25
Total		80	100
Religion	Christianity	73	91.25
	Islam	2	2.50
	Traditional religion	5	6.25
Total		80	100

*Field survey data, 2018

Table 3 shows the percentage distribution of the respondents by the crops they marketed. From Table 3, it was observed that 77.5% of the respondents marketed only yam while the other 22.5% marketed yams and other crops. The result indicates that greater percentage of the respondents marketed only yam.

Table 3. Percentage Distribution of Respondents by Crops Marketed*

Crops Marketed	Frequency	Percentage (%)
Yam only	62	77.50
Yam and other crops	18	22.50
Total	80	100

*Computed from field survey data, 2018

Table 4 shows the distribution of yam marketers according to their marketing status. The marketing status portrays if the respondents were full time or part time marketers. The result shows that 75% of the marketers were full time yam marketers; while the other 25% were part time marketers. The result posits that preponderance of the yam marketers in the study area were full time marketers. Full time marketers are expected to devout their time, resources and effort in making profits; assuming all things are equal.

Table 5 shows the distribution of yam marketers according to their source of marketing information. The result shows that 25% of the marketers obtained marketing information from their fellow marketers, 8.75% got it from marketing agent; while 45% of the respondents obtain marketing information from wholesalers.

Table 4. Distribution of yam marketers in Ngwa Road Market (Ahiaohuru) Aba, Abia State according to their marketing status*

Marketing Status	Frequency	Percentage (%)
Full Time Marketer	60	75.00
Part time marketer	20	25.00
Total	80	100

*Computed from field survey data, 2018

Further result shows that 20% of the yam marketers in Aba, Abia state obtain marketing information within themselves. The result infers that greater percentage of the respondents obtained marketing information from large scale marketers or wholesalers.

Table 5. Distribution of Yam Marketers in Ngwa Road Market (Ahiaohuru) according to the source of marketing information*

Source of Marketing Information	Frequency	Percentage (%)
Fellow marketers	20	25.00
Marketing Agents	7	8.75
Wholesalers	36	45.00
Self	16	20.00
Others	1	1.25
Total	80	100

*Computed from field survey data, 2018

Table 6 shows the percentage distribution of yam marketers according to their level of marketing information. From Table 6, it was observed that 80% of the respondents stated that there was free flow of price information; while the other 20% stated that there was restricted flow of price information. The result portrays that greater percentage of the yam marketers in the study area had free flow of price information. The result suggests that there was a good knowledge of price information among the marketers in the study area.

Table 6. Percentage distribution of respondents according to the level of marketing information*

Level of Marketing Information	Frequency	Percentage (%)
There is free flow of price information	64	80.00
There is restricted flow of price information	16	20.00
Total	80	100

*Computed from field survey data, 2018

Table 7 shows the data relating to fixing and setting of yam price in the study area. From Table 7, it was observed that 73.75% of the yam marketers specified that the price of yam was fixed through collective bargaining; 16.25% of the respondents observed that the price of yam in Aba, Abia state was determined through the quantity traded (otherwise referred to as the interaction of demand and supply dynamics). A total of 6.25% and 3.75% noted that the price of yams was determined through the prevailing market price and through group discussions. The result suggests that greater percentage of the yam marketers fixes the price of yam through collective bargaining. This implies that the price of yams in Ahiaohuru, Aba, Abia state was determined through collective bargaining.

Table 7. Percentage distribution of respondents according to fixing and setting of yam prices among the Yam Marketers in Aba, Abia State, Nigeria*

Fixing of Price of Yam	Frequency	Percentage (%)
Through bargaining	59	73.75
Through quantity traded	13	16.25
Current/prevailing market price	5	6.25
Through group discussion	3	3.75
Total	80	100

*Computed from field survey data, 2018

Table 8 shows the percentage distribution of respondents by the level of entry and exit into the yam markets in Ahiaohuru, Aba, Abia State, Nigeria. It was observed that 90% of the yam marketers stated that there was free entry and exit of members into the market; while the minority 10% noted restricted entry and exit into the market. The result suggests that there was free entry and exit of members in the market. This suggests that yam marketing in the study area is a competitive venture.

Table 8. Entry and exit situation among Yam Marketers in Ahiaohuru, Aba, Abia State, Nigeria*

Fixing of Price of Yam	Frequency	Percentage (%)
Free entry and exit	72	90.00
Restricted entry and exit	8	10.00
Total	80	100

*Computed from field survey data, 2018

Yam marketing association provides useful information to the buyers and sellers which enable them make rational decisions in the market environment they operate. Table 9 shows the information pertaining to membership of yam marketing association. About 68.75% of the yam marketers stated they belong to yam marketing cooperative; while the other 31.25% specified otherwise. The result shows that preponderance of the yam marketers in Ahiaohuru, Aba, Abia state belongs to yam marketing association or cooperatives.

Table 9. Membership of Yam Marketing Organization among the Yam Marketers in Aba, Abia State, Nigeria*

Membership of Yam marketing Association (Cooperative)	Frequency	Percentage (%)
Yes	55	68.75
No	25	31.25
Total	80	100

*Computed from field survey data, 2018

3.3. Average Cost and Returns involved in Yam Marketing in Ahiaohuru, Aba, Abia State, Nigeria

Table 10 shows the average cost and returns associated with yam marketing in Aba, Abia State, Nigeria. From Table 10, it was observed that the total revenue accruable from yam sales by the 80 randomly selected yam marketers in Ahiaohuru, Aba, Abia state was N620,793.12. The cost items included yams purchased for resale, rent, transportation, storage, labour expenses amongst others cost items. The cost of yams purchased for resale was N471,900; while the cost of rent was N70,763.75. Other cost items was transportation representing N58,700 while storage was N17,775. The total cost items was N680,293.25. The net profit/loss which is a measure of the profitability of the marketers was calculated as the total accruable revenue less the total cost incurred in marketing operations. The result of the net profit/loss gave a negative value of –N59,500.12. This shows that the marketers were running deficit. This implies that yam marketing in the study area was not profitable.

Table 10. Entry and exit situation among Yam Marketers in Ahiaohuru, Aba, Abia State, Nigeria*

Items	Amount in Naira (₦)
Revenue/Sales	$1.00 / ₦365.73
Sale of Yams	620,793.12
Cost Items	
Purchase of yams for resale	471,900.00
Rental fee on shop	70,763.75
Transportation expenses	58,700.00
Storage cost	17,775.00
Cost expenses on Labour	8,866.75
Carriage inward	7,940.62
Carriage outward	7338.75
Taxes	17,190.00
Storage facilities/equipment	4,407.50
Security	1,496.25
Depreciation	9,296.25
Miscellaneous	985.00
Others	3,633.38
Total Cost Items (TC)	680,293.25
Net Profit/Loss = TR – TC	-59,500.12

*Field Survey Data, 2018

3.4. Evaluation of Income obtained from Yam Marketing in Ahiaohuru, Aba, Abia State, Nigeria

The multiple regression coefficients of the total accruable income obtained from yam marketing in the study area was presented in Table 11. From Table 11, the regression model has a coefficient of determination (R2) of 0.698, implying that 69.8% of the variation in the endogenous variable (income from yam marketing) was accounted for by the independent variables (X1-X9). The F-ratio was 18.0 and statistically significant at 1% level, which implies that the model has a good fit. The constant term (β0) was positive and not significant; but has a coefficient of 255359.23. This implies that income from yam marketing will increase by N255,359.23 assuming other explanatory variables were held constant. From Table 11, four out of the nine exogenous variables in the model statistically influence the dependent variable. The significant variables were sex (X1), marital status (X3), source of finance (X6), cash and sales of yam (X8).

Sex of the yam marketers was statistically significant at 5% level; with a negative coefficient of -352814.0; indicating that income of the yam marketers will decrease as the number of female marketers increase. Empirically, an increase in the number of female yam marketers will decrease the income from yam marketing by N352,814.0 assuming other exogenous variables were held constant. Also, the higher the male marketers, the more the income derived from yam marketing in the study area. This could be as a result of the high labour intensive requirement which yam marketing involves which the male gender can render.

In the same vein, marital status of the yam marketers was statistically significant at 10% probability level with a negative coefficient of -188983.71; implying that the income of yam marketers in the study area will decrease as more married marketers are involved in yam marketing. The result connotes that income from yam marketing tends to increase with the married; assuming other explanatory variables were held constant. This implies that the more the married marketers, the more the income derived from yam marketing.

The source of income of the yam marketers was statistically significant at 5% level; with a negative coefficient of -121299.31; indicating that income from yam marketing will decrease as more sources of income are made available. This is contrary to a priori expectations and may be due to high interest rate charged in securing loans from financial institution. Sale of yam was statistically significant at 1% level; with a positive coefficient of 0.735; denoting that income from yam marketing will increase as the sale of yam increases.

3.5. Constraints to Yam Marketing in Ahiaohuru, Aba, Abia State, Nigeria

The constraints limiting yam marketing in the study area was analyzed with the application of 4 point Likert scale. The following scales were Strongly Agree (SA), Agreed (A), Disagree (D) and Strongly disagree (SD). Table 12 is the Likert scale showing the constraints limiting yam marketing in the study area. Any constraints with mean score below 2.5 were rejected; while constraints with mean score above 2.5 were accepted as a major constraint. From Table 12; it was observed that lack of capital (mean score of 3.08), high cost of labour (mean score of 2.63), poor storage facilities (mean score of 2.91), perishability of yam (mean score of 3.28), high cost of transportation (mean score of 2.91) and unfavourable market prices (mean score of 2.55) were the significant constraints limiting yam marketing in Aba, Abia State, Nigeria.

Table 11. Multiple Regression Coefficients showing the Evaluation of Income obtained from Yam Marketing in Ahiaohuru, Aba, Abia State, Nigeria

Variables		Coefficient	Standard error	t – ratio	p-value
Constant	(β_0)	255359.236	334392.998	0.764	0.448
Sex	(X_1)	-352814.003	149222.669	-2.364**	0.021
Age	(X_2)	381.129	5236.948	0.073	0.942
Marital status	(X_3)	-188983.714	110580.404	-1.709*	0.092
Household size	(X_4)	6195.637	14272.091	0.434	0.666
Marketing experience	(X_5)	-15436.462	10459.650	-1.476	0.144
Source of finance	(X_6)	-121299.312	57569.772	-2.107**	0.039
Level of education	(X_7)	-49173.176	43084.889	-1.141	0.258
Sales of Yam	(X_8)	0.735	0.060	12.164***	0.000
Number of items sold	(X_9)	48838.388	171986.252	0.284	0.777
R		0.836			
R^2		0.698			
F – Statistics		18.009***			

*Field Survey Data, 2018

*** P<0.01, ** P<0.05, * P<0.10.

Table 12. Likert Scale showing the Constraints Limiting Yam Marketing among Yam Marketers in Aba, Abia State, Nigeria

Constraints	SA	A	DA	SD	Mean	Decision
Lack of capital	44 (176)	5 (15)	25 (50)	6 (6)	3.08	Accepted
Absence of Market information	15 (60)	13 (39)	47 (94)	5 (5)	2.47	Rejected
High competition	1 (4)	33 (99)	33 (66)	13 (13)	2.27	Rejected
High cost of labour	21 (84)	12 (36)	44 (88)	3 (3)	2.63	Accepted
Poor storage facilities	28 (112)	19 (57)	31 (62)	2 (2)	2.91	Accepted
Perishability of Yam	50 (200)	4 (12)	25 (50)	1 (1)	3.28	Accepted
Cost of transportation	28 (112)	19 (57)	31 (62)	2 (2)	2.91	Accepted
Poor market prices	13 (52)	22 (66)	41 (82)	4 (4)	2.55	Accepted

*Field Survey Data, 2018

The respondents considered lack of capital as a major constraint limiting yam marketing in the study area. This is so because capital is important to enhance access to inputs and offset marketing cost, storage cost and cost of transportation.

Subsequently, perishability caused by pest and diseases are major constraints to yam marketing in the study area. Those attacked by pest and disease result in losses reflected by fall in the price of the yam due to reduction in quality. On the hand, transportation was considered a constraint because yam is heavy, bulky and fragile (can easily break), so transporting the produce can be difficult and costly. Difficulty in transporting yam output to market could result in low income and losses resulting from breakages and spoilage.

4. Conclusion and Recommendations

It can be concluded that greater percentage of the yam marketers in the study area were males. This is because the marketing of yam is an energy demanding activities which require men who are naturally endowed with abundant physical strength necessary. Mainstream of the yam farmers in the study area are in their economic active age. Also, greater percentage of the yam marketers' was married.

Greater percentage of the yam marketers in Aba, marketed only yam. There was good knowledge of price information among the marketers; while the price of the produce was determined through collective bargaining. Yam marketers in the study area operated in a competitive market environment. The result of the net profit/loss from yam marketing in Ahiaohuru, Aba, Abia state gave a negative value of – N59,500.12. This shows that the marketers were running deficit. This entails that yam marketing in the study area was not profitable.

The respondents' sex, marital status, source of finance and sales of yam were the significant variables influencing income from yam marketing in Ahiaohuru, Aba, Abia State, Nigeria. Lack of capital, high cost of labour, poor storage facilities, perishability of yam, high cost of transportation and poor market prices were the significant constraints limiting yam marketing in the study area.

Measures should be taken to reduce the total cost of production; while increasing the total accruable revenues from sales of yam. Perishability due to poor storage was

identified as one of the major problems plaguing yam marketing in the study area. It therefore becomes necessary for Agricultural Development Programme (ADP) through the Extension Service unit to introduce better storage technology. It is hoped that this will help ameliorate the problem. The marketers need to be organized into cooperatives. Through this, the marketers can have access to credits facilities as well as trainings from extension personnel.

Author Contributions

JCM; carried out the project in collaboration with all authors. FOO; guided by the expert advice, JCM; designed the study and wrote the first draft of the manuscript. IMK made contribution to the first draft and supervised the data collection, sorting and coding. FOO and IMK; managed the analyses of the study as well as the literature search. All authors made contributions to the project.

Conflict of Interest

The authors declare that there is no conflict of interest.

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THE CURRENT STATE OF AGRICULTURAL COOPERATIVES IN TURKEY: CHALLENGES, AND COMPARISON WITH THE COOPERATIVES IN AGRICULTURALLY DEVELOPED COUNTRIES

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Abstract: When the agricultural infrastructure of developed countries is examined, it is clear that farmers are organized in order to have a useful role in supplying inputs and in having an active role in the market. Thereby the farmers/producers are also industrialists, and with this method, rural development can be achieved. The most effective way to determine the policies to be applied in agriculture by affecting political mechanisms as in developed economies is the organization of producers. In this context, cooperatives are considered to be the most effective organization model in the development of the agricultural sector. The purposes of this study are; to reveal the current status and problems of agricultural cooperatives in Turkey, to compare with agricultural cooperatives in developed countries, and to offer some advice that will contribute to the more effective operation of agricultural cooperatives in Turkey. As a result, there are important legal, financial and administrative problems in the Turkish Cooperative System compared to developed countries. In the cooperative system in Turkey should be an emphasis on professionalization, inactive cooperatives should be closed. A serious legal arrangement should be prepared to solve the problems of the cooperatives.

Keywords: Cooperative, Agriculture, Production, Rural development, Farmer, Breeder

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1. Introduction

Organizing producers in agriculture is significant in terms of increasing agricultural production activities and obtaining quality products, as well as raising the living standards of farmers. When we have a look at developed countries with economic and social welfare today, the impact of rural organization and industrialization is seen at the basis of this prosperity. It is also accepted that advances in the agricultural sector play an active role in the industrialization of countries (Köroğlu, 2003).

The purposes of producer organization in agriculture are; to solve the problems that farmers or enterprises together, which cannot solve alone, to increase productivity and to add value to agricultural products from production to consumption, and to increase the producer's earnings and to increase marketing opportunities. Cooperatives in ensuring the organization of producers' input supply is the most important form of organization in product evaluation and marketing in ensuring that they take advantage in the face of the seller or buyers. It is safe to say that in countries like Turkey, with a "small farm" structure, for manufacturers, it is only possible to build a more secure, sustainable, and economic scale by the hand of cooperatives.

Turkey is not a country far from the cooperation concepts, and it is possible to examine the developments related to the agricultural cooperative system as a "pre-Republic Period" and "post-Republic period." The first example of the cooperative in the pre-Republican period was the "Homeland Chests" established in 1863 by Mithat Pasha in the Ottoman Empire. It was established to prevent the difficulties faced by farmers in the field of credit (Bilgin and Tanıyıcı, 2008; Can and Sakarya, 2012). Cooperativism in Turkey truly started after the Republic. In the first years of the Republic era, the "reputation??, agricultural unions law" was passed, and in 1925 the cooperative "Ankara Officers Consumption Cooperative" was established in Ankara to provide food and consumer goods cheaply without intermediaries. In the Commercial Code of 1926, cooperatives were adopted as a type of company, and in 1929 the "Agricultural Cooperatives Act" and in 1935 the "Agricultural Sales and Agricultural Credit Cooperatives Act" laws were passed (Bilgin and Tanıyıcı, 2008).

The establishment of cooperatives in Turkey is based on either special laws or the general Law of Cooperatives. Cooperativism in Turkey has been placed under a general law independent of the Turkish Commercial Code with law no: 1163 (Dogan and Yercan, 2016). The Law on Agricultural Sales Cooperatives and Associations no: 4572, which is outside the Law on Cooperatives no: 1163 and which is a special law, was adopted on 01/06/2000

and published in the Official Gazette on 16/06/2000 (Kızılaslan and Menek, 2011). The other special law on cooperatives is the Law on Agricultural Credit Cooperatives and Associations dated 18/04/1972 no: 1581 (Doğan and Yercan, 2016). However, various legal arrangements for the establishment of cooperatives and the development and continuity of established cooperatives without forming a single framework around the law cause confusion of authority in cooperatives. This situation has created disruptions in the regulation of agricultural activities and the processing of land in Turkey.

Turkey's total agricultural production area is 23,763,000 hectares when the data for 2016 are examined. According to the Farmer Registration System, there are 2,267,176 farmers registered in the system, and 14,785,863 hectare areas are used by these farmers for agricultural productions. These data show that there is an average agricultural area of 6.52 hectares per farmer nationwide (BUGEM, 2017). Based on these data, it is understood that the need for agricultural organizations in Turkey is greater when evaluated together with the situation in developed countries. Since Turkey has fertile agricultural lands, its contribution to economic development can be further increased. In this respect, cooperative remains essential. However, despite the positive examples in Turkey, cooperatives have not made progress at the expected rate. Cooperativism is vital in terms of the development of the individual and society in the social and economic sense and the increasing momentum of commercial activities and its positive contribution to economic development. Therefore, it is necessary to ensure sustainability and competitiveness by providing the appropriate environment and support to cooperatives by increasing confidence in the sector.

This article aims to present knowledge about the current situation and problems of agricultural cooperatives in Turkey, to compare agriculture with cooperatives in some developed countries (Germany, France, Netherland,UK) and cooperatives in Turkey. In addition, some suggestions will be presented to solve the problems of the Turkish cooperative system.

2. Cooperative Concepts and Definitions in Turkey Constitution

ICA (International Cooperative Alliance), the highest international organization of cooperatives, defines cooperatives as; an autonomous and democratic organization where people voluntarily come together to meet their economic, social, and cultural needs (ICA, 2017).

The constitutions of 1961 and 1982 contained provisions on cooperativism in Turkey. In Article 51 of the 1961 constitution, it is mentioned that “The State takes measures to ensure the development of cooperatives”. Additionally, in Article 52 of the same constitution, “The State provides for the proper feeding of the people, increasing agricultural production following the benefit of the society, preventing the losses of agricultural lands and takes the necessary measures to evaluate the labor of those involved in”. In Article 171 of the 1982 Constitution, “The State takes measures to ensure the development of cooperatives aiming at increasing production and protecting consumers, taking into account the benefits of the national economy. Cooperatives are subject to all kinds of control and supervision of the State; they cannot engage in politics and cannot cooperate with political parties ”.

As seen above, the constitutions of 1961 and 1982 envisaged the development of cooperativism and the state's cooperativism, which aims to increase production and protect the consumer, taking into account the benefits of the country's economy.

The state has guaranteed the cooperative organizations by various laws. The establishment of cooperatives in Turkey is based either on special laws or the general "Law of Cooperatives." In 1969, the cooperative law in Turkey with the Turkish Commercial Code numbered 1163 has been recognized as an independent public law (Doğan and Yercan, 2016).

From the "Law of Cooperatives," it is defined that "The mutual assistance and solidarity with the labor and monetary contributions of the specific economic interests of its partners, including its legal personality, and especially the needs of their profession or livelihoods, the exchanged partnerships established by real and legal persons in order to provide and protect them by bail are called cooperatives.”

Despite various legal arrangements for the establishment of cooperatives and the development and encouragement of continuity of the cooperatives, various problems in terms of understanding and execution of cooperatives in Turkey appears to be encountered.

3. Types and Numbers of Cooperatives for Agricultural Purposes in Turkey

Participation in cooperatives is voluntary. There are 11,493 cooperatives and 3.286.849 partners in the Turkish agricultural sector, where producers voluntarily participate. Cooperatives are a model of initiative that seeks to increase agricultural production as well as economic development (Anonymous, 2017a).

Agricultural cooperatives in Turkey are usually named and classified according to the services they bring to their members;

1. Agricultural development cooperatives
2. Irrigation cooperatives
3. Aquaculture cooperatives
4. Beet planters cooperatives
5. Agricultural credit cooperatives

According to the Turkish Cooperative Report in 2020, the number of cooperatives and partners for agricultural purposes in Turkey is shown in Table 1.

Table 1. Agricultural cooperative and partner numbers in Turkey (Anonymous, 2017b)

Ministry	Cooperative Type	Cooperatives	
		Number	Number of Partners
Agriculture and Forestry Ministry	Agricultural development cooperatives	6.823	745.371
	Irrigation cooperatives	2.451	298.301
	Aquaculture cooperatives	563	30.362
	Beet planters cooperatives	31	1.382.627
	Agricultural credit cooperatives	1.625	830.188

4. General Problems of Cooperatives in Turkey

Although cooperatives can have the most significant potential of non-governmental organizations in the country, with the fact that the experience of cooperatives in Turkey is based on the past and the legal guarantees for the development of cooperatives are established, its inability to reach the level of success and sophistication is based on a number of reasons. These problems, the inability to create a favorable environment for cooperatives, inadequacies in education and awareness-raising activities, the inability to develop a culture of working partnership between cooperatives, lack of capital and financing, professional management deficiency, and problems arising from legislation can be grouped into 6 groups.

Failure to create a favorable environment for cooperatives: disruptions resulting from the failure to achieve a sustainable understanding of cooperativism in economic and social terms. There are setbacks due to the lack of public regulation, surveillance, supervision and enforcement, and the long legislative, implementation, and judicial process (GTB, 2012).

Inadequacies in training and awareness-raising activities: As a general problem in cooperatives, low level of education of cooperative members (Amount et al., 2014), together with partners' lack of interest in cooperative activities problems with interpreting economic events and consequently are faced with the inability and closure of cooperatives to perform their essential functions (Kanlı, 2016).

The problem of working partnership between cooperatives: The main reason for the lack of co-operation among agricultural cooperatives is that co-operative managers and their partners refrain from taking responsibility. For this reason, the tasks given within the scope of cooperation are not fulfilled and innately these initiatives often end without reaching their goal (Tutar et al., 2014).

Lack of capital and financing problem: The problems related to the lack of capital due to the low shareholding of the cooperative partners (Kanlı, 2016) and the lack of collateral that the cooperatives have access to finance raise, which the issue of financing (GTB, 2012).

A vital lack in professional management problem shows that professional managers cannot be employed in cooperatives in Turkey and certified training to become a member of the board of directors with the lack of business management knowledge and experience of existing managers. However, the lack of a condition leads to difficulties in managing cooperative managers. The latter exist under current conditions (Kanlı, 2016).

Problems arising from legislation: Inadequate and complex laws regulating cooperativism in Turkey, insufficient guarentee in the fundamental values and principles of cooperativism have caused the legislation to be inadequate (GTB, 2012).

As mentioned earlier, various legal arrangements have been carried out to regulate the cooperative structure. However, despite the legal regulations, cooperatives and unions are confronted with a confusion of authority regarding the delivery of products to the market and the realization of services. Such organizations, rather than as competitors, should be supportive and complementary to each other. Moreover, it is also necessary to establish a framework law that unites such organizations under one roof and sets the limits of their Powers.

5. The Status of Cooperatives in Developed Countries in Terms of Agricultural Production

The European continent has been the starting point of the cooperative movement in the modern sense. The first cooperative organizations emerged in Germany and England after the industrial revolution. In the following periods, it continued to spread all over the world (Köroğlu, 2003). Countries that have developed in terms of agricultural production are firmly committed to the principles of cooperativism, and cooperatives continue their activities within competition rules. The main reason for the existence of cooperatives is to support the improvement of the professional development level of the members of the cooperatives.

While the number of agricultural cooperatives in developed countries has decreased except for the UK and Italy, there has been an increase in the number of partners (İnan et al., 2010). In these countries, there is a period of structuring in the field of industry and trade where cooperatives replace large enterprises. Especially in countries such as Germany, France, and the Netherlands, the agricultural sector has begun to gather under the monopoly of cooperatives rather than businesses with high turnover.

In England, where cooperativism was born and developed in a modern sense, the main starting point of cooperativism is developing the field of activity of small

capitalists within the free market economy. Rochdale Pioneers, who founded a consumer cooperative by weaving workers in the middle of the 19th century, came together to provide a cheap supply of their basic needs. The Rochdale Pioneers are also customers of the cooperative they founded (Anonymous, 2015). Hundreds of cooperatives were established similarly as a result of the increase in profits of the cooperative movement, which also affects a significant increase of members.

With a modest start in the middle of the 19th century, cooperative communities in Germany increased dramatically. At the beginning of the 20th century, it hosted a large network of credit, consumer, and trade cooperatives. The members of the cooperative make up about one-third of the German population. The cooperative movement was the largest social movement in Germany's history (Fairbairn, 1994). Although some of the cooperatives are specialized in dairy farming, the majority are credit unions serving small and medium-sized farms (Saunders, 2016). These loans, which are "microcredits" given by Raiffeisen credit cooperatives for the purchase of agricultural inputs such as fertilizer, feed, and animal purchases, are even given to the poorest farmers in society (Bartlett, 2014). The idea of specializing in various production areas such as dairy, livestock, and field products lies at the heart of the German cooperative concept. Although not included in the cooperative membership terms, cooperative members have their land and work on their farm. Many of the farmworkers are employed on farms, even though they are not cooperative members (Bennet, 2014).

In Germany, the state does not interfere with the administrations of cooperatives. Cooperatives, like large corporations, are seen as private and autonomous organizations and do not receive financial assistance from the state. In order not to have trouble competing with European and world agricultural markets, cooperatives in German agriculture have joined together to act together (DGRV, 2017). In German agriculture, in many products, from production to end consumer control is in the hands of cooperatives.

Agriculture has a crucial place in the Dutch economy. In the Netherlands, agricultural cooperatives are service cooperatives that operate and market the products of producers and provide agricultural input and credit to their partners (İnan, 2008). In the Netherlands, the majority of milk and dairy products, eggs, meat, vegetables, and fruit production produced in rural areas are purchased and marketed by cooperatives from producers (Köroğlu, 2003). Since farmers meet their financing needs through the "Dutch Bank of Agricultural Credit Cooperatives (Roba Bank)," foreign funding or government support is not used in the financing requirement (İnan, 2008). In the Netherlands, as in Germany, the number of cooperatives has not increased, but existing cooperatives prefer the way to unite.

The cooperative model in French agriculture was shaped following the rules of the trade unions. The stockpiling and marketing of the products obtained as a result of production activities take place under the control of cooperatives (Morales, 2005). French agricultural cooperatives, representing three out of four farmers, have become powerful actors in the organization of supply chains with 60% in wholesale trade and 40% in marketing. French agricultural cooperatives have a special law to improve their activities and to provide services to their members. The collection of membership and products by cooperative law is subject to regional limitations. Regional restriction of cooperatives is offset by tax exemptions (Filippi, 2012).

6. Conclusions and Suggestions

Today, cooperativism is an important tool for the development and improvement of the agricultural sector. The importance of agricultural production processes has been understood by the increasing development of communication, production and information technologies, and the increase in the level of education of the society. In order for agricultural production to be a solution to social and economic problems, cooperatives must be supported. Since cooperatives serve as a sector other than the state and private sectors, they also have the potential to create jobs. Cooperatives in Germany are an example of this situation, and not all workers working in cooperatives are members of the cooperative. A large number of cooperatives in a country is not considered as an indicator of the development of cooperatives. In developed countries, the general trend is to reduce the number of cooperatives and increase the number of partners. The aim is to monopolize the agricultural activities from production to the consumer. Furthermore, the staging of cooperatives instead of enterprises operating act as middlemen in the agricultural sector.

Considering that Turkey is an agricultural country and its potential in the field of "plant and animal production," the momentum towards cooperative formations in the sector should be increased. A large number of cooperatives in Turkey should be seen as an obstacle to a sustainable understanding of cooperativism. Because a large number of cooperatives cause control, surveillance, and sanctions to be lacking. The number of cooperatives should be determined according to the needs taking into account the structure of the regions.

Cooperatives are voluntary organizations based on the principle of voluntariness under the principle of cooperatives and having their service areas. An understanding of the conscious partnership between partners who are members of cooperative should be encouraged. Since cooperatives determine their policies and decide on the direction of their policies, it is a democratic organization that passes through the control of the members actively involved in the cooperative. However, as in any democratic organization, the understanding of professional management should be adopted in cooperatives. One of the major problems of

cooperativism in Turkey is the low level of education of cooperative members and the limited or no resources to transfer funds from cooperative sources to education and awareness-raising activities. By the partnership between cooperative and universities on awareness-raising activities in cooperation should be carried out, and with these activities, the interest of members in cooperatives should be increased. Furthermore, by instilling the consciousness of co-operation and organization, partnerships between cooperatives should be achieved, and a large-scale structure should be aimed. Because in Turkey, cooperatives are a model of enterprise that has not completed its professionalism. Cooperatives need some factors to support professionalization. These factors are; the initiation of professional executive employment in cooperatives, the completion of the training established in cooperation with universities, for membership, providing basic business management information to managers in particular, and ensuring that this program is mandatory for both members and administrators.The main point that needs to be resolved based on these problems is the creation of a "framework law." The law no: 1163 in force in Turkey deals with issues related to the establishment and operation stages of cooperatives. However, cooperatives often experience their main problems in the stages after they are established. Any lack of obstacles in establishing the stages of the cooperatives might lead to the establish large but inactive cooperatives. Determining the functioning and operating conditions, job descriptions, and member and managerial requirements by a framework law within the framework of cooperative principles will be a solution to both confusion in the bureaucratic structure and passive cooperativization. This framework, which will unite the cooperatives under one roof, will become a model of institutional enterprise that complements each other within the rules of competition. In countries that have developed agricultural production, cooperatives are engaged in supportive and complementary activities within the framework of competition rules. That is based on adherence to the principles of cooperativism. Besides, the purpose of the existence of cooperatives is to increase the level of professional development of its members. Thanks to the importance given to professionalization, cooperatives have become an economic unit. In Turkey, especially in the recent period, there is a significant increase, especially on fruit and vegetable prices and agricultural products. It can be said that brokers mostly cause these increases. These price increases have contributed significantly to the re-questioning of the system and a slightly better understanding of the importance of cooperativism. It will be of considerable benefit to keep this on the agenda by taking the wind back. Consequently, in order to establish a strong cooperative system, the closure of inactive cooperatives in Turkey must be accelerated and facilitated with the above-proposed arrangements.

Author Contributions

SÖ; searched the literature and wrote the draft of the manuscript, worked out on the technical details. OA; initiated the idea, detailed and supervised, ÖG; structured and edited the manuscript and made the revision of the article. All authors agreed to approve the final version of the article.

Conflict of Interest

The authors declare that there is no conflict of interest.

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