Technical and Economic Assessment of Cattle Herds of some Experimental Research Stations in Egypt

Elsorougy, M. A.1; M. A. I. Khalil1; Sahar A. Abd El-Rahim1 and M. h. Yacout2

1Animal Production Systems Research Dpt., Animal Production Research Institute (APRI), Agricultural Research Centre (ARC), Ministry of Agricultural and Land Reclaimed, Dokki, Giza, Egypt.
2By-product Utilization Research Dpt., Animal Production Research Institute (APRI), Agricultural Research Centre (ARC), Ministry of Agricultural and Land Reclaimed, Dokki, Giza, Egypt.

ABSTRACT

This study was carried out as a beginning to evaluate cattle herds of experimental research stations belonging to Animal Production Research Institute (APRI) - Ministry of Agricultural to stand on constrains and reveals opportunities to improve productivity in view of economic aspect. The study targeted evaluation of cow and buffalo herds in Sakha and Mahalat Mosa stations in Kafr El-Shaykh governorate, El-Serv I and El-Serv II stations in Damietta governorate. Cattle herds differentiated local cow and Friesien (crossbred) at El-Serv I station, Friesien (crossbred) and Angus (crossbred) at Sakha station, buffalo at Mahalat Mosa and El-Serv II stations. Dairy cattle contributed 47% of the total herd size of the studied stations, meanwhile 39% for female calves and 10% for male calves. Milk yield recorded 3150 L per head per season for cow herd in Sakha station, followed by 3000 L, 2400 L and 1620 L for cow herd in El-Serv I, and buffalo herds in El-Serv II and Mahalat Mosa stations, respectively. Highest dairy outcome (10701 LE/ head /season) contributed by buffalo herd in El-Serv II station due to milk income and calving production generates buffalo as major dairy cattle to approach abundance price from livestock products. Cows were prominent for meat production; its calves sold at bargain prices as it offered municipal meat in local markets. Results of the study indicated importance to initiate semi-commercial dealing contributes to cover part of costs conducted for experimental researches and as well enlarge stations’ income.

Keywords: Cattle herds, Experimental research stations, Profitability

INTRODUCTION

Livestock is considered fuel of the Egyptian agricultural national economy; it provides exploitation of natural and human resources, and key for wages for producers of prevailing farming systems. Different roles of livestock have been highlighted in many studies given capitals, services, supply of agricultural products and biological diversity (Ashley et al., 1999; Faye and Alary, 2001; Thornton, 2010). Faye and Alary (2001) mentioned that even as rule in sustainable economic growth and poverty reduction, livestock had limit interest from public governments and international communities.

Buffalo and cow are the predominant species of large ruminants reared under different farming systems of Egypt. Rapid growth in number of buffaloes and cows has been recorded over the last 60 years, reaching 3,476,396 buffaloes and 4,898,893 cows (FAO-STAT, 2019). Buffalo milk contributes 44% of the total milk production in Egypt, whereas it contributes 39% of the total meat production (FAO-STAT, 2014). Despite low milk production from buffalo in compared to exotic cattle breeds, they have longer productive life and produced milk with high fat ratio. Cow (baladi) are mostly raised for meat production because of low demand for milk from local cow. Galal (2012) reported that Baladi cows registered a decrease of their number over the period from 1961 to 2010; moreover, average contribution to milk supply did not exceed 17% from 2000 to 2006. There were no organizations to promote action preserve Baladi breed although its highly valued meat production, particularly in rural areas could be potential located market (Osman et al., 2016).

Experimental research stations describe production systems constraints as Technical: define production inputs and their assimilation; Financial: variable and fixed costs, farm budget and returns; Management: production inputs administrating, plan for enhancement and decision making and Environmental: interaction between livestock production systems and environment. Experimental research stations instructed to seeking applied research in livestock production to approach optimal utilization of agricultural and livestock resources, and dissemination of production systems perception to the concerned producers. This study aims to analyze constrains and opportunities in order to improve productivity of Cow and Buffalo herds of Sakha and Mahalat Mosa Experimental Research Stations in Kafr El-Shaykh governorate and El-Serv in Damietta governorate belonging to Animal Production Research Institute (APRI), Ministry of Agricultural in Egypt concerning economic aspect.

MATERIALS AND METHODS

Case study

The study integrated four experimental research stations: Sakha, Mahalat Mosa, El-Serv I and El-Serv II
located in delta region in Kafr El-Shaykh and Damietta governorates (Fig.1). Nile Delta farming systems convey mixed crop-livestock production systems inclusively lower and Upper Egypt, and around 76% of large ruminants' population (Tabana, 2000). Areas close to Nile valley distinguish farmyard household where livestock represents large ruminants (cow and buffalo), small ruminants (sheep and goat) and poultry. Farm size provides less than five feddans with high cropping intensity. Flock size contributed around 2–5 heads of large ruminants. Feeding systems mainly based on berseem in winter and green corn (darawa) in summer, crop residues and concentrates.

Data collection
Sampling method depended on official records of Buffalo herds in Mahalat Mosa and El- Serv II and Cow herds in Sakha and El- Serv I stations for the year 2021-2022. The idea was to get perceptive of herd productivity for each station based on qualitative and quantitative issues.

Questionnaire
Data gathered detailed information of: stations location and their area capacity in feddan (1feddan= 4200 m²), herd structure and composition; herd reproductive related traits, herd productivity (milk, meat, manure production and offspring), animal selling (included monetary value upon herd dynamic), feeding systems, labor sort and stations income.

Farm income
Income criteria calculated by assessing total variable costs, total income and outcome (difference between total value of outputs and variable costs). This criteria was determined to realize farm budget, feature may increase income.

Statistical analysis
Chi-square test ($\chi^2$) was performed to investigate categorical variables. Linear model was designed to analyze the effect due to location (stations) and animal grade as following:

$$Y_{ijk} = \mu + L_i + AG_j + e_{ijk}$$

Where, $Y_{ijk}$ is the total number of animal for each herd structure, $\mu$ is the general mean, $L_i$ is the fixed effect of the $i^{th}$ studied stations, $i= 1$ to 4 (where: 1= Mahalat Mosa, 2= El-Serv II, 3= El-Serv I and 4= Sakha), $AG_j$ is the fixed effect of the $j^{th}$ animal grade, $j= 1$ to 6 (where 1= adult females (lactating), 2= heifer > 1 year, 3= heifer < 1 year, 4= male calves > 1 year, 5= male calves < 1 year, 6= sire) and $e_{ijk}$ is the random error assumed to be NID (0, $\sigma^2$).

RESULTS AND DISCUSSION
Farming systems
The studied stations established on area of 40 feddan for Sakha, 20 feddan for Mahalat Mosa and 12 feddan for El- Serv (I, II) stations. Research cadre represented 89%, 78% and 88%, meanwhile administrative staff represented 11%, 22% and 12% for Sakha, Mahalat Mosa and El-Serv stations, respectively (Fig.2). Animal labor distinguished milking and others daily animal farm operations (animal feeding, drinking, cleaning and help veterinarian for animal’s treatment) (Fig.3). In a study of buffalo production systems in Delta and Upper Egypt, Fahim et al. (2018) reported that number of farm workers increases by growing of herd size. The main factor determined herd size was availability of animal feed (Debele and Verschuur, 2014).

Fig. 1. Study targeted governorates (kafr El-Shaykh and Damietta governorates)

Fig. 2. Percentage of Research and administrative cadre of the studied stations

Fig. 3. Percentage of Animal labor of the studied stations
Milk production

Dairy production was the main component of cattle types raised at the studied stations. Local cows and Friesien (crossbred) were the species reared at El-Serw I, next to buffalo at El-Serw II station. Friesien (crossbred) and Angus (crossbred) were the types of cow reared at Sakha station. Buffalo were the main dairy animal raised at Mahaler Mosa station. Buffalo is characterized by well adaptation to humid climate (Das et al. 2017); they are resistance to diseases and parasites (El Nahas et al., 2013). Contribution of buffalo in milk and meat production declined in last decades requires studying buffalo production systems taking into account strengths and weaknesses in addition to perform strategies improve efficiency of these production systems. There has been no acute attempt to identify “baladi” among different located breeds (Galal, 2007). Economically, Friesien or crossbred cattle kept for dairy production regardless consumer preference towards "baladi" products due to poor production and high costs when raising "baladi" breed. It is worth noting that baladi cow's milk may be used to feed young calves because of high price of buffalo milk, often reserved to sale or processed. However, local cattle breeds comprise longer lifetime than foreign or crossbred in developing countries; explain their resistance to harsh conditions (Sraïri and Baqasse, 2000). Produced milk from the stations trade by a contract supplier according to requirements. Feed roughage included rice and wheat straws. Cultivation land is essential for availability of green forages which affects economic efficiency of present production systems (El Sorougy, 2018), indeed animal productivity, particularly for dairy animals, and their reproductive traits (El-Keraby et al., 1981). Feeding systems and resilience to feed price variability need to be renowned (Daburon, 2013).

Reproduction

Fertility percentage reached 80% of cow herd in El-Serw I, but 70% of buffalo and cattle herds in El-Serw II, Mahaler Mosa and Sakha stations, respectively. Grouping natural mating was the methodology followed within the cattle herds of the studied stations where sire inseminates female precise in the same group. Fertility obstacles were caused by Artificial Insemination (AI) due to insufficient qualities of equipment, labor and comprehensive-related technologies used in AI. Similar results were obtained by Mugisha et al. (2014) who accepted raise in number of producers using natural mating to availability factor. It was observed absence of guidance and extension service from agricultural institutes describing magnitude of AI expertise.

Veterinary care

Cattle herds weren’t registered any epidemic diseases, except for pathological symptoms of mastitis, lumpy skin disease (LSD), dystocia, milk fever and diarrhea of nursing calves; implies majority of sanitary term to infection by aforementioned diseases. Mortality rate didn’t exceed the percentage 5% for young calves or even adult animals. Vaccines are permitted in governmental immunization through veterinary authorities. Chronic diseases are treated by veterinarian assigned for each station.

Herd structure and composition

In table (1), data shows significant effect (p< .0001) of cattle graded age and gender located within the studied stations on number of animals for each herd structure. Dairy cattle represented high percentage (around 47%) of the studied herds. Female calves contributed around 39% of the total herd size, meanwhile 10% for male calves that confirms adoption of breeding systems of female calves to replacement for dairy production. Fattening wasn’t included production systems inside the stations that young calves traded on demand for occasions. Percentage of sire didn’t over 4%; they are only required for breeding (Fig.4). Herd dynamic differentiates the on-farm inputs and recourses, breeding systems, selling and purchasing theme. Producers rely to keep female stock to replacement and male calves for fattening or saving for surfacing events (Tabana, 2000 and El-Wardani et al., 2003).This is in accordance with Aboul-Ela et al. (2000) who reported that breeding female is the ordinary strategy applied in traditional farming systems in delta region of Egypt, donated 76% of the total buffalo herds. Dairy production is considered a part of traditional (mixed) – farming systems of Egypt with farms of around 5 feddans, breeding buffalo assorted with cattle herds by maximum 5 animals for one farm (Mansour, 1997). Due to shortages of cultivated land, accounted 3.5% of the total area of Egypt (around 8.5 million feddan) located in Nile Basin and Delta (FAO-STAT, 2011), dairy production illustrated source of income to offset gap between costs and revenue. Smallholders disseminated primarily of dairy production systems in Egypt supplying above 4.3 billion liters of fresh liquid milk (FAO, 2010). Producers’ income is essentially from milk which sold raw or manufactured to increase farm return.

Table 1. Herd structure and composition of the studied stations

<table>
<thead>
<tr>
<th>Item</th>
<th>Buffalo</th>
<th>Cow</th>
<th>Test</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mahaler Mosa</td>
<td>El-Serw II</td>
<td>El-Serw I</td>
<td>Sakha</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Adult (lactating)</td>
<td>284(46.10)</td>
<td>88(40.18)</td>
<td>18(36.73)</td>
<td>137(53.10)</td>
</tr>
<tr>
<td>No. Heifers (&gt;1 year)</td>
<td>118(19.16)</td>
<td>68(31.05)</td>
<td>14(28.57)</td>
<td>43(16.67)</td>
</tr>
<tr>
<td>No. Heifers (&lt;1 year)</td>
<td>102(16.56)</td>
<td>58(26.48)</td>
<td>11(22.45)</td>
<td>34(13.18)</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Calves (&gt;1 year)</td>
<td>23(3.73)</td>
<td>0(0)</td>
<td>2(4.08)</td>
<td>8(3.10)</td>
</tr>
<tr>
<td>No. Calves (&lt;1 year)</td>
<td>52(8.44)</td>
<td>0(0)</td>
<td>2(4.08)</td>
<td>31(12.02)</td>
</tr>
<tr>
<td>No. Sire</td>
<td>37(6.01)</td>
<td>5(2.28)</td>
<td>2(4.08)</td>
<td>5(1.94)</td>
</tr>
<tr>
<td>% No. Sire/Heifers (&gt;1 year)</td>
<td>0.31</td>
<td>0.07</td>
<td>0.14</td>
<td>0.11</td>
</tr>
<tr>
<td>% No. Sire/Total Herd Size</td>
<td>0.06</td>
<td>0.023</td>
<td>0.041</td>
<td>0.019</td>
</tr>
<tr>
<td>Total herd size</td>
<td>616</td>
<td>219</td>
<td>49</td>
<td>258</td>
</tr>
</tbody>
</table>
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Monetary value was calculated for price of livestock unit in regard with total herd size for the fiscal year 2021-2022 (Fig. 5). Buffalo accounted 23.133 LE of Mahalet Mosa station of Kafr El-Shaykh governorate, and 24.580 LE of El-Serv I station of Damietta governorate. Cow accounted 22.193 LE of Sakha station of Kafr El-Shaykh governorate and 18.890 LE of El-Serv I station of Damietta governorate. This support validity of buffalo cattle adopted breeding systems practiced in the studied stations, however investment from concerned producers. Prevailing farming systems of Egypt where buffalo kept divided into: Extensive, semi-intensive and intensive farming systems (AnGR. 2003).

Buffalo is outstanding by high conversion rate allied feed efficiency. Buffalo milk sold at extremely price due to consumer preference and high fat ratio. With implementation of genetic improvement and crossing programs, buffalo reveals increase in production rate and profitability (Borghese, 2005). Local cow are common for breeding to meet production given low milk production, and consumer abstaining milk produced from cow; its milk processed to home consumption. Whilst historical site of local cattle as domesticated breed in Egypt since ancient, in terms of adaptability to local conditions and resistance to common diseases (Flori et al., 2015), genetic engineering and selection programs have not been included such species (Galal, 2012) except from experiments of crossing with foreign cattle. The foremost exotic cattle breed crossed with local cattle is “Friesien”; achieved notable increase in milk yield, but wasn’t sustainable as a result of poor management and inability to resist environmental trace. It has to search genetic assets of local cattle, conserve them by course that these assets abuse to improve animal productivity as well as farm income.

Table 2. Dairy outcome (LE)/head /season of Buffalo and Cow herds in the studied stations

<table>
<thead>
<tr>
<th>Item</th>
<th>Buffalo</th>
<th>Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mahalet Mosa</td>
<td>El-Serv II</td>
</tr>
<tr>
<td>Milk performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AV. Milk production/L/head/day</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>AV. Lactation period/day</td>
<td>180</td>
<td>300</td>
</tr>
<tr>
<td>AV. Milk production/L/head/season</td>
<td>1620</td>
<td>2400</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total concentrate cost/LE/head/season</td>
<td>8775</td>
<td>11700</td>
</tr>
<tr>
<td>Total roughage cost/LE/head/season</td>
<td>441</td>
<td>1440</td>
</tr>
<tr>
<td>Total labor wage/LE/head/season*</td>
<td>1182</td>
<td>1160</td>
</tr>
<tr>
<td>Total Vet. Cost/LE/head/season</td>
<td>704</td>
<td>466</td>
</tr>
<tr>
<td>Total costs/LE/head/season</td>
<td>11102</td>
<td>14766</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk income/LE/head/season</td>
<td>14580</td>
<td>21600</td>
</tr>
<tr>
<td>Calving production/LE/head/season**</td>
<td>1800</td>
<td>3692</td>
</tr>
<tr>
<td>Manure output/LE/head/season</td>
<td>186</td>
<td>175</td>
</tr>
<tr>
<td>Total income/LE/head/season</td>
<td>16566</td>
<td>25467</td>
</tr>
<tr>
<td>Dairy outcome/LE/head/season</td>
<td>5464</td>
<td>10701</td>
</tr>
</tbody>
</table>

*Calculated for one labor salaried 1200 LE per month multiplies by the total number of animal labor

** Estimated upon current regional price of calf at birth

Concentrate cost contributed the highest value of the total variable costs with an average over 12000 LE/head/ season. The lowest animal feed cost was for roughage didn’t exceed 1000 LE/head/season. The other portion of animal labor cost distributed highly amount of 1754 LE/head/season for cow herds in El-Serv I station. The lowest amount of animal labor cost was recorded in Sakha station (938 LE/head/season). Animal labor costs were recorded 1182 and...
1160 LE/head/season for buffalo herds in Mahala Mosa and El-Serv II stations. Veterinary costs represented by cow herd in Sakha and buffalo herd in Mahala Mosa stations by 728 LE and 704 LE, meanwhile 466 and 400 LE per head per season in El-Serv II and El-Serv I station, respectively. Large amount of dairy outcome was contributed by buffalo herd in El-Serv II station (10707 LE) of Damietta governorate with milk income accounted 21600 LE, and 3692 LE for calving production per head per season. High price of buffalo milk (9 LE/L) added reasonable price of producing calves (an average 2746 LE/season) exposed superiority of buffalo as dairy animal integrated available resources located in the studied stations. Cow are the prominent species for meat production explains high price of calves produced by cow (an average 3653 LE/season) represented as source of bovine meat in local markets.

CONCLUSION AND RECOMMENDATION

Largest dairy outcome accounted by buffalo herd in El-Serv II station of Damietta governorate (10701 LE per head per season) was proved by high income of milk production in addition to adequate price from producing calves validates buffalo as major dairy livestock to approach abundance price from livestock products hence improve profitability of production systems incorporated the studied stations. Cows were prominent for meat production. High price of calves produced from cows explain it being representative of municipal meat in local markets. Demonstrate fattening systems for produced calves enhance stations’ income in parallel with income gained from dairy production. Providing capacity of land to cultivate green fodder to feed animals, particularly for dairy production, is of great importance to raise livestock profitability. It has to highlight productive aspectual of experimental stations to offset partial costs conducted for research studies. This requires initiate semi-commercial dealings to cover this part of costs, and as well enlarge stations’ income.

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REFERENCES


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أجريت هذه الدراسة كبداية لتقييم قطعان الماشية لمحطات البحوث التجريبية التابعة لمعهد بحوث الإنتاج الحيوى - وزارة الزراعةقوم بحثاً في حالة محطة بحوث الانتاج الحيوى في مصر: محمد أنور السروجى، مصطفى عبد الرؤف إبراهيم خليل، محمد حلمى ياقوت، محمد أحمد عبد الرحيم، محمد حلمى باقوت

الكلمات الدالة: قطعان الماشية، محطات البحوث التجريبية، الربحية.