DAIRY BUFFALO ON SMALL FARM "THE APPROACH TOWARDS RURAL DEVELOPMENT"

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Introduction

Buffaloes population expands in 43 countries in the world. Most of them (25 countries) are in Asia, 11 countries in Europe, and the rest are distributed between Latin America and Africa. However, the buffalo stocks are negligible (less than 500 heads) in 11 countries. Whereas such stocks reach less than 100 heads in some countries as Jordan and Guam, they surpass one million heads in 31 countries. About one-third of the World buffalo populations are dairy buffaloes, which produced about 76.7 million tons of milk in 2004, of which more than 59 million tons were processed as butter or ghee, while only 1.1 million tons were processed as buffalo cheese. Most of buffalo cheese quantity processed was in Egypt followed by Italy and then China. The average world milk yield per dairy buffalo is not high. It reached 1000 Kilograms per a dairy buffalo in 2004. This is because a quite number of buffalo stocks are swamp buffaloes, which are kept mainly for draft work and meat production. It should be mentioned that comparison of buffalo milk yield with cattle should be done after adjusting the fat content of buffalo milk to a comparable percent with cattle. Adjustment of buffalo milk yield to 4% fat may raise the average yield to 1700 kilograms per dairy buffalo. Although the buffalo stocks off-take for slaughter was low, i.e. 13% in 2004, it provided 3.1 million tons of carcasses meat in the same year. Buffalo hide is an important output. Its production as fresh hides reached 7.85 million tons in 2004.

Except few countries in Europe where buffaloes are raised, most of the countries holding significant buffalo stock size are developing countries. Therefore, the Egyptian Economy is a case study representing many developing countries in either Asia or Africa. Buffaloes are raised under small farming system of a mixed pattern (to raise livestock and cultivating crops). Under this system, the farm acreage is usually a function of the wealth and endowments, i.e., it is a function of the farm income level. The village site usually reflects the marketing advantages. Villages close to cities and main roads with reasonable level of infrastructure have much high marketing advantages than the ones far from main urban markets and main roads The classical argument is that although small traditional farms produce 82% of milk production in Egypt, the yield per head and the aggregate milk supply per farm is relatively low. It is, also, argued that a high proportion of milk produced is consumed by the farm-household, which leads to relatively small contribution from this source to the commercial supply.

Therefore this study investigates the productive and economic performances of dairy buffalo holdings with the traditional mixed farming system and the impacts of the availability of efficient marketing system on providing incentives to those farmers to increase the productivity and to expand their buffalo milk production and marketable surplus of such supply.

The target objectives are investigated from several sample surveys conducted by the author in recent years from the rural Egypt to analyze the economic performance of the buffalo holdings in rural areas, according to farm size and village location. The analysis focused upon the share of buffalo in farm output, buffalo milk productivity and its relation to the feed use pattern and labor employment. It extended to the economic impact of draft work on milk production, and the impacts of the efficient marketing system on the market surplus of dairy buffalo output

Data Base and Methodology

The local unit used for is the "feddan" which measures 4,200 m^2; one feddan can be divided into 24 Karats and one Egyptian pound (L. E.) equivalent to US$ 0.174. An animal unit (A. U.) used in this study equals one adult camel, a buffalo of 3 years or older equals 0.8 A. U, and the rest of livestock types have assigned less proportion of animal unit than a mature buffalo.

The economic efficiency criteria used for comparison of dairy buffaloes system with other potential systems under Egyptian conditions included the return to investment, profitability, and costs per kilogram of milk. However, the return to investment indicator used was the return to equity, i.e. to the own farm capital invested. Also it was the economic rate of return (ERR), rather than the financial rate (IRR). As in 2001, the year of estimation was under free market economy conditions the cost of 1-kilogram of milk was calculated as net costs after deduction of the non-milk output. The milk production was adjusted for differences in fat contents to get a fair comparison. It was corrected for a homogeneous percent, i.e. 4% fat. The normal profit is the ultimate measure of profitability. It represents the dividend of the farmer (enterpriser) in the output of the project after the share distribution of all other inputs involved in the production process. The normal profit is the return to management and entrepreneur. The budgets were derived from sample surveys conducted in 2001 from the middle and eastern Nile Delta Governorates

All estimated regression models applied were derived from cross section data of sample surveys were to estimate the considered response functions. Therefore, coefficient of any variable was counted statistically, significant, up to a significant level 0.1.

Data used for estimating the model the effect of dairy buffalo farm work on the milk production were derived from a sample field survey from five regions in Egypt, early in eighties when using buffaloes for farm work was significant. These regions represented upper (far-southern) Egypt middle-southern Egypt, North-Nile Delta, and East-Nile Delta, Mid of Nile delta. 2 villages were selected from each region with a total sample of 10 villages and 150 farms. Only farms with milking animals were included into the response function.

A sample survey data were used to estimate the buffalo milk marketable surplus of small farm holdings. The sample composed of 160 farms from two governorates. Two villages were selected from each governorate. Forty farms were drawn from each village to cover all farm size classes. The first region is located in the Middle Nile Delta, which enjoyed marketing advantages. These advantages are how close the distance to a big city is and how near is the village to the main roads. the existence of a milk collection center and/or processing plants. The Second region is in the East Nile Delta where the farms lack of marketing advantages.

Buffalo Holdings in Rural Areas:

Almost one-half of the small farms under the traditional mixed farming system in Egypt are with buffalo holding, (Table 1). Whereas larger farms tend to have more buffaloes than smaller ones, buffaloes per feddans decreases gradually from 0.89 heads with farms less than one feddans to 0.15 buffaloes on farms larger than 10 feddans. Therefore, it is clear, that smaller farms are far more intensive in buffalo enterprise than larger farms.

The proportion of the dairy buffaloes within the herd increases with farm size, due to the opportunity to expand the berseem area on farm for feeding more dairy heads. However, the proportion of the replacement buffalo heifers (up to one and half year old females) decreases as farm size increases.

This implies that the smaller farms are the main buffalo breeders, (Table 1). Even though, most of the livestock supporting policies are biased to the large farms. Accordingly, any successive buffalo-breeding program should focus on the smaller farms (less than 3 feddans, which represent more than 80% of the farms in rural areas. A national program for establishing nucleus herds that raise genetically potential buffalo-sires, which can serve the dairy buffalo stocks o small farms is vitally required.

Table 1 Buffalo Holdings Pattern in Rural Areas

Farm size class in feddans	Average farm Size (Feddans)	Animal Units per farm	Average Buffalo Heads per farm	Animal Units per feddans	Average Buffalo Heads per feddans	Relative Frequency (%) of: Number of farms	Acreage in Class	Farms with buffalo	Dairy Buffaloes in Buffalo herd	Replacement heifers in Buffalo herd
-1	0.83	1.26	0.74	1.52	0.89	40.0%	12.4%	51.0%	80%	9.0%
1-3	1.97	1.42	0.72	0.72	0.37	41.1%	33.7%	48.0%	89%	8.0%
3-5	4.06	2.59	1.22	0.64	0.30	13.0%	19.8%	61.0%	97%	3.0%
5-10	6.56	1.70	0.41	0.26	0.06	5.4%	15.8%	35.0%	99%	0.0%
10+	21.63	3.80	1.30	0.18	0.06	0.5%	18.3%	39.0%	97%	0.0%
Grand average	5.22	1.54	0.78	0.30	0.15	100%	100%	50%	87%	8.0%

In should be motioned that there is an economic decision, behind selling males and females buffalo veal for slaughter (before weaning). The farmer gains high price paid for a buffalo-veal calf and also saves more buffalo milk for sale at high price as the consumer preference. Table 1 shows that dairy buffaloes represent 87% of the buffaloes herd while such proportion is 74% in cattle population. This support the evidences that buffalo is the main dairy animal in Egypt.

Share of Buffalo in Farm Output:

Livestock output surpasses crop output per feddan of farm size less than one feddan, as shown on table 2. Its share decreases as farm size increases from about two-thirds on farm class less than one feddan to 13.6% on farm class larger than 10 feddans. Buffalo share reaches about 37%f livestock output per feddan. However, such share fluctuates among farm size classes, with a minimum around 28% on farms with 1-3 feddans to 46.5% on farm size larger than 10 feddans. Such fluctuation reflects the location, i.e. the availability of marketing incentives, particularly for milk. Such variation, also reflects the funds and feeds availability for buffalo male calves fattening

Table 2 Livestock and Buffalo Share in Farm output

Farm size class in feddans	% Of Livestock share in farm output	% Of buffalo share in livestock output
-1	63.5%	41.4%
1-3	45.0%	28.4%
3-5	33.9%	37.1%
5-10	19.3%	45.7%
10+	13.6%	46.5%
Average	42.9%	37.3%

Buffalo Milk Productivity

Table 3 presents a comparison of milk production by farm class of two different regions (villages in the Center of Nile Delta in Egypt). The first region (village) is close to a big city adjacent to the main country road crossing delta areas and equipped with infrastructure. Therefore, the farm gate milk price is high and the marketing incentives are available. The second region is far from the big city and even isolated from the main roads with poor infrastructure.

Comparing the milk yield of the same lactation in the same region, presented in Table 3, shows that the smaller the farm size the larger is the average yield per dairy buffalo. Surprisingly, it is the smaller farms, which have the highest yield of milk. For example the average yield per lactation per dairy buffalo in the first region decreases from 1966 Kg for farms less than one feddan, to 1610 Kg for the farms larger than 10 feddans.

Comparing the milk yield of the same lactation and same farm size between the two regions showed that the farmer in the village that enjoys marketing incentives invests in a much higher productive dairy buffalo than his colleague in the other region that lags of marketing incentives. For example, a dairy buffalo one a farm less than one feddan in the first region yields more than 2000 kilograms of milk in the fourth lactation while that one, on a farm of the same size in the second region, yields less than 1.400 kilograms during the same lactation, Table 3.

Table 3 Milk Yield in Kg per Dairy Buffalo by Region, Lactation and Farm Size

Lactation Season	Region Type	Farm size class in feddans				Average per Dairy Buffalo
		-1	1-3	3-5	More than 5	
1st lactation	1st region	1,906	1,625	1,597	1,550	1,494
	2nd region	1,298	1,017	989	942	946
2nd lactation	1st region	1,953	1,672	1,644	1,597	1,536
	2nd region	1,345	1,064	1.036	989	989
3rd lactation	1st region	1,998	1,717	1.689	1,642	1.576
	2nd region	1,390	1,109	1.081	1,034	1,029
4th lactation	1st region	2,005	1,724	1.696	1,649	1.583
	2nd region	1,397	1,119	1,088	1,041	1.036
Average per Dairy Buffalo	1st region	1,966	1,685	1,657	1,610	1,547
	2nd region	1,358	1,077	1,049	1,002	1,000

Feed Use Pattern on Traditional Farm:

Table 4 presents the feed intake of buffalo herd on farm as per one dairy buffalo and its followers, across the farm size classes. It is clear that the intake, of not only berseem, but also the intake amounts of other feeds increase as farm size increases. Surprisingly, as shown from table 3 the yield per dairy buffalo decreases as farm size increases. The proper interpretation of such contradicted result can be deducted from table 4. Generally, there is a surplus in feed use for buffalo feeding. The surplus is in both energy and protein. However, the small the smaller farm does not only hold dairy buffalo of higher yield, but it also is more rational in feed use, which helps in releasing more land for wheat and broad been cultivation. Such rational management of limited endowments and resources lead to minimization of costs of buffalo production on farm, as shown later.

Due to the enlargement of feeds miss use as farm size increases, the surplus increases as farm size increases. Such surplus is transformed as shown in Table 4, into berseem area. It is the main feed for livestock in Egypt. This illustrative presentation of feed surplus as berseem acreage also reflects the potential saving of agricultural land from under berseem for wheat. Therefore, on the average, saving in berseem area reaches about one-half of feddan per farm. The postulated saving increases from one-tenth feddan per farm with less than one feddan to 1.4 feddan per farm larger than 5 feddans.

Table 4 Feed Use Pattern for Buffalo by Farm Size

Farm size class in feddans	Egyptian clover	Other feeds	Net Feed Surplus (Kg/farm)		Surplus in Feeds per farm as Berseem equivalents
Measure Unit	Kg/A.U	Kg/A.U	S.E.	D.P.	Feddans
-1	4,284	756	192	288	0.10
1-3	8,215	1,210	1,034	396	0.54
03 - 5	93,565	1,045	2,830	843	1.47
5+	10,918	1,041	2,622	791	1.37
Average	7,417	1,940	1,082	494	0.45

Impacts of Draft Power for Farm Operations on Dairy Buffalo:

Mechanization saves the income foregone in terms of milk loss due to the use of dairy buffaloes for farming operations. Several attempts had been devoted to estimate such losses. However, most of them estimated the losses based upon some theoretical calculations. They calculated the feed intake transformed for animal work that would have been saved, if dairy buffaloes were liberated from work. Such saved net energy was transformed into milk production Other study used farm survey data and showed that there is no loss in milk yield if the dairy buffalo worked less than 4 hours a day. However, if the dairy buffalo worked more, i.e. up to 7 hours a day there would be a loss of 1-2 Kg of milk in the evening milking. Such decrease would increase to 2-3 Kg of milk, if the dairy buffalo were used as a draft power for a tough job such as plowing up to 7 hours.

Another researcher used the same data [14] tried to estimate a milk response function. The model included animal work in aggregate form (not by farm operation) as an explanatory variable for milk yield. However, the function was statistically insignificant including a lot of wrong specifications of the variables and miss explanations of the results.

Therefore, another study was conducted using a purposive sample survey to estimate the effect of the draft work of farm operations on the buffalo milk production. The study used a function model that reflected the response of the following input variables on the total farm milk yield per year from dairy buffaloes (FMY): Farm milk yield per year

(MB) = Number of dairy buffaloes older than 3 years

(MRC) = The percentage of buffalo milk devoted for rearing calves

(LPD)= Dairy buffaloes draft work, as working days per head for land preparation (Plowing, leveling and lining)

(WID) = Dairy buffaloes draft work, as working days per head for irrigation.

The estimated function is presented by the equation (1); where values between parentheses beneath the estimated regression coefficients show the standard error of the corresponding estimates:

$$FMY = -343.056 + 1491.58\ MB - 4.631\ MRC - 3.185\ WPLD + 0.494\ WID \quad \ldots(1)$$

$$(195.39) \qquad (128.488) \qquad (3.245) \qquad (2.152) \qquad (2.184)$$

$$R^2 = 0.799, \qquad F = 219.51$$

The analysis of the estimated function showed that an additional buffalo female above 3 years old adds about 1491.6 kilograms to the farm total milk supply. The effect of draft work on milk production depends upon the type of farm operation served by the dairy buffalo. The animal power used for land preparation is the only type of work that has a drastic negative impact on milk yield.

Using a dairy buffalo for one day to operate the plow decreases the farm milk production by 3.2 kilograms. Once the land is cultivated twice a year the buffalo would be used for plowing the field about 14 hours per year. Transformation of such loss of milk into annual per feddan results in about 46 kilograms of milk. If the total agricultural land is about 7.5 million feddans, then the total regret value of milk loss due to using dairy buffalo for farm land preparation would be more than 322 thousand tons a year. Saving of such quantity by liberation of dairy buffaloes from farm work may surpass the Egyptian imports of milk products equivalent (4% fat). Therefore, using dairy buffalo for land preparation had been vanished to zero, even before the onset of the national program for agricultural mechanization in mid of eighties.

Surprisingly, using dairy buffalo for operating the "Sakia" -water wheel- for field irrigation has a little slightly positive impact on milk yield. However, this result is supported not only by other field observation but also it is confirmed by the principals of animal physiology. "Sakia" operation is a type of moderate effort, similar to the intended exercises practiced in dairy cattle farms to the dairy cows in order to stimulate milk secretion and to avoid fattening of the dairy cows.

Labor Use Pattern for Buffalo Enterprise on Small farming System:

The contribution of livestock, in general, and dairy buffaloes, in particular, to creating year-round employment for farmers and farm-household members, cannot be denied. Labor demand for dairy buffalo enterprises increases in the winter months when crop production demands for labor are lowest. Table 5 shows that the smaller is the farm size the higher is the density of the family labor supply per farm, which is associated with higher density per feddan of livestock, particularly, buffalo holding size. Therefore, the density of hiring labor per feddan decreases as farm decreases. The same table also provides evidence that while the abundance of family labor on farm is highly absorbed by serving livestock production, the hired labor is devoted mainly to crop production. On the average 56% of the agricultural labor is devoted to crop production and 44% is devoted to livestock. This shows how significant the role of livestock in generating employment opportunities for rural labor force, where the small mixed farming system is the common pattern. Assuming that the working hours per day on the farm is 6 hours, then from both tables (5 and 6) the labor devoted for serving buffaloes on farm reaches around one-third of the labor for livestock.

Table 5 **Allocation of l labor for crops and livestock**

Comparative Item	-1	1-3	3-5	5-10	-10	Weighted average
Average farm size (feddans)	0.8	2.0	4.1	6.6	21.6	2.1
Average Family Size (Persons/Feddan)	7.7	3.9	2.3	1.2	0.4	5.1
Buffalo Heads/ feddan	0.93	0.36	0.30	0.06	0.06	0.37
Livestock holding size Animal units / feddan	1.52	0.72	0.64	0.26	0.18	0.63
Total hired labor (days) / feddan of Which:	30	50	62	65	59	53
₹ For crops	98%	96%	92%	96%	87%	55%
₹ For Livestock	2%	4%	8%	4%	13%	45%
Total family labor (days) / feddan of Which:	445	216	145	99	69	207
₹ For crops	22.8%	51.9%	57.6%	77.9%	82.7%	45.7%
₹ For Livestock	77.2%	48.1%	42.4%	22.1%	17.3%	54.3%
Total Labor (days) / feddan of which	475	266	207	164	128	260
₹ For crops	27%	60%	68%	85%	85%	56%
₹ For Livestock	73%	40%	32%	15%	15%	44%

Table 6 shows that the hired labor share in the total labor hours of a dairy buffalo holding on a traditional mixed farming system increases from 4% on a farm size class less 5 feddans up to 39% on farms larger than 10 feddans. Time-wise feeding and watering operations consume more than 60% of the labor hours for dairy buffalo work, as presented in Table 6. Although milk processing on farm utilizes around 7% of the labor time devoted to buffalo herd operations (Table 6) its value added generates an opportunity cost about nine-times that of rural labor devoted for other buffalo operations (Table, 7). The family labor devoted for buffalo production on farms less than one feddan is the only class that generates opportunity income greater than the average wage rate in the village. The largest farm class above 10 feddans generates a negative average opportunity cost for family labor devoted to dairy buffalo enterprise.

Table 6 Labor Use Pattern For traditional Dairy Buffalo Enterprise

Farm size class (feddans)	-5	5-10	10+	Average
Total labor hours / dairy buffalo/ year of which:	983	846	574	622
Feeding (%)	36.2%	35.5%	36.2%	33.3%
Watering (%)	25.8%	25.8%	20.2%	17.8%
Cleaning (%)	20.3%	20.2%	26.0%	23.7%
Milking (%)	10.1%	10.0%	10.1%	9.3%
Milk processing (%)	7.5%	7.6%	7.5%	6.9%
% Of hired labor (%)	4.0%	10.0%	39.0%	7.0%

Table 7 Opportunity Income Of Family Labor For The Dairy Buffalo

Opportunity cost of family labor per hour (L. E.)	Farm size class (feddans)			
	-5.00	5-10	10+	Average
Milk processing	10.10	8.40	7.10	8.90
Other operations	0.93	0.08	-0.62	0.55
All operations	1.62	0.71	-0.04	1.17

Economic Efficiency of Dairy buffalo production:

Table 8 shows that the buffalo production systems, in general, recognize higher profitability and return to investment than exotic dairy breeds enterprises, which mainly Holstein breed. Often, the exotic breeds do not perform their potential yield under the various sources of stresses that face the herds in tropical and sub tropical regions, and even if they do it would not resist for the successive lactations, due to in sufficient rich abundant feeds required.

Table 8 Comparison of Economic Efficiency of Buffalo versus Exotic breeds in 2001

Item of Comparison	Small Mixed farm Dairy buffalo Holding	Commercial Dairy buffalo Enterprise	Small Scale Holstein Dairy Cows	Large Scale Holstein Dairy Cows
Net cost in L.E. of 1-Kg milk (adjusted 4% fat)	0.30	0.29	0.36	0.47
Normal Profit in L.E. of 1-Kg milk (adjusted 4% fat)	0.34	0.33	0.07	0.15
Average Return to Investment (ERR)	39%	32.47%	8.36%	12.25%

In general, buffalo production systems also achieve lower net cost of 1- kilogram of milk, adjusted for difference in fat content, than exotic breeds. This is because exotic breeds require intensification of feed inputs to assure the potential high yield (Table, 9). Also, to avoid the expected sources of environmental stresses the investment in establishing buildings and equipments for exotic breeds are much higher than that required for adapted animals such as buffaloes, (Table 9). The probability of mortality is also more frequent than buffaloes

However, raising dairy buffalo under the small-scale mixed farming system surpasses the economic efficiency of the commercial dairy buffalo system. This is because the small farmer, often, intended to compensate his very limited endowments and resources by holding the highest productive buffalo, (Table, 3) and being very rational in using feeds (Table, 4).

In addition to that, the small farmer establishes the cheapest sufficient barn structure and required equipments. As Table 9 shows that the costs of investment per 1-Kg of buffalo milk under the traditional system is the lowest value among other systems, including commercial buffalo system. The high care of the small farmer of his very few numbers of buffaloes controlled the mortality rate to very minimum (Table, 9)

Table 9 Cost Structure Profile per 1- Kg corrected 4% fat Milk in L.E. in 2001

Cost Item	Small Mixed farm Dairy buffalo Holding	Commercial Dairy buffalo Enterprise	Small Scale Holstein Dairy Cows	Large Scale Holstein Dairy Cows
Feeds	17.27	26.77	29.04	37.89
Hired labor	0.68	1.23	2.35	3.93
Imputed costs of family labor	5.83	0.45	0.75	0.00
Total costs of labor	6.51	1.68	3.10	3.93
Total Investment Costs (depreciation + Interest)	1.16	1.73	3.07	4.44
Imputed costs for mortality	0.08	0.26	0.39	0.52
Other Cost items	0.40	0.87	2.15	2.83
Aggregate Costs	25.42	31.31	37.75	49.61
Non milk Output	1.08	5.48	10.58	11.21
Net Costs	24.34	25.83	27.17	38.40

Impact of farm size on milk marketing Pattern:

The proportion of buffalo milk produced devoted to traditional processing on farm by the household increases as farm size decreases. It is about two-thirds for the farm class less than one feddan to about 5% for the farm class more than 10 feddans. However, the proportion of milk sold increases as farm size increases. It is hardly reaches one-fourth of the farm production within the class of farms less than one feddan. Such proportion expands gradually with larger farm size to reach more than three-quarters of the total farm supply with more than 10 feddans. It seems that the smaller farm has fewer opportunities to sell milk due to either limited farm production available or the less potentiality to reach the marketing channels and/or the fair price. Therefore the rational decision of the smaller farm is to allocate more milk for being processed at home. The sale of home processed products is less than 5% of the milk produced (as milk equivalent). The rest of cheese, butter and ghee processed at home are for farm household consumption. Home processing of milk produced absorbs more of the abundant household labor supply, mainly women (Table, 10).

Although most of the processed milk on farm is for the consumption of household members, with poor marketing opportunity, it is an approach to increase the value added of milk produced as shown form the index calculated in (Table, 10). Such index presents the trend of the value added per one kilogram of buffalo milk produced on farm

Table 10 Effect of Marketing Advantages on Milk Marketable Surplus

Comparative Item	First region	Second Region	Weighted Average
Annual milk produced per farm (Kg)	1520	6100	1980
Annual milk sold per farm (Kg)	290	3721	772.2
% Of milk sold from the total produced.	19.1%	61.0%	39.0%
Milk price (L. E./ Kg)	2.45	1.95	2.25
Share of milk production in total output	72.1%	60.2%	64.4%
Average number of milking buffalo per farm	3.68	1.1	
Feed Use Pattern/ milking buffalo (Kg) of which:	6500	1050	2950
Fodders	6500	1050	2950
Straws	750	1000	875
Concentrate feeds	790	212	452
Profitability as % of the milk sale price	57.0%	39.5%	42.5%

Impact of Marketing Incentives on milk Supply per farm:

Table (11), shows the average milk production and milk sold per farm in the two selected regions as well as the average price per kilogram of milk. The two villages of the first region are adjacent to a big city and located across the main country road of Nile Delta with good infrastructure and a milk collection center. The two villages of the second region represent a typical traditional area, which is far or even isolated from the main milk market. Therefore, the milk production per farm of the first region is more than four-times the comparable average of the second region. The difference was statistically significant

Table 11 Milk marketing pattern as % of total production

Farm size class in sedans	Sale	Home consumption			Index of the value added per kg of milk 100%
		(Processed)	(Liquid)	Total	
-1	24.00%	63.84%	12.16%	76.00%	64%
1-3	44.00%	39.20%	16.80%	56.00%	50%
3-5	47.00%	34.98%	18.02%	53.00%	31%
5-10	63.00%	13.32%	23.68%	37.00%	31%
10+	76.00%	5.22%	23.78%	29.00%	64%
Average	39.00%	44.53%	16.47%	61.00%	100%

Table 3 above indicates that the availability of marketing incentives add about 50% to the yield per buffalo. It means that the buffaloes in the first region are more productive than the second region. The marketing advantages are translated into higher milk price, lower costs of transportation in the first region, which provide considerable incentives to expand the buffalo milk supply of the small traditional via a rational economic decision by the farmer. These decisions include reaching a maximum intensification of his limited resources. This intensification plan is transformed into more specialization in milk production. The share of milk in the farm livestock output reaches 72% while it is only 60% in the second region. More dairy buffaloes on the farm of the same size with higher yield per head are holed in the first region. Availability of the marketing incentives in the first region lead to allocate larger area to fodders, mainly be seem in winter. Therefore, the farmer is capable to provide fodders at a rate of six times the rate provided by the farmer in an area that lacks of marketing incentives. Besides, the concentrates feeding rate reaches also more than three times what the farmer provides in the other region for dairy buffalo on a similar size farm. The farmer in the second region surpasses his colleague in the second region only with respect to straw level per head, table 11. Accordingly, the profit margin reaches 57% of the milk sale price in the first region and only 39.5% in the second region.

Milk Marketable Surplus

Literatures showed that the principal factors responsible for the substitution of farm household consumption for sale of farm produce are the farm size, the farm-household size, the farm income and the product price ([20,21]).

The previous sections of the study showed that larger farm size and availability of marketing advantages are associated with expansion in milk production which leads to higher proportions of milk marketable surplus, because the marketing advantages implies higher milk price and lower marketing costs. Under traditional farming system larger farm size reflects higher level of income. Therefore, the farm size in this analysis is used to reflect

Therefore, the study attempted to estimate the impact of the increase in milk production, due to the factors mentioned above, on the dividend of the home consumption and sale in the additional increase in milk production. The best fitted form was a linear relation (Equation 2), where ((MOLD) represents the kilograms of farm milk supply devoted for sale as a function of total farm milk supply (TMS). Values in parentheses under the estimated parameters are the corresponding standard errors. The number of observations is referred to 175 farms

MSOLD = 1028.56 + 0.831 TMS .... (2)

(20.58)   (0.0195)

$R^2 = 0.912$ F = 1818.9, N = 175

From Equation (2), 1-Kg increase in farm milk production does not only increase the quantity of milk for sale by 0.8309 Kg, it also raises the level of household consumption by (1 - 0.831) = 0.168 Kg. Therefore, the expansion in milk sale is also associated with improvement in the nutrition status of the rural household, Particularly, the vulnerable groups (children, pregnant and lactating women) by raising per capita consumption of such intuitively rich food item, at low price (costs of production. The proportion of rural population who suffer from poor animal protein intake is higher than the urban people[22]. Furthermore, the expected high increase in milk marketed surplus results in higher farm household income.

On the other hand, from equation (2), if the milk marketable surplus reached zero, i.e. no sale of milk products, the quantity of the total milk supply per farm would be around (-1238) kilograms fresh milk. Such negative sign quantity of milk indicates that the switching value between the subsistence and market-oriented farm per farm is a farm production of 1238 kilogram. Substitution of total milk supply of the farm for zero, (the farm is not milk producible), implies that the minimum quantity of milk for home consumption, is about 1029 kilograms. Whereas, the average farm household size is 5.5[23], the minimum average quantity of daily milk to be purchased for per capita consumption is 500 grams, i.e., two cups of milk per day.

In conclusion, where milk marketing advantages exist, the decision of the farmers, even with very small holding size, will be keeping a head of dairy buffalo with an annual milk yield much above 1238 kilograms, Table (3). The comparable farmers in a rural area isolated from such incentives, try only to assure that his buffalo holding, is hardly covering the subsistence milk consumption level for the rural household, i.e. of about 1029 kilograms per lactation. Accordingly, if the development target is to raise the rural household income, considering the principal of comparative advantage in resource use, the approach is to reform the milk marketing system in villages. Such approach would not only expand the milk marketable surplus, but it would assure the success of any genetic improvement or feeding program for buffaloes. The lack of an institutional framework in the rural area is the obstacle facing all efforts for raising the buffalo productivity and expansion of marketable rural supply of milk. The success of any recommended framework should not be of a governmental nature. Therefore, the adoption and adaptation of a model of "village milk marketing cooperative" developed in Rural India is highly recommended, with only governmental support and not intervention.

References

1. FAO Internet Site " Statistics and Data Base: FSTAT- AGRICULTURE
2. Fitch, J. F. and Ibrahim Soliman (1983). "Livestock and Small Farm Labor Supply", in "Migration Mechanization and Agricultural Labor Markets in Egypt". Edited by Richard, A. and Martin. F. PP. 45-79, West-View press, Boulder, Colorado, U.S.A.
3. Soliman, Ibrahim and Zaki, E. S. (1982). "Socio-Economic Factors Affecting Decisions of Traditional Farmer on Investment in Livestock in Sharkia Governorate in Egypt", the 7th International Congress for statistics, computer science, social and demographic research. Computer center. Ain Shams University, Cairo.
4. Soliman, Ibrahim, Fitch, J. B. and N. Abdul Aziz. (1982), "The Role of Livestock Production on the Small farm" Research Bulletin No. 625. Faculty of Agriculture, Zagazig University, Zagazig Egypt.
5. Soliman, Ibrahim, (1985). "Analysis of the Buffalo Milk Response under the Conventional Egyptian Farming System". 9th International Congress for statistics, computer science, social and demographic research. Computer center. Ain Shams University, Cairo.
6. Soliman, Ibrahim and Abdul-moneim Ragab, (1985). "Labor Use Patterns for Livestock Operations on Conventional Farms in Egypt". Zagazig Journal of Agricultural Research, Vol. 12, No. 1
7. Soliman, Ibrahim and El Nagar, R. (1981). "Credit policies for livestock in Egypt'. Res. Bulletin No. 221, faculty of agriculture, Zagazig University, Egypt.
8. Soliman, Ibrahim, and James Fitch, (1982), "Economics of Livestock on Traditional Farm". Res. Bulletin No. 679. Faculty of Agriculture, Zagazig University, Egypt.
9. FAO/ World Bank (1977), " Egypt Agricultural Development Project". Preparation Mission Report. FAO, Publications, Rome, Italy.
10. Louis Berger. 91978), 'Consulting Inc., "Technical and Economic Feasibility of Electrifying Tertiary Canals Pumping means in the middle and upper Egypt. A study for the Egyptian ministry of irrigation.
11. The World Bank (1978), "Agricultural Development Project in Monofia and Sohag in Egypt".
12. ERA 2000 Inc. (179), "Further Mechanization in Egypt: Hopes and fears". AID/ Egypt.
13. El tambadawy, M. (179). "Economics of production and Marketing of Milk in Sharkia governorate". M. Sc. Thesis. Dept. Agric. Econ. Faculty of Agriculture, Zagazig University, Zagazig Egypt.
14. Dyer, W. (1981). "The Opportunity Cost of Animal Labor in Egyptian Agriculture". Agricultural Development Systems Project ARE Ministry of Agriculture and University of California, Davis. Economics working paper No. 3
15. Soliman, Ibrahim (1983)."Livestock Working Power in Egyptian Agriculture". The Proceedings of the 18th annual conference of statistics, computer science, operation research and mathematics. Vol. 18, No. 1PP. 1-18.
16. Soliman, Ibrahim And J. Fitch: (1985) "Relative Economic efficiency of Buffalo Milk Production in Egypt". Proceedings of the 1st World buffalo Congress, Held in Cairo Egypt. Organized by The International Buffalo federation, Vol. 3: 640-648.
17. Ragab, M. T. and Askar, A. A. (1968). "Milk production from Cattle and Buffalo. 3ed edition. Ein Shams University Press, Cairo, Egypt.
18. Forest Walters, (1981). "The Livestock Enterprise on Survey farms in Abu-Raia, Kafr El-Sheikh: selected Implications for Water Distribution and Field Management". Staff working Paper No. 68, Egypt Water Use and Management Project, Ministry of Irrigation, Cairo, Egypt.
19. Soliman, Ibrahim and A. Mashhour, (2003). " Socio-Economic Aspects of Buffalo Production". Proceedings of the 4th Asian Buffalo Congress, on: Buffalo for Food Security and Rural Development". Vol. 1: Lead Papers. P. 272- 283.
20. Schultz, W. Theodore. (1953), : The Economic Organization of Agriculture", 3rd Edition, TATA McGraw Hill Publishing Company LTD. Bombay and New Delhi, Copyright. PP. 223-244.

21. Chinn, Dennis (1976), " The Marketed Surplus of Subsistence Crop: Bady Rice in Taiwan". American Journal of Agricultural Economics, Vol. 58, No. 3, P. 584-587.
22. Soliman, Ibrahim and Shahlla Shapouri, (1984). "Impact of Wheat Price Policy on Nutrition Status in Egypt". Research Bulletin of the International Economic Research Service, USDA, Wash. Dc., U.S.A.
23. Fitch, J. B. and Ibrahim Soliman (1983), "Livestock and Small Farm Labor supply in "Migration, Mechanization and Agricultural Labor Market in Egypt". Edited by Richard A. and Martin, P. PP. 45-79.
24. Ganguly, B. K. (1983). "ANAND Pattern: 1st significance of Dairy Development", in Gupta et al, Editors of "Dairy India". PP. 29-35, Rechla Printers Pvt., Int., New Delhi, India.