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Buffalo Share in Small Farmer Welfare under Intensive Agricultural System: The Case Study of Egypt

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ABSTRACT

The study focused on the share of buffalo in generating income for small farm household, and its relation to crossing the poverty line. Such farm category represents the majority of farmers in the countries raising buffaloes in Asia and Africa. The small farmers in Egypt are the holders of less than 2 ha. Such category represents about 92% of the total agricultural holders. Even though, they hold only less than 50% of agricultural area, 72% of cattle and 87% of buffaloes. 10% of buffalo holders are without agricultural land holding and 14% of cattle holders are also without land holding. The study used a farm sample survey of 120 small farms in rural Egypt to achieve its objectives. The analysis of the sample survey data showed that the average land holding of the small farmer is less than 1 ha and the average household size is 5 persons. The average buffaloes stock on farm is almost one head and its followers. The main feed source is the cultivated winter green fodder "Berseem, which occupies on the average about 25% of the farm land. While 62% of the farm managers are fulltime males 20% are fulltime females. Whereas, 77% of wives share in farm labor 56% of them share in livestock operations.

The estimated total annual income of small farm's household is about US$ 4,170. Livestock generates more than one third of this income, poultry share is 1%, and crop income share is only 18%. i.e., around 52% of the small farm income is generated by agricultural enterprises .The rest, i.e. 48% is from off farm income. The sources of off farm income are, 3% from off farm agricultural work, 40% regular salaries, 5% from remittance of the farmer's work abroad. The study estimated the daily per capita income per household as US$ 2.3, which just passes the poverty line. Milking buffalo has a significant role in alleviation of poverty that might face small farm households. Without milking buffaloes holding on farm the household would suffer from being significantly below the poverty borders. To raise milk productivity is the proper approach to increase the income generated by buffalo, once there is no room for horizontal expansion. It requires an (A.I.) program using imported semen of potential high milk yield from e.g. Italy. Such program should be associated with reform of the institutional framework in the Egyptian village and establishment of an efficient marketing system, modern animals' health care and a nonconventional feed regime.

Keywords: agricultural resources, equity, farm income, poverty alleviation

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INTRODUCTION

The study focused on the share of buffalo in small farmer welfare. Such category represents the majority of buffalo holders in Asia and Africa (Nasser, 2009; Soliman, 2009). Therefore, they should be the target group of any proposed integrated rural development program in these countries.

The generated income from farming is a final proper indicator of welfare for small farm household. The higher the farm income, the most probable the small farm household will cross the poverty line. Employment of the household members in farming and buffalo production on farm is another criterion of such welfare, condition that the employment opportunity on farm is economically feasible, (Soliman, 2008). Even though the small farmers are willing to achieve welfare, the lack of equity in agricultural land holding and thereof, disability to acquire a satisfactory income enhanced a fast stream of migration to urban or even abroad (Soliman and Mashhour, 2002).

DATA AND ANALYTICAL METHODS

The socio-economic literatures on Egyptian rural had identified the small farm size of less than 5 feddans (Soliman, 2006). One feddan (Area unit in Egypt) = 4200m^2. The US$ exchange rate for one Egyptian pound was 6.07 in 2011 (Central Bank of Egypt, 2012). The study used a farm sample survey of 120 small farms in rural Egypt as a case study. They were collected from four villages. While two villages were close to urban market, the other two were relatively far from the urban market. The urban market was identified as the capital of the district. The selected district (Minia Al Kamh) occupied the first rank of livestock holdings in Sharkia governorate. Such governorate represents the rural community of Zagazig University (80 kilometers from Cairo). 30 small farms were randomly drawn from each village, according to three small farms categories (10 farms from each). These categories were (<2 feddan), (2-4 feddan), (4-5 feddan). The sample method was identified as cluster (village) stratified (farm size category) random (farms within each category). The appropriate analytical models were applied to achieve the study's objectives. These included the farm income statement analysis and the estimation of some response functions (regression analysis). In addition, the GINI coefficient was estimated to quantify the magnitude of inequalities of the agricultural resources (land) distribution among farm holdings in Egyptian rural. The Gini coefficient is often calculated with the Brown Formula shown below.

$$G = |1 - \sum_{k=0}^{k=n-1} (X_{k+1} - X_k)(Y_{k+1} + Y_k)|$$

Where;

G: Gini coefficient

X: cumulated proportion of the population variable

Y: cumulated proportion of the income variable

In order for G to be an unbiased estimate of the true population value, it should be multiplied by {n/ (n-1)}, (The World Bank, 2004). The Gini coefficient is an index of wealth concentration. The coefficient represents the gap between the

perfect distribution of a country's diagonal and a country's actual distribution curve of wealth. It is a score between zero and one, although it sometimes appears in percentile form. It represents the degree of inequality in the distribution of income in a given society. A Gini score would register zero (0.0 = no inequality) where each member has exactly the same share of the country's wealth (resource). The Gini score would register one (1.0 = maximum inequality) if one citizen received all the wealth and the rest of society gets nothing.

RESULTS AND DISCUSSIONS

Lack of equity in agricultural resources distribution

About 92% of the farming households hold farms are less than 5 Feddan, even though they hold less than 50% of the arable land. Estimated Gini coefficient was 44% for the consistency between the number of holdings and arable land which implies poor equity of agricultural resources. On the other hand, the small farmers hold the majority of livestock assets, i.e. more than 87% of buffaloes and about 72% of cattle (Table 1). Due to limited area (the average farm size was 2.12 Feddan, the stocking rate of livestock was too high generating high demand for purchasing feeds as the average cultivated green fodder (Berseem) was 0.5 feddan (Table 2). Berseem is a winter legume crop. It is also called Egyptian clover. Thereof, the trend of feed prices goes up fast and also, there is no room for horizontal expansion in livestock assets. The only feasible option is the vertical expansion (to raise the productivity) (Soliman and Mashhour, 2011). In spite of limited land resources the small farmer has shown much capital accumulation, mainly due to investment in livestock over the last 20 years. The annual rate of increase in capital assets on farm was 10% (Table 2).

Human resources distribution

The estimated average household size of the small farm was 5 persons with 3.2 children. Among them about 60% were at the age of work, Table 2. Managerial-wise, 20% of full time farm managers were women, only 62% of the farmers were full time for farming and 18% were part time for farming, i.e. they have other jobs (Table 3). In addition, among the farmer's children at the age of work about two thirds have nonagricultural jobs with salaries and 28% working off-farm on farms of others, the rest, i.e. 9% were unemployed (Table 4).

Farm household's income sources

Surprisingly, the crops sale generates only 18% of the small farm household, while livestock generates 33% and poultry 1%. Even by adding up the off-farm income from seasonal hiring of the small farm household's member for farming, the aggregate agricultural activities income was estimated as only 55%. 45% of the total income was from non-agricultural activities, where 40% from salaries and 5% from remittances of the farmers worked abroad (Table 5).

Role of buffalo enterprises in income generated from livestock activities

As shown from Table 6, the total herd size on a small farm was 3.5 heads, of which 31% milking buffaloes, generated 41% of livestock income, while milking cows share in the herd structure was 23% but generated only 20% of livestock income. The economic efficiency of a milking buffalo is two folds that of a milking cow on a small farming system. It seems that the small farmer raises cattle mainly

for meat production (fattening of males), while buffaloes are mainly for milk. While the Cattle feeder calves share in herd structure was 26% generated 33% of livestock income, buffalo feeder calves share in herd structure was 3%, generated only 2% of livestock income.

Role of buffalo enterprises in alleviation of farm household poverty

Going back to Table 5, the annual average total income (farm and off-farm income) provided US$ 2.3 per capita per day, i.e. 30% above the poverty line which was estimated as US$ 2.00 per capita per day (Chen and Ravallion, 2007). All agricultural sources of income generated only US$ 1.26, i.e., leaving a poverty gap of around 37% (the difference between the poverty line and the agricultural activities income). Without buffalo enterprising the poverty gap would have been deeper, reaching 55%. Therefore, buffalo enterprising decreased significantly the poverty gap impacts on the small farm household particularly that the dairy products income is almost daily.

Identification of the factors determining buffalo herd size on farm

It seems that the green fodder area is a main factor that determines the milking buffalo holding on the small farm. From the regression model in Table 7 if there is availability to allocate one more feddan of the farm area holding for Berseem the carrying capacity per one feddan two milking buffaloes (with their followers) will be added to livestock holding on the farm. The economic incentives were also of highly positive effect on the buffalo holding size on farm. These identified incentives were the farm price of milk and the volume of the milk processed on the small farm. The estimated response function (Table 7) showed that the farmer would be ready to add almost one more milking buffalo if either the farm price per kg of milk increased by L.E. 1 or if the value of sold dairy products, processed on farm increased by L.E. 100. It should be mentioned that the study did not find significant impact of these marketing incentives on the milking cows holding size on the farm. However, the response function of milking cows was omitted from the study as the focus was on buffalo's role.

Identification of the factors determining berseem area on farm

As shown from the estimated model in Table 7 that the allocated area of Berseem is a highly significant factor that determines the buffalo holding size on farm, the study estimated the effect of farm size on determining the Berseem area. Table 8 presents the estimated response function. Such response implied that Berseem is determined by the farm acreage; in addition the income per feddan of Berseem is an economic factor that provides incentives to expand Berseem area.

The small farm size constrain has implication on the nature of the Berseem area and farm size relationship. It is a curvilinear relation rather than linear. Therefore, whereas the estimated response at the average farm size (2.12 feddan) estimated a Berseem area about 0.9 feddan, at the maximum small farm area (5 feddan), the Berseem area would be 2.1 feddan, i.e. the farmer would not allocate more than 42% of his land to Berseem in the winter season (Oct. – May) leaving the rest for subsistent competitor crops, mainly wheat.

CONCLUSIONS AND RECOMMENDATIONS

Milking buffalo has a significant role in alleviation of poverty that might face small farm households. A program to raise milk productivity is the proper approach to increase the income generated by buffalo, because there is no room for increasing, horizontally, the buffalo population due to limited agricultural land, water resources and competition between human food and animal fodders on such limited resources. Such program requires expansion in artificial insemination using imported semen carrying potential genetic makeup of high milk yield. Italy, probably, is the appropriate market to import such semen. Such program needs reform of the institutional framework in the Egyptian village to assure the success of such technology transfer package. It should be associated with establishment an efficient marketing system, animals' health care and a nonconventional feed regime to overcome the scarce feed consrain.

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Table 1. Land and livestock holding structure in Egypt.

Category of farm area	Holdings	%	Area (Feddan)	%	% of cattle	% of Buffaloes
Less than 1-Feddan	109307	34.72%	53360	6.17%	16.81%	21.54%
1 to less than 2 feddans	82199	26.11%	108079	12.49%	20.07%	26.92%
2 to less than 3 feddans	59405	18.87%	133786	15.47%	19.03%	23.67%
3 to less than 4 feddans	26300	8.35%	85143	9.84%	10.50%	9.32%
4 to less than 5 feddans	11455	3.64%	48726	5.63%	5.36%	5.71%
Sub total	**288666**	**91.68%**	**429094**	**49.61%**	**71.77%**	**87.16%**
5 to less than 6 feddans	12897	4.10%	70589	8.16%	6.32%	6.12%
6 to less than 7 feddans	4969	1.58%	39966	4.62%	2.84%	2.63%
7 to less than 10 feddans	3475	1.10%	39930	4.62%	1.97%	1.61%
10 to less than 15 feddans	1560	0.50%	25479	2.95%	1.00%	0.85%
15 to less than 20 feddans	1613	0.51%	36820	4.26%	0.85%	0.69%
20 to less than 30 feddans	1059	0.34%	39081	4.52%	0.77%	0.59%
30 to less than 50 feddans	494	0.16%	30634	3.54%	0.40%	0.28%
50 feddans and more	132	0.04%	153404	17.73%	0.11%	0.07%
Total	**314865**	**100.00%**	**864997**	**100.00%**	**100.00%**	**100.00%**

(One Feddan = 4200 m^2), Estimated GINI coefficient = 44.00% for the equity of the agricultural land distribution.
Source: Compiled and calculated from: Ministry of agriculture, Egypt (2010) “Agricultural Census”

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Table 2. Average resources on a small farm.

Variable	Average
Average farm area (Feddan)	2.12
Household size (Number)	5.0
Number of children (Total)	3.2
Number of children (At Work Age)	1.9
Berseem area (Feddan)	0.50
Beginning inventory (L.E./Farm)	7954
Farm End inventory (L.E/Farm)*	30300
Change in inventory (L.E/Farm.) over 20	22346
Annual growth in inventory	10.33%

One US$ = 6.10 L.E. (Egyptian Pound) in 2011
Source: Compiled and Calculated from the Sample survey of this Study in 2011.

Table 3. Type of small farm manager.

Type of Farm Manager	% of farms
Full time male farmer	62%
Full time female farmer	20%
Part time male farmer	18%
Wives share in farm operations	77%
Wives share in livestock husbandry	58%

Source: Compiled and Calculated from the Sample survey of this Study in 2011.

Table 4. Employment of farm household children.

Type of Employment	Number per farm	%
Number of children at work age of which:	1.9	100%
Working in non-farming jobs	1.2	63%
Working on other farms	0.5	28%
Unemployed	0.2	9%

Source: Compiled and Calculated from the Sample survey of this Study in 2011.

Table 5. Sources of farm household income and daily per capita income.

Source of income	Annual farm income			Daily/ Capita income	
	L.E.	%	US$	L.E.	US$
Crop Sale	4478	18%	740	2.45	0.40
Livestock Output	8296	33%	1371	4.54	0.75
Poultry Output	236	1%	39	0.13	0.02
Working on Other Farms	876	3%	145	0.48	0.08
Total Agricultural Activities	13886	55%	2295	7.60	1.26
Salaries	10145	40%	1677	5.55	0.92
Remittances of the Farmer's work Abroad	1200	5%	198	0.66	0.11
Grand Total	25231	100%	4170	13.83	2.3

One US$ = 6.10 L.E. (Egyptian Pound), in 2011Source: Compiled and Calculated from the Sample survey of this Study in 2011.

Table 6. Role of buffalo in income generated from livestock on small farm.

Livestock Category	Heard Structure Per Farm		Livestock Income/ Farm		Productivity/Head		
	head	%	L.E.	%	Income per Head (L.E.)	Productivity Index	Animal Unit Index
Milking Buffaloes	1.1	31	3621	41	3292	100	1.00
Milking Cows	0.8	23	1725	20	2156	65	0.65
cattle Male Feeder Calves	0.9	26	2864	33	3183	97	0.97
Buffalo Male Feeder calves	0.1	3	194	2	1941	59	0.59
Mature Sheep and Goats	0.3	9	196	2	653	20	0.20
Lambs	0.3	9	139	2	463	14	0.14
Total Herd	3.5	100	8739	100	2497	76	0.76

Source: Compiled and Calculated from the Sample survey of this Study in 2011.

Table 7. Factors determine milking buffaloes on small farm.

Explanatory Variable	Estimate	Standard Error	t Stat	Significance Level	Goodness of Fit	
Intercept	0.8172	0.1313	6.2245	<0.01		
Farm Price per 1-Kg of Milk	0.3760	0.0581	6.4686	<0.01	R Square	42
Revenue of Dairy Processing on Farm	0.0037	0.0008	4.6223	<0.01	Adjusted R Square	0.41
Berseem Area (Feddan)	0.8541	0.1329	6.4244	<0.01	F Ratio	28.43

Source: Compiled and Calculated from the Sample survey of this Study in 2011.

Table 8. Factors determining the berseem area on farm.

Explanatory Variable	Estimate	S.E.	t Stat	Significance Level	Goodness of Fits	
Intercept	0			0.97	Observations	120
$(\text{Farm Area/Farm})^2$	0.428	0.058	7.338	< 0.01	R Square	0.893
(Farm Area/Farm)	-0.035	0.013	-2.628	< 0.01	Adjusted R Square	0.883
(Income from 1-Feddan of Berseem)	0.00007	0.00002	3.314	< 0.01	F Ratio	325.35

The regression model was estimated under the assumption of zero intercept.
Source: Compiled and Calculated from the Sample survey of this Study in 2011