Egyptian J. Anim. Prod., 49 Suppl. Issue, Nov. (2012):119-129

WATER EFFICIENCY UNDER THE MIXED (CROP/LIVESTOCK) FARMING SYSTEM IN EGYPT:
1. WATER EFFICIENCY OF MILKING BUFFALO COMPARED TO CASH CROPS

M.A.I. Khalil[1] and A.I.M. Ahmed[2]

1- ***Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture and Land Reclamation, Dokki, Giza, Egypt, 2- Economic Research Institute, Agricultural Research Center, Ministry of Agriculture and Land Reclamation, Dokki, Giza, Egypt***

SUMMARY

Hundred fifty farms were randomly selected in three governorates (fifty per each). The objective of the study was to assess Dairy Buffalo Water Efficiency (DBWE) compared with Crop Water Efficiency (CWE) in the three governorates. The selected farms represent two mixed farming systems (buffalo – rice base system) for El-Beheira (B) and Kafer El-Sheikh (K) and (buffalo - sugar cane base system) for Qena (Q). Questionnaire was designed and pre tested on limiting groups of farms in the three studied areas. Data were collected through farmer's interview to find out land use, buffalo management and water used in dairy buffalo production. Water was calculated for animal and crop production and services to measure DBWE and CWE. Results showed that dairy buffalo revenues /m^3 were LE. 3.63, LE. 3.89 and LE. 5.05/m^3 for Kafer El-Skeikh, Qena and El-Beheira, respectively. Meanwhile, rice production in Kafer El-Skeikh and El-Beheira were LE. 0.59 and LE. 0.30 /m^3 and sugar cane was LE.1.38/m^3 in Qena. Corn revenues were LE. 0.63, LE. 0.41 and LE. 0.46/m^3 in K, Q and B, respectively. Revenues for winter crops in delta were LE. 2.30, LE. 1.19 and LE. 2.11 per m^3 for wheat for the same governorates, respectively and LE. 0.19 for bean in El-Beheira. In view of the results it could be concluded that milk production has better water efficiency compared to cash crops.

Keywords: Water efficiency, milking buffaloes, farming systems, cash crops

INTRODUCTION

Water scarcity is a major factor limiting food production. Improving dairy buffalo water efficiency (DBWE) is one of the approaches to address such limitation. DBWE and crops water efficiency (CWE) were defined as the ratios of dairy buffalo or crops beneficial outputs and services to water depleted in their production. Increasing DBWE can help achieve more production per unit of water depleted. In view of Egypt's fixed share from the Nile River and the increase of non-agricultural water uses, the amount of water allocated to agriculture needs to be rationalized by other mean return on irrigation water that must be maximized. Recent discussion on water efficiency (WE) in agriculture highlights livestock as a key area for WE improvement (Molden, 2007).

Peden *et al*. (2007) define livestock water efficiency (LWE) as the ratio of net beneficial livestock-related products and services to the water depleted in producing them. Livestock water efficiency is a system concept, and obtaining LWE success is unlikely to occur unless it is understood as a system wide change.

About 450 m^3 of water is required annually to produce the feed needed to maintain one Tropical Livestock Unit (TLU: measured at 250 kg live body weight). The framework identifies four basic livestock development strategies that can lead to more productive and sustainable use of water resources through improving the sourcing of animal feeds; 1- Enhancing animal productivity (products and services) through better veterinary care, genetic improvement, marketing of animal products, and value-added enterprise. 2- Little is known about water depleted to produce feed, the efficiency with which feed is converted into animal products and services, and the impact animals have on water resources. 3- There are also large variations in animal productivity and animal impacts on water resources. Thus, generalized estimates of livestock water efficiency require analysis, and assessments of livestock water efficiency are needed. 4- While there is still much to learn about production system-specific policy, technologies, and practices that can lead to increased and sustainable livestock water efficiency, integration of existing knowledge of animal production with range and water resources management options affords good opportunities to increase sustainability and the efficiency of water used for livestock production.

The objective of this study was to quantify and analyze agricultural water efficiency in milking buffalo compared with some cash crops under two mixed farming systems (Buffalo - sugar cane base systems) in southern Egypt and (Buffalo-rice base system) in northern regions of Egypt.

MATRIAL AND METHODS

This study was conducted in three governorates through primary data collected by interviewing farmers who raised milking buffaloes under mixed farming system. Farmers who have buffalo and cultivated rice were randomly chosen in Kafer El-Sheikh and El-Beheira in Delta and those who have buffalo and cultivated sugar cane were found in Qena in Upper Egypt. Water required for irrigated crops was calculated from collected data with help of secondary data obtained from Ministry of Agriculture and Land Reclamation (MALR), Economic Affairs Sector, (2011). The data was collected during the period from October 2010 to February 2011, on 150 farms in the three governorates (50 farms each). The three governorates were selected geographically to represent most buffalo farms in northern and southern Egypt with variation in environmental temperature. Questionnaire was designed and pre-tested for clarity on limited numbers of farmers who have good experience in buffaloes with or without cow raising under mixed farming system. This study focused only on milking buffaloes while, young stock and fattening will be considered in part 2 of this research work. The questions covered various aspects of dairy buffaloes number, quantity of animal feeding, estimated animal drinking water consumption in summer and winter, variable costs (feeding , labor and veterinary services cost), revenues (milk, manure, offspring, animal change value, this parameter was calculate according to inflation rate that reported by (Central Egyptian Bank 2011) and gross margin/animal/year. Cops production water depleted, costs and revenues for most winter and summer crops. Water utilization by green forage in winter or summer was calculated from total green forage production divided by water requirements /feddan (1 feddan = 4200 m^2). Water for berseem (*Trifoflium alexandrinum*), hay and corn silage was calculated within green forage produced in farms. Moreover, water was calculated for purchased concentrate feed mixture from the label with the ingredients. Some farmers produce some ingredients on their farms and/or purchase others to formulate rations. All these concentrates calculations were based on individual ingredients quantity over the year. Straws were calculated as total quantity from wheat or rice straws multiplied by feeding period per each type of straw. Total quantity of two straws recalculated as cultivated area to find out how much water used to produce such quantities of straws. Final calculation of straws water based on revenues of total crops, afterwards this revenues were divided into two parts: water to produce cereals representing 75%, 58% and 77% of water per feddan, and by-products 25%, 42% and 23% for wheat straw for El-Beheira, Qena and Kafer El-sheikh, respectively. Most of farmers in the studied areas cultivated almost one feddan for green forage each in winter and summer, to cover the needs of four milking buffaloes/season. Livestock extension people in the studied areas were trained and administered the questionnaire. Green forage,winter or summer, concentrate feed and straws were calculated based on kg price. The prices of animal feed ingredients are shown in Annex (1 and 2). Both corn silage and berseem hay were not used all the year but farmers produce the surplus of green forages to cover the critical periods between cultivating seasons. Manure production was calculated according to the barn ground type , dust or cement. Calf revenues was calculated as average number of calves /cow multiplied by 12 then divided by actual calving interval. Water consumption by the animals was measured considering water drinking places in the farm once then multiplied by times of drinking per day in winter (November - April) and summer (May - October).

Quantitative analysis was used to calculate average and percentage of different technical and economic variables. Two models were used in the statistical analysis. Model I was used to study different factors affecting milk production, to evaluate variation among governorates, parities, calving interval and age at first calving. Model II was used to test affect of Governorate on cash crop traits. The degree of significant among means were performed through Duncan test (Duncan, 1955) using the SAS program (SAS, 2004).

Model I

$$Y_{ijklm} = \mu + G_i + P_j + C_k + A_l + e_{ijklm}$$

Where

Y_{ijklm} = milk yield of animal;

μ = overall mean

G_i= the effect of governorate (i = 1, 2 and 3 where: 1=Kafer El-sheikh, 2= Qena and 3= El-Beheira)

P_j = the effect of parity number (j = 1, 2….. and 7=…….);

C_k = the effect of calving interval (k = 1,2,3), 1= 12-13 month, 2= 14-15 month and 3= 16-20 Month);

A_l = effect of age at first calving (l =1,2,3), 1= 24 – 30 month, 2= 32-36 month and 3= >36 months)
e_{ijklm} = the residual effect.

Model II

$Y_{ij} = \mu + G_i + e_{ij}$

Where:

Y_{ij} = any observation for cash crop traits.

μ = overall mean

G_i = the effect of governorate (i = 1, 2 and 3 where: 1=Kafer El-sheikh, 2= Qena and 3= El-Beheira)

e_{ij} = the residual effect.

RSULTS AND DISCUSSION

Results indicated a significant effect of governorates ($P \leq 0.05$) on milk yield (Table 1). According to analysis of milk yield was higher ($P \leq 0.05$) for buffaloes in El-Beheira compared to Kafer El-Sheikh and Qena while, difference was not significant between Kafer El-Sheikh and Qena. The differences might be attributed to higher ambient temperature in Qena than El-Beheira. Difference between Kafer El-Sheikh and El-Beheira could be attributed to better farm management and efficient utilization of farm feeding resources.

Khalil and El-Ashmawy (2008) found that average daily milk production in Upper Egypt was between 5.00 and 6.02 kg and total milk yield per lactation was between 1172kg and 1253 kg. El-Ashmawy *et al.* (2006) reported that average daily buffalo production in El-Beheira was 7.1 kg/day and total milk yield/lactation was 1835 kg.

Least square means for milk yield per governorates, parity number, calving interval, and age at first calving are shown in Table (1). Buffalo age at first calving ranged between 24 and 30 months and was higher ($P \leq 0.05$) than the other two categories of age. The variations among the three age categories could be attributed to genetics, punctual heat detection and/or environmental temperature. It could be also attributed to better management in El-Beheira and utilization of simple feeding technologies such as green forage conservation, crops by-products treatment or feed additives.

Table (2) shows variable costs, revenues and gross margin (total revenues – variable costs) for milking buffalo in the three studied areas. Feeding was the element with the highest cost. Winter green forage cost in El-Beheira was higher ($P \leq 0.05$) than in Qena and Kafer El-Sheikh while, summer green forage quantity was significantly the reverse ($P \leq 0.05$). This might be because farmers in El-Beheira were cultivating potatoes and watermelon or other more profitable crops than green forage. However, framers usually provide their animals with more berseem hay in summer and with more quantity of fresh berseem in winter. El-Ashmawy *et al.* (2006) reported that cultivated area of berseem in El-Beheira ranged between 37% and 43% of total winter crops while in summer rice represents 31% to 48%, and corn, darawa with elephant grass and kidney bean in total represent only 4.8%. Khalil and El-Ashmawy (2008) found that berseem and alfalfa represented 31.8 % of winter crops in Qena while in summer sorghum, alfalfa and darawa represented 52.8% of summer crops. Therefore, farmers fed their animals less green forage than in winter. In the present study farmers fed their animals more quantities of concentrate feed mixture in summer than in winter. The calculated figures in Table (2) are average between summer and winter consumption. The period of concentrate consumption calculated from a sample farms in three governorates were 180, 227 and 210 days for Kafer El-sheikh, Qena and El-Beheira, respectively. From feeding and total variable costs, it could be concluded that farmers feed their milking buffaloes according to their milk yield, i.e., the higher they produce the more concentrate they get. Milk price in Kafer El-Sheikh was lower ($P \leq 0.05$) than that in Qena and El-Beheira. This might be due to the higher supply of buffalo milk than local market demand in Kafer EL-Sheikh. Total milk revenue/buffalo in El-Beheira was higher ($P \leq 0.05$) than that in Qena and Kafer EL-Sheikh. This could be due to two reasons, total milk yield/animal/lactation and higher quantity of total milk produced in El-Beheira. Milk production in El-Beheira was higher ($P \leq 0.05$) than that in Qena, however, milk price was almost the same. This could be due to feeding costs or the additional cost of cooling milk tanks needed for transportation of milk between villages and collection centers.

Manure revenues in Qena was lower ($P \leq 0.05$) than in the other two governorates and El-Beheira was less ($P \leq 0.05$) than Kafer El-Sheikh. These differences might be due to stable ground type: cement against dusty or according to feeding type or long distances between milk producing cities and manure beneficiaries. Total revenue and gross margin showed that buffalo milk in El-Beheira was the most efficient followed by Qena. The main reason might be attributed to that milk price was lower (P≤0.05) in Kafer El-Sheikh compared to Qena and El-Beheira. Moreover, milk production in Qena was significantly lower compared with El-Beheira. El-Ashmawy *et al.* (2006) reported that total variable costs for buffalo/year in delta region were L.E. 3550. While, revenues from buffalo milk, claves, body change value, manure, total revenue/year and gross margin were L.E. 5291, 1300, 544, 434, 7569 and 4019, respectively.

Water consumed by buffalo (drinking and cleaning):

Table (3) shows water consumption for drinking and cleaning during summer and winter. The results showed that no significant differences among the three studied areas in water consumption, however, buffaloes in Qena showed a little bit higher consumption possibly due to the high temperature. Cleaning water was estimated to be 20% of total water consumption.

Water efficiency of milking buffalo:

Results in Table (4) presented results for water return from milking buffalo in LE./m^3 in the three studied governorates, Qena was less water efficient compared to Kafr El-Sheikh and El-Beheira while, El-Beheira was the best in water efficiency. These results might be attributed to two reasons, the first: milk price in Kafer El-Sheikh is lower than the other two areas and the second: milk production in Qena was much lower compared to Kafer El-Skeikh and El-Beheira.

Water required to produce 1 kg of milk in Qena was the highest followed by Kafer El-Sheikh and El-Beheira. Gebreselassie *et. al.* (2008) reported that livestock water productivity (LWP) values of USD was between 0.3 and 0.7/ m^3. The authors added that feed, age, breed and herd structure account for variability in LWP. Haileslassie *et al.* (2009) found that LWP is less than CWE under mixed farming systems in Ethiopia. The same author found that LWP 0.4 USD. Tulu *et al.* (2008) showed that Livestock Water Efficiency revenue is significantly higher than CWE and lower than the domestic water use efficiency. Hoekstra and Hung (2003) reported that 0.9 m^3 is needed to produce 1 kg of milk. Gawelly and Mohamed (2005) reported that red meat is less water efficient compared to other livestock products; 1 ton of red meat needs 2408.89 m^3. The same authors found that return from animal production per m^3 water was LE. 4.82.

Cropping pattern:

Table (5) shows cropping pattern in the three studied areas. Multi-cropping systems are common in all studied areas where the farmers cultivate two or more crops in one year. In winter wheat and berseem where found in three areas and Faba bean only in El-Beheira. Summer crops were rice in Kafer El-Sheikh and El-Beheira corn and darawa were found in all studied areas. Two annual crops were found only in Qena (Sugar cane and Alfalfa). Rice represent main summer crop in two studied governorates in Delta. Percentage of corn was the second impotent summer crop in El-Beheira while, in Kafer El-Sheikh darawa was the second main crop. It might be attributed to that average herd size in Kafer El-Sheikh was bigger than that El-Beheira. Concerning winter crops wheat scored the highest percentage in El-Beheira followed by kafer El-Sheikh and Qena. Berseem was the highest percentage in Kafer EL-Sheikh followed by El-Beheira and Qena. It might be attributed to the increase in herd size. The differences among the relative importance of cash crops in three studied areas might be attributed to market prices of cash crops and cost of labor.

Water efficiency for common cash crops in three studied areas:

The results in Table (6.1) show that the most important winter crops found in the studied areas (wheat and bean). The returns of cubic meter of water from wheat were LE. 2.30, LE. 1.19 and LE. 2.11 in Kafer El-Sheikh, Qena and El-Beheira, respectively.

CONCLUSION

The results of the study showed that water used in milking buffalo production was more efficient than that in cash crops. However, further experimental studies are still needed to test this pilot study under different production systems to get more accurate estimates.

REFERENCES

Central Egyptian Bank, 2011. Economic report for financial year 2010-2011.

Duncan, D.B., 1955. Multiple ranges and multiple F test. Biometrics 11: 1.

El-Ashmawy, M.M.I., H.B. Sammour, M.A. I. Khalil, M.A. El-Wardani and Y.A. Abdel-Aziz, 2006. Comparative technical and economic study of dairy farming systems in west delta region. Egyptian J. Anim. Prod, 43 suppl. Issue, Dec. 303-323.

Gawelly, A. A. and A. A. Mohamed, 2005. Estimated water efficiency for Egyptian food safety. The 13th agricultural economicconference. 28-29 September pp. 441- 477

Gebreselassie, S., D. Peden, A. Haileslassie, D. Mpairwe, 2008. Cost-effective assessment of livestock-water efficiency using previous feeding trials. In: proceeding of CPWF second international workshop November 2008, Addis Baba Ethiopia.

Haileslassie, A., D. Peden, S. Gebreselassie, T. Amede, K. Descheemaeker, 2009. Livestock water efficiency in mixed crop-livestock farming systems of the Blue Nile basin: Assessing variability and prospects for improvement. Agricultural Systems, (102): 33-40.

Hoekstra, A., and P. Hung, 2003. Virtual Water Trade: A Quantification of Virtual Water Flows between Nations in Relation to International Crop Trade. Value of Water Research Report Series 11. Delft, Netherlands: United Nations Educational, Scientific and Cultural Organization, Institute for Water Education.

Khalil, M.A. I. and M.M.I. El_Ashmawy, 2008. Characterization of dairy farming systems in Upper Egypt. Egyptian J. Anim. Prod, 45 suppl. Issue, Dec. 43-55.

MALR, 2011. Ministry of Agricultural and Land Reclamation Agricultural statistics, Economic Affairs sector, Egypt.

Molden, D., 2007. ‘Water for Food, Water for Life. A Comprehensive Assessment of Water Management in Agriculture.’ (Earthscan: London, and the International Water Management Institute: Colombo.)

Peden, D., G. Tadesse, and A. K. Misra, 2007. Water and livestock for human development. *In*: ‘Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture’. (Ed. D. Molden.) pp. 485–514. (Earthscan: London, and the International Water Management Institute: Colombo)

SAS, 2004. SAS/STAT Users guide Release 9.0 S.A.S. Institute, Inc., Cary, North Carolina, USA.

Tulu, M., E. Boelee, G. Taddesse, Penden, D. Aredo,2008. Estimation of livestock domestic use and crop water productivity pilot project in Ethiopia. In: proceeding of CPWF second international workshop November. Addis Baba Ethiopia

Table 1. Least square means (LSM±SE) for milk yield per governorates, parity number, calving interval and age at first calving

Effects	No. of animals*	Milk yield per lactation, kg	
		LSM	± SE
Overall mean	306	1575	245
Governorates			
Kafer El-Sheikh	126	1498[b]	61
Qena	71	1400[b]	61
El-Beheira	109	1858[a]	59
Parity No.			
1	16	1566	114
2	15	1673	102
3	30	1531	93
4	56	1640	62
5	112	1667	54
6	53	1493	84
7	24	1529	116
Calving interval			
12 – 13 months	37	1544	83
14 – 15 months	188	1657	39
16 – 20 months	81	1556	68
Age at first calving			
24 – 30 months	84	1760[a]	60
32 - 36 months	70	1501[b]	66
> 36 months	152	1495[b]	50

[abc] means within a column with different superscript differ significantly ($P \leq 0.05$).

The differences of animal numbers is that the effects were missing data of some animals

Table 2. Average Herd size, milking buffalo variable costs, revenues and gross margin

Items	Kafer El-Sheikh		Qena		El-Beheira	
	N	$(\overline{X})^{-}$±SE	N	$(\overline{X})$±SE	N	**Error! Book not defined.**
Average herd size / governorate (animal)	47	23.43	36	19.86	40	20.77
Berseem or alfalfa/buffalo/day (kg)	47	72.63^{b}±2.7	36	65.97^{b}±3.1	40	87.10^{a}±2.9
Darawa or sorghum /buffalo/day/kg	46	30.67^{a}±1.1	36	32.13^{a}±1.4	40	25.52^{b}±1.0
Concentrate feed/buffalo/day/kg	47	4.93^{a}± 0.2	36	3.88^{b}± 0.2	40	4.32^{b}± 0.2
Straw/buffalo/day (kg)	47	6.06± 0.2	36	6.02 ± 0.3	38	6.02 ± 0.2
Silage/buffalo/day (kg)	28	18.67± 0.7	3	16.66± 1.7	25	16.36± 0.6
Beseem hay/buffalo/day (kg)	30	3.21^{c}± 0.2	9	4.11^{b} ± 0.4	23	5.26^{a} ± 0.2
Total feeding cost/buffalo/year (L.E)	6469.89		5528.2		6190.26	
Labor cost/buffalo/year (LE)	244		237		161	
Vet. cost/buffalo/year (L.E)	66		53		74	
Total cost/buffalo/year, LE	6769.9		5818.2		6425.3	
Number of calves/buffalo/year	0.85^{a} ± 0.3		0.72^{b} ± 0.2		0.78^{a} ± 0.4	
Milk prod./buffalo/lactation (kg)	1497.7^{b} ± 61		1400.9^{b} ± 61		1857.8^{a}± 58	
Milk price (L.E) per kg	2.97^{b}±0.04		4.16^{a} ± 0.2		4.04^{a} ± 0.1	
Milk revenue/buffalo/lactation	4448.17		5827.74		7505.51	
Manure revenue/buffalo/year	375.28		280.65		289.72	
Claves revenue/buffalo/year (L.E.)	1780.5		1849.1		1918.3	
Buffalo change value* (L.E.)	1950		1875		1920	
Total revenue /Buffalo/year (L.E)	8034.95		9332.49		11121.53	
Gross margin /buffalo/year (L.E.)	1264.05		3514.29		4696.23	

N: Number of farms

*Change values of animal were estimated as 11% of cow price according to the inflation rate that reported by central Egyptian Bank 2011).

Manure quantity for studied areas were 13.36, 11.82 and 14.00 m^3 and its price was L.E. 28.09, 23.74 and 20.70 for Kafer El-sheikh, Qena and El-Beheira, respectively.

Table 3. Drinking water and cleaning or other used (in litter, L) for milking buffalo

Items	Kafer El-Sheikh		Qena		El-Beheira	
	N	$(\overline{X})^{-}$±SE	N	$(\overline{X})^{-}$±SE	N	$(\overline{X})^{-}$±SE
Drinking water in summer /cow/day (L)	46	71.95±1.3	35	74.00±1.0	40	71.15±0.9
Drinking water in winter /cow/day (L)	26	43.13±1.6	33	47.27±1.4	40	43.00±0.9
Cleaning water or other used* /cow/year (L)	4200		4426		4166	
Total water cons./buffalo/year (L)	25202		26558		24998	

Cleaning water was assumed to be 20% of total drinking water or other water using

Table 4.. Variable costs, revenues and water efficiency for milking buffalo

Items	Kafer El-Sheikh	Qena	El-Beheira	Gov. average
Total costs/cow/year (LE.)	6769.9	5818.2	6425.3	6338
Animal water drinking/year (m^3)	21.002	22.132	20.832	21.322
Water requirement per/cow/year (m^3) from green forage	1069.25	1486.25	1069.25	1277.75
Water requirement per/cow/year (m^3) from concentrate feed	382.43	438.75	382.43	401.20
Water requirement per/cow/year (m^3) from straws	732	447	724	634.33
Cow cleaning water + other used /cow/year (m^3)	4.200	4.426	4.166	4.3
Total water cons./cow/year	2208.88	2398.56	2200.68	2269.37
Total cow revenue/year (LE.)	8034.95	9332.49	11121.53	9496.32
Revenue of water LE./M^3	3.63	3.89	5.05	4.18
Water requirements for m^3 / 1 kg milk	1.48	1.70	1.18	1.44

Water used for animal cleaning was assumed to be 20 % of drinking water or other used

Table 5. The relative cropping areas occupied by different summer and winter crops in studied areas

Crops	Kafer El-Sheikh			Qena			El-Beheira		
	Area/ feddan	**% S***	**%Y****	**Area/ feddan**	**% S***	**% Y****	**Area/ feddan**	**% S***	**% Y****
				Summer crops					
Rice	4.16	53	30	-	-	-	3.03	45	20
Corn	1.63	21	12	3.83	63	17	2.63	40	17
Darawa	2.04	26	15	2.21	37	10	0.96	15	6
Summer cultivated area	**7.83**	**100**		**6.04**	**100**		**6.62**	**100**	
				Winter crops					
Wheat	3.02	50	22	4.48	61	19	3.84	44	25
Faba Bean	-		-	-	-	-	2.60	29	17
Berseem	2.99	50	22	2.71	39	12	2.41	27	16
Winter cultivated area	**6.01**	**100**		**7.19**	**100**		**8.85**	**100**	
				Annual crops					
Sugar cane	-		-	5.00		22	-		-
Alfalfa	-		-	4.91		21	-		-
Total cultivated area	**13.84**		**100**	**23.14**		**100**	**15.47**		**100**

S%: percentage per each crop in the summer or winter season
Y%: percentage per each crop over the year

Table 6.1. Return on cubic water unit of the most important winter field crops at Kafr El-Sheikh, Qena and El Beheira governorates

Crop	Items	N	Kafer El-Sheikh	N	Qena	N	El-Beheira
Wheat	Total revenue /farm (L.E.)	41	15529.8^{c}±2957	46	29751.13^{a}±4673	41	24230.38^{b}±4615
	Revenue / feddan. (L.E.)	41	5915.5^{b}±997	46	5925.7^{b}±1068	41	7495.7^{a}±1243
	Total cost/fed*	41	2360^{c}±157	46	3388^{b}±214	41	4216^{a}±187
	Net return/fed (L.E.)	41	3556	46	2538	41	3280
	Water /fed/m^{-3}	41	1552	46	2128	41	1552
	Return / water unit m^{-3} (L.E.)	41	2.30	46	1.19	41	2.11
	Av. cultivated area in Feddan	41	2.6		5.00		3.20
Faba bean	Total revenue/farm (L.E.)		-		-	19	11520±1140
	Revenue / fed. (L.E.)		-		-	19	4160±714
	Total cost/fed (L.E.)		-		-	19	3906±245
	Net return/fed (L.E.)		-		-	19	254
	Water /fed/m^{-3}		-		-	19	1337
	Return of the water unit m^{-3}		-		-	19	0.19
	Av. cultivated area in Feddan						2.78

Total costs of crops in details in Annex 3.1 and 3.2

Differences between rice return/m^3 of water in the two areas might be attributed to cultivation costs. Moreover, Kafer El-Sheikh has heavy soil holding water for long time; therefore, the water efficiency in Kafr El-Sheikh is better than El-Beheira. Corn return /m^3 of water was the best in Kafr El-Sheikh compared to Qena and El-Beheira. The differences between the three studied areas might be attributed to seed varieties or cultivations treatments from soil preparation. While sugar cane return in Qena was L.E.1.38/m^3 of water.

Table 6.2. Return of cubic meter of water unit to the most important summer field crops

Crop	Statement		Kafer El-Sheikh		Qena		El-Beheira
Rice	Total revenue/farm	49	25560±3725		-	39	13662±2805
	Revenue /fed.	49	6185.54±883		-		5898±944
	Total cost/fed	49	2752		-		4139
	Net return/fed	49	3434		-		1759
	Water/fed	49	5852		-		5852
	Return on the water unit m^3	49	0.59		-		0.30
	Av. cultivated area in feddan		4.13				2.32
Corn	Total revenue/farm	27	6126.67±2183	32	14148.91±3595	45	12347.05±2045
	Revenue /fed.	27	4540±1306	32	4540±906	45	3488.5±780
	Total cost/fed	27	2856±	32	3095±	45	2244±
	Net return/fed	27	1684	32	1445±	45	1244.5
	Water/fed	27	2677	32	3510	45	2677
	Return of the water unit m^3	27	0.63	32	0.41	45	0.46
	Av. cultivated area in feddan		1.35		3.12		3.54
Sugar cane	Total revenue/farm		-	24	69788		-
	Revenue /fed.		-	24	12708		-
	Total cost/fed		-	24	6831		-
	Net return/fed		-	24	5877		-
	Water/fed		-	24	9184		-
	Return of the water unit m^3		-	24	1.38		-
	Av. cultivated area in feddan				5.49		

Annex 1. Green forage prices and quantity per feddan used in calculation

Feed ingredients	Average production/feddan (Ton)	Average production/kirat (Ton) / 4 cuts	Average production/ kirat (kg)	Price /kg (L.E.)	Feeding periods
Berseem in Beheira	31.31	1.566	391	0.22	150
Berseem in kafer El-Sheikh	41.29	1.877	469	0.27	150
Berseem in Qena	28.86	1.443	361	0.21	150
Alfalfa in Qena	42.00	1.909	477	0.27	365
Darawa in El-Beheira	13.38	0.608	608	0.20	120
Darawa in kafer El-Sheikh	11.86	0.539	539	0.18	120
Darawa in Qena	14.00	0.636	636	0.21	120
Sorghum in EL-Beheira	39.00	1.773	591	0.15	120

Annex 2. Concentrate feed, straws and conservation green forage prices used in the study calculation in studied areas

Feed ingredients	El-Beheira		Qena		Kafer El-Sheikh	
	Price (L.E.)	Feeding periods (days)	Price (L.E.)	Feeding periods (days)	Price (L.E.)	Feeding periods (days)
Concentrate feed	2145	210	2322	227	2330	180
Wheat straw	800	180	1000	220	700	150
Rice straw	300	180	-	-	250	180
Corn silage	250	60	320	30	250	60
Berseem hay	700	60	1000	60	700	80

Annex 3.1. The costs of the most important field crops in both the Kafr El- Sheikh, Qena and El- Beheira

Crops	Gov.	Fertilizer	Organic fertilizer	Pesticides for grass	Pesticides	Seeds	Machines	Labor	Irrigation	Taxes	Others	Total	Total wages Seaso-nal agricultural LE/ fed.	cost total
	K	366	183	60	67	134	109	340	180	-	-	1439	921	2360
	Q	394	248	73	55	318	286	291	490	50	150	2355	1033	3388
	B	590	268	133	100	210	784	760	310	36		3190	1026	4216
wheat	total	450	233	89	74	221	393	464	327	43	150	2442	993	3436
	K	-	-	-	-	-	-	-	-	-	-	-	-	-
	Q	-	-	-	-	-	-	-	-	-	-	-	-	-
	B	400	-	250	300	600	300	700	300	30	-	2880	1026	3906
Bean	total	400		250	300	600	300	700	300	30	-	2880	1026	3906

Annex 3.2 the costs of the most important field crops in both the, Kafr EL- Sheikh, Qena and EL- Beheira

Crop	Gov.	Fertilizer	Organic fertilizer	Pestisieds[1]	Pestisieds[2]	Seeds	Machines	Labor	Irrigation	Taxes	Others	Total	Total wages Seasonal agricultural LE/ fed.	Total Cost
	K	355	-	96	88	182	114	316	680	-	-	1831	921	2752
	Q	-	-	-	-	-	-	-	-	-	-	-	1033	1033
	B	530	300	108	104	298	641	690	410	32		3113	1026	4139
Rice	total	443	300	102	96	240	378	503	545	32		2638	993	3631
	K	665	200	100	94	196	151	150	242	137		1935	921	2856
	Q	449	260		32	228	208	204	428	42	213	2062	1033	3095
	B	1950	400	115	220	250	300	1730	200	53		5218	1026	6244
Corn	total	1021	287	108	115	225	220	695	290	77	213	3249	993	4242
	K											0	921	921
	Q	1200	633	217	67	1250	283	840	838	40	430	5798	1033	6831
	B	-	-	-	-	-	-	-	-	-	-	-	-	-
Sugar can	total	1200	633	217	67	1250	283	840	838	40	430	5798	1033	6831

كفاءة إستخدام المياه تحت النظام المزرعى المختلط (النباتى/ الحيوانى) فى مصر. 1- كفاءة إستخدام المياه للجاموس الحلاب مقارنة بالمحاصيل النقدية

مصطفى عبد الرازق إبراهيم خليل[1]، على أبراهيم محمد أحمد[2]

1- معهد بحوث الإنتاج الحيوانى، مركز البحوث الزراعية، الدقى، جيزة، 2- معهد بحوث الإقتصاد الزراعى، مركز البحوث الزراعية، الدقى، جيزة

أجريت هذه الدراسة فى ثلاث محافظات هى البحيرة وكفر الشيخ (ممثلين لمنطقة الدلتا) ومحافظة قنا ممثلة لمصر العليا. وتم تجميع البيانات من 50 مزرعة من كل محافظة خلال الفترة من أكتوبر 2010 الى فبراير 2011 بأستخدام أستمارات أستبيان بعد أختبارها. وكان الهدف من الدراسة هو تقييم كفاءة أستخدام الجاموس الحلاب للمياه مقارنة بكفاءة المياه فى إنتاج المحاصيل النقدية الأكثر شيوعا فى منطقة الدراسة وبخاصة أن مناطق الدراسة هى الأعلى استهلاكا للمياه فى مصر لإنتاج الأرز او قصب السكر. تم تجمع البيانات على إستخدمات الأرض ، رعاية الجاموس الحلاب وإستخدام المياه فى هذا الانتاج من خلال مقابلات مع المزارعين فى منطقة الدراسة مع الاستعانة ببعض البيانات السنوية المنشورة فى إحصائيات وزارة الزراعة. تم تقدير استخدام المياه للانتاج الحيوانى فى الشرب أو الإستخدامات الاخرى من خلال مناقشة المزارعين . قدرت المياه المستخدمة فى الغذاء بحساب المساحات المأكولة من كل محصول ثم تم حساب احتياجات المياه لتلك المساحة من خلال جداول الرى لكل محصول. وقد أظهرت النتائج أن العوائد بالجنية من المتر المكعب مياه فى إنتاج الألبان من الجاموس كانت 3.63 ، 3.89 ، 5.05 لكل من كفر الشيخ ، قنا ، البحيرة على التوالى بينما كانت العوائد من المحاصيل الصيفية فى الدلتا للأرز 0.59 و 0.30 جنية للمتر المكعب مياه وفى مصر العليا كان العائد للمتر المكعب مياه من قصب السكر 0.64 جنية بينما كان العائد من محصول الذرة هو 0.63 ، 0.41 ، 0.46 جنية للمتر الكعب مياه لكفر الشيخ ، قنا ، البحيرة على التوالى. بينما كان العائد من المحاصيل الشتوية 2.30 ، 1.19 ، 2.11 جنية لمحصول القمح فى نفس المحافظات السابقة كان العائد من الفول البلدى 0.19 جنية للمتر الكعب ووجد فقط فى محافظة البحيرة.