FEASIBILITY OF BUFFALO PRODUCTION IN EGYPTIAN ECONOMY THROUGH A PLANNING MODEL

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INTRODUCTION

Egyptian economy,as many other economies today,is moving strongly towards free market economy through liberalization and privatization of market.Review of literature indicate that shortage of feeds is a major constrain behind horizontal expansion in livestock production,i.e. expanding the population size(1).Berseem is the main feed in winter and it occupies around one third of the limited agricultural area in Egypt at the expenses of wheat,also short season besteem occupies one million acres before cotton,which could be used for some vegetable crops(2).In spite of feed shortage there are more the four million heads of buffalo,native cattle and and little of friesian cattle are competing for the existing feeds supply,beside sheep and goats(however they are mainly nomadic or semi-nomadic),(3&4).Recent economic studies showed that Egypt has comparative advantage in milk production rather than in red meat production(5&6&7).The maximum economic return to feeds is for milk production and very low for meat production under free price policy (8).Accordingly the objectives of the study is to design a livestock-feed planning model,linear programming model(9),to assess the feasibility of raising buffalo in comparison with the native cattle and friesian within the constrains of available feeds and under the free market prices of the feeds.

THE MODEL'S VARIABLES

The feasible variables of the model represents the seasonal availability of conventional feeds used in Egypt.These are X1 is The Long Season Berseem,consumed in winter.X2 is The Short Season Berseem,consumed in summer.X3 is The Aggregate Straw consumed in winter.X4 is The Aggregate Straw,consumed in summer.X5 is The

Berseem – Hay, consumed in summer .X6 is Green Maize, consumed in summer. X7 is Concentrate Feed Mix , avaible (at free price) along the year.

THE TECHNICAL COEFFICIENTS OF THE MODEL

In general the technical coefficients are the nutrient contents of the feeds (the feasible variables) as shown in Table 1.

Table 1 NUTRIEN CONTENTS PER KG OF FEED

NUTRIENT	X1	X2	(X3&X4)	X5	X6	X7
STARCH EQUIVALENT(KG)	0.09	0.075	.25	.27	.5 21	
DIGESTIVE PROTEIN(KG)	.02	.016	0.0	.06	.21	.13
DRY MATTER(KG)	.17	.14	.91	.89	.18	.90
CALCIUM(KG)	4.0	3.4	2.0	8.9	6.0	3.0
PHOSPHORUS(KG)	0.8	0.6	0.6	7.0	3.0	7.0
CAROTENE(KG)	80	78	0.0	21	60	1.7

SOURCES: REFERENCES NO.(10&11&12)

THE OBJECTIVE FUNCTION OF THE MODEL

The objective of the model is to minimize the costs of the daily ration in both seasons,under free market price policy of feeds.Therefore,the coefficient of each variable(feed) in the objective function is its shadow (free market) price.Table 2 shows the estimated shadow price of each feed by season and the type of the method used.

Table 2 ESTIMATED SHADOW PRICE OF FEEDS BY SEASON EGIPTIAN PIASTURES / 1 – KG

FEEDS	SHADOW PRICE	METHOD OF ESTIMATION
Long season berseem	2.9	Net income foregone due yo not cultivating wheat.
Short season berseem	1.91	Net income foregone due to not cultivating vegetables.
Straw in summer	7.81	Weighted. market price in summer
Straw in winter	9.07	Weighted market price in winter
Green maize	14.5	International corn price adjusted by green maize nutritive value
Berseem hay	12.0	Equivalent to the price of 5KG of long season berseem
Concentrate feed mix (1)	17.0	Weighted border price of the mix ingredients + the processing costs

(1) Composes of:23% Cotton Seed Cake,49% Bran,20%Corn,4% Molasses,2%LimeStone and 15 Salt.
SOURCES: References No. (13 & 14 & 15).

THE ANIMAL UNIT

The animal unit in the model was considered as a "MILKING-COW AND ITS FOLLOWERS".The feed requirements were estimated according to the productive performance of the animal unit((A.U.)).The daily requirements for milk production were

distributed between winter and summer according to the probability of calving in both seasons.(Table 3).The maintainence requirements were added as constant for both seasons.The requirements of the followers were calculated for each category of the herd and weighted by its proportion to ONE milking-cow on the herd.The data in Table 3,basedupon field surveys done by the author and the latest agricultural census(References are below Table 3).The herd structure was omitted from the table because of simplicity and space limits.

Table 3 . PRODUCTIVE PERFORMANCE OF AN ANIMAL.UNIT

Productive Performance	buffalo	native cattl e	friesian
Liveweight Of A Dairy Cow(kg)	550	400	500
Daily Milk Yield(kg)	7.5	5.5	5.5
Days Of Milking Season/year (1)	175	135	295
CAlving Cows In Winter(%)	70	65	....
Calving Cows In Summer(%)	30	35	....
Milk Yield/cow/year (kg)	1312.5	742.5	1622.5
Fat Content (%)	7	4.8	3.5
(2) (4% Fat Milk)/cow/year (kg)	2077	733	1475
Total Milking Cows (head)	1241300	1116600	34200
National milk Production,tons	2578000	818500	50464

(1) FOR FRIESIAN:milking days in winter are 180,in summer are 115 and dry period of 95 days.(2)Gene's Equation was used.(3) average carcass weight,weighted by off-take rate and herd structure proportions.

SOURCES:REFERENCES NO.(16 & 17 & 18).

THE MODEL CONSTRAINS

According to the nature of the constrain,the model included four sets.The cropping pattern constrains (one constraint) that reflect the availability of short season berseem (6 months).The nutrient requirements constrains(six constrains) that determine the weighted daily requirements per animal season unit in both seasons,depending upon Table 3 and the most reliable livestock nutrition textbooks (10,11 and 12).These constrains include:Starch equivalent(SE),Digestive protein (DP),Dry matter (DM),Calcium(CA),Phosphorous (P) and CAROTENE (CAR).The ration boundaries constrains(four consrains),derived from nutrition textbooks(10,11 and 19).They are:The boundaries of dry matter weight of daily ration(Upper limit = U-DM & Lower limit = L-DM),The boundaries of calcium content of the ration(Upper limit = U-CA & lower limit = L-CA),The maximum content of straw in the daily ration (MAX-S) to avoid heat stress of metabolism and The maximum content of the ration from concentrate feed mix(MAX-CONMIX) to avoid poor quality of milk processing features and bad fermentation.The non-negative values of the model output (one constrain),i.e.$X_1,\ldots,X_2 \geq$ Zero.

THE MATHEMATICAL FRAME OF THE MODEL

The following SET of inequalities presents the structure of the model which was adjusted for each season and each type of livestock:

Σ a $X \geq$ SE, DP, L-DM,L-CA,P,CAR.....6 CONSTRAINS
Σ $b_i X_i \leq$ U-DM,U-CA,MAX-S,MAX-CONMIX.....4 CONSTRAINS
$X_2 - .33X_1 = 0$.....1 CONSTRAIN
$X_1,\ldots,X_7 \geq$ ZERO.....1 CONSTRAIN

RESULTS AND DISCCUSION

The six scenarios of the model for the livestock types under the two seasons were run. Table 4 presents a summary of the empirical results.

TABLE 4. EMPIRICAL RESULTS OF THE LIVESTOCK-FEED PLANNING MODEL

Daily Ration/a.u.	Buffalo	Native Cattle	Friesian
IN WINTER:			
LONG SEASON BERSEEM (KG)	5.59	4.51	5.33
SHORT SEASON BERSEEM (KG)	1.84	1.49	1.76
CONCENTRATE FEED MIX (KG)	12.01	10.22	11.38
STRAWS (KG)	7.96	6.67	6.13
COSTS OF DAILY RATION (EPT*)	296.09	250.16	267.88
OF WHICH :			
FOR DAIRY-COW	256.53	158.10	215.48
FOR THE FOLLOWERS	39.56	92.06	52.40
COST/1-KG MILK (4% FAT)	21.378	29.28	43.10
IN SUMMER:			
CONCENTRATE FEED MIX (KG)	6.93	8.93	8.68
GREEN MAIZE (KG)	12.57	5.60	9.03
BERSEEM-HAY (KG)	0.0	0.0	0.0
STRAWS (KG)	7.78	6.60	4.50
COSTS OF DAILY RATION (EPT*)	360.84	284.56	313.64
OF WHICH:			
FOR DAIRY-COW	299.13	170.54	245.80
FOR THE FOLLOWERS	94.71	114.02	67.84
COST/1-KG MILK (4% FAT)	24.92	31.58	49.16

*EPT = an egyptian piaster, where one egyptian pound = 100 piasters

Assessment of the feasibility of the three livestock types depended upon cost of feeds for adjusted one kilogram of milk (4% fat),because as shown from the literature that Egypt has comparative advantage in milk production.Meat should be considered economically as a by-product of milk production.Therefore from table 4,buffalo is the most feasible type of livestock,because it has the minimum feed costs per 1-KG of milk (4% fat).On turn the study investigated the implication of keeping the optimum herd of buffalo that could utilize economically the available feed resources.From table 4,the number of buffalo-cows that produce the current national milk production would be 1,655,000 heads.Accordingly,an area of 1,534,000 acres would be transferred from under long season berseem to wheat production which add around 3,068,000 tons of wheat.840,000 acres would be taken from under short season berseem to produce vegetables.Additional summer green fodder of 162,382 acres would be required,which should be taken from maize area.However,the expected decrease in maize production could be compensated by raising the maize productivity by only 7%.The extra wheat production would yield 3,068,000 tons of straw,of which 1,026,000 would cover the additional requirements,leaving a surplus of 2,042,000 tons,plus additional 514,000 tons of wheat bran.Such additional by-products of extra wheat production could be treated and processed to cover around 63% of the additional requirements of processed concentrate feed-mix (4,028,100 tons).Excluding the additives of 7% of the mix,the rest 30% of the mix could be produced locally as corn by raising the corn yield by 28% (the current yield is 1.8 tons/acre).The costs of the additional buffalo-cows (414,000 heads),with the market interest definitely could be covered through selling the 1,116,000 native cattle cows.The program could be implemented over 7 years.

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