J. Animal and Poultry Production, Mansoura Univ., Vol. 1 (9): 425 - 440, 2010

ASSESSMENT SOME FEEDING PACKAGES ON FARM REVENUE OF FATTENING FRIESIAN CALVES IN THE DELTA REGION OF EGYPT

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ABSTRACT

Two methods were used to assess six rations Linear Program Model (LPM) and actual feeding trials (validation). The six rations tested by LPM represented as six scenarios; three winter scenarios WS1 (control) (Egyptian clover + concentrate mixture + rice straw), scenario 2 (WS2) where ration had two constrains using corn silage and Egyptian clover at the rate of 6 kg and 10 kg daily, respectively, plus concentrate mixture and rice straw ad-libitum. Scenario 3 (WS3) was the same as WS2 but constrain was to double corn silage quantity. The three summer scenarios were: Scenario 4 (SS4 control) (Egyptian clover hay + concentrate mixture + rice straw), Scenario 5 (SS5) had two constrains use Egyptian clover silage and corn silage at the rate of 5 kg daily plus concentrate mixture and ad-libitum rice straw. Scenario 6 (SS6) was as the same as SS5 with the only constrain to replace the corn silage by 5 kg sugar beet tops silage. All rations had to cover the feed requirements of 1 kg daily gain according NRC. Extra revenues realized for winter were L.E. 2.50 and 3.10 for WS2 and WS3 compared to WS1. Summer results showed increase in farm revenue of L.E. 1.44 and 0.78, for SS5 and SS6 compared to SS4.

The previous winter or summer six scenarios that evaluated by LPM were reevaluated by real feeding trials on Friesian fattening calves as six rations with the same feeding packages. All rations had to cover the feed requirements of 1 kg daily gain according NRC. Extra revenues realized for winter rations were L.E. 2.33 and 1.37/head/day for two winter groups (WG2) and WG3 compared to WG1 respectively. The summer rations showed increase in farm revenue of L.E. 2.16 and 2.26/head/day for SG5 and SG5 compared to SG4 respectively. It could be concluded that using feeding packages in animal feeding can reduce feeding costs and improve the fattening farm revenue.

Keywords: Corn silage**,** Egyptian clover silage, sugar beet tops silage, clover hay

INTRODUCTION

Beef production systems in Egypt depend mainly on fattening local and exotic breeds and their crosses and buffalo male calves which are fed mainly concentrates and wheat straw. The system is based on purchasing male calves with initial body weight of 200-250 kg for fattening for a period of six months to a marketing weight of 400 - 450 kg. About 40% of total beef supply is locally produced in Egypt (MOAL R., 2006). Farmers usually pursue best mixed farming activities that maximize their farm income. In other words, they look for the best possible ways of allocating their limited resources for cropping and livestock activities and often follow their instincts and experience in this regard. This practice does not always guarantee optimal results. Effective techniques in farm planning such as linear programming offer a better alternative in addressing such problems for optimal results (Ahmed *et al*., 2002).

Linear programme model plays an important role in assessing the impact of innovation packages on farm income before implementation on a large scale. This technique offers a powerful tool in analyzing prevailing production systems and simulation of the behavior of complex systems. Linear programming models have the advantage of testing any intervention in farming systems precisely and quickly. They make use of the physical input/output of the data in the form in which they are commonly available.

A number of studies (Bonnier *et al.,* 1995 and Tabana, 2000) used simulation techniques and linear programming to improve the overall efficiency of the current crop/livestock production system in the Nile Delta Region of Egypt. A scope exits for the development of integrated innovation packages for livestock on small holder farms in Egypt and elsewhere. The main objectives of this study were:

(a) To develop and validate a linear programme model that enables generation of useful information for better and more accurate feed management decision making in fattening farm.
(b) To compare results between a computer linear programme model and the actual feeding trials (validation) on some available feeding packages (corn silage, sugar beet tops silage,Egyptian clover (*Tryfolium alexandrinum*) silage supplemented with molasses and Egyptian clover hay) for fattening calves.
(c) To assess farm income using some available feeding packages for fattening calves in the Delta region of Egypt.

MATERIALS AND METHODS

Six rations were evaluated by two methods, the 1st was linear programme model (LPM) and the other was feeding trials. Both methods were conducted to assess technical and economic assumptions of six rations which had some available feeding packages in winter and summer in Delta Region. Eighteen Friesian calves with body weight of between 286 and 288 kg and of an average age of 14 – 17 months were used to assess the six rations for both methods. In the feeding trials calves were divided into three groups of six calves per each group and fattened for a period of three months in winter (from March to May 2008). Winter rations were as follows: winter group1 (WG1 control) as traditional winter ration in Delta Region, (Egyptian clover + concentrate mixture + rice straw). In winter group 2 (WG2), ration had the constrain to use corn silage as a fixed quantity at rate 6 kg/head/day. These quantities were average of three months plus concentrate mixture and rice straw, average corn silage residual was 2 kg/head/day. In winter group 3 (WG3) as the same as WG2 but the corn silage quantity was doubled quantity of WG2.

The same animals groups were continued for another period of three months in summer (from June to August 2008) to examine the three proposed summer rations. Summer rations were consisted of (Egyptian clover hay + concentrate mixture + rice straw) which represent as control ration (SG4). Ration 5 (SG5) had two constrains to use Egyptian clover silage and corn silage in the rations plus rice straw and concentrate mixture. In ration 6 (SG6) it was as the same ingredients as ration (SG5) but corn

silage was replaced by sugar beet tops silage. All winter or summer rations were formulated to cover the requirements of 1 kg daily gain. Replace part of feedstuff in the rations consequently changed the quantity of other ingredients in these rations. Feed requirements were changed gradually from month to month according to the changes in body weight.

Before the feeding trials, the same rations with the same constrains were tested by a linear program model (LPM). The LPM was built in Excel Spreadsheet as linear mathematical equations linked to the Optimization Program (What's Best, 2002). Through the Optimization Program, the best combination was obtained from available feeding resources included some innovation packages to minimize feeding cost and improve farm revenue. The first part of the model was feeding resources, their feeding values and prices. The second part was the same data as the fattening herd of the six groups of Friesian calves in the feeding trials; each animal had its own feed requirements with an assumption of 1 kg gain/day. Linear programming models were constructed with six proposed scenarios according to the type of rations during winter and summer period. The three scenarios for winter rations were (WS1) as base run scenario for winter ration, (WS2) and (WS3) used the same feed resources as feeding trial rations, respectively.

Scenarios for summer rations were (SS4) the base run scenario for summer rations, scenarios (SS5) and (SS6) used the same feed resources as feeding trial rations, respectively. Substitution of part of feedstuff in the rations consequently changed the quantity of other ingredients in these rations. The third part of the model was mathematical equations that matched feed resources (including feeding packages) with animal requirements. The optimum animal feed requirement from available feeding resources and packages was calculated together with the purchased concentrate feeds to meet the animal requirements. Feeding cost and farm revenue were calculated to compare groups using the feeding packages with control groups in winter and summer. The feeding requirements were expressed as dry matter (DM), crude protein (CP) and total digestible nutrients (TDN) according to (NRC 2001).

The objective functions were:

$$\text{Minimize calf feed cost} = \sum P_i X_i,$$

P_i price for each feed stuff of X_i, there are number of feed stuffs: Egyptian clover (X_1), concentrate mixture(X_2), rice straw (X_3), corn silage (X_4), Egyptian clover hay (X_5) Egyptian clover silage (X_6) sugar beet tops silage(X_7)

Dry matter requirement per calf $\leq \sum D_j X_i$

D_i is dry matter for each feed stuff; Xi as before

TDN requirement per calf $\geq \sum T_j D_j X_i$

T_j is TDN for each feed stuff; Xi as before

CP requirement per calf $\geq \sum C_j D_j X_i$

C_j is crude protein for each feed stuff; Xi as before.

Constraints

$X_1 \leq 1000$ kg, $X2 \leq 14000$ kg, $X_3 \leq 7000$ kg, $X_4 \leq 15000$ kg, $X_5 \leq 3000$ kg, $X_6 \leq 6000$ kg $X_7 \leq 6000$ kg

The feeding trials were conducted in Karada Experimental Station, one of the experimental stations of the Animal Production Research Institute in the Delta Region.

RESULTS AND DISCUSSION

Linear Programme Model results

Table (1) shows the Linear Program Model LPM results consisting of average initial and final weights, total and daily gains for the three groups during winter and summer seasons. Three proposed scenarios were used for three different rations containing some available feeding packages in the Delta Region. It included scenarios (rations) for the winter season i.e. WS1, WS2 and WS3 and the other three scenarios for summer season i.e. SS4, SS5 and SS6. Four scenarios (rations) for 2 in winter and 2 in summer were an attempt to make use of most common and available conserved green forage as a feeding system for 6 months fattening period. There were two rations used as control, one for winter (WS1) and the other for summer (SS4). The scenarios assumed that the average daily gain for calves is 1 kg/day as the common average gain for adapted Friesian calves. The six scenarios were used to meet calves feeding requirements according to (NRC 2001).

Table1: Initial and final weights and total and assumed daily gains for fattening calves fed various rations

Winter Scenarios					Summer Scenarios				
Ration	Initial weight (kg)	Final weight (kg)	Total gain (kg)	Daily gain (kg)	Ration	Initial weight (kg)	Final weight (kg)	Total gain (kg)	Daily gain (kg)
WS1	286	379	93	1.00	SS4	379	472	93	1.00
WS2	286	379	93	1.00	SS5	379	472	93	1.00
WS3	288	381	93	1.00	SS6	381	474	93	1.00

WS1, WS2 and WS3 are represent winter rations and SS4, SS5 and SS6 are represent summer rations total and daily gains are based on assumptions

Three winter scenarios in Table (2) showed that, WS1 served as the base run (control) to simulate the existing winter feeding situation in the Delta Region (concentrate mixture + Egyptian clover + rice straw) without any feeding packages. The second scenario (WS2), had a constrain to use corn silage as a part of ration 6 kg/head/day. The third scenario (WS3) used the same ration as in WS2 but constrain was to double quantity of corn silage. Total feeding costs per each scenario were L.E.10.50, 8.00 and 7.40 for the three scenarios, respectively. The feeding cost saving with fixed level of daily gain for WS2 and WS3 were L.E.2.50(23.8%) and L.E.3.10(29.5%)/head/day compared to WS1.

Savings in feeding cost can be attributed to the use of corn silage in rations WS2 and WS3. The results also show that the more corn silage was applied, the more saving in feeding costs was realized. Also, the reduction in feed cost might be due to that the concentrate mixture is the most expensive ingredient in rations WS2 and WS3.

It's reduced from 30.76% to 14.00% and 8.00% as shown in Table (2). Using corn silage reduced the Egyptian clover in the ration from 57.57% in the control to 48.00% and 42% in WS1 and WS2, respectively, which means that there are an opportunity to increase the winter cultivated areas with cash crops. Swift (2003) found that corn silage provides a palatable and digestible source of energy. Mohamed et al.(1999) and Gaafar (2001) found that feed cost of buffalo calves increased with increasing of corn silage up to 75% and decreasing the concentrate mixture in the rations. Khalil, *et al.* (2005) found that using some innovative packages such as millet and corn stalk silages in East Delta reduced winter feeding cost by 19.45%. Sammour (2002) also reported that reduction in feeding costs can be obtained by better utilization of maize stalk silage and Egyptian clover silage.

Table 2: Feed ingredients quantity, their percentages on fresh basis and prices of winter rations for fattening calves.

	WS 1			WS2			WS3		
Rations ingredients	**Quantity. (kg)**	**% of total ration**	**Cost (L.E.)**	**Quantity. (kg)**	**% of total ration**	**Cost (L.E.)**	**Quantity (kg)**	**% of total ration**	**Cost (L.E.)**
Conc. Mix.	5.34	30.76	9.10	3.00	14.00	5.10	2.00	8.00	3.40
E.C.	10.00	57.57	1.00	10.00	48.00	1.00	10.00	42.00	1.00
Corn silage	-	-	-	6.00	29.00	1.50	12.00	50.00	3.00
Rice straw	2.00	11.67	0.40	2.00	9.00	0.40	-	-	-
Total feed cost (L.E./head/day)	-	-	10.50	-	-	8.00	-	-	7.40

The prices in this study were based on the average price in L.E. of 1kg in year 2008.
L.E.: Egyptian pound
Conc. Mix: concentrate mixture (L.E. 1.70), EC: Egyptian clover (L.E. 0.10)
Corn silage (L.E. 0.25), Rice straw (L.E. 0.20)

The three summer scenarios in Table (3) revealed that ration (SS4) served as the base run to simulate the existing summer feeding situation in the Delta Region consisting of (concentrate mixture + Egyptian clover hay + rice straw) without interventions of any feeding packages. Scenario (SS5) substituted part of ration (SS4) with 5 kg/head/day corn silage and 5 kg/head/day Egyptian clover silage, respectively. Scenario (SS6) used the same ration as in (SS5) but corn silage was replaced with sugar beet tops silage of 5 kg/head/day. Replace whole or part of any ingredient the diets consequently changed the quantity of the ingredients in these rations.

Total feeding costs for the three previous summer scenarios, SS4, SS5 and SS6 were L.E.10.04, L.E 8.60 and L.E. 9.26, respectively. The feeding cost decrease with a fixed level of daily gain the feeding cost savings were L.E. 1.44 (14.34%) and L.E. 0.78 (7.77%)/head/day compared to summer base run scenario SS4 (control). The decrease in feeding costs can be attributed to the use of corn silage and sugar beet tops silage in SS5 and SS6 plus Egyptian clover silage in both rations. The results also showed that the use of corn silage decreased feeding cost more than sugar beet tops silage.

The feed cost saving was due to the quantity of TDN and CP in the corn silage which was more than in sugar beet tops silage on dry matter

basis. Corn silage contains approximately 3% crude fat, in the form of corn oil from the kernel (Swift 2003). The present results agreed with Khalil et al. (2005) who found that using such fodder beet silage in the East Delta of Egypt reduced summer feeding cost by 21.44% animal unit.

Table 3: Feed ingredients, quantity and their percentages on fresh basis and prices of summer rations for fattening calves.

	SS4			SS5			SS6		
Rations ingredients	**Quantity. (kg)**	**% of total ration**	**Cost (L.E.)**	**Quantity (kg)**	**% of total ration**	**Cost (L.E.)**	**Quantity (kg)**	**% of total ration**	**Cost (L.E.)**
Conc. Mix.	4.69	50.67	7.98	3.46	21.96	5.89	3.97	24.07	6.75
C.S	-		-	5.00	31.69	1.25	-		-
E.C.S.	-		-	5.00	31.69	1.00	5.00	30.30	1.00
S.B.T.S.	-		-	-		-	5.00	30.30	1.00
E.C.H.	2.78	30.00	1.70	-		-	-		-
Rice straw	1.79	19.33	0.36	2.31	14.66	0.46	2.53	15.33	0.51
Total feed costs (L.E./head/day)			10.04			8.60			9.26

The prices in this study were based on the average price in L.E. of 1 kg in year 2008.
CS: corn silage, ECS: Egyptian Clover Silage supplemented with molasses (L.E. 0.20)
S.B.T.S: sugar beet tops silage (L.E. 0.20), ECH: Egyptian Clover Hay (L.E.0.60)

Table (4) shows that the extra revenues gained from the use of corn silage for fattening calves were L.E. 2.50 and L.E.3.10 for winter and L.E 1.44 and L.E 0.78 for summer rations, respectively. The results revealed that the more corn silage used in calves fattening ration, the more the reduction in feeding cost with fixed level of daily gain compared to the base run scenario SW1.

This can be due to the reduction of the quantity of most expensive ration ingredients (concentrate mixture and Egyptian clover hay) /head/day in SS5 and SS6, respectively. In addition, the use of sugar beet tops silage in SS6 with the same level of daily gain reduced the quantity of Egyptian clover hay by 2.78 kg/head/day. The results also reflected that feeding values of corn silage are better than sugar beet tops silage. The popular use of corn silage compared to sugar beet tops silage implies that it has certain competitive advantages over other feedstuffs. This means that in the long term, feeding corn silage diets will have higher returns than diets with less commonly used feeds such as concentrates mixture, wheat bran and soybean or other ingredients of concentrates, corn silage provides certain nutrients at lower costs.Gelan, *et al.* (2000) reported that diet cost was decreased by feeding the higher level of corn silage in both the calf and yearling experiments. Despite the lower diet cost, cost of gain was increased by feeding the higher levels of silage to yearlings from $41.76 per 100 lb gain to $46.99 and $43.99 for the 30 and 45% silage diets, respectively. For calves, cost of gain increased from $38.82 to $40.81 and $43.06 for the 30 and 45% silage diets, respectively. The increase in cost of gain is due to lower gains and increased yardage and interest for the higher levels of silage. Compared to other feedstuffs, these results agree with the present results. The important nutrients provided by corn silage must be determined in order to have an accurate value of corn silage.

Table 4: Total revenue from using available winter and summer feeding packages.

Items	Winter			Summer		
	WS1	WS2	WS3	SS 4	SS5	SS6
Total gain (kg)	93	93	93	93	93	93
Fattening period (days)	93.00	93.00	93.00	93	93	93
Daily gain (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Total feed cost L.E.	10.50	8.00	7.40	10.04	8.60	9.26
Type of Feeding packages	-	Less CS	More CS	-	C.S. + E.C.S.	S.B.T.S. + E.C.S.
Benefits form feed reduction cost L.E./head/day	-	2.50	3.10	-	1.44	0.78

Price of calves live body weight is L.E. 18 in year 2008
CS: corn silage, ECS: Egyptian clover silage, SBTS: Sugar beet tops silage

Khalil and Sammour (2006) found that use of corn silage in winter feeding ration in West Delta dairy farms in Egypt reduced the feeding cost for crossbred cows by 14.82%. Khalil *et al.* (2005) also found that using fodder beet silage in Ismailia region reduced summer feeding cost by 21.44% for animal unit. El-Ashmawy (2003) reported that rations consisting of corn silage or corn stalk silage improved feeding cost by L.E. 1.91 and L.E. 0.57, respectively, compared with control ration. These findings are consistent with the present results.

The feeding trials (Validation) results

Reducing feed cost was studied during using linear program models. On the other hand, actual feeding trial was conducted using the same assumed feedstuffs and carried out to represent the same previous scenarios and compared between the results obtained from the assumption model and validation. Chemical composition of the ingredients and calculated composition of experimental rations are presented in Table (5). It could be noticed that the nutritive contents of all ingredients (concentrate feed mixture, corn silage, berseem silage, sugar beet silage, Egyptian clover hay, berseem silage, rice straw were within the range of values obtained by (NRC 2001) In addition, chemical composition of winter tested ration showed that the CP content appeared to higher with ration WG1 compared to WG2 and WG3. The same trend was observed with CF content, while EE content tended to the same of the three previous rations.

With respect to summer tested ration, it could be noticed that the crude protein (CP) of ration SG6 recorded the highest value (16.40%). This increase in CP% might be due to higher portion of Egyptian clover silage beside the amount of sugar beet tops silage. On the contrary, the EE content was the lowest (2.21%). Also, chemical composition of tested feedstuffs and experimental rations showed that the contents of CP and ash were high in sugar beet tops silage compared with corn silage (14.80 and 19.60 vs. 07.43 and 06.71%, respectively). While, the content of OM and CF were high in corn silage compared with sugar beet tops silage.

Data presented in Table (5) showed that the CF content decreased with using corn silage in winter and summer rations, being 23.85 and 17.79% for WG1 and WG2 versus 20.99 and 19.49% for SG4 and SG5, respectively.

Increasing amount of corn silage (SG5) or adding sugar beet tops silage (SG6) tended to some what higher CF contents (Table 5).

The OM content ranged between 87.07 to 91.55% and the NFE content ranged between 46.27 to 54.19%. From these results, it could be noticed that ration SG4 recorded lowest OM, while ration SG6 had the highest OM content (91.55%) and the lowest ash content (8.45%).

Table (5): Chemical composition of tested feedstuffs and experimental rations used in feeding calves.

Feedstuffs		Composition of DM%					
	DM%	OM	CP	CF	EE	NFE	ASH
Concentrate feed mixture	90.72	89.78	17.45	14.22	3.25	54.86	10.22
Corn silage	35.33	93.29	7.43	17.54	2.85	65.47	6.71
Berseem silage	29.32	86.11	16.40	22.24	1.94	45.53	13.89
Sugar beet tops silage	25.60	80.38	14.80	12.80	2.53	50.25	19.62
Fresh berseem	15.40	88.65	16.10	24.50	3.20	44.85	11.35
Berseem hay	91.30	87.85	13.92	24.57	2.69	46.67	12.15
Rice straw	90.48	81.45	3.76	35.55	1.32	40.82	18.55
Calculated composition of experimental rations%							
WG1	39.85	87.92	14.82	23.85	2.98	46.27	12.08
WG2	34.74	88.61	13.67	17.79	2.96	54.19	11.39
WG3	35.91	89.61	12.82	22.01	2.98	51.80	10.39
SG4	90.80	87.07	12.90	20.99	2.60	50.58	12.93
SG5	40.91	88.93	13.74	19.49	2.43	53.27	11.07
SG6	38.16	91.55	16.40	20.09	2.21	52.85	8.45

WG1, WG2 and WG3 are represent winter rations and SG4 SG5 and SG6 are represent summer rations

Concentrate feed mixture content : 42% undecorticated cotton meal, 10% wheat bran, 30% yellow corn, 10% rice bran, 5% molasses, 2% limestone, 1% common salt.

Results obtained in Table (6) showed that the digestibility coefficients of CP were 76.10, 79.01, 80.89, 58.91, 82.97 and 79.21% for ration WG1, WG2, WG3, SG4, SG5 and SG6, respectively. These results indicated that the highest CP digestibility was recorded with SG5 which contained Egyptian clover silage and corn silage, while the lowest CP digestibility was for WG1, which contained Egyptian clover hay.

Also, it could be noticed that introducing corn silage or increasing its amount instead of Egyptian clover tend to increase CP digestibility and decreasing NFE digestibility. More over, adding Egyptian clover silage to summer rations lead to increase CP digestibility and decrease NFE digestibility. At the same time, summer ration appeared to be of EE digestibility with adding silage of Egyptian clover, corn or sugar beet tops instead of Egyptian clover hay. Differences in digestibility coefficient of nutrients in different tested rations might be attributed to different amounts and percentages of components in each tested ration.

Generally, the winter rations (WG1, WG2 and WG3) tended to increase digestibility's of OM, CF and NFE and decrease of EE digestibility, while summer rations (SG4, SG5, SG6) showed higher digestibility of EE and

lower OM digestibility. From these results, it could be noticed that higher or lower nutrient digestibility might be attributed to digested amounts, feed intake and feed excreted which were changed according to statue of animals and season period.

Table (6): Digestibility coefficients% and Nutritive values% of the experimental rations.

Feeding groups	Digestibility coefficients %					Nutritive values %	
	OM	CP	CF	EE	NFE	TDN	DCP
WG1	62.62	76.10	59.00	57.72	75.21	64.20	11.28
WG2	62.30	79.01	89.32	50.68	61.67	63.90	10.80
WG3	63.10	80.89	76.01	60.74	65.01	65.11	10.37
SG4	57.86	58.91	58.50	79.32	69.14	61.29	07.60
SG5	60.72	82.97	69.27	78.39	57.82	66.06	11.40
SG6	60.54	79.21	53.01	80.34	57.28	65.07	12.99

The nutritive value of experimental ration recorded 64.20, 63.90, 65.11, 61.29, 66.06 and 65.07% TDN for rations WG1, WG2, WG3, SG4, SG5 and SG6, respectively. The corresponding values of DCP were 11.28, 10.80, 10.37, 07.60, 11.40 and 12.99% for respective rations, as shown in Table (6). These results showed that adding corn silage to winter ration did not affect TDN but increased its amounts and tended to higher nutritive values as TDN. On the contrary, adding corn silage or increasing its amounts decrease DCP%.

With respect to summer rations, it could be noticed that using of Egyptian clover-, corn- or sugar beet tops silage instead of clover hay appeared to increase nutritive values expressed as TDN and DCP.

From these results, using corn silage and increasing its amounts tended to lower feed cost during winter period. The same trend was observed during summer period when silages of clover, corn or sugar beet tops were used. Moreover, average daily gain recorded higher value with tested ration compared to control ration during winter and summer periods. The reduction in feeding cost was clear with tested ration. So, feeding Friesian calves during fattening period according to results obtained from using linear programming model tend to higher daily gain, higher feed efficiency and decreasing feed cost.

Nutritive values in table (6) indicated that using of corn silage and sugar beet tops silage or berseem silage in the rations reduced the feed cost.

These results agreed with those obtained by Mohamed et al.(1999) and Gaafar (2001) who found that feed cost of buffalo calves increased with increasing of corn silage up to 75% and decreasing the concentrate mixture in the rations. Savings in feeding cost can be attributed to the use of corn silage in rations SW2 and SW3. The results also show that the more corn silage was applied, the more saving in feeding costs was realized. (Swift 2003) found that corn silage provides a palatable and digestible source of energy.

Khalil and Sammour (2006) found that use of corn silage in winter feeding ration of dairy farms in the West Delta Region of Egypt reduced 14.82% of feeding cost for crossbred cows.

El-Ashmawy (2003) reported that rations consisting of corn silage or corn stalk silage improved feeding cost by L.E. 1.91 and L.E. 0.57, respectively, compared with control ration. These findings are consistent with the present results.

Table (7) shows the feeding trials results consisting of average initial and final weights, total and daily gains for the three groups in winter and summer seasons. The six proposed rations used in the feeding trials were as the same as six scenarios that were tested by LPM. The rations in the feeding trials had the same available feeding packages and constrains that were considered in LPM scenarios. These rations in winter and summer assumed that the average daily gain for calves is 1 kg/day as the common average gain for adapted Friesian calves. The six rations were used to meet calves feeding requirements according to (NRC 2001).

The results in table (7) showed that the average daily gains for winter ration were more than 1 kg gain /head/day. While the daily gain for summer rations were less than 1 kg gain/head/day. These results might be due to heat stress on animals in summer than in winter that would consequently lead to loss animal appetite and less feed conversion.

Table 7: Initial and final weights and total and daily gain for fattening calves fed various rations

	Winter rations				Summer rations				
Feeding groups	Initial weight (kg)	Final weight (kg)	Total gain (kg)	Daily gain (g)	Feeding groups	Initial weight (kg)	Final weight (kg)	Total gain (kg)	Daily gain (g)
WG1	286	390	104	1118	SG4	390	462	72	774
WG2	286	396	110	1183	SG5	396	473	77	82 8
WG3	288	394	106	1140	SG6	394	471	77	828

Table (8) showed the three winter rations. Control (WG1) consists of (concentrate mixture + Egyptian clover + rice straw). Ration WG2 part of ration WG1 was replaced with average quantity of silage of 6 kg/head/day for three months winter, average corn silage residuals were 2 kg/head/day. This residuals quantity of corn silage might be because the feeding system in experimental station was that introducing the concentrate mixture and rice straw at the first before offering the corn silage. Ration WG3 used the same ration as in WG2 with double quantity of corn silage. Total feeding costs were L.E.10.83, L.E. 8.50 and L.E.9.46 for the three rations, respectively. The feeding cost reductions with a fixed level of production were L.E. 2.33 (21.50%) and L.E. 1.37 (12.65%)/head/day for WG2 and WG3, respectively, compared to winter base run of WG1.

The feeding costs saving for validation rations might be attributed to the use of corn silage in rations WG2 and WG3 which is similar to the linear LPM results. Also the percentage of concentrate mixture in WG2 and WG3 were 11 % and 12% compared to 20% in WG1. In addition, the Egyptian

clover was reduced by 4% and 17% in WG2 and WG3, respectively compared to WG1. These results had the same trend as LPM results.

Table 8: The ingredients, quantity, percent on fresh basis and their prices of winter rations for fattening calves.

	WG 1			WG 2			WG 3		
Rations ingredients	**Qua. (kg)**	**%**	**Cost (L.E.)**	**Qua. (kg)**	**%**	**Cost (L.E.)**	**Qua. (kg)**	**%**	**Cost L.E.**
Conc. Mix.	5.00	20	8.36	3.00	11	5.10	3.33	12	5.66
Egyptian clover.	17.00	68	1.70	18.00	64	1.80	14.00	51	1.40
Corn silage	-	-	-	4.00	14	1.00	8.00	29	2.00
Rice straw	3.17	12	0.63	3.00	11	0.60	2.00	8	0.40
Total feed cost L.E/head/day	-	-	10.83	-	-	8.50	-	-	9.46

Conc. Mix.: concentrate mixture, Qua: Quantity

Validation results indicated that the more application of corn silage the less saving in feeding cost, however, regarding the quantity of corn silage, the results were on the contrary with the LPM. Gelan, *et al.* (2000) reported that diet cost was decreased by feeding the higher level of silage in both the calf and yearling experiments. Despite the lower diet cost, cost of gain was increased by feeding the higher levels of silage to yearlings from $41.76 per 100 lb gain to $46.99 and $43.99 for the 30 and 45% silage diets, respectively. For calves, cost of gain increased from $38.82 to $40.81 and $43.06 for the 30 and 45% silage diets, respectively. The increase in cost of gain is due to lower gains and increased yardage and interest for the higher levels of silage. Compared to other feedstuffs these results are agreed with the present results.

Costanzo *et al.* (1998) reported that feeding the whole plant corn silage should give the greatest amount of flexibility but slower gains and poorer efficiencies, while feeding the grain gives the least amount of flexibility but faster gains and better efficiencies. (Galen *et al.*, 2000) reported that three dietary corn silage levels (15, 30, and 45% of diet DM) were evaluated in corn finishing diets fed to calves through the winter/spring and yearlings during the summer to determine effects on performance and nitrogen mass balance in feedlot. Yearling gains decreased with increasing corn silage. However, both rations WG2 and WG3 have reduced feeding cost compared with control ration in winter. Khalil *et al.* (2005) found that a simulation model in East Delta using some innovation packages such as millet and corn stalk silages reduced winter feeding cost by 19.45%. Sammour (2002) reported from a field survey, that there was reduction in feeding costs by applying better utilization of maize stalk silage and Egyptian clover silage; these results are in agreement with the present study findings.

Table (9) shows the three validation rations for summer. The first ration i.e. SG4 served as the control representing the common existing feeding situation in Delta (concentrates mixture + Egyptian clover hay + rice straw). Second rations SG5 replace part of ration SG4 with corn silage and Egyptian clover silage of 6 and 10 kg/head/day respectively.

Table 9: The ingredients, quantity, percent on fresh basis and their prices of summer ration for fattening claves

	SG 4			SG 5			SG 6		
Feedstuff	**Qua. (kg)**	**%**	**Cost (L.E.)**	**Qua. (kg)**	**%**	**Cost (L.E.)**	**Qua. (kg)**	**%**	**Cost (L.E.)**
Conc. Mix.	4.60	40.7	7.82	3.00	15.8	5.10	3.00	15	5.10
CS	-	-	-	6.00	31.6	1.50	-	-	-
ECS				10.0	52.6	2.00	15.0	75	3.00
SBTS							2.00	10	0.40
Clover Hay	4.00	35.4	2.40						
Rice straw	2.70	23.9	0.54						
Total feed costs L.E./head/day			10.76			8.60			8.50

The prices in this study were based on the average price of 2008.
CS: corn silage, ECS: Egyptian Clover Silage supplemented with molasses
SBTS: Sugar beet tops silage, ECH: Egyptian Clover Hay

The third ration SG6 used the same ration as in SG5 but replace the corn silage with sugar beet tops silage of 2 kg/head/day. Total feeding costs for summer rations were L.E.10.76, L.E. 8.60 and L.E.8.50 respectively. The feeding cost saving with a fixed level of daily gain were L.E.2.16 (20.1%) and L.E. 2.26 (21%)/head/day for SG5 and SG6 compared to summer control ration, respectively.

The improvement in feeding costs can be attributed to the use of corn silage and sugar beet tops silage plus Egyptian clover silage both in SG5 and SG6. Also as shown in table (9) the reduction in feeding cost was might be due to the concentrate mixture was reduced from 40.70% in control ration to 15.80% and 15.00% in SG2 and SG3, respectively. In addition the Egyptian clover hay was replaced by inexpensive feedstuffs corn and sugar beet tops silages. The results also showed that use of corn silage gave better improvement in feeding cost compared to sugar beet tops silage. This might be attributed to the differences in feeding costs for corn silage and sugar beet tops silage. The price of one ton fresh corn silage and sugar beet tops silage were L.E. 250 and L.E. 200, respectively. But the dry matter DM in corn is between 30-35% which is suitable for silage making without any application of additives. The DM content of sugar beet tops silage generally is low (10-15%) and this requires the use a dry absorbent such as bean straw to raise the DM content necessary for silage making. In addition, the TDN and CP unit price in corn silage is much cheaper than sugar beet tops silage on DM basis. It could also be attributed to the more efficient utilization of available energy in corn silage compared to sugar beet tops silage. Khalil et al. (2005) found that using such fodder beet silage in East Delta Region reduced summer feeding cost by 21.44% per animal unit.

Table (10) shows that the extra revenues gained from the use of corn silage in winter rations for fattening calves were L.E. 3.50 and L.E. 1.67 for WG2 and WG3 rations, respectively. The total extra revenues resulted from two factors mainly, increase in average daily gain and feed costs saving. The results revealed that the more corn silage used in calves fattening ration, the

less feeding cost reduction. Furthermore, average daily gain in ration with low corn silage did better than high corn silage ration.

The extra revenues gained from the use of corn silage or sugar beet tops silage and Egyptian clover silage for fattening calves in summer were L.E. 3.13 and L.E. 3.23 for SG5 and SG6, respectively. The results indicated that the corn silage with Egyptian clover silage has the same effect on increasing average daily gain of 7% as Egyptian clover silage with sugar beet tops silage compared with control. In addition, saving of feeding cost was a little higher between SG5 than in SG6. There is no big difference in growth of WG1, WG2 and WG3 for winter seasons and of SG4, SG5 and SG6 for summer season and it was most probably attributed to the narrow differences in the initial body weight. El-Ashmawy (2003) found that winter or summer rations containing corn silage or corn stalk silage were economically efficient compared with control.

Results in table (10) clearly showed that the final body weight and daily gain in winter rations were a little higher than the LPM results in the three scenarios. The differences in average daily gain between the LPM and validation results may be attributed to good feeding efficiency for the three rations in winter seasons as well as better management's practices and good weather.

Table 10: Total revenue from using feeding packages compared with control.

	WG 1	WG 2	WG 3	SG 4	SG 5	SG 6
Av. Total gain (kg)	104	110	106	72	77	77
Fattening period (days)	93	93	93	93	93	93
Daily gain (kg)	1.118	1.183	1.140	0.774	0.828	0.828
Total feed cost L.E.	10.83	8.50	9.47	10.76	8.60	8.50
Reduction in feeding costs vs. control (L.E.)		2.33	1.36	-	2.16	2.26
Feeding packages		Less CS	More CS	-	CS + ECS	SBTS+ ECS
Extra weight vs. control (%)	100.00	106	102	100.00	107	107
Extra daily benefits from extra daily gain (L.E.)		1.17	.40	-	0.97	0.97
Total extra daily benefits vs. control (L.E.)		3.50	1.76	-	3.13	3.23

Price of live body weight is L.E. 18 in year 2008
CS: Corn silage, ECS: Egyptian clover silage.

The summer rations produced less daily gains compared to the LPM results and it might be due to that calves reached their sexual maturity and therefore needed more energy to gain 1 kg/head/day. This showed that age progress influenced the daily gain. This biological phenomenon is previously recorded as the result of turning physiological activity towards fat deposition (Lawrence and Fowler 1998). These results might be due to heat stress on animals in summer than in winter that would lead consequently to loss animal appetite and poorer feed conversion. Average daily gain in the present study is in line with Alsheikh et.al. (2004) who found that daily gain ranged between 1024 to 1228 g /day for Friesian calves. The same author also reported that it was higher in winter than in summer.

EL-Asheeri (2008) reported that differences in age, management practices and season of growth could be the main reason contributed to the variation in average daily gain. The same author also found that initial body weight between 225 and 275 kg and final body weight of around 400 kg maximized return under Egyptian conditions.

The main comparison between LPM and validation results is that, LPM result in winter rations clearly showed that the more corn silage used in the ration, the more feed cost saving. On the contrary, the validation results showed the opposite this results which agree with Costanzo *et al.* (1998) who reported that feeding the whole plant corn silage should gives the greatest amount of flexibility but slower gains and poorer efficiencies, while feeding the grain gives the least amount of flexibility but faster gains and better efficiencies. The validation results also showed that feeding costs saving are less in winter rations than those in LPM results. In summer rations, LPM results revealed less feeding cost saving than validation rations. However LPM and validation results have more feeding cost saving than control because the use of less expensive feed resources in rations.

Conclusion

The present study has shown that linear programme bio-economic model is a useful tool to assess the impact of using available feeding packages in farm income. The differences between LPM and validation results clearly showed that linear programme bio-economical model in practices have to consider the environmental and animal conditions. By including the dynamic LPM of the subsystem effect of climate change in animal behavior-green forage production, it would be possible to give greater realism and flexibility to secondary production model, thus providing more independence vis-à-vis the availability of empiric data on growth and the green forage production. Using feeding packages in animal feeding can reduce feeding costs and hence improve the revenue. The validation results showed that feeding costs saving are better in both of winter or in summer rations than those in simulation results. However simulation and validation results have more feeding cost saving than control because they use more inexpensive feed resources in rations.

Acknowledgement

Special appreciation and thanks to Prof. Dr. Salah Galal and Dr. Abdul Razak Okine for their valuable comments and revision of this manuscript. Sincere gratitude to all my colleagues in the Livestock Production System Department for their assistance and cooperation during the experiments.

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Comment [C1]:

تقيم بعض الحزم الغذائية على عوائد تسمين العجول الفرزيان بمنطقة الدلتا - مصر

مصطفى خليل ، حسن النحاس و محمد تاج الدين
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استخدمت طريقتين لتقيم ستة علائق تحتوى على بعض الحزم الفنية الأولى باستخدام نماذج البرمجة الخطية والأخرى بأجراء تجربه فعليه على العجول الفرزيان بمحطة التجارب بالقرضا.

البرمجة الخطية أولا التقييم عن طريق

ثلاثة سيناريوهات تم اعددها بالكمبيوتر تعبر عن العلائق فى الشتاء وهى مجموعه مقارنة(س1) تستخدم العلائق التقليدية فى الدلتا (5.34كجم علف مركز+ 10كجم برسيم +2كجم قش ارز) ، العليقه الثانية (س2) أستخدم سيلاج الذرة كما يلى(3كجم علف مركز+ 10كجم برسيم +6كجم سيلاج الذرة+2كجم قش ارز) و العليقة الثالثة(س3)كانت نفس العليقة الثانية مع مضاعفة كمية سيلاج الذرة كما يلى (2كجم علف مركز+ 10كجم برسيم +12كجم سيلاج الذرة+2كجم قش ارز) .

بالنسبة الصيف فكانت ثلاثة سيناريوهات اخرى تعبرعن علائق الصيف تم اختبارها هى عليقه مقارنه (ص4) (4.69كجم علف مركز + 2.78كجم دريس برسيم +1.79كجم قش أرز) . العليقة الثانية (ص5) (3.46كجم علف مركز+5كجم سيلاج برسيم + 5 كجم سيلاج ذرة + 2.31كجم قش أرز)، العليقة الثالثة (ص6) كانت نفس العليقة الثانية مع استبدال سيلاج الذرة بسيلاج عروش بنجر السكر 5 كجم / حيوان/يوم كما يلى(3.97 كجم علف مركز+5كجم سيلاج برسيم + 5 كجم سيلاج بنجر + 2.53كجم قش أرز). كل العلائق المستخدمة تكفى لنمو 1 كجم / يوم طبقا لمقررات NRC. العوائد للعلائق الشتاء كانت 2.5 ، 3.10 جنيه/حيوان/يوم زيادة للمجموعات الثانية(س2) والثالثة (س3) على التوالي مقارنة بالمجموعة الأولى (س1) (مجموعة المقارنة). وكانت الزيادة من العلائق الصيفية 1.44 ، 0.78 جنيه/ حيوان/ يوم للمجموعة الخامسة (ص5) والسادسة (ص6)على التوالي زيادة عن المجموعة الرابعة (ص4)(مجموعة المقارنة).

ثانيا التقييم عن طريق تجارب التغذية لعجول الفرزيان :

نفس العلائق السابقة أعيد تقيمها بطريقة استخدام تجارب تغذية فعلية على عجول فرزيان فى محطة التجارب بالقرضا التابعة لمعهد بحوث الانتاج الحيوانى مع نفس الحزم الغذائية المستخدمة فى نموذج البرمجة الخطية ونفس مجاميع التغذية طبقا لمقررات NRC و كانت فى الشتاء كما يلى مجموعه مقارنة(س1) (5كجم علف مركز+ 17كجم برسيم +3.17كجم قش ارز) ، العليقه الثانية (س2) كانت كما يلى (3كجم علف مركز+ 18كجم برسيم +4كجم سيلاج الذرة+3كجم قش ارز) و العليقة الثالثة (س3) كانت نفس العليقة الثانية مع مضاعفة كمية سيلاج الذرة كما يلى (3.33كجم علف مركز+ 14كجم برسيم +8كجم سيلاج الذرة+2كجم قش ارز) . بالنسبة الصيف فكانت ثلاثة مجاميع غذائية اخرى تعبرعن علائق الصيف تم اختبارها وهى عليقه مقارنه (ص4) (4.60كجم علف مركز + 4كجم دريس برسيم + 2.7 كجم قش أرز). العليقة الثانية (ص5) كانت (3كجم علف مركز+10كجم دريس برسيم + 6 كجم سيلاج ذرة)، العليقة الثالثة (ص6) كانت نفس العليقة الثانية مع استبدال سيلاج الذرة بسيلاج عروش بنجر السكر2 كجم / حيوان/ يوم كما يلى(3 كجم علف مركز+15 كجم دريس برسيم + 2 كجم سيلاج بنجر). كانت العوائد من تجارب التغذية للعلائق الشتوية التى تم تغذيتها فى شهور(فبراير – مارس – ابريل) 2.33 ، 1.37 جنيه/حيوان/ يوم زيادة للمجموعات الثانية والثالثة على التوالي مقارنة بالمجموعة الأولى (مجموعة المقارنة). وكانت الزيادة من العلائق الصيفية التى تم تغذيتها فى شهور (مايو – يونيو – يوليو) 2.16 ، 2.26 جنيه/ حيوان/ يوم للمجموعة الخامسة والسادسة على التوالي زيادة عن المجموعة الرابعة (مجموعة المقارنة). من النتائج يمكن القول ان استخدام الحزم الغذائية فى تغذية الحيوان يمكن ان تخفض تكاليف التغذية وزيادة عوائد مزارع تسمين العجول. البرمجة الخطية تعتبر مؤشر جيد للتجارب التى تحتاج لوقت وجهد ومال للتجريب.

قام بتحكيم البحث

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