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General Directorate for Development Planning and Agricultural Investments (DGPDIA)
Ministry of Agriculture, Republic of Tunisia

IMPACT OF REMOVAL OF FEED GRAIN SUBSIDIES AND IMPORT LIBERALIZATION

APIP Report 90-7

November 1990

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In collaboration with

Abt Associates Inc., Washington, D.C.

Subcontractors:

Institut Supérieur de Gestion, Tunis, Republic of Tunisia

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IMPACTS OF REMOVAL OF FEED GRAIN SUBSIDIES AND IMPORT LIBERALIZATION

1. INTRODUCTION

1.1 Background Information

During the 1970s, Tunisia pursued a price policy based on controlling the price of agricultural products and subsidizing both factors of production (fertilizer, animal feed) and final consumer products (meat, milk, cereals). A major effort was made to strengthen the poultry and feed milling industries. All feed blending was done by parastatals or private firms acting as contractors for the state. The Government set margins which were very lucrative. The feed industry grew considerably as a result of incentive investment policies coupled with subsidies on feed ingredients (between 1978 and 1984 the Government subsidized two-thirds to three-fourths of the cost of feed ingredients). In the early 1980s, the Government allowed private firms to sell blended feed under their own labels instead of as contractors.

The production of feed increased from 8,570 metric tons (mt) in 1968 to over 600,000 mt in 1981. Tunisia now has over 200 feed mills, with a total production capacity of around 1,730 mt/day, or 1,835,800 mt/year assuming 260 work days/year. The demand for feed has never exceeded 650,000 mt/year. This implies that only around 30 percent of the capacity of these mills is being used.

The growth in production of blended animal feed coincided with a significant expansion of the poultry sector, which absorbs 70 percent of the feed that is used in Tunisia. The poultry sector contributes 35 percent of total meat production in Tunisia; its fast growth is also due mainly to incentives created by policies. These policies have contributed to the following distortions in the livestock sector:

- The weak development of forage crops and poor integration of livestock and cereal production.
- Limited interest in pasture development in the center and south of the country, and relatively primitive livestock production patterns; and
- Poor allocation of resources and pressure on public finances, which has been strongly felt recently with large world price increases for imported barley, maize, and soybean meal.

Faced with severe budgetary constraints, the Government began pursuing a structural adjustment program in 1985 involving changes of certain agricultural policies, particularly the liberalization of prices of animal products (beef, poultry meat, agricultural products). In 1982, feed subsidies were reduced drastically in one action that had severe repurcussions for the feed and poultry industries. In November 1982, feed prices more than doubled, and poultry production fell by over 30 percent the following year. Many small feed plants went out of business. By 1987, however, feed ingredients were still subsidized.

In 1987, the Tunisian Government reached an agreement with the World Bank to gradually eliminate subsidies on feed ingredients. Unfortunately, 1988 and 1989 were severe drought years. Barley production dropped from 536,500 mt in 1987 to 60,000 mt in 1988. As a result, the program of subsidy reduction was frozen, and subsidies have increased substantially since 1987. Subsidy reduction resumed in 1990 when production conditions returned to normal.

1.2 Objectives of the Study

1. Analyze the impacts of the elimination of feed ingredient subsidies on the cost of production and income of poultry and livestock producers, the demand for inputs, and the supply of livestock products.

2. Evaluate the effects of liberalization of imports of inputs (e.g. barley, maize, soybean meal) into the formulation of feed.

3. Discuss the process of liberalization of feed grain imports.

1.3 Organization of the report

Chapter 2 provides a describes the animal feed industry in Tunisia, including a short history on the development of the sector, historical levels of consumption of feed and feed ingredients as well as imports of feed ingredients. Chapter 2 also describes the current structure of the feed manufacturing industry, and problems facing it. The growth and development of the poultry sector in recent years is explored in Chapter 3. Cost of production information for broilers and eggs are presented. Chapter 4 describes other livestock production systems (including dairy, beef, and sheep), cost of production estimates, and the use of blended feed.

Chapter 5 analyzes the impacts of trade liberalization and removal of subsidies on animal feed rations, the cost of producing animal feeds, meat, milk, and eggs. A linear programming model is used to formulate optimal feed rations when policies change. The impact of subsidy removal and trade liberalization on economic efficiency is also explored. Chapter 6 focuses on the impacts of subsidy elimination on cost of production of poultry and other livestock enterprises. Broader issues concerning trade liberalization and subsidy removal are treated in Chapter 7. Chapter 8 provides overall conclusions and recommendations for implementation of policy changes.

2. DESCRIPTION OF THE ANIMAL FEED INDUSTRY IN TUNISIA

2.1 Introduction

Tunisia's Office des Céréales (OC or cereals marketing board) imports and distributes animal feed ingredients in Tunisia. Feed blending companies purchase maize, soybean meal, and barley from the OC to mix in varying proportions with vitamin/mineral supplements into different blended feeds for each livestock and poultry enterprise. The Government fixes the price at which the ingredients are sold to the feed manufacturers, which in recent years has provided an indirect subsidy to livestock producers.

2.2 History of the Development of the Feed Industry

In 1964, the OC established a barley and bran sales network throughout the country to encourage livestock producers to increase output. Previously, very little poultry had been produced, and 80 to 90 percent of nutrition for livestock came from natural vegetation, farm harvest residues, and the limited supply of agricultural by-products. Barley, oats, and wheat in their natural state and vegetable waste, beans (fève), and dried kidney beans (fèverole), comprised the remaining livestock feed.

In 1965 the OC plant opened in Bir Kassaa, initiating the manufacture and marketing of compound feeds. The production of animal feeds grew only slightly between 1965 and 1969. In 1968, 8,570 tonnes (mt) of animal feeds were produced. In the 1970s, however, consumption of blended feed surged spectacularly, reaching 360,000 mt by 1980 (Exhibit 2.1).

This surge corresponds to a period of considerable growth in Tunisia's poultry industry which was developed to help fill the country's protein needs and reduce the meat shortage. The demand for feed fluctuates considerably from year to year (Exhibit 2.2) but has generally risen throughout the 1980s. The use of simple or compound feeds has been promoted through a number of incentives, such as subsidies on raw materials, easy credit for setting up high-tech feed processing plants, and extension agent's efforts to encourage the use of synthetic vitamins and amino acids.

2.3 Imports of Raw Materials

As early as 1965, when Tunisia's industrial feed production was just getting started, the country was already importing 240 mt per year of soya, 1,145 mt of corn, 19.9 mt of vitamin and mineral pre-mix (CMV), and 26.5 mt of dicalcium phosphate. The volume has been growing ever since, reaching 201,046 mt of corn, 109,295 mt of soybean meal, and 485,537 mt of barley in 1988, a year of shortfall in production due to drought (Exhibit 2.3).

Exhibit 2.1
Production of Animal Feed: 1970-1987
(mt)

Year	Poultry	Ruminants	Total	Percent Poultry
1970	8,903	2,244	11,147	79.9%
1971	13,458	5,550	19,008	70.8%
1972	31,779	20,667	52,446	60.6%
1973	42,371	30,069	72,440	58.5%
1974	56,302	31,593	87,895	64.1%
1975	81,260	54,173	135,433	60.0%
1976	104,493	31,327	135,820	76.9%
1977	126,308	100,538	226,846	55.7%
1978	170,781	134,512	305,293	55.9%
1979	251,432	181,750	433,182	58.0%
1980	327,568	318,490	646,058	50.7%
1981	354,116	198,190	552,306	64.1%
1982	256,605	102,416	359,021	71.5%
1983	311,756	108,562	420,318	74.2%
1984	313,780	90,489	404,269	77.6%
1985	333,047	143,998	477,045	69.8%
1986	334,524	99,868	434,392	77.0%
1987	369,953	199,775	569,728	64.9%

Source: Direction Générale de Production Animale (DGPA)

Exhibit 2.2
Consumption of Feed Ingredients: 1970-1990
(mt)

Year	Barley	Soybean Meal	Sor-ghum	Trit-icale	Bran	Maize	Total
1970	1,240	2,050			1,200	5,400	4,490
1971	3,025	3,000			2,500	8,100	8,525
1972	5,853	7,010			4,500	13,000	17,363
1973	10,000	13,000			11,809	11,809	40,509
1975	20,000	10,700			15,612	49,000	46,312
1976	28,500	23,824			21,362	61,500	73,686
1977	30,000	37,000			27,830	99,000	94,830
1978	60,500	47,300			43,061	133,000	150,861
1979	49,500	60,000			41,061	175,000	150,561
1980	92,370	76,472				216,698	168,842
1981	164,570	96,685				278,855	261,255
1982	43,000	92,492				317,934	135,492
1983	22,600	71,485				214,944	94,085
1984	75,000	87,426				240,225	162,426
1985	49,894	86,691		4,000		212,825	143,585
1986	76,033	92,135		2,150		223,650	171,318
1987	48,200	92,300		11,750		213,800	152,250
1988	471,500	104,200		18,560		242,700	594,260
1989	248,500	114,200	38,900	8,944		248,400	410,544
1990*	130,000	117,000	50,000	300		270,000	487,800

*provisional as of Oct. 1990
Source: Office des Céréales

The large growth in demand has outstripped the growth in supply of locally produced raw materials going into the processing of blended feed (Exhibit 2.4). As a result, the industry has increasingly depended upon outside supply sources. Approximately 80 percent of feed ingredients are now imported.

Exhibit 2.3
Feed Ingredients Imports: 1970-1990
(mt)

Year	Maize	Barley	Soybean Meal	Sorghum	Total
1970			2,087		2,087
1971	9,830	2,985			12,815
1972	21,624		7,068		28,692
1973	34,568	35,000	13,596		83,164
1974	31,248	24,164	10,370		65,782
1975	55,321	18,272	24,585		98,178
1976	64,793		17,087		81,880
1977	114,859	61,778	45,842		222,479
1978	148,914	63,940	4,500		217,354
1979	178,961	123,845	59,770		362,576
1980	23,900	32,000	104,921		160,821
1981	270,000	58,000	87,000		415,000
1982	343,000		107,000		450,000
1983	220,000		56,000		276,000
1984	247,000	11,000	118,000		376,000
1985	222,320	20,774	70,000		313,094
1986	211,350	109,573	103,037		423,960
1987	190,471	22,000	64,036		276,507
1988	201,046	485,537	109,295		795,878
1989	251,095	169,169	110,456	60,600	591,320
1990*	270,000	125,673	110,000	70,000	575,673

Source: Office des Céréales as of Oct. 1990.

Exhibit 2.4
Locally Produced Feed Ingredients Used in Blended Feed
(mt)

Year	Barley	Triticale	Fish Meal	Bran	Beans	Total Supply
1970	1,240			1,200		2,440
1971	3,025			2,500		5,525
1972	5,853			4,500		10,353
1973				8,000	2,537	10,537
1974			141	11,809	1,735	13,685
1975			250	15,612	10,549	26,411
1976			225	21,362	754	22,341
1977				27,830	309	28,139
1978			280	43,830		44,110
1979				41,000		41,000
1980		282		71,330		71,612
1981		525		96,908		97,433
1982	138,250	2,138		82,832		223,220
1983	56,650	4,726		53,853		115,229
1984	15,000	8,302		64,725		88,027
1985	28,266	4,000		60,411		92,677
1986		3,150	534	71,568		75,252
1987	26,200	11,750	250	65,159		103,359
1988		18,560		85,457		104,017
1989	79,331	7,260		90,000*		176,591

Source: Office des Céréales
*Approximate figure

2.4 The Development of Local Products used in Feed

The share of locally produced barley that goes into blended feed remains small and inconsistent (Exhibit 2.4), representing only a slight proportion of national output. Most barley is consumed on small farms either as it is or in traditional feeds.

Other locally produced inputs into feed include bran, triticale, and fish meal. An average of roughly 15 percent of total bran production is used in feed processing and the rest is used as is. Production of triticale began timidly in 1980 with only 282 mt produced, rising to 26,782 mt in 1987. Its incorporation rate, however, remains low, having peaked at 18,560 mt in 1988 (Exhibit 2.4). Due to problems of quality of fish meal, its use in feed is highly irregular and weak, with only 534 mt utilized in 1986.

2.5 Structure of the Feedgrain Industry

Livestock feed manufacturing units have experienced fast growth in local demand due to the development of the poultry industry, subsidies granted to raw materials, and the policy of protecting livestock during shortages.

Up to 1972, the OC owned the only feed manufacturing units. The Bir Kassaa unit was set up in 1965 with a 4 ton/hour capacity, followed by the Sousse unit which had the same capacity. Subsequently, due to such incentives as cheap financing, subcontracting with lucrative profit margins, and tax advantages, state-owned, semi-private, and private feed plants began producing and selling feed, including the Medjerda Office, the Office of State Lands, the Office of Livestock and Grazing Land, and certain cooperatives.

In the late 1970s and early 1980s, deregulation resulted in a rise in the number of privately-owned units. The capacity of these units varies widely, from 1 to 160 mt/day, with varying degrees of automation. In 1988, one firm, Poulina, imported 34% of total imports of maize, soybean meal, and barley.

2.6 Evolution of Production Capacity

The number of feed mills grew from two in 1970 to 284 by 1990, with a total processing capacity of 1.8 million mt per year. (Exhibits 2.5 and 2.6). Of the 284 feed mills, 109 are operations integrated with livestock production, and 175 are solely industrial feed plants. Since annual feed production fluctuates around 500,000 mt/year, considerable over-capacity exists.

Exhibit 2.5
Number and Capacity of Tunisian Feed Plants

Year	No. of Units	Capacity mt/day	Feed Output mt/year
1965	1	40	2,165
1970	2	250	11,147
1975	11	372	87,895
1980	102	4,242	475,536
1985	192	5,897	402,740

Source: Office des Céréales

Exhibit 2.6
State and Private-Owned Feed Plants: June, 1990

Sector	No. of Units	Capacity mt/year	Percent of Total Capacity
Public	51	265,290	14%
Private	233	1,588,062	86%
Total	284	1,853,352	100%
Industrial	175	1,565,010	84%
Integrated	109	288,342	16%

Source: DGPA

2.7 Regional Distribution

The regional distribution of feed plants has been determined by many factors, including the following:

- Demand for feed and the concentration of various types of livestock, especially poultry and dairy farming.
- The existence of feed processing units in state-owned and partially state-owned livestock production enterprises.
- Investment capacity among private owners.

Exhibit 2.7 shows that 50 percent of the country's feed manufacturing capacity is located in the north, 29 percent in the south, and the remaining 21 percent in the center of the country. This distribution is consistent with the distribution of livestock, particularly poultry, the majority of which is located in the northeast close to high consumption urban areas. The south is the next most important region, due mainly to the demand for emergency sheep feed and the needs of certain dairy farmers on oases and small irrigated areas

Exhibit 2.7
Regional Distribution of Feed Plants: 1990

Region	No. of Units	Capacity mt/day	Percent of Total Capacity
North	128	3,571	50%
Center	52	1,514	21%
South	91	2,044	29%

Source: Office des Céréales

Analysis of regional distribution also shows that 10 regions, or gouvernorats (five in the north, three in the center, and two in the south), account for 69 percent of the units and 75 percent of the country's capacity. The 186 feed plants within these 10 gouvernorats have a daily capacity of 5,337 mt.

2.8 Utilization of Processing Capacity

The total production capacity of existing feed plants is 7,129 mt/day. However, 63 units have recently closed down, representing a loss of capacity of 1,437 mt/day, or 20 percent of the country's overall capacity. Fifty-three of these inoperative plants are privately owned and 10 are owned by the government.

2.9 Issues and Problems Facing the Industry Today

The following observations are based on interviews with government and industry experts, as well as tours of four feed plants with a range of sizes and levels of technology. The major problems facing the feed industry involve the supply of raw materials, the quality of both raw materials and finished products, manufacturing efficiency, and storage. These issues are described below with the exception of storage, which is discussed in Chapter 7.

2.9.1 Supply of Raw Materials

The supply of raw materials is limited in variety and volume, leaving little or no flexibility to formulate and create feeds from feed ingredients already in stock. Receiving feed ingredients at the port, storing them at both the port and the feed manufacturing locations, loading at the port (excessive time required), and transporting ingredients and final products, all create

severe problems and costs for Tunisian feed manufacturers. Feed manufacturers presently only have access to the following feed ingredients: maize, soybean meal, local or imported barley, and occasionally sorghum grain. This limited selection does not provide sufficient flexibility in feed formulation or opportunity for least-costing.

2.9.2 Quality of Raw Materials and Finished Products

Quality control begins with the purchasing function. Rigid specifications must be established and followed by suppliers. High quality animal feeds cannot be produced from inferior raw materials. The second step of quality control is to inspect the raw materials at the port and the manufacturing plant to determine whether the materials meet purchasing specifications. The inspection must include both physical and analytical processes. It is imperative that the feed formulaters and manufacturers know exactly what they are getting in order to provide balanced rations in their finished products.

The third step of quality control is in processing (grinding) to ascertain that the particle size of grains and other materials are reduced to achieve best mixing results and to reduce product separation/segregation in materials handling. Mixers must be tested to determine their ability to provide an adequate blend of the various ingredients. Pelleted products must be tested to determine their relative durability.

The final step of quality control is the inspection of finished products at the packaging or bulk load-out locations to ensure that they meet the company's product specifications.

Laboratory analyses should follow the physical (i.e. visual) inspections at every step to ensure that the raw materials and finished feeds meet all chemical and/or nutritional requirements.

Indications are that Tunisian government agencies, feed manufacturers, and feeders all but ignore these quality control checkpoints. The result is less efficient production of meat, milk, and eggs, and higher costs to producers and consumers. Following are some specific examples of quality problems:

Soybean meal. Protein values of soybean meal are often lower than the 44 percent specification; problems arise if the feed manufacturers do not compensate for a low incidence of protein in ration formulation, which may occur in many Tunisian feed plants. Low soybean meal proteins generally mean higher fiber in the meal than specified in the tender and lower levels of essential amino acids. Further, trypsin inhibitors are likely to be present, and either overcooked or undercooked soybean meal is a real possibility. Some protein destruction may also occur in the crushing process. All of these factors lead to poor animal performance.

Maize (corn/maïs). The user (feed manufacturer/feeder) cannot know if grade specifications have been met and maize is generally not inspected as it is received. Inspection is necessary, however, to determine if toxins (Aflatoxin, for example) are present in the grain, because they can seriously affect the growth and health of animals, especially young livestock and poultry.

Processing. Poor control of the particle size of ground grains, especially maize, was observed. Many whole kernels of corn were found in collected samples of finished feeds and even CMV. This causes poor mixing, product segregation, and selective eating, especially with automatic feeders.

Mixers were not being tested to determine appropriate mixing times or whether they would mix. This is a practice recommended to increase processing efficiency.

Problems were also found in the manufacture and usage of CMV. The vitamin and mineral pre-mix was poorly mixed, subject to severe segregation, and, in many cases, an unnecessary step in the feed compounding procedure.

It was unclear whether or how much amino acids were included in the CMV. Our analysis shows that current rations are deficient in methyanine, cystine, and lystine, unless these are in fact already included in the CMV. Rations deficient in amino acids lead to low feed conversion levels, and therefore may be an important and easily remedied constraint to improved efficiency.

Finished Product Quality Control. Little if any laboratory analysis was undertaken in the plants visited to determine the nutritional values of finished feeds (whether they were intended for commercial sales or for the feeding of owned animals). If a growing meat bird (broiler) requires 18 percent protein for best growth results, it should be fed 18 percent protein feeds. The observed rations and processing methods are not meeting required calcium/phosphorus ratios. Energy levels are lower than is required for best feed conversion or feed to gain ratios.

Feed Labelling. Feed labels, or guarantees, if they exist, are practically meaningless without quality controls at all levels - government, purchasing, receiving, processing, and finishing products. Failure to meet standards or guarantees leads to less efficient feeding, higher costs of end product production, higher prices to consumers, and possibly a much lower quality end product (meat, milk, and eggs).

2.9.3 Manufacturing Efficiency

Labor Efficiency. To improve labor efficiency in feed manufacturing, it is imperative that raw materials and finished feeds be handled in bulk rather than in bags. This conversion would put some Tunisian feed manufacturers on a par with their counterparts in other developing or developed countries. Handling bagged ingredients and/or feeds is the most labor intensive function of feed manufacturing.

Plant Efficiency. Plant efficiency (utilization of the facility) is a function of plant capacity versus plant production. Current feed production in Tunisia is approximately 20-30 percent of capacity of plants operation on an eight-hour day or approximately 10 percent on a 16-hour day basis, both of which are totally inefficient.

Production of feed can grow only at the rate of an increase in the number of animals or the demand for animal end products. This implies that growth, at

best, will be moderate to slow and Tunisian feed plants cannot in the foreseeable future increase feed production to anything near existing plant capacities. Therefore, the only feasible solution is to let marginal operators leave the industry or stay in it at their own financial peril. Subsidizing marginal operations can only prolong inefficiencies in the system to the ultimate detriment of both the overall economy and the consumer.

One solution to excessive operating costs and inefficiencies is vertical integration of all steps in the livestock and poultry industries, including breeding, hatcheries, grow-out, and the processing and marketing of end products. The poultry industry already has a high degree of vertical integration.

2.10 Feed Ingredient Prices

Current prices of feed ingredients, shown in Exhibit 2.8, are used in the cost of production estimates in Chapters 3 and 4 and the analysis of impact of subsidy removal in Chapters 5 and 6.

Exhibit 2.8
Feed Ingredient Prices: July, 1990

Feed Ingredients	Price Dinars/metric ton
Maize	158
Soybean Meal	255
Triticale	127
Sorghum	92
Barley	125
Wheat Bran	65
Bicalcium Phosphate	213
Calcium Carbonate	26
Salt	82

3. THE POULTRY SECTOR

3.1 Recent Development of the Poultry Sector

Chicken production increased rapidly from the late 1970s to 1982 when poultry output reached 67,000 metric tons (mt) live weight. Low feed prices encouraged production, and low chicken prices relative to other meats encouraged consumption. Production dropped to 50,000 mt in 1983 as a result of reduction in food subsidies and a doubling of the cost of feed ingredients. Since 1984 production has been increasing again at the rate of about 3.5 percent per year, reaching 63.5 thousand mt (26.2 million broilers) in 1989. It has not yet regained the level achieved in 1982.

Egg production also increased rapidly in the late 1970s and continued to increase steadily in the 1980s despite the 1982 feed price increase. The price of eggs rose 60 percent from 1981 to 1983, but consumption rose 21 percent during the same period, indicating price played a minor role in the determination of egg consumption.

Egg production increased 42 percent from 1980 to 1989, from 726 million to 1,029 million eggs. Average production was 1,033 million eggs in the five years since 1985, indicating the significant production growth occurred before 1985. The price of eggs increased 42 percent as well, during the period 1985 to 1988. Thus, in recent years price seems to be playing a more important role in determining demand for eggs.

Foreign trade is not significant for either poultry or eggs. Thus, consumption has been essentially equal to production of these products.

The farm-level value of poultry and eggs in 1988 is found in Exhibit 3.1.

Exhibit 3.1
Value of Chicken and Egg Production: 1988

Product	Production	Price	Value (millions of dinars)
Chicken	59,300 metric tons	1182 D/mt (live)	70.09
Eggs	1129.6 million eggs	.064 D/egg	72.29

3.2 Technical and Economic Characteristics of the Sector

Both broilers and eggs are produced using modern facilities and techniques. Production technology is world class and production units are sufficiently large to attain scale efficiencies. Feed conversion has been lower than desirable for both chicken and eggs. The energy level of feeds is inadequate to allow poultry to perform at their true genetic potential.

Marketing follows traditional patterns with about 75 percent of broilers transported and sold live by small retailers who may slaughter the birds on site. Eggs are not graded or sized except by eye. They are packed and transported on flats without refrigeration or any other obvious means to maintain quality. Small wholesalers distribute eggs to small retailers, usually the same ones who handle chicken. The high cost, small scale distribution system is a definite contrast to the relatively modern production system.

Poultry markets have been free of government control other than retail margin limits for eggs since 1974. Prices have been volatile and show a tendency to go through cycles, particularly for chicken. The Groupement Interprofessionnel des Produits Avicoles (G.I.P.A.) attempts to adjust supply to achieve a fair price for producers and consumers. These efforts have been more effective for eggs than for chicken, a difference attributed to the structure of the sub-sectors.

Large producers control an estimated 85 percent of egg production. The remaining 15 percent is controlled by medium and small producers, mostly holding flocks of 5,000-10,000. Much of the larger producer volume is on contract with farmers. The small number of large producers facilitates the coordination of production levels and storage, which is voluntary and less than perfect. An estimated 20 percent of egg production is integrated with pullet growing and feed preparation, 10 percent with pullet growing without feed milling, and 30 percent with feed milling only. The remaining 40 percent of producers are involved solely in egg production.

Chicken production is less concentrated with about 40 percent of production by producers characterized as large with flocks larger than 5,000 chickens (Exhibit 3.2). Only about 30 percent of chicken production is integrated with feed milling. Some independent producers do operate under an arrangement with a feed supplier who finances the feed and carries any losses forward on the grower's account. Under this arrangement the grower assumes all risk. The small growers are reportedly least able to survive low price (or high cost) periods. The fragmented structure of the chicken sub-sector and overcapacity limit the ability of G.I.P.A. to counter instability.

The data in Exhibit 3.2 are for 1986, and may not reflect the true current level of concentration in the industry, which appears to have become more concentrated in the last four years, according to knowledgeable sources.

Exhibit 3.2
Number of Poultry Producers by Size of Flocks: 1986

Type	<5000	5-10000	>10000	Total
Broilers	723	198	168	1089
Layers	77	50	112	239
Pullets	11	13	31	55
Breeders	2	1	11	14
Total	813	262	322	1397
% Capacity	50%	15%	35%	100%

Source: Ministry of Agriculture/ DGPDIA

The cost of production estimates for non-integrated units of broiler and egg production in Exhibits 3.3 and 3.4 illustrate the importance of feed cost to the poultry producer.

Exhibit 3.3
Cost of Production for Broiler Chickens: 1990

Cost Item	Millimes/Head	% of Total Cost
Day old chick	300	17%
Feed		
Starter (1 kg feed)	263	
Grow/Finish (3.5 kg feed)	900	66%
Other Variable Costs	211	12%
Total Variable Costs	1674	95%
Fixed Costs	90	5%
Other Costs	30	
Manure Credit	-40	
Total Cost/head	1754	100%
Cost/kg live (@1.8 kg)	974	

Source: Abt Associates

Exhibit 3.4
Cost of Production for Eggs: 1990

Cost Item	Millimes/layer	% of Total Cost
Started Pullet	3200	22%
Feed (45.6 kg)	10716	75%
Other Variable Costs	715	12%
Hen Sale	-750	
Total Variable Costs	13881	97%
Fixed Costs	470	3%
Total Cost/layer	14351	100%
Cost per egg (@240 eggs/layer)	60	

Source: Abt Associates [2]

The cost of production estimates are meant to be illustrative only, since production costs vary considerably from one operation to another[3]. However, it is apparent that the cost of feed is a significant proportion of total broiler and egg production costs. For broilers, feed constitutes 66 percent of total costs, and eggs, 75 percent, a figure that becomes 85 percent when half of the pullet cost of 3,200 millimes is attributed to feed costs.

3.3 Issues and Problems Facing the Sector

A limited variety of low quality ingredients are available to poultry producers, which prevents the achievement of the full genetic capability of the birds. Feed conversion, which is also affected by high temperatures, is below commonly accepted standards. Feed conversion by meat birds is reported at 2.5 kg feed per kg live weight, 25 percent over that of U.S. or European operations (i.e. the lower the feed conversion ratio, the better). Feed conversion in layer operations is 190 grams of feed per egg, or about 30 percent higher than it

[2] There are two accepted ways of calculating the cost of production of eggs: 1) in the manner presented here, and 2) by considering the sale of spent hens along with the sale of eggs as a revenue, and allocating all costs to the two sources of revenue. If one took the latter approach, the total cost per egg would be the same as shown above.

[3] Feed costs are found in Exhibit 5.11 and prices of feed ingredients in Exhibit 2.8.

should be.

The distribution system is high cost in terms of both dinars and quality. If consumers prefer to purchase live birds despite the added cost, we are in no position to suggest that they are wrong. On the other hand, if this system is needed to ensure quality that could be achieved through a system of grading, inspection, and control of conditions in marketing at lower cost, this alternative should be examined. It is difficult to imagine that consumers would choose stale, randomly sized, dirty eggs over the alternative of fresh, graded, attractively packed eggs that the production system could deliver.

Cyclical prices for chicken present problems for producers and consumers alike. The tendency to overproduce is exacerbated by the presence of excess capacity at both the feed manufacturing and farm production levels. Unfortunately, the tendency to cycle is inherent in a competitive market in which production can be changed easily but only after a time lag. Better information on producer plans and market conditions as well as education and analysis may ameliorate the tendency somewhat.

The poultry sector is particularly vulnerable to interruptions in the supply of imported feedstuffs. Even one day without feed would seriously diminish a poultry flock's potential. Other species are less dependent on prepared feed and can be fed other material for short periods without a large loss of efficiency.

4. DESCRIPTION OF LIVESTOCK SYSTEMS

4.1 Introduction

The average gross annual value of agricultural production in Tunisia is around 860 million dinars. The livestock sector contributes approximately 250 million dinars or 30 percent of gross, of which beef (21% of livestock value) and dairy production (18%) earn 97 million dinars per year. The value of sheep production is 77 million dinars (31% of livestock value), the poultry industry earns 57 million (23%), and the value of goat production is 11 million dinars (4%).

In 1986, approximately 230,000 people were involved in livestock production in Tunisia, of which 40 percent were associated with small farms of less than 5 hectares (Exhibit 4.1). Another 43% were on farms of between 5 and 20 ha. Over 600,000 head of cattle and over 5 million sheep were found throughout Tunisia in 1986. Farm families who own less than 20 ha of land raise 67% of beef and dairy cattle and 52% of sheep.

Exhibit 4.1
Distribution of Livestock by Farm Size: 1986

Farm Size (ha)	Number of Persons	%	Total No. of Cattle	%	Of which: Cows	Total No. of Sheep	%	Of which: Ewes
0-5	92,056	40	178,248	29	92,756	850,866	16	499,046
5-10	52,279	23	131,398	21	68,983	735,234	14	417,072
10-20	46,652	20	105,737	17	57,262	1,211,255	22	714,107
20-50	28,831	13	80,292	13	40,869	1,188,573	22	703,182
50-100	6,559	3	33,393	5	16,464	564,003	10	352,221
>100	3,533	2	95,222	15	57,636	859,139	16	469,902
Total	229,910	100	624,290	100	333,970	5,409,070	100	3,182,530

Source: Ministry of Agriculture, DPGDIA

Domestic production accounts for about three-quarters of total domestic availability of beef, and close to all domestic availability of mutton and poultry. Milk imports are the most important livestock import, needed to satisfy over half of consumption demand. Imports of red meat and milk powder have increased in recent years as demand grows more rapidly than output.

4.2 Dairy Production

The 1988 livestock survey estimated 347,000 dairy cows of which 92,000 (26 percent) are purebred (Pie Noire, Holstein, and Brown Swiss). The remainder are

either crossbred or indigeneously bred. Most of the latter are considerably less productive than the purebreds.

The majority of cattle are raised in small herds of five to six cows. Forty-seven percent are raised by producers who own no land or only a small parcel of land, usually less than 10 ha. A group of small to medium-sized farms raise purebred and high quality crossbred cows. Finally, the larger units with 200 to over 1,000 cows are the smallest group numerically but provide most of the milk processed by commercial dairy plants.

Bovine production systems are distinguished by their relative degree of integration with other agricultural activities (i.e. the low degree of reliance on purchased animal feed as opposed to the on-farm production of forage crops or the use of agricultural residues as feeds). Three systems are considered here: integrated, semi-integrated, and landless.

4.2.1 Integrated Bovine Production

In integrated operations, animal feed is produced at the same location. Hay, straw, and silage are produced on the farm, while a feed supplement is purchased. In this type of system, the size of herds varies from 20 to 200 or more cows according to the type of farm. State-owned farms run by l'Office des Terres Domaniales, cooperative units in northern Tunisia, and certain medium to large sized private farms are all integrated operations.

In general, these farms are in the north where the higher level of average annual rainfall (400-500 mm/year) permits the production of forage crops. The availability of irrigation water also permits the production of two crops of hay, one in spring and one in summer. Both dairy and beef cattle are raised in such integrated operations.

Use of Concentrated Feed and Cost of Production. Daily and yearly feed rations for integrated dairy operations are shown in Exhibits 4.2 and 4.3.

Straw, hay, silage and concentrated feed are the principal components of the diet. The cost of feed and total cost of production estimates for integrated dairy operations are shown in Exhibit 4.4. Concentrated feed represents around 50 percent of feed costs, and approximately 35 percent of total production costs for this production system.

Exhibit 4.2
Daily Feed Rations: Integrated Dairy Operations
(kg/cow/year)

Type of Feed	Level of Milk Production: kg/year			
	3500	4000	4500	5000
Hay	4	4	4	4
Straw	35	37	10	10
Silage	-	-	32	35
Concentrate	4.5	5	5.8	6.1
Daily Requirements UFL	9.2	9.8	11.4	12.3

Exhibit 4.3
Yearly Feed Rations: Integrated Dairy Operations
(mt/cow/year)

Type of Feed	Level of Milk Production: kg/year			
	3500	4000	4500	5000
Hay	1.5	1.5	1.5	1.5
Straw	12.8	13.5	3.7	3.7
Silage	-	-	11.7	12.8
Concentrate	1.6	1.8	2.2	2.3

Source: Abt Associates

Exhibit 4.4
Cost of Production of Milk: Integrated Dairy Operations: 1990

(Dinars/cow)

Cost Item	Level of Milk Production (kg/year)			
	3500	4000	5000	6000
Feed Costs[4]				
Hay @ 102.5 D/mt	153.75	153.75	153.75	153.75
Straw @ 13.5 D/mt	172.80	182.25	49.95	49.95
Silage @ 18.5 D/mt	-	-	216.45	236.80
Concentrate @ 185 D/mt	305.25	388.55	407.00	425.50
Total Feed Costs	631.80	674.55	827.15	866.00
Other Variable Costs	308.00	308.00	364.00	364.00
Miscellaneous Costs (5%)	47.40	49.57	60.10	62.07
Veal Credit	-120.00	-120.00	-120.00	-120.00
Total Cost of Production	867.20	912.12	1131.25	1172.07
Cost of Production per liter of milk: millimes/kg	247.77	228.03	226.25	195.35
Concentrate Cost as % of Total	35%	37%	36%	36%

Source: Abt Associates

4.2.2 Semi-Integrated Systems

Semi-integrated systems are generally family-run operations with herds that vary in size but average around five cows per enterprise. These herds are often located on the irrigated perimeters of lots averaging 5 ha in size generally located near the large cities where there is a large demand for fresh milk.

In such an enterprise, straw is produced and hay and feed supplements are purchased. The other type of (traditional) feed used consists of a mix of bran and barley for milk production, or beans and barley for short-term fattening of beef. By-products from vegetable gardens are also used as feed.

Feed Use and Cost of Production. Daily feed rations for semi-integrated/family dairy operations are shown in Exhibits 4.5 and 4.6. Feed rations for family operations consist of both purchased commercial

[4] Cost of production of forage crops is found in Appendix A.

Exhibit 4.5
Daily Feed Rations: Semi-Integrated/Family Dairy Operations
(kg/cow/year)

Type of Feed	Level of Milk Production: kg/yr	
	3500	4000
Hay	4	4
Straw	35	40
Concentrate Produced On-Farm & Purchased	5.1	5.2

Exhibit 4.6
Yearly Feed Rations: Semi-Integrated/Family Dairy Operations
(mt/cow/year)

Type of Feed	Level of Milk Production: kg/yr	
	3500	4000
Hay	1.5	1.5
Straw	12.8	14.6
Concentrate Produced On-Farm & Purchased	1.86	

Source: Abt Associates

concentrated feed and traditional feed mixed on the farm. Cost of feed and total cost of production estimates for family dairy enterprises are given in Exhibit 4.7. The cost of concentrated feed represents around 40 percent of feed costs, and approximately 24 percent of total production costs for this production system.

Exhibit 4.7
Cost of Production of Milk: 1990
Semi-Integrated Dairy Operations
(Dinars/cow)

Cost Item	Level of Milk Production: kg/yr	
	3500	4000
Feed Costs		
Hay @ 150 D/mt	225.00	225.00
Straw @ 13.5 D/mt	172.80	197.10
Concentrate @ 139.5 D/mt	259.47	256.05
Total Feed Costs	657.27	678.15
Other Variable Costs	382.70	382.70
Miscellaneous Costs (3%)	31.19	32.09
Veal Credit	-100.00	-100.00
Total Cost of Production	971.16	1001.94
Cost of Production per liter of milk: millimes/kg	266.00	250.50
Concentrate Cost as % of Total	27%	25%

Source: Abt Associates

4.2.3 Beef Feed and Production Costs

The cost of production for fattening of young bulls is presented in Exhibit 4.8. Estimated cost of production for local breeds of young bulls as well as milk breeds are shown. Two types of diets are assumed: one based on silage and the other based on hay. Again, cost of production data can vary considerably depending on the size of operation as well as many other factors, and are presented here to illustrate the approximate incidence of feed costs in total costs. As can be seen in Exhibit 4.8, concentrated feed makes up only 7 to 12 percent of total production costs.

4.2.4 Landless Livestock Systems

Livestock producers who own no land purchase all their animal feed. In general, this type of system is found outside of large cities and makes heavy use of by-products from market gardening and agro-industry. Information regarding use of feed and cost of production is difficult to obtain and was not found for these types of producers.

Exhibit 4.8
Cost of Production: Beef (Fattening of Young Bulls): 1990

(Dinars/Bull)

Assumptions and Cost Items	Local Breeds		Dairy Breeds	
	Silage-based diet	Hay-based diet	Silage-based diet	Hay-based diet
Assumptions:				
Initial weight:live kg.	200	200	280	280
Final weight:live kg.	327	327	430	430
Fattening cycle:days	176	176	167	167
G.M.Q:grams	720	720	900	900
Carcass yield:percent	54	54	54	54
Carcass weight:kg	176	176	232	232
Feed Costs				
Silage @ 18 D/mt	85.54	-	96.19	-
Hay @ 100 D/mt	7.50	140.80	9.00	167.00
Concentrate @ 170 D/mt	59.50	74.80	56.78	70.97
Total Feed Costs	152.54	215.60	161.97	237.97
Other Costs	427.02	430.76	649.09	653.63
Total Production Costs	579.56	646.36	811.06	891.60
Percent Concentrated Feed of Total Costs	10%	12%	7%	8%
Cost of Production per kg live (@ 327 kgs local; & 430 kgs dairy)	1.77	1.98	1.89	2.07
Cost of Production per kg carcass	3.27	3.65	3.48	3.83

Source: Abt Associates

4.3 Sheep Production Systems

The majority of sheep are raised for meat production. In 1988, the number of ewes found in Tunisia was estimated to be over 3 million. The majority are local breeds (barbarine) which are very well-adapted to the varying climatic conditions found in both the north and the south.

4.3.1 Sheep Production in the North

Cereal production is integrated with sheep production in the north, and the animals feed on stubble and fields left fallow, as well as by-products of barley and other crops including alfalfa. Herds typically have around 220 ewes.

This type of system is semi-intensive, using purchased feed supplements at particular points in the growing cycle: the protection of the herd against pests (May), and the preparation for birthing (end of September).

Some farms which have better opportunities for growing forage produce young lambs which are marketed at between 25 and 30 kilograms in late November and during December.

4.3.2 Sheep Production in the Center and South

Small herds of sheep and goats are grazed on ranges, and also fed by-products of vegetables, alfalfa, and oasis products in the center and the south. Some livestock in these regions are moved seasonally to find pasture, farther north in drought periods, for example. Most herds are now given some simple feeds of bran, barley and hay.

5. IMPACT ANALYSIS OF SUBSIDY REMOVAL AND TRADE LIBERALIZATION

5.1 Introduction

The impacts of trade liberalization and removal of subsidies on animal feed ingredients are estimated using a variety of economic analysis tools and estimation techniques. The basic aim is to determine the impact of subsidy removal and trade liberalization on the cost of producing the various animal feeds and to translate that higher cost into changes in the cost of producing meat, milk, and eggs. Of course, one ultimate objective of this type of impact analysis is the elusive estimation of incidence of subsidy removal and trade liberalization on various producer and consumer groups (e.g. by region and income class). This type of incidence analysis requires far more data and analysis than was possible in this limited study. However, we will discuss the question of incidence by drawing upon secondary data and economic theory to infer the incidence of animal feed ingredient subsidy removal and trade liberalization on the Tunisian economy.

The second major objective of most impact studies of this type is to evaluate changes in economic efficiency that might result from the policy changes. In this case, changes may be introduced in the production of blended feeds and feed concentrates and ultimately in the production of animal products. Economic theory generally tells us that market price signals lead to an efficient allocation of resources and that market distortions such as subsidies and trade barriers result in a less overall economic efficiency.

In addition to the direct impacts on economic efficiency and equity, changes may occur in the incentive structure, leading to more efficient use of a country's resources. For example, higher imported feed grain prices may give farmers an incentive to become more efficient in barley production.

Clearly, a small study such as this cannot produce definitive estimates of impacts in each of these dimensions. Nonetheless, we will attempt to cover each of these areas in our discussion of the impacts of subsidy removal and trade liberalization.

The impact analysis is divided into three parts. This chapter describes the approach used in the analysis and a validates the quantitative tools to be used. Chapter 6 discusses the impacts of subsidy removal and considers some alternatives to implementing the change. Chapter 7 examines the issues and impacts associated with trade liberalization in animal feed ingredients, explores the linkages between the two policy changes, and discusses implementation alternatives.

5.2 Animal Feed Rations

Under current procedures in Tunisia, the Government specifies both the nutritional qualities and the ingredient composition of animal feed rations. That is, the Government specifies both the minimum levels of energy, protein, etc., and the percentage of ingredients such as maize and soybean meal. In practice, however, there is very little control over either. Government regulations specify the quality and composition of the blended feeds, but neither

regulation is well enforced.

This section concentrates on poultry rations since most of the subsidy applies to poultry feeds whose ingredients are generally imported. The current composition of poultry rations is provided in Exhibit 5.1, which makes clear that the broiler rations consist entirely of maize, soybean meal, and the vitamin-mineral supplement (CMV). The layer rations have some bran and additional calcium but no other ingredients. Hence, the current rations use a very limited range of mostly imported feed ingredients.

Exhibit 5.1
Government Prescribed Poultry Rations
(percent)

Raw Materials	Starter	Broiler	Pullet	Layer
Maize	60.5	59.6	68.0	65.0
Soybean meal	35.5	35.4	16.5	13.5
Bran			10.5	11.0
$CaCO_3$				5.5
CMV	4.0	5.0	5.0	5.0
Total	100.0	100.0	100.0	100.0

Each poultry ration has several possible standards providing various combinations of energy and protein levels. The ratio between energy and protein levels is critically important. Exhibit 5.2 contains one such standard for each ration type.

Exhibit 5.3 contains the actual nutritional values calculated from the prescribed rations in Exhibit 5.1. Exhibit 5.3 assumes the feed ingredients meet accepted international norms for quality and nutrient contents. Exhibit 5.4 contains the same calculations but assumes that the soybean meal is of inferior quality. Countless sources in both the public and private sectors told the study team that the soybean meal received in Tunisia is normally substantially below accepted quality standards. We were told that the actual protein percentage is usually 39-40 percent instead of 44 percent and that the fiber content is higher than accepted standards. The results in Exhibit 5.4 assume 40 percent instead of 44 percent protein, and 10 percent instead of 7 percent fiber.

Several important points can be drawn from the comparisons between the standards in Exhibit 5.2 and the calculations based on the recommended rations, which are shown in Exhibits 5.3 and 5.4. First, the rations are in every case low in energy, sometimes considerably lower than accepted standards, which results in lower feed conversion efficiencies. Second, for the broiler starter and finish rations, the protein levels using international standards are considerably higher than needed in the diets. (Compare the protein levels in Exhibits 5.3 and 5.2) On the other hand, the protein levels assuming the reduced

Exhibit 5.2
Nutritional Requirements for Poultry Rations

Item	Starter	Broiler	Pullet (8-20 weeks)	Layer
Min Energy (kc/kg)	2900	2900	2800	3000
Min Protein (%)	19	17	14	16
Max Fiber (%)	5	5	10	5

Exhibit 5.3
Nutritional Values of Prescribed Rations
(International standards)

Item	Starter	Broiler	Pullet (8-20 weeks)	Layer
Energy (kc/kg)	2795	2763	2790	2632
Protein (%)	21.07	20.94	14.96	13.44
Fiber (%)	4.00	3.97	3.91	3.67

Exhibit 5.4
Nutritional Values of Prescribed Rations
(Reduced quality soybean meal)

Item	Starter	Broiler	Pullet (8-20 weeks)	Layer
Energy (kc/kg)	2795	2763	2790	2632
Protein (%)	19.65	19.52	14.30	12.90
Fiber (%)	5.06	5.03	4.40	4.08

Source: Abt Associates

quality of soybean meal are closer to the recommended levels. One can speculate that the recommendations have taken into consideration the fact that the quality of soybean meal is less than international standards and that the rations have been formulated on that basis. Third, the layer rations are low in both protein and energy. These deficiencies would result in considerably reduced feed conversion efficiency and lower egg production.

5.3 Ration Optimization

Animal feed rations are formulated using a technique called linear programming (LP), which optimizes (minimizes or maximizes) an objective function subject to a set of constraints. In animal feed LP models, the objective is to minimize cost of the feed ration subject to requirements (constraints) that the ration meet certain nutritional values for energy, protein, fiber, amino acids, and minerals. Hence, the resulting ration is the combination of feed ingredients that meets the nutritional requirements (in the constraint set) at the lowest possible cost. Mathematically, the LP feed ration problem may be represented as follows:

$$Min \sum_{i=1}^{n} p_i x_i$$

$$Subj\ to \sum_{j=1}^{n} a_{ij} x_i \geq b_j \quad j = 1, \ldots, m$$

$$x_i \geq 0 \quad i = 1, \ldots, n$$

where p_i are the prices of the n feed ingredients x_i, a_{ij} are the nutritional contents of each feed ingredient, and b_j are the nutritional requirements (energy, protein, etc.) associated with the m constraints. The constraints can be greater than (≥), less than (≤), or equality (=) constraints. For example, the energy and protein constraints are ≥, meaning that the ration must have at least the stipulated energy and protein content, whereas the fiber constraint is ≤ indicating that the ration fiber content cannot exceed the stipulated level.

Feed ration models can be quite complicated involving many feed ingredients and constraints for all the important amino acids, vitamins, and minerals as well as energy, protein, and fiber levels discussed above. A model also often has both minimum and maximum constraint levels for certain nutrients. Fortunately, the Tunisia models for this study can be much simpler because all the vitamins and minerals are included in the premix. Hence, the poultry ration models for this analysis need include only constraints for energy, protein, and fiber.

5.3.1 Ration Model Results

LP feed ration models were developed for each poultry feed depicted in Exhibit 5.2. The results indicated again that the desired energy levels from Exhibit 5.2 generally cannot be obtained from the feed ingredients currently

being used in Tunisia. Sensitivity analysis was done to determine what energy levels could be achieved. The results of the ration optimization using international standards for soybean meal and the other ingredients are presented in Exhibit 5.5. Results assuming inferior quality soybean meal are presented in Exhibit 5.6. Feed ingredients included in the models are maize, soybean meal, barley, wheat bran, calcium carbonate ($CaCO_3$), and CMV. Wheat bran and barley were selected only for the pullet ration, which demands lower energy and protein levels than the other rations. With optimized rations, the energy constraints were met for the broiler and pullet rations but not for the starter and layer rations using standard quality. With inferior quality soybean meal, the energy requirement was met for only the pullet ration. These rations were formulated by successively lowering the energy requirement until the solution became feasible.

Exhibit 5.5
Optimal Poultry Feed Rations

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	29.6	24.1	14.2	21.3
Maize (%)	66.4	70.9	62.8	68.2
Barley (%)	0	0	12.0	0
Wheat bran (%)	0	0	6.0	0
$CaCO_3$ (%)	0	0	0	5.5
CMV (%)	4.0	5.0	5.0	5.0
Ration cost (D/mt)	206	201	180	181
Energy (kc/kg)	2868	2902	2800	2752
Protein (%)	19.0	17.0	14.0	15.5
Fiber (%)	3.7	3.5	3.8	3.2

Source: Abt Associates

In comparing the two sets of optimized rations, the most obvious difference is that the rations with inferior quality soybean meal need more meal to meet the protein requirements stipulated for each ration. Because the rations contain more soybean meal, they must contain less maize. Because the rations contain less maize, the energy levels are lower. Because the lower quality soybean meal is higher in fiber and more of it is used, the resulting rations are higher in fiber. Also, because soybean meal is more expensive than maize, the rations with lower quality soybean meal are more expensive.[5]

[5] The ration costs reported in Exhibits 5.5 and 5.6 are feed ingredient costs only and do not include cost of labor, sacking, transport, storage, etc.

Exhibit 5.6
Optimal Poultry Feed Rations with Lower Quality Soybean Meal

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	33.4	27.3	16.3	24.0
Maize (%)	62.6	67.7	61.7	65.5
Barley (%)	0	0	12.0	0
Wheat bran (%)	0	0	5.0	0
$CaCO_3$ (%)	0	0	0	5.5
CMV (%)	4.0	5.0	5.0	5.0
Ration cost (D/mt)	210	204	183	183
Energy (kc/kg)	2821	2863	2800	2718
Protein (%)	19.0	17.0	14.0	15.5
Fiber (%)	4.9	4.4	4.3	4.0

Source: Abt Associates

5.3.2 Comparison of Model Results with G.I.P.A. Rations

It is interesting to compare the optimized rations with the rations provided by G.I.P.A. (Exhibit 5.7). A comparison of the results in Exhibit 5.6 with the figures in Exhibit 5.7 reveals a very close correspondence between the model's optimal rations assuming inferior quality soybean meal and the rations supplied by G.I.P.A. In only one case do maize and soybean meal differ by more than 1 percent.[6] This very close correspondence indicates that in fact the G.I.P.A. rations are essentially optimal, given the limited range of ingredients available and the inferior quality of the soybean meal.

The ration cost figures in Exhibit 5.7, like those in Exhibits 5.5 and 5.6, reflect only the feed ingredient costs. G.I.P.A. estimates other costs at 52-55 D/mt or 25-29 percent of the feed ingredient costs. The cost figures differ slightly from those in Exhibit 5.6 primarily because we used different prices for CMV. We obtained CMV values from Provital for this analysis.[7]

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[6]For the pullet ration, G.I.P.A. used more wheat bran than the model, and the model used barley up to the maximum constraint of 12 percent. The percentage for maize is lower in the model ration than in the G.I.P.A. ration because the model substituted barley to meet some of the energy need.

[7] The CMV costs are 637, 540, 507, and 344 D/mt for starter, broiler, pullet, and layer rations. The corresponding G.I.P.A. CMV values are 850, 560, 500, and 340 D/mt. Hence, the main difference is in the starter ration CMV.

Exhibit 5.7
G.I.P.A. Poultry Feed Rations

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	33.0	27.0	16.5	24.0
Maize (%)	62.0	68.0	68.0	65.0
Wheat bran (%)	0	0	10.5	0
$CaCO_3$ (%)	0	0	0	6.0
CMV (%)	5.0	5.0	5.0	5.0
Ration cost (D/mt)	225	204	181	183

Source: Groupement Interprofessionnel des Produits Avicoles

5.4 Direct Impacts of Subsidy Removal

In this section we calculate the direct impact of subsidy removal using several sets of alternative assumptions. The section begins by describing actual subsidy levels. Next, the change in cost of the optimal rations depicted above are calculated. Then new optimal rations are created assuming a wider variety of input feed ingredients become available. Finally, the impact of subsidy removal assuming the wider ingredient availability is calculated.

5.4.1 Feed Ingredient Subsidies

In 1989, feed grain subsidies cost the government 50 million dinars,[8] representing 13.% of CGC (Caisse Générales de Compensation) expenditures. (Redjeb, M. and M. Lahouel, "Etude sur la Caisse Générales de Compensation" APIP, July 1990.) Around one half of total subsidies paid out by CGC go to durum wheat products and bread (171 million dinars in 1989).

The amount of the subsidy in a given year is a residual determined by the difference between the actual cost of the feed ingredients to the OC (prix de revient) and the price the OC charges the feed blenders (prix de retrocession), which the Government sets. The cost to the OC includes the c.i.f. import price, the various import/customs taxes, a value-added tax (for soybean meal only), and a margin to cover handling costs.

The Government does not determine the price the farmer pays for blended feed, although it does set an allowable profit margin for the feed industry of 15 percent over costs. The industry claims that competition currently keeps the realized margin down at 6 percent or less.

The actual level of the subsidy has varied considerably and has been

[8]The Tunisian dinar was worth $1.11 in early 1989.

negative in some years, as can be seen in Exhibit 5.8. From 1985 through 1987, subsidy levels were very low for soybean meal and negative for maize and barley. This implies maize and barley were taxed rather than subsidized, since the "prix de retrocession" at which the OC sold the grains was actually higher than the equivalent import (c.i.f.) price.

The subsidy level increased substantially in 1988 and 1989, particularly for soybean meal. In 1989, the subsidy on soybean meal was 55 percent of the c.i.f. price. If the various government taxes are not included in this calculation(since they are only a transfer payment within the government), the subsidy level is lower.[9] Soybean meal was purchased abroad by the OC at 274 dinars/metric ton (D/mt), their costs were 14 D/mt, and they sold it for 204 D/mt. This implies a subsidy (ignoring taxes) of 84 D/mt, or 30 percent of the import price. The feed industry has argued that if these import (and TVA) taxes were decreased, the amount of the subsidy (from the Caisse Générale de Compensation) would decrease substantially.

The 17 percent import duty on barley was dropped in 1989 (as the drought of 1988 continued into 1989 and imports of barley sharply increased), and the subsidy level reached 49 D/mt or 36 percent of the import price. The maize subsidy was 45 D/mt or 32 percent of the c.i.f. price (13 percent if the import duty is ignored).

Subsidy levels were slightly lower in 1990, at 38 D/mt for maize, 31 D/mt for barley, and 65 D/mt for soybean meal. These figures were provided by UTICA, not OC. For soybean meal, if subsidies were eliminated, the cost of soybean meal to the feed blender would increase from 255 to 294 D/mt, or 13 percent[10].

The case of barley subsidies is complicated by the fact that unlike maize and soybeans, a substantial amount of barley is produced domestically. At first, the Government maintained a low barley price for the benefit of the feed industry, which discouraged local production of barley. Then a higher price for domestically produced barley was introduced by the interministerial price commission to encourage increased barley production. As a result, producers delivering their barley to the OC received 155 D/mt in 1990, and then were able to buy it back from the feed blenders for around 120 D/mt. At the same time, apparently only 15-20 percent of domestic barley production enters the official marketing chain, so most barley handled by the OC is imported.

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[9] The import duties and TVA taxes are paid to customs when the feed ingredients are imported and thus become part of government revenues. The subsidy comes out of the Caisse Generale de Compensation (a subsidy fund).

[10] This calculation assumes that the import duty and TVA decrease from a cumulative rate of 23% in 1989 to 17% at present, and the import price of soybean meal is 241 D/mt (derived by adjusting the 1990 average 4-month Rotterdam price for soybean meal).

Exhibit 5.8

CALCULATION OF LEVEL OF FEED SUBSIDIES

dinars/metric ton

	(1) Purchase Price	+	(2) Import Duty	+	(3) TVA tax	+	(4) TFD	+	(5) RC	+	(6) TC	+	(7) OC Margin	=	(8) Prix de Revient	-	(9) Prix de Retro-cession	=	Subsidy
I. Maize																			
1985	110.57		7.19		0.00		5.53		0.17		1.65		5.53		130.63		103.31		27.32
1986	83.28		5.41		0.00		4.16		0.16		1.24		4.16		98.42		127.50		-29.08
1987	76.38		7.64		0.00		3.82		0.23		1.14		3.82		93.02		127.50		-34.48
1988	93.41		15.88		0.00		0.00		0.24		1.40		4.67		115.60		127.50		-11.90
1989	139.08		23.64		0.00		0.00		0.35		2.08		6.95		172.11		127.50		44.61
1990*																	158.10		38.00
II. Barley																			
1985	109.32		8.20		0.00		5.47		0.16		1.63		5.47		130.24		104.89		25.35
1986	64.44		4.83		0.00		3.22		0.10		0.96		3.22		76.77		107.40		-30.63
1987	55.41		5.54		0.00		2.77		0.08		0.83		2.77		67.40		107.40		-40.00
1988	99.10		16.85		0.00		0.00		0.25		1.48		4.95		122.63		95.00		27.63
1989	135.14		0.00		0.00		0.00		0.00		2.02		6.76		143.91		95.00		48.91
1990*																	125.00		31.00
III. Soybean Meal																			
1985	133.60		8.68		12.95		6.68		0.20		2.00		6.68		170.79		183.50		-12.71
1986	154.91		10.07		15.00		7.75		0.23		2.32		7.75		198.02		193.75		4.27
1987	166.68		16.67		16.65		8.33		0.25		2.50		8.33		219.41		204.00		15.41
1988	257.42		43.76		15.45		0.00		0.89		3.86		12.87		334.25		204.00		130.25
1989	274.07		46.59		16.44		0.00		0.95		4.11		13.70		355.87		204.00		151.87
1990*	241.00																255.00		65.00

(1) c.i.f. price paid by OC for imported feed ingredients
(2) droit de douane
(3) value-added tax
(4) tax pour formalite douaniere
* subsidy level as of June, 1990 (Source: A. Chaouch, UTICA)
Source: Office des Cereales

(5) redevance compensatoire
(6) tax compensatoire
(7) margin to cover costs incurred by OC - handling, etc. costs
(8) Prix de revient = actual cost to OC
(9) Prix de retrocession = price feed millers pay (set by interministerial commission)

5.4.2 Impact of Subsidy Removal on Existing Rations

The ration costs presented above included only the feed ingredient costs. Exhibit 5.9 contains the structure for the remainder of the feed mixing costs using the data for the optimal feed rations without subsidies. This cost structure is adapted from information provided by G.I.P.A. The non-feed ingredient costs generally represent about 21-24 percent of total feed costs.

Ration costs with subsidies removed are presented in Exhibit 5.10. These results assume continued use of current feed ingredients. The no-subsidy rations are re-optimized for the higher prices, but the resulting rations do not change because of the limited range of feed ingredients available. Subsidy levels of 38, 31, and 65 D/mt are assumed for maize, barley, and soybean meal, respectively. Of course, the actual subsidy levels are a function of the world market price for these ingredients. The rations without subsidy generally cost about 19 percent more than those with subsidies (Exhibit 5.11).

5.4.3 Poultry Rations with More Feed Ingredients

As indicated above, a major problem in Tunisian poultry rations is that the limited variety of ingredients available means that the current rations do not meet the nutritional requirements, especially for energy. This deficiency is especially acute due to imports of the lower quality soybean meal. To test the quantitative importance of the limitation on feed ingredients, the basic rations depicted in Exhibit 5.2 are reformulated using a wider variety of feed ingredients. The presumption is that with trade liberalization, the private sector would be free to import whatever ingredients were needed to produce the best poultry rations. Clearly, this study cannot consider all possible feed ingredient imports. For this analysis, the models include maize, soybean meal, wheat bran, barley, $CaCO_3$, and CMV, in addition to animal fat, soybean oil, tapioca, and fish meal. These additional ingredients are sufficient to test the importance of a greater diversity of ingredients. The results of this analysis are presented in Exhibit 5.11 for the case with subsidies and in Exhibit 5.12 for the no subsidy case.

The rations for the case with subsidies retained (Exhibit 5.11) are very similar to the optimal poultry rations found in Exhibit 5.5. In fact, the broiler and pullet rations are identical. The major difference is that the availability of soybean oil or animal fat enabled the model to meet the nutritional requirements for energy for all four rations. Previously, the energy requirements were not met for the starter or layer rations. Since fat is more expensive than corn or soybean meal, the starter and layer rations are more expensive than in the base case. However, the rations now meet the nutritional needs of the poultry, so the increased productivity should more than offset the increased cost of the rations.

While there are few differences in the subsidy retained case presented in Exhibit 5.11, there are marked differences in the rations when subsidies are removed, as can be seen in Exhibit 5.12. The subsidy case differs little because with subsidized maize, soybean meal, and barley, it is most profitable (least cost) to continue to use the subsidized ingredients. Hence, the only significant

Exhibit 5.9
Cost Structure of Poultry Feeds Without Subsidy

Item	Starter	Broiler	Pullet	Layer
Soybean meal	9472	7712	4544	6816
Maize	13021	13903	12315	13374
Barley			1872	
Wheat bran			390	
$CaCO_3$				141
CMV	2548	2700	2535	1720
Ingredient cost	25041	24315	21656	22051
Blending cost	1700	1700	1700	1700
Sacking	950	950	950	950
Subtotal	27691	26965	24306	24701
+ TVA of 6%	29353	28583	25764	26183
Tax refunds	1098	970	703	840
Total	28254	27614	25061	25343
Other Costs (10%)	31080	30375	27567	27878
Total Cost (D/mt)	311	304	276	279

Exhibit 5.10
Impacts of Subsidy Removal on Current Rations
(D/mt)

Poultry Feed	Starter	Broiler	Pullet	Layer
Standard soy meal quality				
Cost with subsidy	261	255	234	234
Cost without subsidy	311	304	276	279
Percentage difference	19.2	19.2	17.9	19.2
Inferior soy meal quality				
Cost with subsidy	264	258	237	236
Cost without subsidy	315	307	280	282
Percentage difference	19%	19%	18%	19%

Source: Abt Associates

Exhibit 5.11
Optimal Rations with Subsidies and More Ingredients

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	29.8	24.1	14.2	22.5
Maize (%)	65.6	70.9	62.8	62.1
Barley (%)	0	0	12.0	0
Wheat bran (%)	0	0	6.0	0
Soybean oil (%)	0.6	0	0	4.9
$CaCO_3$ (%)	0	0	0	5.5
CMV (%)	4.0	5.0	5.0	5.0
Ration cost (D/T)	208	201	180	196
Energy (kc/kg)	2900	2902	2800	3000
Protein (%)	19.0	17.0	14.0	15.5
Fiber (%)	3.7	3.5	3.8	3.1

Exhibit 5.12
Optimal Rations without Subsidies and More Ingredients

Feed ingredient/ Nutrient level	Starter	Broiler	Pullet	Layer
Soybean meal (%)	25.2	20.4	15.8	20.0
Maize (%)	25.9	25.6	0	9.6
Barley (%)	12.0	12.0	12.0	12.0
Wheat bran (%)	5.0	5.0	10.0	5.0
Soybean oil (%)	4.0	3.6	3.2	8.8
Tapioca (%)	19.0	23.4	49.0	29.1
Fish meal (%)	5.0	5.0	5.0	5.0
$CaCO_3$ (%)	0	0	0	5.5
CMV (%)	4.0	5.0	5.0	5.0
Ration cost (D/mt)	245	236	208	227
Energy (kc/kg)	2900	2900	2800	3000
Protein (%)	19.0	17.0	14.0	15.5
Fiber (%)	5.0	5.0	6.5	5.0

Source: Abt Associates

difference is that the model is able to satisfy the starter and layer ration energy requirements with the availability of fats and oils. In the no-subsidy case, however, the higher maize, soybean meal, and barley prices provide incentives to use other ingredients in an effort to reduce total feed costs. The models are able to substitute other ingredients for the three current imports and thereby reduce total feed costs.[11] The difference in total feed costs due to substitution of other ingredients once the price of maize, soybean oil, and barley rises is illustrated in Exhibit 5.13. Exhibit 5.14 shows the increased price of blended feeds with and without trade liberalization and the introduction of new feed ingredients. It is very important to note that the rations with new ingredients are able to satisfy all the nutritional requirements. Since the original layer ration was the most deficient in energy, the improved ration is actually more expensive because of the cost associated with meeting the higher energy level.

Exhibit 5.13
Reduced Subsidy Elimination Impacts with Substitution

Cost of Feeds in D/mt

Poultry Feed	Starter	Broiler	Pullet	Layer
Original optimal rations with no subsidy	311	304	276	279
Improved rations with new inputs and no subsidy	307	296	266	287
Percentage difference	-1.2	-2.6	-3.6	+2.8

Source: Abt Associates

NOTE: The improved rations meet all the nutritional requirements, whereas the original rations are optimized in the sense that they find the best possible formulation given the available ingredients. Both the original optimal starter and the layer rations are deficient in energy.

[11] We attempted to estimate cif Tunis prices plus port charges of the other ingredients based on sources of Rotterdam or Spain prices in U.S. dollars. The prices used in the models are 419, 457, 412, and 147 D/mt for animal fat (beef tallow), soybean oil, fish meal (64%), and tapioca pellets respectively.

Exhibit 5.14
Difference in Subsidy Elimination Impact with Substitution

Percent Change in Price of Feeds

Case	Starter	Broiler	Pullet	Layer
Subsidy elimination impact with original feed ingredients	19.2	19.2	17.9	19.2
Subsidy elimination impact with substitution of new ingredients	17.6	16.1	13.7	22.6

Source: Abt Associates

NOTE: The rations in the substitution case all meet the nutritional requirements, whereas the starter and layer rations in the no new ingredients case do not meet the nutritional requirements for energy. That explains why the layer ration impact is greater with substitution.

Clearly, the ingredients and rations illustrated in Exhibit 5.12 do not exhaust the possibilities that will exist once subsidies are removed and imports are liberalized. For example, domestic feed ingredients such as beans may become more attractive and competitive once the subsidies on imports are eliminated. One would expect, in fact, that domestic production and consumption of animal feed ingredients would increase once the subsidies on imports are eliminated.

5.5 Summary of Direct Impacts of Subsidy Removal

The bottom line is that **excluding the improved layer ration case, the net impact of the subsidy elimination ranges between 14 and 19 percent of total poultry feed cost.** Generally, one could say that **allowing free trade in feed inputs could reduce the impact of subsidy elimination by about one-sixth.** That is, holding quality constant, the increased feed cost would drop from about 19 percent to about 16 percent.

However, the reduction in direct subsidy impacts is probably not the greatest advantage of trade liberalization. The greatest gain is associated with the improved poultry rations that could result from a greater variety of inputs being available. It is impossible to precisely quantify this gain, but the order of magnitude can be estimated. In Tunisia today at least 190 grams of feed is required to produce one egg, whereas only about 150 grams are needed in Europe. No doubt this lower conversion efficiency is due to several factors such as amino acid imbalances, but the low level of energy in the layer diet is certainly a major cause. In fact, it is reasonable to assume that at least half this difference in feed conversion efficiency is due to feed quality. If a well-balanced layer ration would improve the feed conversion in Tunisia to yield one egg for each 170 grams of feed (half the difference), the overall feed cost of producing eggs would fall by 20 grams of feed per egg or 11 percent. Hence, **over half the increased feed cost due to subsidy removal could be recouped through improved feed conversion efficiency.** It is important to note, however, that this efficiency gain can be achieved only by removing trade restrictions so that feed blenders have access to the ingredients needed to produce well-balanced, high

energy rations.

This chapter has analyzed and estimated the direct impacts of subsidy removal and trade liberalization on the poultry sector. Chapter 6 extends the impact analysis on poultry and also provides general estimates of impacts on other livestock sectors.

6. IMPACTS OF SUBSIDY ELIMINATION ON COST OF PRODUCTION

This chapter provides quantitative estimates of the impacts of elimination of subsidies on imported maize, soybean meal, and barley. The subsidy elimination would affect the costs of blended feeds for poultry, cattle, sheep, and other animals which would increase the costs of producing meat, eggs, and milk. Both producers and consumers of these products would be affected.

6.1 Impacts on Poultry

Since poultry uses a large proportion of the subsidized feeds, much of the impact of subsidy elimination would fall on the poultry sector. Also, from the production cost data in Chapter 3, it is clear that feed costs are the most important component of total production costs of both broilers and eggs. Feed costs constitute 66 percent of the total cost of producing broilers and 85 percent of the cost of producing eggs.[12] We can calculate the impact on production costs of broilers and eggs directly from the cost structures provided in Chapter 3 and the ration cost data in Chapter 5. Exhibit 6.1 provides the results for broiler production with the first column representing current costs and the second column costs with subsidies removed and rations reformulated under trade liberalization of feed inputs.

Exhibit 6.1
Current Broiler Production Costs and Costs with Trade Liberalization and Subsidy Removal (millimes/broiler)

Cost Item	Current Costs	Improved rations with no subsidies
Day old chick	300	300
Feed -- starter	263	276
Feed -- grow/finish	900	932
Other variable costs	211	211
Total variable costs	1674	1719
Fixed costs	90	90
Other costs	30	30
Manure credit	-40	-40
Total cost	1754	1799
Cost: mil/kg live @ 1.8 kg.	974	999

Source: Abt Associates

[12] The 85 percent figure is the sum of 73 percent direct feed cost and half the pullet cost (1600 millimes or 12 percent), which is attributed to feed cost.

The bottom line is that broiler costs increase 25 millimes or about 2.6 percent from 974 to 999 mil/kg. This result assumes that feed conversion efficiency improves from 2.5 kg feed per kg of meat produced to 2.25, which is half the difference between the Tunisian and the European conversion efficiency. In other words, each improved ration is assumed to use 90 percent of the present ration quantities. The prices of concentrated feeds are the same as those reported in Exhibits 5.10 (current optimal ration feed costs) and 5.13 (costs of improved rations with no subsidies) of Chapter 5.

Exhibit 6.2 presents the results of the same analysis for egg production. In this case the cost of eggs increases by 4.7 millimes from 59.8 to 64.5, for a difference of 8 percent. Feed cost figures are taken from Chapter 5 (234 D/mt for the layer ration). The feed cost of the pullet (1,600 millimes) is assumed to increase 9 percent increasing the pullet cost from 3,200 to 3,344 millimes. Feed conversion is assumed to increase from 190 grams/egg to 170. Again, this increase represents half the difference between the Tunisian and the European conversion.

Exhibit 6.2
Egg Production Costs at Present and with Trade Liberalization and Subsidy Removal
(millimes/layer)

Cost Item	Current Costs	Improved Rations with no Subsidies
Started Pullet	3200	3344
Feed	10716	11710
Other variable costs	715	715
Hen sale	-750	-750
Total variable costs	13881	15019
Fixed costs	470	470
Total cost/layer	14351	15489
Cost per egg @ 240 eggs/layer	59.8	64.5

Source: Abt Associates

6.2 Dairy Impacts

The analysis for dairy is similar to that for poultry, but without the changes in rations and analysis of trade liberalization. The dairy analysis simply traces the impacts of the higher feed costs through the cost structure to determine the impact of the higher feed costs on the cost of producing milk. No possibility of improved or cheaper rations through import diversification is considered.

The analysis draws on information on dairy rations and cost structures provided in Chapter 4. We used the current dairy ration of 45 percent barley, 26 percent wheat bran, 20 percent soybean meal, 2 percent bicalcium phosphate, 1 percent each salt and $CaCO_3$, and 5 percent CMV. The total cost of this ration is 185 D/mt with current subsidies and 216 D/mt without subsidies, an increase of 16.8 percent. We assumed an annual level of milk production of 5,000 kg, for which 2.2 mt of concentrate would be needed per year. The annual concentrate cost increases from 407 to 475.2 dinars when subsidies are removed, an increase of 68.2 dinars. This feed cost increases total production cost from 1131.25 to 1199.45 dinars, an increase of 6 percent. Milk cost increases from 226 to 240 mil/kg.

The 6 percent difference would vary among production techniques and levels of milk production and represents an upper limit. The part of concentrated feed in total production cost is 36-38 percent for all the production levels of integrated systems, so the variation among production levels would be very small. For family production systems, the part of concentrated feed in total cost drops to around 24 percent, so the increase in production cost would drop to around 4 percent.

6.3 Beef Production Cost Impacts

For beef production, the share of concentrated feed in total cost was estimated in Chapter 4 to range between 7 and 11 percent. We estimate that concentrated feed cost would increase by about 15 percent from 170 to 196 D/mt. Assuming concentrated feed represents 10 percent of total cost, the cost of producing beef would rise about 1.5 percent when subsidies are removed. As in the case for dairy, this result does not permit any substitution of cheaper feed ingredients and is in that sense an upper limit.

6.4 Lamb Production Cost Impacts

Less than 5 percent of the feed concentrate is destined for lamb production. The concentrate is 65.5 percent barley, 20 percent wheat bran, 12 percent soybean meal, and 3.5 percent CMV. The cost increase with subsidies eliminated would be about 19 percent, which would yield a lamb meat cost increase of less than 2 percent.

6.5 Other Livestock Cost Increases

We anticipate that the cost increases for other livestock would be around the same level as those for lamb and beef, that is, less than 2 percent. No estimates of these values were undertaken because the volumes are so small.

6.6 Impact Summary

Exhibit 6.3 summarizes the direct animal product cost impacts. The largest impact is on the cost of producing eggs (8 percent). Dairy has the second highest increase at 4-6 percent. The smallest impact is on beef (1.5 percent), but the impacts on sheep and other ruminants would be quite small as well.

Exhibit 6.3
Livestock Production Cost Impacts

Livestock product	% Increase
Broiler	2.6
Eggs[13]	8.0
Milk	4.0-6.0
Beef	1.5
Other ruminants	<2.0

Source: Abt Associates

6.7 Distribution of Impacts

Large producers control approximately 85 percent of total production of eggs, 40 percent of chickens, 50 percent of dairy and beef, and 70 percent of sheep (see Chapters 3 and 4). The biggest impact of subsidy elimination in the poultry sector--especially egg production--will therefore fall upon these large producers. There are indications that the broiler industry, as with egg production, has been become more concentrated in recent years. However, broiler production costs were estimated to only increase by 2.6 percent with subsidy elimination, so the overall impact on all producers will be small.

The size of production units for dairy, beef, and sheep varies considerably. The majority of cattle are raised in small herds of five to six cows. Most of milk processed by commercial dairy plants, however, is produced by large producers owning from several hundred to over one thousand cows. With the cost of milk production estimated to rise 6 percent upon subsidy elimination, these large dairy producers will be affected to a larger degree than small producers. The same holds for large beef or sheep production units. The percentage of feed costs for beef and other ruminant meat production, however, is so small that the overall effect of subsidy removal will not be large.

[13]Includes feed cost of replacement pullets.

7. ISSUES IN TRADE LIBERALIZATION AND SUBSIDY REMOVAL

In principle, the issues of trade liberalization and subsidy removal could be treated separately. However, as we can see from the results in Chapters 5 and 6, there are important linkages between trade liberalization and subsidy removal. In this chapter, we examine the issues directly related to trade liberalization, the issues common to both trade liberalization and subsidy removal, and the ties between the two.

7.1 Trade Liberalization

The major issues directly associated with trade liberalization are the following:

- o Determining how to protect liberalized imports[14],
- o Assuring competition in a liberalized trade environment, and
- o Providing incentives for storage.

Each of these is discussed below. The issue of timing of liberalization is discussed in the context of these issues.

7.1.1 Approaches to Protection with Trade Liberalization

Trade liberalization is a general term that can have several possible interpretations. We define trade liberalization as the elimination of prohibitions and quantitative restrictions on imports. In that sense, the state would relinquish its monopoly power over importation, and anyone could import a liberalized commodity without authorization from the state. In this context, trade liberalization does not mean the total absence of protection. Protection could be accomplished through *ad valorem* tariffs, variable levies, or other means. An *ad valorem* tariff is simply a percentage of the cost of the imported good. A variable levy is quite different. It is the difference between a reference price and the cost of the imported good. A simple example illustrates the difference between these two methods of protection. Exhibit 7.1 shows the tariff that would be collected and the total import cost for three different imports of a given commodity. The import costs are assumed to be 100, 150, and 200. Under an *ad valorem* tariff, the amount of the tariff is simply the tariff percentage multiplied by the cost of the import. For example, if the import cost is 100 and the tariff is 25, the total import cost is 125, the sum of the import cost and the tariff. A variable levy works quite differently. In this example, we assume a reference price for the variable levy of 200. The amount of the variable levy is the difference between the import cost and the reference price. For example, if the import cost if 100, then the variable levy is 100. The total

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[14] We use the term protection here in a broad sense, meaning any form of price wedge between domestic and world prices. For feed ingredients like corn and soybean meal that are not produced in significant amounts in Tunisia, the objective of price intervention is not to protect local production, but to increase government revenue and/or to attain greater price stability.

Exhibit 7.1
Comparison of *Ad Valorem* Tariff and Variable Levy

Import Cost	*Ad Valorem* Tariff		Variable Levy	
	25% Tariff	Total Cost	Levy	Total Cost
100	25	125	100	200
150	37.5	187.5	50	200
200	50	250	0	200

Source: Abt Associates

NOTE: The variable levy calculation assumes a reference price of 200.

cost is always equal to the reference price, which is also equal to the sum of the import cost and the amount of the variable levy.

The Variable Levy System. The variable levy system, widely used in Europe, has the advantage of assuring a stable cost of imported goods subject to the levy. The major disadvantages of the variable levy system are that it is quite complicated to administer and if not done well, is susceptible to fraud, and that it isolates the country from world markets. There are basically two ways to implement the system. First, the import cost is determined for each importation from the importer's actual import costs. The levy is then calculated as the difference between the importer's cost and the reference price. Under that approach, the importer has absolutely no incentive to import at the lowest possible price because the difference between his import cost and the reference price becomes a levy. The second approach entails the government determining and announcing an "import cost" for some time period. In Europe, this "price" is changed daily. The levy is the difference between the announced import cost and the reference price and is the same for all importers during that time period. Under this approach, the importer still has some incentive to import at the lowest possible cost because the amount of the levy is somewhat independent of the actual import cost. This is especially true in Europe where there are many importers. It becomes more problematic for a country like Tunisia with one or two imports per month.

A variable levy system for Tunisia probably would be best implemented using the second approach described above but with the import cost figure announced for a period not exceeding one month. Shorter intervals, even daily, would be preferred to prevent speculation on the amount of the levy near the end of each period. The import cost basis for determining the variable levy could be announced at the beginning of each period. All importations during that period

would be subject to a levy equal to the difference between the previously announced reference price and the stipulated import cost for that period. Hence, regardless of the actual import cost, the levy assessed would be a constant for that period.

In order to maintain a link with world markets, the reference price using this system should be tied to world market prices. One means to maintain this link while isolating the country from the short-term fluctuations in world markets is to use a moving average world price as the basis for determining the reference price. A measure of protection could be applied to the moving average to calculate the actual reference price[15]. For example, if the moving average price of the last five years for a given commodity were 200, and a protection level of 25 percent were desired, then a reference price of 250 could be established for the upcoming year. With this approach, the reference price would change annually to maintain the linkage with world markets. Exhibit 7.2 illustrates the reference price calculation for soybean meal. This exhibit assumes a five-year moving average and 25 percent protection to calculate the

Exhibit 7.2
Illustration of a Variable Levy System

Year	Soybean Meal (Rotter-dam) ($/T)	Moving Average ($/T)	Exchange Rate ($/D)	Moving Average (D/T)	Refer. Price 25% Protection (D/T)	Actual Import Cost (D/T)	Approx Levy (D/T)	Total Cost of Imports (D/T)
1980	258							
1981	253							
1982	220							
1983	236							
1984	197							
1985	158	233	0.83	193	291	134	157	291
1986	185	213	0.79	168	266	155	111	266
1987	104	199	0.83	165	249	167	82	249
1988	245	176	0.86	151	220	257	0	257
1989	248	178	0.94	167	222	274	0	274

Source: Abt Associates

[15] If in the future Tunisia would like to increase exports of poultry products, it is very important that there be little or no price wedge between domestic and world market feed ingredient prices. In our example, the level of protection would need to be close to zero. Otherwise, Tunisian poultry producers would be paying higher than world prices for feed inputs, making it very difficult to compete in product markets.

reference price. Given that oilseeds are not produced in Tunisia, one could argue that the rate of protection should be zero. Also, one could use a shorter moving average period, say three years, to obtain a closer alignment with world prices. Nonetheless, Exhibit 7.2 illustrates how a variable levy system would function. Note that in the example, there would have been a substantial levy in the early years (1985-86) and no levy in the later years (1988-89).

Alternatively, the variable levy could be established with negative values when imports cost more than the reference price. In essence, imports would be subsidized when the import costs were greater than trend and taxed when costs were below trend. However, this system would be difficult to implement because it would require the government to have the fiscal flexibility to make payments when necessary and the administrative capacity to operate a variable levy system with both collections and payments.

The *Ad Valorem* Tariff. The *ad valorem* tariff is much simpler to administer than the variable levy system. It also maintains a closer linkage with world market prices, which is both its major strength and weakness. Economists advocate this form of protection if protection must be implemented at all because it imposes fewer restrictions on trade than quotas or variable levies. Political forces sometimes dislike this approach because it does not isolate the country from fluctuations in world market prices and because it does not offer the kind of absolute protection provided by quotas or variable levies.

In the context of this study, the question of protection seems to be less-critical for the major feed imports, corn and soybean meal. Neither of these ingredients nor their close substitutes (in poultry feed) are produced in significant amounts in Tunisia. Therefore, the major purpose of the protection appears to be to raise revenue for the government. If that is the case, an *ad valorem* tariff would be preferred because of its simplicity and ease of administration. It functions equally well to raise revenue as the variable levy system.

Other systems. Other methods of protection can also be used, such as a minimum import price. The minimum import price system requires that all imports come into the country at a price equal to or above the minimum import price. The major problem with this system is that it passes on the rents associated with protection to foreign suppliers of the commodity. Other protection systems are possible, but none are as widely used as the variable levy or *ad valorem* tariff.

7.1.2 Assurance of Competition

One of the important issues associated with trade liberalization in Tunisia is assurance of adequate competition once imports are liberalized. At present, a government monopoly handles all feed ingredient imports. Substitution of a private sector monopoly for the government monopoly would not likely yield all the benefits possible with liberalized imports and lively competition. With large markets, assuring adequate competition is not normally a problem. But Tunisia imports very little animal feed ingredients relative to the world market. At present, about one shipload of soybean meal and two shiploads of maize are imported each month. Also, at present, one private sector firm (Poulina) controls about 56 percent of the total poultry feed market and 77 percent of the

private sector market. Most likely, no matter what system is adopted, there will be less than perfect competition.

Given these facts, what are the alternatives for implementing trade liberalization in Tunisia? One alternative is for all the feed blenders to form an importing cooperative that would become a *de facto* import monopoly. Another is for Poulina to import for its needs and all the other feed producers would form a cooperative to import for their needs. It is unlikely that more than two entities could import for the Tunisian market given its size relative to the volumes required to purchase by boat load. Another alternative is for firms not associated with the feed mixing industry, those firms specializing in import and international markets for livestock feed ingredients, to do the importing.

The main advantage of the first alternative over the current system is that a private sector importer would likely have more flexibility than the public sector. It would be easier to import the needed fats and oils, for example. The private sector firm also might be better able to build and amortize the necessary storage facilities. A private sector firm might be able to gain the expertise necessary to hedge on futures markets, thereby gaining some price stability.

The major advantage of the second alternative is that it would introduce a measure of competition into feed ingredients importation. The trade-off is that two entities would have to acquire the necessary expertise to function effectively and efficiently in world markets.

The advantage of the third alternative is that importation and feed manufacturing would be separated so that Poulina's market power would be less of an issue. Of course, more than one firm would have to enter the import business to assure some competition.

Given the uncertainties associated with assuring a reasonable measure of competition, it would be prudent to launch a pilot program for a year or so before total liberalization. Given the start-up time necessary for private firms to acquire some of the needed skills, it is imperative that the liberalization be announced well ahead of the implementation date. For example, the Government could announce a one year pilot program that would be followed by total import liberalization on a fixed date one year later.

7.1.3 Storage

Adequate storage facilities are important for the efficient functioning of input supply systems. At present, the lack of price variation in time or space, leaves no incentive to invest in storage in Tunisia. Storage investments receive their return through seasonal and regional variation in prices of products that are stored. Under normal conditions, the private sector invests in creation of adequate storage because it can pay for the facilities through the seasonal and regional price variations. At present, Tunisia has no seasonal or regional price variation; hence, the private sector has not invested in storage. The government also has not invested sufficiently in storage. Hence, current storage capacity is insufficient.

Adequate storage is essential to capturing the benefits of trade liberal-

ization. As discussed in Chapters 5 and 6, one important benefit is the incentive to import a greater diversity of feed ingredients, thereby improving the quality of the rations and reducing the ration cost. To accomplish this requires improved storage facilities to handle the greater diversity of feed ingredients. In particular, storage and handling facilities for fats and oils would need to be constructed.

The Government of Tunisia is considering incentive programs to increase and improve storage facilities. Probably the greatest incentive would be to decontrol prices, thereby permitting regional and seasonal variation. If the private sector became convinced that prices would become and remain decontrolled, it would invest in additional storage, probably without any additional incentives. The only incentive that might be necessary at the beginning would be a guarantee that if, for whatever reason, the liberalization program were reversed and prices again became controlled, the Government would reimburse private sector investors for their invested capital plus a reasonable rate of return.

Again, timing is a key to solving the storage issue. The liberalization program must be announced at least one year in advance to provide adequate time for private sector investments in storage and handling facilities.

7.2 Linkages Between Subsidy Removal and Trade Liberalization

Two major linkages between subsidy removal and trade liberalization need to be considered: the timing of the two policy changes, and the impact of the efficiency gains from liberalization on diminishing the adverse impacts of subsidy removal. Clearly, these two issues are related as the efficiency gains cannot be achieved instantaneously.

As discussed in the trade liberalization section, it is important to announce the change in trade policy well ahead of implementation. Similarly, to avoid more severe impacts of subsidy removal without improved efficiency in feed production, it would be better to time the next phase of subsidy elimination with the date of implementation of trade liberalization. In other words, subsidy elimination should be announced in advance of the date of implementation and the implementation date should be the same as that for trade liberalization. For both, announcement of the changes one year in advance should be sufficient.

8. CONCLUSIONS AND RECOMMENDED ACTIONS FOR IMPLEMENTING POLICY CHANGES

Today, like no time in history, national economies are being liberalized and are converting from a control "command" system to a market orientation. This transformation offers tremendous benefits to economies in terms of greater efficiency and higher income levels. However, the path of conversion from a controlled economy to a market economy is fraught with potential difficulties and uncertainties. There is no way one can be sure of the precise timing or result that will be achieved. It is certain that the control system is very inefficient, results in lower productivity, and limits the economic growth potential of the economy. It is equally certain that a free economy in which the economic actors have the incentive and the liberty to pursue their own interests will be a more vibrant, higher growth economy. However, the optimal path from control to free markets cannot be defined with certainty. It is very important to plan the major objectives and the proposed path. It is equally important to retain flexibility to adapt to changing economic conditions, while holding to the objective of achieving an economy driven by market signals.

8.1 Conclusions on Impacts of Subsidy Removal and Liberalization

The major objective of subsidy removal and trade liberalization is to improve the efficiency of the livestock sector. A secondary objective is to reduce budgetary outlays. Removing subsidies will lead to higher costs in the short run, and better allocation of resources and increased efficiency (and lower costs) in the long run. The analysis has shown that benefits from trade liberalization partially offset the short-run costs associated with subsidy removal. These benefits include:

- Diversification of feed ingredients (i.e., more variety in ingredients used to formulate blended feed).
- Improved timing in availability of feed ingredients,
- Better quality of feed concentrates and better conversion ratios.

Trade liberalization would potentially have both direct and indirect impacts on feed users. The direct effect would be to allow producers and feed manufacturers to diversify the type of feed ingredients they buy, so they are no longer restricted primarily to purchasing imported maize and soybean meal. Although the prices of these inputs would rise with the removal of subsidies, if the Office des Céréales no longer monopolized feed ingredient imports, producers would no longer be restricted to using only these inputs. This would also allow the formulation of feeds that produce a higher feed conversion efficiency. **This indirect effect of increased efficiency represents the highest potential gain from liberalization.**

The impacts of subsidy removal are the greatest for the poultry sector since feed costs constitute 67 percent of the total cost of producing broilers and 85 percent of the cost of producing eggs. Since most eggs and a substanital part of broiler production are controlled by large producers, they will be the

most affected by the elimination of subsidies. The analysis shows that a complete removal of subsidies tomorrow would result in a 13 percent increase in the cost of producing broilers, and a 14 percent increase in the cost of producing eggs. If, however, subsidy removal was linked with trade liberalization, broiler costs would increase by only 2.6 percent, and the cost of eggs would increase by 8 percent. In other words, the impacts of subsidy removal would be much larger without trade liberalization.

The direct impact of subsidy removal on other livestock--dairy, beef, and sheep--would be low for most producers. The cost of blended feed is typically less than half of the total cost of feed (since forage crops are also fed to livestock), and less than one-third of the total cost of production. This is especially true for smaller, family-run enterprises. Therefore it is the largest producers who will be affected the most.

One negative impact of the feed subsidies (and particularly for small family operations) has been the lack of development of domestic production of crops such as barley, triticale, and forage crops going into feed. Access to cheap feed has led to overgrazing in some instances since the availability of cheap feed provided little incentive to limit herd size. With subsidies eliminated and higher purchased feed costs, farmers would have an incentive to be more efficient in producing substitutes for feed concentrates such as forage crops. A recent FAO study (Programme de Developpement des Productions Fourrageres et de l'Elevage) emphasizes the need for more diversified forage crops, improved varieties and production techniques, and improved conversion ratios. The study predicts that the demand for forage will be far greater than supply by the year 2001 unless production increases significantly. Producers will have little incentive to increase forage crop production, however, as long as they have access to cheap imported feed ingredients. Subsidy reduction on imported feeds will provide an incentive for greater productivity in domestic products.

8.2 Implementation Alternatives

There are many possible approaches to the tasks of eliminating subsidies and liberalizing trade in animal feed products. The Government of Tunisia has agreed in principle to eliminate the subsidies on animal feed ingredients in two more installments, resulting in an elimination of all subsidies by 1992-93. In the analysis of alternatives that follows, we assume that subsidies are eliminated by that date or earlier. Hence, the discussion of alternative approaches concentrates on issues in trade liberalization.

Based on discussions with Tunisian government officials, we have chosen three import liberalization plans for further analysis. The advantages and disadvantages of these approaches are outlined in Exhibit 8.1.

Exhibit 8.1
Advantages and Disadvantages of Import Liberalization Alternatives

Alternative	Advantages	Disadvantages
1) OC permits part of the annual needs to be imported by the private sector, with the percentage private increasing each year until the total imports are private after a three year phase-in period.	Allows the private sector to acquire import experience while OC continues to assure national stock security.	More difficult to manage a "mixed" system.
2) OC continues to launch the tender offers, but allocates the imports to the private sector which handles all the transport, storage, etc. once the material has arrived in Tunisia.	Easy transition -- OC continues its current role of launching tender offers, but on behalf of the private sector actors.	Difficult to administer in a manner that achieves real change from the current system.
3) Imports of protein sources are freed in 1991-92, and energy sources are liberalized in 1992-93. Under this option, the subsidy on soybean meal would need to be eliminated in the next installment (rather than a uniform reduction of the subsidies on soybean meal and maize).	Frees an important part of the market quickly. Permits import flexibility for all protein feed ingredients, which provides incentives to increase efficiency. Subsidy would be eliminated on soybean meal at the same time imports are liberalized. Provides experience to importers in one class of imports before all imports are private.	Temporarily distorts the relative price of protein and energy feed ingredients.

From the information in Exhibit 8.1, it appears to us that either alternative 1 or alternative 3 or a combination of the two would be the best course to follow. If one used a combination of 1 and 3, the private sector would begin importing soybean meal almost immediately. During the first year, protein imports would be shared between the private sector and OC. By the end of the first year, all protein imports would be private. During the second year, the private sector would begin to import maize, and by the end of the second year, all energy feed imports would be private.

Our recommendation is that import liberalization proceed following this approach, which is a blend of alternatives one and three. The tentative steps to implement this approach would be as follows:

1) Announce in advance that subsidies will be eliminated in two more installments. In the next installment, the entire subsidy on soybean meal (and perhaps part of the remaining subsidy on maize) will be eliminated. The remaining subsidy on maize will be eliminated in the final installment no later than 1992-93.

2) OC invites private sector participants to import soybean meal and establishes the procedures permitting them to do so.

3) OC shares import duties for protein sources during the first year with all imports being handled in the private sector by the end of one year.

4) Near the beginning of the second year, OC invites the private sector to import maize and establishes the procedures enabling the private imports.

5) By the end of the second year all imports of animal feed ingredients are handled by the private sector, and all subsidies have been removed.

6) During the two year transition period, OC, the Ministry of Agriculture, and the Ministry of Economic Affairs would need to put into place or strengthen the monitoring and quality control activities discussed below.

7) After the transition period, the role of government agencies would be assurance of competition and assurance of quality of blended feeds.

8.3 Additional Recommendations

Our analysis of the proposed policy changes regarding feed ingredient subsidies and liberalization of feed ingredient imports have led to other recommendations linked to the above implementation plan. These recommendations cover border measures, assurance of compeitition, monitoring the changes, storage, and feed manufacturing.

1. Border Measures

A. Maize, soybean meal, and other ingredients not produced in Tunisia. If the government objective of putting a wedge between the domestic and import prices of maize and soybean meal is to increase government revenues through tariff collections, then an ***ad valorem* tariff** is recommended. However, any significant tariff would virtually guarantee that Tunisia could not be competitive in export markets for poultry products.

If the government objective is to stabilize the domestic price of imported maize and soybean meal, then a variable levy is recommended. A variable levy will stabilize domestic prices but will tend to destabilize exports. In periods in which the producers are not paying a levy, they will be competitive in export

markets. When they are paying a levy, however, they may not be able to remain competitive.

B. Barley. If the objective is to assure that no imports come in below the domestic support price in order to afford Tunisian barley producers absolute price protection, then **the use of a variable levy would be the most effective option.** This would involve announcing an import cost each period of importation (not longer than a month and preferably shorter) and a reference price tied to the world market price once a year. All imports during that period would be subject to a levy equal to the difference between the previously announced reference price and the stipulated import cost for that month. Using a three or five-year moving average world price as the basis for determining the reference price is recommended. See Newman et al., "A Plan of Action for Tunisia's Cereals Sector: First Phase Report", May, 1989, for further discussion of a variable levy system.

2. Assurance of Competition

From economic theory we know that in general a monopoly will result in higher prices and less production than would a competitive market. In this case, the issue is not the difference between a private monopoly and a competitive market, but the difference between a private monopoly and a public sector monopoly. Given the size of Tunisia's feed ingredient import market relative to the size of shipments of ingredients, it is unlikely that a truly competitive market will develop. While we believe that it is definitely advantageous to shift import responsibilities from the public to the private sector, it is also important to consider in advance how best to deal with potential problems that may arise.

As indicated above, the classic problem with a monopoly is higher prices than would prevail in a competitive market. Therefore, it will be desirable to have a mechanism for monitoring prices charged for feed ingredients and blended feeds in comparison with world prices. **It is not desirable to regulate prices.**

A commission should be set up to monitor prices and determine how well prices correspond with import prices plus other costs. If, at some point in the future, it is determined that the private importing monopoly is charging excessive prices, it may be necessary to impose some sort of price regulation. However, we do not believe that this will happen. Much of the poultry industry (where most of the blended feeds are used) is integrated, meaning that feed manufacturing is combined with poultry production. Integrated producers will have an interest in producing eggs and chicken meat at the lowest possible prices, so they will attempt to keep feed prices low. Thus, private sector importers are unlikely to find it attractive to price feeds or feed ingredients significantly higher than would a competitive market.

3. Monitoring and Evaluating the Reform Program

In making major changes such as those discussed in this study, one needs to ask how to measure the success or failure of the changes. Monitoring the impacts of the changes is particularly important in the early years of implementation. Important components of monitoring policy impacts should include: price monitoring, evaluating how effectively a good variety and quality of feed ingredients is being provided, and determining to what extent the nutritional content of the rations have improved.

Any evaluation of program success cannot simply be based on changes in prices and other performance indicators before and after program implementation, however. These indicators may change due to external factors unrelated to the policy change. For example, the price of imported feed ingredients may rise considerably due to world market factors. Thus, we want to compare prices (or any other impact measure) with what they would have been in the absence of policy changes. In other words, direct before and after comparisons are not valid because many of the underlying domestic or world market conditions could have changed. Policy impact analysis must isolate the impact of policy change from any other changes that may have occurred. It must be case in a "with-without" policy changes framework rather than a "before-after" framework.

4. Storage

In order to provide incentives to increase private sector investment in storage, the Government should:

- **Decontrol feed ingredient prices**, permitting regional and seasonal variation,

- **Provide guarantees to the private sector** that if the liberalization program were reversed, they would be reimbursed for storage investments made in anticipation of liberalized markets, and

- **Announce intentions on the schedule of liberalization at least one year in advance** to allow adequate time for the private sector to invest in storage and handling facilities.

5. Timing of Subsidy Removal

The major problems facing the feed industry involve the supply of raw materials, the quality of both raw materials and finished products, manufacturing efficiency, and storage (covered under recommendation 5 above). The first set of recommendations are aimed at whoever is purchasing the feed ingredients. The second set are aimed at feed manufacturers.

1) Purchasers

- **Set rigid specifications for feed ingredients** which meet international standards.

- **Materials should be inspected as they are loaded onto the ship** in the country where they are purchased.

- **Feed ingredients must be inspected again at the port in Tunisia** when unloaded.

2) Feed Manufacturers

- **Inspect raw materials at the manufacturing plant** to determine whether the materials meet purchasing specifications. The inspection must include both physical and analytical processes.

- **Increase quality control at the processing stage** (grinding, mixing, and pelleting) to ascertain that the particle size of grains and other materials are reduced to achieve best mixing results and to reduce product separation/segregation in materials handling. Mixers must be tested to determine their ability to provide an adequate blend of the various ingredients. Pelleted products must be tested to determine their relative durability.

- **Inspect finished products** at the packaging or bulk load-out locations to ensure that they meet the company's product specifications. Laboratory analyses should follow the physical (i.e. visual) inspections at every step to ensure that the raw materials and finished feeds meet all chemical and/or nutritional requirements. Labels or guarantees should be used to show that the end product has met established standards.

- **Refurbish plants to allow handling of raw materials and finished feeds in bulk** rather than in bags as more storage and port facilities become available.

3) Feed Quality Regulation

To help assure high quality feeds and "truth in labeling," it would be desirable for **the government to enforce quality control of blended feed products.** If the government enforces quality controls on these final products, no other government quality control measure would be needed. Control of ingredient quality should be the responsibility of the private sector. Purchasers will have incentives to make sure they are getting the quality of inputs they are paying for.

A simple labeling regulation requiring feed manufactureres to label the important ingredient levels (protein, energy, fiber, essential amino acids, vaitamins and minerals) for each feed sold is needed. The government quality control group would conduct periodic random surprise tests of feeds to determine if they meet the labeled quality. Violators would be subject to stiff fines. Repeat violators would lose the right to manufacture and sell blended feeds.

4) Overcapacity

Marginal operators should be allowed to leave the industry or stay in it

at their own financial peril, since there is such a high degree of overcapacity in the system. Subsidizing marginal operations can only prolong inefficiencies in the system to the ultimate detriment of both the overall economy and the consumer.

8.4 Recommendations for Additional Analysis

In this study, we have provided general recommendations and procedures for implementing subsidy reduction and trade liberalization. Additional work will be needed to develop the detailed schedule and legal texts for implementation.

The most important follow-up work needed concerns monitoring and evaluation of the impacts of these policy changes. Conducting impact analysis in the "with-without' policy changes context requires a detailed understanding of other factors (i.e. unrelated to the particular policy changes) that cause differences in the levels of the impact variables.

ANNEX A

COST OF PRODUCTION OF FORAGE CROPS

Cost of Production: Barley

Denomination	Semi-Aride		Sub-humide	
	Quantité tm	Valeur dinars	Quantité tm	Valeur dinars
Main d'oeuvre (JT)	8	28	10	35
Mécanisation:				
Traction lourde (Jr)				
Traction moyenne (Hr)	12	108	14	126
Traction animal (J)				
Moissonneuse batteuse	1	25	1,5	37,5
Pressage Paille		38,75		51,7
Fertilisation (QX)				
Ammonitre	1	12,3	1,5	18,5
Super 45	0,7	8,5	1,0	12,2
Sulfate de Potasse				
Semences (kg)	80	12,4	100	15,1
Produit de traitement		4		10
Autres		45		65
Total charges en DT		281,99		370,95
Deduction valeur Paille	1,5	67,5	2	90
Charges Nettes	2	214,49	3	280,95
Coût de production de la tonne	1	107,25	1	93,65

Source: Abt Associates (Mr. Majdoub)

Cost of Production: Annual Forage Crops

Denomination	Vesce		Bersim		Orge en vert	
	Quan tm	Val dt	Quan tm	Val dt	Quan tm	Val dt
Main d'oeuvre (JT)	10	350	14	49	15	52,5
Mécanisation: Traction lourd (Jr) Traction moyenne (Hr) Traction animal (J) Fauchage et/ou Préssage (Hr)	15 6	135 54	25 6	225 54	25 4	225 36
Fertilisation (QX) Ammonitre Super 45 Sulfate de Potasse	1 1	12,3 12,2	,5 1,0	6,15 6,10	1 1	12,3 12,2
Semences (kg)	100*	34,5	20	3,4	100	15,5
Produit de traitement				10		
Autres		65		65		65
Total charges en DT		348		467,7		418,5
Rendement (T de verdure)	25		35		35	90
Coût de production de la tonne: verdure foin		13,9 102,5**		13,4		11,9

* 60 avoine + 40 vescue
** charges supplémentaires de pressage incluses (62 D/ha)

Source: Abt Associates (Mr. Majdoub)

Cost of Production: Irrigated Forage Crops

Denomination	Mais-Ensilage		Luzerne		Sorgho	
	Quan tm	Val dt	Quan tm	Val dt	Quan tm	Val dt
Main d'oeuvre (JT)	22	77	90	315	20	70
Mécanisation: Traction lourd (Jr) Traction moyenne (Hr) Traction animal (J)	22	198	29	261	20	180
Fertilisation (QX) Ammonitre Super 45 Sulfate de Potasse Fumier	 2 1 100	 24,6 12,2 120	 ,5 1,5 1,5 300	 6,15 18,3 15,5 360	 3 2 100	 36,9 24,4 120
Semences (kg)	40	10	15	4,05	25	3,5
Produit de traitement				20		
Autres		65		65		65
Total charges en DT		678,8		1495		714,8
Rendement (T de verdure)	55		55		55	
Coût de production de la tonne: vert ensilage		12,3 18,5*		27,2		13,0

* charge ensilage incluses

Source: Abt Associates (Mr. Majdoub)

ANNEX B

List of Persons Contacted

DGPDIA

Monsieur Mohamed Gharbi / Directeur Général
Monsieur Badr Ben Ammar / Directeur de la Planification
Monsieur Abdelhakim Khaldi / Sous-directeur
Monsieur Amor Chouchane / Sous-directeur

DIRECTION GENERALE DE PRODUCTION ANIMALE (DGPA)

Monsieur Ayed Fkaier

OFFICE DES CEREALES

Monsieur Ali Debaya / Président Directeur Général
Monsieur Rezgui / Directeur de la Distribution

DIRECTION DES PRIX ET DU CONTROLE ECONOMIQUE - Ministère de l'Economie

Monsieur Slaheddine Makhlouf / Directeur Général

GROUPEMENT INTERPROFESSIONNEL DES PRODUITS AVICOLES (GIPA)

Monsieur Ali Bousrih / Directeur Général
Monsieur Riadh Karma / Directeur Technique

SOCIETE DE NUTRITION ANIMALE

Monsieur Abdelmajid Feki / Président Directeur Général

USAID

Madame Shirley Pryor / APIP Project Officer
Monsieur Charles Uphause

UTICA - Chambre Syndicale des Fabricants d'Aliments de Bétail

Monsieur Abdelkader Chaouch / Président de la Chambre

US EMBASSY, BUREAU DE COMMERCE AGRICOLE (ATO)

Monsieur Abdelazia Meddeb / Conseiller Agricole
Monsieur Abdallah A. Saleh / Directeur

SPAC

Monsieur Abdelkader Daly / Président Directeur Général
Monsieur Fethi Khedar / Directeur Général

List of Persons Contacted, continued.

PROVITAL, Grombalia

Monsieur Rachid Najar / Président Directeur Général

SEPAG, Soliman

Monsieur Tahar Rais / Directeur

SNA

Monsieur Abdelkader Jali / Président Directeur Général

INAT

Monsieur Boubaker Thabet
Monsieur Ali Selmi