

BEEF PRODUCTION SYSTEMS IN TUNISIA

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SUMMARY

The objective of the present work is to review published data on beef production systems in Tunisia and to spot problem areas that need research efforts. Existing literature concerning beef production during the last four decades have been compiled and reviewed. Five major beef production systems were identified according to basal diets. Data showed that on grazing system, average daily gains (ADG) in the range of 700 to 800g and 900 to 1000g were obtained for local and exotic breeds respectively for a grazing period of 4 to 5 months. Similar results were observed with hay based diets but with high feed conversion ratio (FCR). Better performances were obtained with silage based fattening systems. They ranged between 900 and 1100g with an oat-vetch silage and between 1100 and 1300 g with a corn silage respectively for local and exotic animals. Dressing percentage varied between 52 and 54% for the oat-vetch silage and between 54 and 56% for corn silage. Byproduct-based diets, mainly those with beet pulp and molasses gave ADG similar to those found with oat-vetch silage. Ammonia-treated straw can substitute up to 30% of total dry matter in the diet of either oat hay or silage without affecting animal performance. Use of more intensive systems based on concentrate feeds equivalent to the US feedlot system for meat production is also possible in Tunisia but does not appear to be economical under the current conditions. It was concluded that better fattening performances could be obtained through improving actual prevailing systems. A finishing period in feedlot is needed for grazing animals. Chemical and/or biological treatment of poor quality forages would improve their utilization and hence beef performance. More research work is needed in areas such as the improvement of poor quality forage utilization, and the quality of the meat.

Keywords: Beef, fattening, feed resources, production systems, Tunisia

INTRODUCTION

Like in most developing countries, beef production in Tunisia is carried out at the smallholder level. Most production systems are based on locally available low quality roughages and concentrate feeds. In 1998, the country's total red meat production was 104.000 tones; the contribution of beef being 46% (GLVR, 1999). However, such production level does not cover the population total need of meat despite the efforts taken by the government in all its agricultural development plans to improve nutritional standards and raise farmers' income. Fattening performance and productivity of cattle remain low because of many constraints. Major limiting factors have been identified (UTAP, 1995).

These include the low availability of good quality forages and the inappropriate use of low quality feed resources, the irrational use of fattening animals, and most importantly the neglect of research results. Therefore, one of the main recommendations that have always been made was to synthesize all research done on beef production in a review that can be made available to extension people involved in beef production. The objective of the present work is to review published data on beef production systems in Tunisia during the last four decades and to spot problem areas that need research efforts in the future.

Information available

So far, research on beef production in Tunisia was focused on growth performances. Most of the available data refer to the effect of diets on ADG, FCR, and carcass yield. Studies on meat quality, processing, and technology are lacking. For that reason, in this review, beef production system will refer only to two major components: the animal and the diet. This paper tries to relate these factors with the obtained results. In the first part of the article, a rapid survey of types of animals used for meat production in Tunisia and their characteristics will be made in order to situate the effect of genotype on fattening performances. The second and main part is a review of data on diets, ADG, FCR and carcass yield, and the variations of these traits according to breed or nutrition will be covered. Work related to genetic improvement of local breed for better meat production will also be considered. Finally, in a third section, problem areas that need future research efforts will be covered. Any scientific research work, which had for objective to improve beef production, particularly in feeding management and genetic improvement, was considered. Only papers published in national or international scientific

journals and research conducted for post-graduate programs were used. However, as the only source of information covering work done in the sixties and the eighties is in the form of documents of development projects conducted with international cooperation, final reports of these projects were also considered whenever data are available.

A- Types of fattened animals

The population of cattle in Tunisia is composed of the native (local) cow, the imported (exotic) pure breeds, and their respective crossbreds. Imported breeds include the Holstein-Friesian, the Brown Swiss, the Tarantaise and more recently the « Pie Rouge ». All these animals are primarily used to produce milk. They supply beef as a by-product when surplus calves and cull cows are slaughtered for meat.

A-1 Native and cross-bred young bulls

The local population of cattle is mainly the «Brune de l'Atlas» and the «Blonde du Cap Bon». According to Skouri and Ben Dhia (1977), these animals are of the iberique type. They have a low birth weight and are very early maturing. They are small in size, have small horns and are predominantly brown in color. They are well adapted to harsh environment, very poor milk producers and have low aptitude for meat production. They are especially useful in the utilization of highly fibrous vegetation, forages and grasses in semiarid and range regions of the country, which otherwise would be of limited use to people. Published data (Ben Dhia and Antic, 1971; Verkeck, 1971; Rondia *et al.*, 1984 and Atti and Ben Dhia, 1987 and 1990) showed ADG of only 750 g for local young bulls between the age of 3 and 12 months when raised under favourable conditions. Basic production performances of these animals are given in table 1. However, these performances can be greatly improved through better management and feeding and by the use of selection. Many exotic breeds of cattle have been introduced into the country to primarily produce milk and to determine their possible use in crossbreeding with local animals for more efficient beef production. Efforts have been directed to identifying appropriate crossing level for better growing and fattening performances. The three major breeds retained were the Friesian, the Schwitz and the Tarantaise (Djemali *et al.*, 1999). Improvement was made in milk and meat production of crossbred animals. Table 1 shows published meat production results obtained for these crossbred animals. Maximum ADG increase (+36 %) was obtained with F2 Schwitz.

Table 1. Birth weight (BW) and average daily gains (ADG) for local and exotic animals and their respective cross bred young bulls (Rondia *et al.*, 1984)

Genotype	F0		F1		F2		F3	
	BW (Kg)	ADG (g)	BW (Kg)	ADG (g)	BW (Kg)	ADG (g)	BW (Kg)	ADG (g)
Schwitz	40.7	1036	31.0	952	36.0	1022	36.2	957
Friesian	35.8	1014	27.5	915	33.8	983	34.8	972
Tarantaise	37.0	1016	28.5	916	33.9	970	34.2	990
Holstein	35.8	1043	31.0	872	-	-	-	-
Local	24.8	753	-	-	-	-	-	-

Straight-bred young bulls

Many exotic dairy cattle breeds have been imported into the country to primarily produce milk and to determine their possible use in crossbreeding for more efficient beef production. It is our purpose here to summarize meat production performances of these breeds which were introduced first and which have been increased in numbers since their arrival. The ADG were in the range of 1000 g/day (table 1). Others studies showed higher gains, particularly with silage based diets.

A-2 Cull cows

Cull cows provide 30% of total beef in Tunisia. They are generally slaughtered while in poor body condition soon after being culled without any fattening. Carcass yield is low and the meat is of low quality. However, fattening cull cows is a common practice in many countries to seek increased liveweight and improved carcass traits and meat characteristics. Such practice is not used by producers in Tunisia and therefore research in this area is required. The only attempt was made recently by Majdoub *et al.* (1997) where different cull heifers, young, and mature cows were fattened for 60 days on a medium quality silage diet obtaining total weight gains of 63.3, 37.4, and 22.5 kg and ADG of 721, 621 and 375 g, respectively. However, when considering added values, mature cows had the highest gain (217 vs 190 and 168 US \$ for mature cows, heifers and young cows, respectively). Such results suggest that fattening cull cows can be of big interest in bridging the gap between supply and demand for beef.

B- Feeding systems and fattening performances

In Tunisia, the low meat consumption per capita, the continuous population increase and the improved revenue of household have served to emphasize the need for more meat production. Research objectives have focused on evaluating different diets for more meat production. Several systems of beef cattle fattening have been used. They were defined based on the used feed resources and the basal diet. One is to fatten cattle on pasture alone. A second is to feed hay-based diets and grains. A third is to use silage. A fourth is to fatten cattle in a feedlot on full feed for 180 or more days. A fifth is to use crop residues and agricultural by-product based diets.

B-1 Fattening cattle on pasture

Pasture crops are extremely important as a source of nutrients for beef production. There is no doubt that they are the least expensive way for using forages produced at the farm level. Available data indicate that this system was studied during the 1967-76 period as a part of the PEDAEF and the OEP-USAID projects. ADG varied between 500 and 700 g for native animals and between 800 and 1000 g for exotic breeds and crossbreds grazing on pasture with a mixture of barley and ray grass for a period of 95 to more than 150 days (Verkeek, 1971; OEP-USAID, 1976). Similarly, Jaritz and Schulke (1972) reported ADG of 722 and 553g with Schwitz and local by Schwitz crossbreds grazing clover pasture. However, it appears that although this fattening system is rather of interest both technically and economically (Verkeek, 1971) and has several advantages (cheaper gains, less labor, better use of land for the production of cultivated crops), fattening cattle on pasture alone has some disadvantages. Cattle fattened on pasture make low gains and may sell less than those fed in drylot because they may not carry as much finish when marketed. An additional fattening period in the feedlot on full feed for 60 days or more is necessary for this system to work well. More future research is warranted in this area in order for this system to make better use of pastures available in north of the country which otherwise would be of limited use to humans.

B-2 Fattening cattle on grass and/or legumes hay

This is the most common traditional fattening system used by beef producers in Tunisia. Grass hay is one of the most important roughages fed to beef cattle. Widely used crops for producing grass hay include barley and oats. Much of the hay fed is of poor quality because it is not harvested at the appropriate stage or is not stored properly. ADG were in the range of 700 to 800g and 900 to 1000g for local and exotic animals, respectively (Verkeek, 1971). FCR and the cost of the feed unit for meat (UFV) are high. Production cost of meat is therefore high. Only small farmers and those having no land to cultivate forages use such system. It is often associated with crop residues and agricultural byproducts. Sansoucy *et al.* (1984) reported an ADG of 800 g and a FCR of 11.99 Kg DM/Kg of gain when fattening native animals for 125 days using a hay based diet supplemented with concentrate. However, Fraj *et al.* (1996) reported an ADG of 1172 g and a FCR of 7.6 Kg DM/Kg of gain using Friesian young bulls and an oat-vetch hay based diet. Such system will remain in practice by small farmers and in areas where silage or other forages can not be produced. More research work should be carried out on chemical and/or biological treatments of poor quality hay for a better utilization by beef cattle.

B-3 Fattening cattle on silage

B-3.1. Fattening system based on cereal and/or cereal-legume silages

Cereals or cereals plus legumes, particularly the oat-vetch association, were largely cultivated for silage used for beef production in Tunisia. This fattening system was developed by large operations to partially replace the traditionally widespread hay fattening system of low efficiency. It was started in the early seventies and has been studied quite extensively between 1970 and 1980. ADG ranged between 730 and 1218 g according to the diet and the type of fattened animals. Verkeek (1971) reported ADG of 1108 and 944g respectively for Friesian and crossbred animals when fed silage-hay based diets (Table 2). Sansoucy *et al.* (1984) observed lower gains (937g) and a FCR of 8.8 using local bullocks fed 5.6 kg of silage and 2.7 kg concentrate on dry matter basis. While Majdoub *et al.* (1989) reported in a large scale trial ADG of 730 to 940 Kg on a diet containing 7 to 8 kg silage DM and 2.5 kg concentrate DM for a fattening period of 110 to 130 days. Adding monensin (200-250 mg/head/day) to such ration improved FCR. More recently Fraj *et al.* (1996), using Friesian bullocks fed 5.24 kg of an oat-vetch silage and 2.85 kg of concentrate reported ADG of 1218 g and a FCR of 6.65. This fattening system will remain in use by large operations

Table 2. Fattening performances of young bulls fed diets based on cereal silages

Genotype	Fattening period (days)	Diet	DMI (Kg/d)	ADG (g/d)	FCR (Kg DM/kg of gain)	Reference
Friesian	130	silage	3	1108	8.39	
		concentrate	3.7			
		hay	2.6			
X Local ¹	143	silage	2.6	944	9.00	Verkeek (1971)
		concentrate	3.0			
		hay	1.8			
Friesian	143	silage	3	943	9.6	
		concentrate	3.56			
		hay	2.5			
Local	125	silage	5.59	937	8.84	Sansoucy <i>et al.</i> (1984)
		concentrate	2.7			
X FH ²	126	silage	7.72	936	12.66	Majdoub <i>et al.</i> (1989)
		concentrate	2.58			
X FH	119	silage	7	912	11.29	
		concentrate	2.58			
		monensin	250 mg			
Friesian	143	silage	5.24	1218	6.65	Fraj <i>et al.</i> (1996)
		concentrate	2.85			

¹X Local: Crossbred Friesian-Local, ²X FH: Crossbred Friesian-Hereford, DM: Dry matter intake, ADG: average daily gain, FCR: feed conversion ratio.

B-3.2 Fattening system based on corn silage

In area where irrigation can be used to grow corn, corn silage is becoming a main winter feeding source for both dairy and beef cattle. Research findings confirm that corn silage is a very desirable crop for meat and milk productions. Results showed that ADG were about 1300 g for Friesian bullock on a fattening period of 125 to 143 days (Heni and Majdoub, 1991; Fraj *et al.*, 1996). FCR were 6.3 to 6.65 Kg DM/Kg gain. Moreover, ensiled broiler litter can be used as a source of nitrogen in corn silage rations (Heni and Majdoub, 1991; Mami and Majdoub, 1998). On the other hand, Mami and Majdoub (1998) showed that the use of monensin in this type of rations lowered the FCR and thus improved feed efficiency. These different tunisian results confirm worldwide literature findings and show that corn silage, when adequately corrected for nitrogen and minerals, is a good feeding source for fattening young cattle.

Table 3. Fattening performances of Friesian bullocks fed corn silage based diets

Diet	Fattening period (days)	DMI ¹ (kg/d)	ADG ² (g/d)	FCR ³	Dressing %	Reference
silage	125	6.53	1285	6.65	55.2	Heni and Majdoub (1991)
concentrate		2.0				
Silage	125	6.08	1035	8.90	54.0	
Concentrate		2.0				
Poultry litter		1.1				
Silage	99	3.2	1073	5.49	51.2	
Concentrate		2.6				
Silage	99	4.06	1223	6.11	50.8	Fraj <i>et al.</i> (1996)
Feverole		2.05				
Silage	143	5.43	1359	6.30	56.0	
Concentrate		2.52				
Silage	145	5.43	1064	7.89	54.5	
Concentrate		2.52				
Silage	145	4.68	1042	9.00	54.4	Mami and Majdoub (1998)
Concentrate		2.39				
Poultry litter		1.76				
Silage	145	3.39	1086	8.27	54.4	
Concentrate		1.87				
Poultry litter		1.36				

¹DMI: Dry matter intake, ²ADG: average daily gain, ³FCR: feed conversion ratio.

B-4 Fattening cattle on high-energy grains

Although fattening cattle on grains is well studied and in practice in many countries around the world, it is not a common use among producers in Tunisia because it is not cost effective under current

conditions. Most of cereal grains (corn, barley) and soybean meal are imported at increasingly prices. For that reason, studies involving high grain diets were scarce. The only published work was reported by Majdoub *et al.* (1989) where Friesian young bulls were fattened on corn grain gave higher ADG (1546 vs 1234 g/d) and lower FCR (4.56 vs 5.16 Kg DM/Kg gain) compared to the same type of animals receiving barley grain. Average dressing percentages were 58 and 55%, respectively. Under current conditions, this system does not appear to be profitable, particularly in the absence of meat animals that require diets high in energy. Studies of the return/cost type are needed to shade the light on the controversial use of this fattening system. However, it is most probably that such system will gain more interest in the near future as the country is planning to introduce dual purpose and beef breeds as a part of a new strategy aiming at increased meat production.

B-5 Fattening cattle on crop residues and agricultural byproducts

Crop residues include the forage left when grain is removed from the crop such as barley, wheat, and oat. Agricultural byproducts used in fattening cattle mainly include beet pulp (BP) and poultry litter (PL). Work on BP use in beef cattle production in Tunisia goes back to the early seventies when Verkeck (1971) fattened different breeds of animals for 120 days on diets consisting of ensiled BP, hay, molasses and concentrates. ADG of 900 g was obtained. Further research results confirmed the nutritional value of BP for beef production. Majdoub (1988) summarized major data on BP fattening systems (Table 4). Results are conclusive and probably research on this area was quite intensive. However, because of its high nutritional value, BP is almost exclusively used in dairy rations for milk and not meat production. Straw from small grains is a crop residue that has been used either as it is or chemically-treated to supply a part of the roughage in beef fattening rations. It is low in protein and TDN and was seldom used as the only roughage for meat production. Work done in Tunisia (Chermiti, 1994; Majdoub *et al.*, 1989; Abdouli *et al.*, 1988) showed that ammonia or urea treated straw can partially replace cereal silage or hay commonly used in beef fattening diets. Majdoub *et al.* (1989) reported ADG of 900 g and FCR of 12.25 Kg of DM/Kg of gain when fattened Friesian-Herford crossbred animals on diet consisting of 70% oat-vetch silage and 30% sodium hydroxide-treated straw for 105 days. Similarly, Abdouli *et al.* (1988) showed ADG of 849 g and a FCR of 7.6 when fattening Friesian animals on a diet composed of 3.21 kg of urea treated straw and 3.59 kg of concentrate, on dry matter basis. More research is needed to better develop this system, particularly in areas where small farmers are not able to produce conventional forages.

Table 4. Beet pulp (BP) based fattening system (Majdoub *et al.*, 1988)

Genotype	Diet	Fattening period (days)	DMI (Kg/d)	ADG (g/d)	FCR
Local	Dehy. BP ¹	141	5.1	938	7.57
	hay		1.0		
	concentrate		1.0		
Friesian	Dehy. BP	116	7.0	1068	8.42
	Hay		1.0		
	Concentrate		1.0		
XF-H ²	Dehy. BP	173	6.9.0	1045	9.47
	hay		1.0		
	concentrate		2.0		
Salers	Dehy. BP	109	5.02	1190	7.86
	hay		1.0		
	conc.		2.		
			59		
XF-H	Ensiled. BP	132	6.39	967	9.70
	straw		1.27		
	conc.		1.0		

¹ Dehy. BP: Dehydrated beet pulp, ² XF-H: crossbred Friesian-Herford

CONCLUSION

Most of the research conducted on beef production has been done with young growing and finishing bulls. The work mainly dealt with dietary effects on growing performances. Research on fattening cull cows and steers and on carcass and meat quality evaluation are scarce. Current prevailing systems will most likely remain in use by small farmers and large operations. Methods of more efficient production, including feeding and management, and on producing more tender meat with better flavor and quality will be of greatest importance. Further research is therefore needed to improve the quality of silages, determine their best supplements, and assess the impact of such diets on meat quality. Research efforts should also be focused on improving the utilization of poor quality forages for meat production. Chemical treatments of straw and hay and the use of feed additives (enzymes, yeast cultures) can increase the efficiency of utilizing low quality fibrous roughages and improve the performances of fattening cattle. Research programs on cull cows and steers fattening and on carcass and meat quality evaluation should also be developed. Animals best able to produce beef on forage alone need to be identified as there is an increasing need to use grains for feeding human population while much of the available land in the north of the country can never be used for anything but grazing.

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