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Analysis of reproductive and growth characteristics of Charollais mutton sheep breeds

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3. Aim of thesis
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- Momani Shaker Mohmed (2003): Crossing of Awassi sheep breed with mutton Charollais and prolific Romanov sire breeds in subtropical regions. Habilitační práce, ČZU Praha – Agronomická fakulta.
- Carles (1990) : Sheep production in the tropics
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- Vohradský F., (1999): Místní plemena domácích zvířat tropů a subtropů

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Declaration:

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. This M.Sc. thesis is submitted in partial fulfillment of the requirements for the degree of Master of Animal Science and Food Processing, Czech University of Life Sciences,

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Author, signature……

Abstrakt

Analýza reprodukčních a růstových ukazatelů u masného plemene ovcí Charollais.

Clím práce bylo vyhodnocení vybraných reproduckčních vlastností u ovcí plemene Charollais při pastevním způsobu chovu a zhodnocení vlivu otce, četnosti vrhu, pohlaví věku matek a roku na živou hmotnost jehnat při narození a ve 30 a 100 dnech věku jehnat. Reprodukční ukazatele byly vyhodnoceny metodou analýzy rozptylu. Pro stanovení významnosti rozdílů bylo použito scheffého testu při použití programu PC STATGRAPHIC. Na základě získaných údajů byl metodou lineární interpolace proveden přepočet živé hmotnosti na věk 30 a 100 dnů. Take bylo provedeno vyhodnocení růstové schopnosti jehnat od narození až do věku 100 dnů. Na závěk experimentu byly zjištěné údaje zpracovány matematicko- statistickým programem SAS, podle modelových rovnic s pevnými efekty, metodou nejmenších čtverců.

Bylo zjištěno postupné zvyšování hodnot všech roprodukčních ukazatelů s postupujícím věku matek. Nejvyšší procento plodnosti na bahnici základního stáda a procento plodnosti na obahněnou bahnici bylo zjištěno u šestiletých bahnic (202,00 %; 202.00 %). Věk bahnic ovlivnil průkazně živou hmotnost jehnat a přírůstky ve 30 a 100 dnech věku. Dále byl zjištěn vysoce významný vliv pohlaví na živou hmotnost při narození ($P< 0.001$). Živá hmotnost při narození a ve 30 a 100 dnech věku a průměrný denní přírůstek živé hmotnosti ovlivnují vysoce významně četnost vrhu($P< 0.001$).

Ovce; Charollais; plodnost; růst.

Abstract

The objective of this study was to evaluate the analysis of reproductive and growth characteristics of Charollais mutton sheep breeds. The study was conducted at the farm kostelec, located 16 km from the city of Tabor in south Bohemia. Three hundred and seven, 3- to 8-year-old ewes and 571 lambs of 7 sires were used in the study during 7 breeding seasons over 7 years during the period from 2005 to 2011. Harem breeding was used for mating of ewes. In 195 born lambs live weight was determined at birth and every 30 days. Based on the raw data obtained, selected reproduction characteristics were assessed (by the STATGRAPHIC program) and lambs growth performance were analyzed by a mathematical and statistical program (SAS) according to the model equation with fixed effect by the least squares method. Pregnant lambing ewes received hay with an addition of grain by 0.300 g head /day four weeks before the beginning of lambing. The lambs were given hay and grain mix (ad libitum) until the common beginning of grazing commonly on April. In general, the results showed that conception rate, fertility per ewe lambed and fertility per ewe exposed were 100%, 185.99%, 185.99% respectively. Age of ewes had a high significant effect on fertility per ewe lambed and fertility per ($P<0.001$). The highest percentage of fertility per ewe of basic stock and fertility per ewe lambed was found in sex year old ewes (202.00%; 202.00 %). Also breeding year had a high significant effect on fertility per ewe lambed and fertility per ($P<0.001$). Mortality of lambs till 5 days after birth (12.08%) was affected by Age of ewes and breeding year ($P< 0.001$). Average live weight of lambs at birth was 3.36 kg and at the age of 30 and 60 days 11,23kg and 27.81 kg, respectively. Average daily weight gain (ADG) of lambs from birth until 100 days of age was 236 g. Live weight of lambs at birth was affected by type of birth ($P \leq 0.001$). Other effect on Live weight of lambs at birth in this study was not found, but sires, type of birth, sex year and age of dam were affected ADG, live weight of lambs at 30 and 100 days of age significantly ($P \leq 0.05–0.001$).

Reproductive traits of the Charollais sheep found in this study were higher than average values reported in the literatures and even higher than values of the other mutton breeds rearing in Czech Republic. Otherwise, average daily weight gain and live weight of investigated lambs were less than reported in the literatures.

Keywords: sheep; Charollais; fertility; growth.

LIST OF TABLES

Table (20) Showed Means and F values for average daily weight gain from birth to 30, and 100 days of lambs as depending upon the sex.

Table (21) Shows values for average daily weight gain from birth to 30, and 100 days of lambs as depending on the sire.

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1 INTRODUCTION

Sheep in Yemen are kept mainly for meat production. sheep milk and manures are highly appreciated products by farms, but as yet very little is known about their economic significance. In some regions of yemen sheep and goats are milked for home consumption and for making butter and local cheese mixed with milk from cows and /or goats (Almumary et al. 2002).

Sheep are probably the most widespread species of domesticated animal in the world. They were domesticated about 11,000 years ago in the area that is now known nowadays northern Iraq. There are more than 150 breeds of domestic sheep, in addition to several other distinct species of sheep such as the bighorn sheep, argali sheep, Dall's sheep and mouflon sheep. All sheep are even-toed, hoofed animals. They are called ruminants because they are cud-chewing animals that lack upper incisor teeth, and have a four-compartment stomach. Adult males, depending upon the breed and species can weigh anywhere from 165 to 440 pounds. Adult females weigh between 100 to 250 pounds. Sheep live an average of 6 to 7 years but can live as long as 20 years. Female sheep are called ewes, while the males are called rams. Offspring sheep are called lambs and are born after a gestation period of about 150 days. A lamb can stand up within a few minutes after birth. A lamb can identify which ewe is the mother by her smell and by the sound of her bleat.

Young lambs will stay with their mothers until they are about five months old. By the time the lamb is six months old its weigh will be ranged between 80 and 120 pounds, and can live on its own. The removing tails of the very young lambs is simple and has many benefits for the young lamb in terms of cleanliness and overall good health.

The lamb will probably also receive several vaccinations and a numbered ear-tag. This ear-tag helps to identify the individual lamb as it grows up, so that accurate health and production records can be kept for each animal. Sheep live in groups called flocks, although large flocks consisting of over 1,000 sheep are frequently called herds. Sheep are adaptable to a wide range of climates and management systems.

The proper movement of sheep on a range actually makes the land healthier and more productive for plants to grow and for the wildlife that also rely on the range vegetation. The sheep break up the soil to provide seedbeds for new plants, fertilize the land with their wastes,

and help to keep undesirable plant species under control. Control these undesirable plants, ranchers and other land managers save money because they do not have to use herbicides to do the same job as the sheep do for free. Leymaster (2002) reported that one of the most valuable resources in the sheep industry is breed diversity. Fogarty (2006) reported that increased productivity through crossbreeding can mainly be achieved through breed diversity.

Sheep breeders in many countries have imported breeds and genetic material in an attempt to obtain a quantum leap in productivity, to produce a better quality or a new product or to provide sheep with a major adaptive advantage. Charollias is a breed of domestic sheep originating in France. Charollais breeds are a terminal sire breed so emphasis on selection should be placed on its excellent fleshing qualities and growth. The purpose of the breed is to breed rams for crossing with commercial ewes to produce quality meat lambs for slaughter. Easy lambing is an important trait associated with breed.

Sheep charolliasd are easy animals, whether it be housing, nutrition and adaptation or different natural and climatic conditions.

In 1990 was proportion of mutton breeds only 0, 6 %, while in 2000 it is already 30 % from total breed structure kept in Czech Republic. The highest number of sheep is of Charollais breed. This breed was imported to the Czech Republic for the first time in 1990, it was 20 heads. Number of 1149 heads of sheep was joined to this production tests in 1998. Number of 6268 Charollais sheep's was joined to production control made by breeding company in 2000, i.. e. 18, 7 % from total number of breeds and 50 % from total number of mutton sheep.

Say that this breed reaches very good parameters in reproduction and lambs have very good growth from born to 90 days of age. However this breed has quite vitality demonstrations than national breeds and requires other technological systems of breeding.

Increase in world population has also increased the demand of meat with low fat and high protein to satisfy their protein requirements. Owens et al. (1993) reported that growth rate and daily gain are the most important characteristics when studying the meat production of lambs. Increasing mutton production is influenced by litter size and growth intensity of lambs from birth to weaning for rapidly achieves slaughter weight. Two alternative methods of production development exist:-

Using analysis of reproductive and growth characteristics of mutton sheep breeds charollais.

The knowledge of genetics (selection of local breed and crossbreeding with exotic breeds) and improvement of environmental conditions (management and feed quality). Many authors reported that it is relatively easy and quick to increase fecundity and growth ability of lambs to an optimum level by means of crossbreeding domestic breeds with prolific and mutton breeds (Romanov , finish sheep , charollais , Suffolk Texel etc), (Margetic et al., 1988; EI Fadili et al., 1999; Horák et al., 2000). The real growth and development of lambs in the period after birth is a prerequisite for satisfactory efficiency in further phases of rearing and breeding (Korn et al., 1987; Momani Shaker et al., 1995; said et al., 2000).

The previously authors indicated that the increase in lamb weight during the period of rearing is affected mainly by lamb sex, litter size and dam age.

The specific objectives of this study were:

- To evaluate reproductive performance of the Charollais sheep as depending upon the rearing year and ewe age, include the mortality rate of lambs from birth till 5 days of age.
- To evaluate growth performance of the lamb Charollais sheep as depending upon the particular effects.

In order to achieve the aims which will be defined later on the first part of thesis has been structured into seven chapters:

- Chapter 1 Introduction: It describes the aims and specific objectives of the presented experiments. It states also of reproductive and growth characteristics of mutton sheep breeds charollais, the mortality of offspring of crossing pure sheep breeds charollais.

- Chapter 2 includes a review of theoretical information about sheep breeding, factors influencing reproduction traits, growth performance, carcass characteristics and composition of sheep breeds charollais in the Czech Republic particularly.
- Chapter 3 describes the proposed methodology, materials used and the experimental design used for the statistical analysis.
- Chapter 4 and 5 include the results and discussion respectively.

- Chapter 6 describes the main conclusions and recommendations.
- Chapter 7 lists the different references used in this study.

2 LITERATURE REVIEW

2.1 Small ruminants

Bakht et al. (2003) the term small ruminant denotes sheep and/or goats. This term can be interchangeably used with sheep and goats. The buffalo, cattle and camel (a special ruminant) are considered as large ruminants, whereas sheep and goats, because of their smaller size, are called small ruminants. However, they all are polygastric animals. The following natural advantages are in favor of sheep and/or goat production:

- They are able to convert weeds, bushes, grass and other plants on rangeland and pastureland to useful products, including meat, milk, fiber, leather and pharmaceuticals. They are excellent scavengers for gleaning fields.
- Compared to buffaloes or cattle, they produce more liberally in proportion to what they consume.
- Their returns come quickly. Their young ones, if properly fed, may be marketed when about a year old.
- They are unexcelled in the utilization of the more arid types of grazing.
- Their energy requirements (except dairy goats) are lower than those for other livestock enterprises. Also, the energy requirements for fiber production by sheep are lower than those for synthetic fibers.
- Sheep and goats are highly adaptable and non-competitive with humans for feed.
- Their low purchase price.
- Subsistence farmers keeping goats or sheep need very small amounts of purchased animal feed because their stock can manage on very poor quality roughage if required.

2.2 Sheep in the Czech Republic

Zbyněk (2011) reported that the history of sheep and goat breeding in the Czech Republic from the second half of the 15th century. A time alpine farming began to penetrate the region. It had a strong influence on sheep and goat breeding (Kuchtík 2005). Sereda et al. (2011) reported that Sheep were the first domesticated animals in former Czechoslovakia. The oldest sheep in Bohemia belonged to the Mufflon like type of Ovis staderi, termed also as

"sheep of copper era. The first publication dealing with sheep breeding in our country was issued in Prague in 156 1.

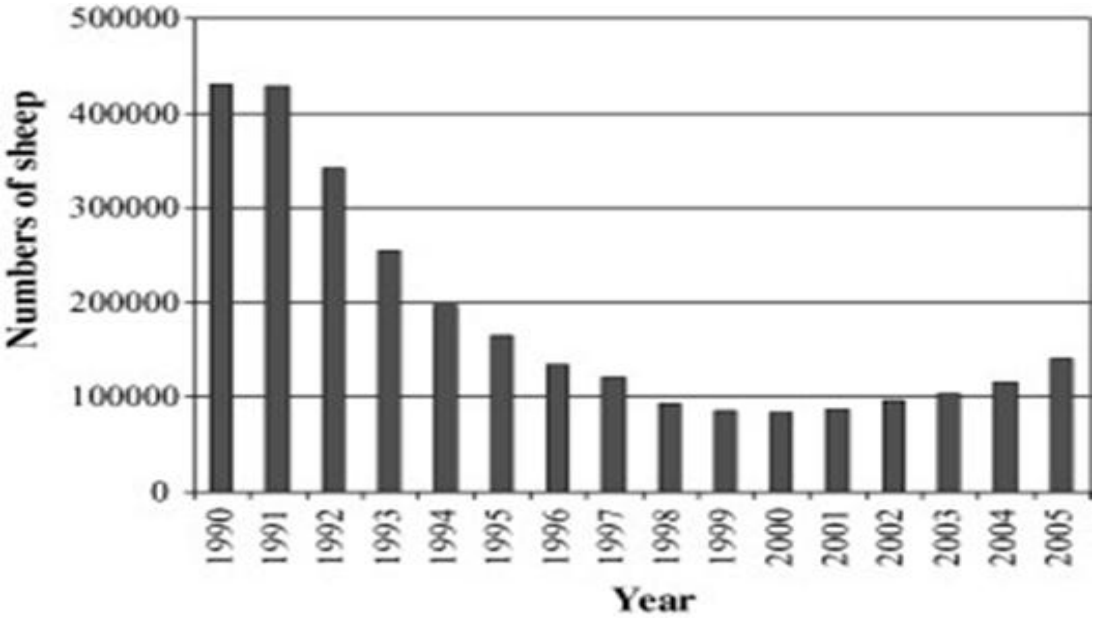
The high standards of Bohemian sheep breeding can be documented by the fact that in 1769 breeding ewes were delivered from Bohemia to upper Austria for improving the flocks there. Petr et al. (2002) reported that In 1945–1989 the country was isolated from the Western Europe because of the socialistic political regime which brought about economic orientation towards the East and specific features of land-use (including so-called "collectivization", involving the concentration of agricultural production into large production units, and the evacuation of border areas and their subsequent colonization). Anne (2006) reported estimation still, to some extent, pigs, and the animals' limited reproductive output means that a large number of breeding units (on farms) are needed in order to disseminate desired characteristics from elite animals at the top of the breeding pyramid. In addition, cows on dairy farms are the mothers of potential future breeding animals and are hence also a part of them breeding chain. The breeding of small ruminants such as sheep and goats is also specialised. The farmers of these species often live in marginal areas, far from the market and with a more limited access to technology than in the case of other species. Small-ruminant farming is often organised in a weaker co-operative system than for cattle. .The importance of these species is likely to increase in the future because of their important environmental impact. New technologies in breeding and reproduction have not yet had much impact and should therefore be stressed. In pigs, many farms are involved in disseminating top breeding animals to the farmer who grows the pig. Breeding programmers are often based on crossbreeding schemes integrating a dissemination level and a core breeding level. In ruminants and pigs, most breeding organizations are cooperatively owned by farmers. The organizations based in Europe are world leaders for their species. In the 1980's, emphasis focused on increasing the fertility and milk production of ewes as well as meat yield while producing slaughter lambs. Presently, rearing meat breeds of sheep is being preferred, wool is considered only as a supplement. Several flocks are oriented towards cheese production especially in Moravia. The reduction of the wool price after 1990 strongly influenced the decrease of the sheep population. Different sheep breeds have been kept in the Czech Republic in spite of unfavorable development: Merino, Walashian sheep, Tsigaya, Sumava sheep, Romanoff sheep, Finnish sheep, Texel, Suffolk, Charolais, East Friesian sheep, etc. The active sheep population accounted for 11,100 ewes in 1995.

Table(1). Evolution of the sheep population during the period 1920 – 1995 (Sereda et al. ,2011)

Year	**Number of head**
1920	217.257
1935	40.302
1945	274.691
1955	424.278
1990	429.14
1994	209.396
1995	***125.000***

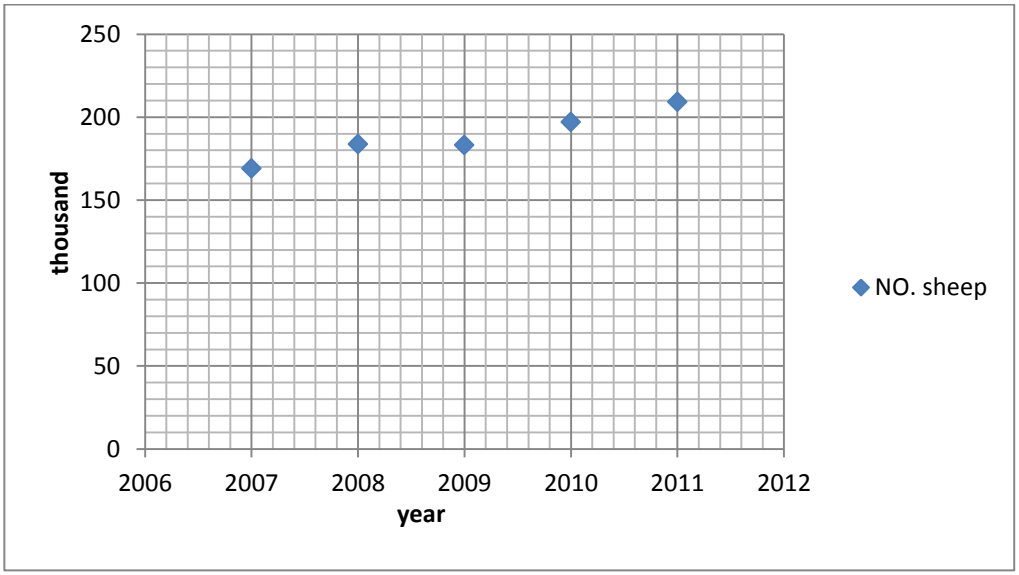
In another study, Mlerski et al. (2005) sheep numbers in the Czech Republic (CR) fell from almost 430,000 in 1990, to 84,000 in 2000 (80% reduction). From 2001, the numbers of sheep in the CR started to increase mainly due to the introduction of ewe premia in less favoured areas (LFAS). According to the official statistics, the number of sheep in the CR was almost 116,000 in 2004, when the CR joined the EU and the new support system was implemented**.**

Graph(1). Changes in the numbers of sheep in the Czech Republic according to official statistics ([0005] and [Králová, 2005



2.2.1 Breeding strategies in the Czech Republic

Ratinger et al. (1997) has shown that The Czech Republic is an industrial country with significant rural features. Predominantly rural areas cover 91% of the country territory and 63% of the population. About 60 % of rural areas are relatively sparsely populated. However, the importance of agriculture in rural economy has declined. Was confirmed Economic and property rights reforms have resulted in a substantial reduction of agricultural employment. During the period 1989-2001, the average number of employees in the sector has dropped by more than two thirds, at present, the process of farm animal breeding and improvement is determined by the Law No. 240/l 99 1 "The improvement and breeding work of farm animals", individual Breeders Associations of pertinent breeds and species of farm animals are responsible for the coordination of breeding programmer of individual breeds including herd-book keeping. All operations combined with testing, improvement, and reproduction, i.e. artificial insemination, embryo transfer, performance recording, determination of breeding value, central records of animals and herd-book keeping, fully determined by law and regulations. Ministry of Agriculture and Food delivered authorization for herd-book keeping to pertinent Breeders' Associations which were also entrusted with the coordination of breeding programmers of individual animal breads. One common herd-book is kept for every breed within the Czech Republic.



(Graf. 2: Development of sheep in the CR from 2007 to 2011: Faostat, 2011)

2.2.2 The breeds commonly in Czech Republic

Bošková (2008). According to the results of performance in 2006 for 31 breed of sheep bred in Czech Republic is relatively high, Since (1945 - 1970) was a great demand for wool, so farmers interested in rearing sheep with a high quality of wool. Subsequently there was a transition to performance-wool and meat since 1990 and even today are at the forefront of breeds with a combined yield meat-milk-wool or meat breeds.

Lucie (2011) reported that until 1990 , sheep strains that produce wool still under the (1st) first grade in Czech Republic (62.9%), sheep strains that produce wool, meat and milk (36.4%), sheep strains that produce meat (0.6%), and milk (0.1%). But in 2007 sheep strains that produce wool, meat and milk (52%), sheep strains that produce meat (39%), strains that produce milk (9%) and strains that produce wool (0%). Jan K (2012) reported that most sheep farms on mountainous areas in the Czech Republic (CR) raise mainly meat type breeds (Suffolk, Charollais and Oxford down) and selected dual and multi-purpose type breeds (Romney march, Sumavska breed and Merinolandschaf.

Khatataev (2007) concluded that It was estimated that 100 g of mutton satisfies the recommended daily requirement of a human for protein by 18.5–20.7% and total amino acid content by 20.4–23.1%, including 19.7–21.3% of essential and 20.8–24.3% of nonessential amino acids. However, mutton satisfies the human body’s requirement for different amino acids to an unequal degree. Higher values were found for lysine (29.4–33.3%), histidine (31.3–33.3%), threonine (26.7–30.1%), glycine (32.1–42.9%), and alanine (33.0–42.6%). Tyrosine (15.3–15.8%) and cystine values (7.1–8.0%) correspond less well to standards of balanced nutrition. Pork fat contained a factor increasing identification of veal as pork, but this factor was water-soluble and could be removed. Lamb fat contained a component, or a fat-soluble component, that significantly increased the identification of veal as lamb.

Horák et al. (1999) reported that meat stored at low temperature after the slaughtering process 3 days mutton, pork 5-7 days, cows 10-14 days, in order to obtain mature meat of high quality. Within the last few years new trends in sheep husbandry resulted in the introduction of intensively bred foreign meat. Type breeds. Rearing of the original breed, well adapted to the conditions of pastoral regions (higher amounts of precipitations, lower temperatures

shorter vegetation period) at the very cost of its lower performance is possible with a subsidy only.

Štolc (1999) reported that sheep in the CR is not expanded as much as in other European countries. Through the transition to a market economy, sheep breeders created considerable economic problems in the sales of wool and a significant reduction in numbers of. At present, there is a shift away from wool breeds and it is therefore necessary to focus primarily sheep to increase fertility and meat yield.

2.3 Breeds triple-purpose (meat, wool and milk)

2.3.1 Sumavka sheep

Lucie (2011) Investigated today, it became the most popular Sumavka strain in Czech Republic.

According to Rodinová et al. (2006) this breed is raised mostly in Sumavka mountain region. It has been developed since the year 1945. In the first phase Czech rustic breed was improved parallel by crossbreeding with Texel, Cheviot, East-Friesian and Soviet Tsigaya rams. Nowadays performance and type traits are genetically fixed. Body is of medium to large frame (live weight of rams 60 - 65, ewes 45kg), lighter skeleton, and slightly curved nose bone. Horns in rams are allowed. Triple purposed breed (wool - meat - milk), well adapted to hill and mountain rearing systems, hard, modest and steady walkers. Milk production after weaning lambs about 60 kg. The wool is semi-fine to semi-coarse, white, combined and sweeping with high rate of long undercoat, elastic with high silvery lustre. Shearing twice per year, sort C/D - E, staple length 20 - 25 cm, fleece yield 65 - 70 %. Fertility for Sumavka sheep 133, 3%, conception rate 90.5%.

2.3.2 Merino sheep

Maijala (1997) reported that the Merino sheep breeds are most renowned for the quality of their wool and have their origin in Spain between 700 and 1200 AD. Lucie (2011) reported Czech Merino originated from German mutton Merino. Flamant (1991) reported there are at least 45 different strains of Merino or Merino-based breeds in at least 27 countries in all

continents. Merino types comprise more than one-third of the world population of sheep. Horák et al. (2004) reported live weight of ewes 65 - 75 kg and male 90 – 120 kg.
Horák (2004) the average live weight of males of this strain 65- 75 kg, this breed was breed in Garman.

2.3.3 Southdown sheep

Lucie (2011) reported According to Otto's encyclopedia (1999), the breed famous for high carcass quality and early maturity, while purebred flocks have been important for meat and wool, breeding throughout the year in the barn, live weight (70), and meat is very tasty and high fertility (160.9%). Woolliams et al (1980) the Southdown produces relatively dense and fine wool.

2.4. Mutton sheep breeds

2.4.1 Suffolk

SCHOK (2011) reported that suffolk breed originated in England, Breed was recognized in 1810. The breed has spread very rapidly and was essentially exported worldwide. Suffolk is the world´s most popular breed which is producing slaughter lambs. It provides a high level of growth, development and good value for slaughter. High performance and quality of production is a guarantee of productivity and profitability of farming.

2.4.2 Charollias

CAB International (2012) reported that Charollais sheep are a medium sized, heavy breed. Adult rams weigh from 110 to 160 kg and the weight of adult ewes varies from 80 to 100 kg. The head is free of wool, is pinkish grey, and often has small black spots. The face is broad with the eyes wide apart. Ears, which are the same colour as the head, are long, fine and flexible. The body is long, with a well-fleshed topline.

Table (2) contains the characteristics of the Charollais sheep about growth profermance

Performance	Optimum	Typical or Moderate	Poor
Growth			
Post weaning growth rate (kg/day) (mammals)	0.35-0.4	0.2-0.3	0.35-0.4
Pre-weaning growth rate (kg/day) (mammals)	0.35-0.4	0.25-0.35	0.35-0.4
Height and Weight			
Age at body maturity (months)		18	
Body height female - birth (cm)	35	32-37	35
Body height female - mature (cm)	72	60-73	72
Body height male - birth (cm)	35	32-37	35
Body height male - mature (cm)	80	70-82	80
Body weight female - birth (kg)	4.5	3.5-6	4.5
Body weight female - mature (kg)	90	80-110	90
Body weight male - birth (kg)	4.5	3.5-6	4.5
Body weight male - mature (kg)	130	110-160	130
Meat			
Carcass yield (%)		50-55	
Juiciness quality		m	
Tenderness quality		h	
Typical slaughter age (months)		4	
Typical slaughter weight (kg)		40	
Weight of weaned calf per year (kg/female/year		45	
Wool			
Wool clean fleece yield (%)		1.5	
Wool crimp		m	
Wool fibre (staple) length (cm		5-6	
Wool fibre diameter (μm)		22-27	
Wool greasy fleece weight (kg		2-3	
Wool natural colour		white	

CAB International (2012) reported that Charollais breed is at present one of the most important French sheep breeds for commercial crossing. The breed is also kept in other countries and the demand for animals is remarkable. Economic and Socioeconomic Aspects Charollais sheep are very suitable for landscape management. Additional profit comes from

selling of Charrollais rams for use as terminal sires, in systems of commercial crossing. Performance Charollais flock in its native area, in France, can achieve an average yearly production of over 500 kg live weight of lambs per hectare. Lambs are finished at 110 to 120 days of age at live weights varying from 36 to 40 kg. Owing to their high fertility and prolificacy (190 %), easy lambing and heavy milking ewes, nearly 1.7 lambs are reared per ewe served. CAB International (2012) reported that under the EUROP system, the average Charollais carcass is classified as class U3. In the Czech Republic the average prolificacy of Charollais sheep is 146.5% and the average daily gains from birth to 100 days of age were 243 g/day in 2000. In the best flock (50 heads), these parameters were 195% and 360 g/day on average. Products the breed is used primarily as a terminal sire to increase the muscling and growth rate of the lambs. Crossbred lambs can afford heavy carcasses with no problem with excess fat. The wool is short and fine. The fleece quality of the purebred Charollais is low, but the fleece of crossbred Charollais lambs is improved by the fleece quality of the mothers. In Britain the Charollais wool is used in high quality fabrics including hosiery, knitting wool, dress fabrics and flannel.

2.4.3 Adapted strain

Horák et al. (2001)reported that Charollais sheep originate from a grassland area with a rather harsh continental climate. They can be kept in semi-outdoor systems. This breed of sheep is very well adapted to pasture systems. It is recommended that temperature is kept at, at least 10 - 12° C during lambing, because young lambs have poorer thermoregulation, than the adult sheep.

2.4.4 Pasture systems

CAB International (2012) reported that Charollais sheep are kept under outdoor and semi-outdoor pasture systems and are often kept together with beef cattle. Flocks in the breed's native area are of average size, generally consisting of 30 to 80 ewes, although in other areas they are often larger. In the Czech Republic more than 400 ewes are kept in the most numerous flocks. Lambs are fattened almost entirely on grass. In France, ewes are served at the beginning of autumn so that lambs are born at the end of the winter. Since the fleeces of lambs are very short at birth, ewes are brought inside for lambing. They remain indoors until the lambs are 15 - 30 days of age, with access to a paddock during the day before

finally going out to grass. This is the only time that the sheep are Housed in this area. In early grassland areas, lambing takes place slightly earlier so that the ewes and lambs can make full use of the spring flush of grass. Lambs are then sold from the end of May to the beginning of July, at carcass weights of 18 to 22 kg. In colder areas, lambing is later and sheep are then kept to complement cattle.

CAB International (2012) reported that in these systems, lambs are weaned at the end of June, finished on grass and sold from September to November at carcass weights varying from 22 to 23 kg. In the harsher conditions of central Europe, ewes are kept indoors during winter. Lambs are usually born from the middle of March to the end of April so that ewes and lambs could take advance of pasture development in May.

CAB International 2012 reported that Charollais sheep are very energetic. They have a rather weak flock instinct and tend to spread themselves over the pasture area. For this reason Charollais is especially suited for fenced pasture fields and grazing systems, as this will keep them from wandering off. Health status of Charollais sheep is good.

Milne and Schock (1998) reported the presence of cerebellar abiotrophy in Charollais lambs. Autosomal recessive gene transmission of disease is possible in this case, but not proven. Green et al., (1995) found a greater proportion of lambs with congenital entropion in those sired by Charollais rams, than in those sired by Suffolk rams.

CAB International (2012) found that nutritional requirements Charollais are typically pasture animals. In the pasture systems, forage growth determines the requirements of the flock. It is usually possible to keep 3 -7 ewes per hectare of land used for sheep per year. Charollais sheep do not require any concentrates in addition to good forage. The supply of supplementary minerals is important.

Table(3) : Nutritional requirements

Daily Requirement	Post-weaning females	Non-pregnant females	Pregnant females	Lactating females	Mature Males
Energy(MJ/day)	7	5	5-8	10-15	10
Water (l/day)	-	5-7	-	7-10	7-10
Protein (g/day)	100	60	65-100	140-210	130-180

Table(4) : Minerals Requirements

Minerals (mg/day)	Post weaning females	No pregnant females	Pregnant females	Lactating females
Magnesium (Mg)	2000	2000	3200	5000
Sodium (Na)	900	1500	2500	3500
Potassium (K)	5000	6000	8000	12000
Sulphur (S)	2300	2600	3400	12000
Chlorine (Cl)	1000	1900	2700	3700

CAB International (2012) found that reproduction fertility of Charollais ewes is high (160-200%). Charollais ewe lambs can be exposed to the ram at 7 months of age and the average litter size 1.3 Lambs, because of their streamlined head and shoulders are known for easy lambing. The ewes have good maternal instinct.

Table (5) Reproductive traits for Charollais sheep.

Performance Criterion	Value
Age at first oestrus (mammals) (months)	5
Weight at first oestrus (mammals) (kg)	45
Age at first conception/lay (months)	8
Weight at first conception (mammals) (kg)	60
Conception rate, natural service (mammals) (%)	80-97
Conception rate, artificial insemination (mammals) (%	55-70
Birthing/laying interval (months)	12
Litter/clutch size	16-2
Fecundity (lifetime number of births/eggs laid)	6-10

CAB International (2012) reported that genetic resources and breeding in France, the Charollais selection scheme consists of three levels: Recording of the flock: includes service recording, lambing recording, weighing of lambs every 21 days (daily gains 10-30 days and 30-70 days of life).

2.5 Breeding management

2.5.1 Ewes

Robison (1981) postulated that understanding of the relationship between direct and maternal effects would facilitate formulation of optimum breeding programmers and improvement of selection efficiency. Colin Palmer. (2009) concluded that Most ewes are capable of giving birth to one to three lambs. Profitability of the flock often depends on the majority of ewes giving birth to multiple offspring, with the goal of obtaining a lambing percentage in excess of 200 percent (number of lambs born / ewes exposed to rams x 100). The objective of most shepherds, when developing breeding strategies, is to ensure an optimal ovulation rate which is directly linked to lambing percentage. Factors influencing ovulation rate are as follows.

2.5.2 Age of ewe

Colin Palmer. (2009) reported that as ewe age increases so does the number of weaned lambs. Of course, mature ewes would be expected to be better mothers, having survived the cull of those that demonstrated poor mothering instincts, but older ewes also tend to ovulate more eggs. Ovulation rates are highest between three and six years of age and decline thereafter, the average life expectancy of a sheep is 10 to 12 years, though some sheep may live as long as 20 years.

Lu Anne et al. (1975) studied the influence of dam age on productive characters of sheep has not been studied as extensively as for beef cattle. Data utilized for this study came from records collected over a 14-year period, 1956 to 1969 inclusive, from a purebred Southdown flock which had been closed to outside breeding since 1957 and selected for date of birth. The lamb traits studied were birth weight, rate of gain from birth to 120 days and 120-day weight. The ewe traits studied were lambs born per ewe exposed (LBEE), lambs reared per ewe exposed (LREE), percent ewes lambing (%ELA), lambing date (LADT), Iambs born per ewe lambing (LBEL), Iambs reared per ewe lambing (LREL), date of first estrus (DAES), ewe wool weight (EWWT) and ewe body weight (EBWT). For the lamb traits, age of dam was a significant source of variation for BTWT only. Lambs from 2-year-old ewes were lighter at birth than lambs from all other age of dam classes. Age of ewe was significant for all ewe traits except %ELA and LADT. In general for the various ewe traits, the mature ewes were more productive than younger ewes with the only exception being that EWWT tended

to decline with advancing age.

Bair et al. (1972) studied estimate for birth weight was 0.39. Including weight as a continuous independent variable decreased the heritability of most characters. Calf sex, calf age and age of dam effects were highly significant (P≤ 0.001) for most characters. Blackwell et al. (1955). Pointed out that age differences among ewes and differences associated with years were the major. Sources of tangible environmental variation in fleece weight. Differences associated with years, age of dam, age of lamb, sex, and type of birth and rearing were important sources of variation in weaning weights in the Corriedale, Hampshire and Shropshire data. Year of birth, age of dam, sex, and type of birth affected birth weights significantly in all breeds. In the Dorset weaning weight and birth weight data the season of birth was an additional source of variation. Age of dam was found to have no significant effect on weaning weight of Dorset lambs. Breed differences were large for all traits studied. El tawil et al. (1970) found that breeding-group, age of dam, type of birth and rearing, sex, age and lamb's birth weight, affected significantly all weaning and yearling traits with minor exceptions. Type of birth and rearing, age of dam, and breeding-group were most influential on weaning traits; sex and year of birth greatly affected yearling traits.

In another study, Vesely et al. (1970) Age of dam had significant effects on birth weight ($P < 0.01$) and weaning weight ($P < 0.05$) but was, relatively unimportant as a source of variation. Birth weight increased with advancing date of birth, and weaning weight, body conformation score, and condition score improved with age at weaning.

Žáčková (2007) found that birth weight of lambs was influenced ($P \leq 0.05–0.001$) by sire, litter size, sex and birth year. Effects of ewe age flock and birth month on birth weight of lambs was not proved. Sire and flock did not influence 30-day weight and 100-day weight of lambs, but effects of litter size, sex, ewe age, birth year and birth month were important ($P \leq 0,05– 0,001$). Daily gain of lambs for the period birth to 30-day was influenced ($P \leq 0.01–0.001$) by litter size, sex, ewe age, birth year and birth month. Effects of sire and flock on daily gain of lambs for the period birth to 30-day were not observed. Litter size, sex, ewe age and birth year highly influenced ($P \leq 0,001$) daily gain for the period birth to 100-day, but effects of sire, flock and birth month were not important. Colin Palmer (2009) Finnish Landrace ewes reportedly have the highest ovulation rates, with three to five lambs being born, on average. Other prolific breeds include the Romanov, Borolo, Merino and Icelandic

sheep breeds. For the purposes of this discussion, prolific breeds are those that are recognized to routinely produce three to five lambs per lambing.

2.5.3 Nutrition requirements

Colin Palmer (2009) reported that animals must be well-fed if they are going to reproduce. The nutrient requirements of the reproductive system are addressed long after those of basic maintenance; in other words, poorly fed animals will focus on life preservation before life creation. Ewes with the greatest nutrient intake tend to have the highest ovulation rates at the onset of the breeding season. This effect is mediated through the direct effect of increased blood glucose on increased ovarian function, and is referred to as flushing. Typically, ewes are fed at energy levels which exceed their daily requirements for maintenance, and to be effective, flushing must begin two to three weeks before the onset of the breeding season.

2.5.4 Effect of lambs' gender

Kuchtík et al. (2011) who found that no significant effect on growth between sexes, although they confirm higher daily gains by males The level of DG 100 defined in the breed standard for Texel is 250 g per day for ram and for ewe – lambs 200 g per day – thus, in both cases the results in the monitored herd were exceeded by 5.39 g per day in rams, respectively 38.17 g per day in ewes.

2.6 Growth traits

Pethick et al. (2005) reported that lamb growth rate is an important determinant of on-farm productivity and profitability. Growth rate varies according to stage of development, which causes variation in meat quality traits. Therefore, developmental traits such as muscle metabolic type and intramuscular fat content are likely to be influenced by early and midlife growth, whereas traits such as the transient storage of muscle glycogen are more likely to be aligned with pre-slaughter growth. Kelman et al.(2011) noted that an accurate model of all phases of growth is necessary to predict the effect of growth rate on meat quality traits. Also reported lamb growth can be modeled using the Brody function, the parameters of which describe birth weight, average mature weight and maximum growth rate at a given time

(Brody, 1945).

2.6.1 Effect of breed on growth

Colin (2009) noted that finnish Landrace ewes reportedly have the highest ovulation rates, with three to five lambs being born, on average. Other prolific breeds include the Romanov, Borolo, Merino and Icelandic sheep breeds. For the purposes of this discussion, prolific breeds are those that are recognized to routinely produce three to five lambs per lambing. Genetic parameters for sheep production traits were reviewed by Fogarty et al. (1995) who reported weighted means of estimates of heritability, genetic and phenotypic correlation between different traits from the literature. Leymaster (1987) however, reported no significant differences between crossbred and purebred lambs in birth weight, weaning weight and post weaning growth rates. Growth characteristics were defined as weight at different ages: birth, weaning, post weaning, and adult form. Demeke et al. (1995) showed that birth and weaning weight increased significantly with increasing level of exotic genes up to 75% so increasing exotic genes using one of the genetic improvement approaches – such – as crossbreeding would increase sheep productivity .

Emsen (2005) studied the body weight gain of Awassi (A) and Redkaraman (R) lambs with their reciprocal crosses R x A (ram lambs) and A x R (ram lambs). They found that Redkaraman lambs were significantly heavier at birth than Awassi and A x R, but at weaning A x R and similar live bodyweights. Body weight was lowest in A rams throughout the study.

Studying the genetic effect on growth from birth up to 1 year of age. Boujenane et al. (1991) said a lambs from Diallel cross of Sardi (S) , D' man (D) and D'man x sardi (DS). They concluded that Sardi direct genetic effects were significantly higher than those of D;man for weight at birth and up to 2 months of age, but the differences decreased thereafter and were in favor of D'man at 6 months of age. Hill et al. (1993) compared the performance of Awassi to Coopwerth breeds in New Zealand. They found no significant differences between breeds in birth weight weaning weight and live weight. Awassi birth weight was 4.66 Kg for and 4.24 Kg for ram and ewe lambs, respectively. In general, crossbred lambs were found to have higher live weights than pure lambs, which are known as hybrid vigor. Bourifa and

Touchberry (1993) reported that significant effect of the breed of the lamb on birth weight, 30 – day's weight and average daily gain (ADG) . Dam breed had significant effect on birth weight, 30 and 90-days with Sardi crosses being the heaviest over D;man, Beni Guil crossbred lambs.

2.6.2 Litter Weight at Birth and Weaning

Boujenane. (2002) worked on sheep breed in Morocco, reported that litter weight at birth averaged 5.35 kg and was ranged from 4.1 kg. Macedo and Hummel. (2006) worked on Pelibuey ewes in Mexico, reported that litter weight at birth averaged 6.69 kg. Rastogi. (2001) worked on Barbados sheep in West Indies, reported that litter weight at weaning averaged 23.48 kg, and was ranged from 16.7 kg. Eriz et al. (2005) worked on Turkish Merino in Turkey, reported that litter weaning 41.58 kg. Momani. (2002, 2010) worked on Charollais sheep in Czech, reported that litter weight at birth averaged and weaning (4.20 ± 1.15 and 19.27 ± 4.59), (4.18 ± 1.13 and 19.25 ± 4.60) respectively.

Indicator	BW	30d	WW	ADG
Lamb weight (kg)	3.4	14.1	30.4	270

The results of performance tests by sheep breeds for 2010 Table (6) (Source: Association of sheep and goats in the CR)

2.7 Effect of genotype on average daily gain and total weight gain

Momani et al. (1995) investigated the factors that affect lamb growth of Charollais breed and concluded that the sire genotype did affect lamb growth. An experiment conducted by Silva et al. (2002) studied the effect of genotype on sheep growth by using Merino Branco (MB) and crossbred Ile de Franco x Merino Branco (IF x MB) sheep.

Hassen et al. (2002) studied the effect of crossbreeding on sheep growth and reported that average daily gain was not significantly affected by genotype and crossing.

In addition Gursoy et al. (2001) studied the growth performance of Turkish Awassi Flock when out crossed with Israeli improved Awassi rams, and found that there was no effect of genotypes on either growth rate from birth to weaning or live weight. On the contrary, Macit et al., (2001) concluded that effect of breed on daily weight gain is significant. This result

was reached when they studied the growth performance of Awassi, Morkaraman and Tushin lambs, with Awassi being intermediate between the other two breeds. Hassin et al. (1996) studying Chios and Ossimi sheep, found that the total body weight gain was significantly affected by breed, but average daily gain was not. Guney (1990) Studied the effect of crossbreeding between Ile – de – france (ILF1), Rambouillet (R) , Chio and Awassi (A) lambs, on lamb growth. He reported that the average daily gain of (ILF1) was significantly higher than the other groups and the feed conversion ratio was 3.82, 4.24, 3.70 and 5.40 for ILF1, RF1, Awassi and Rmbouillet ram lambs, respectively. Momani et al. (2002) examined the growth performance of pure Awassi sheep and the F1 lambs cross bred of Romanov x Awassi (RA) and Charollais x Awassi (CA) crossbred ram lambs and found that F1RA and F1CA had better total weight gain and average daily gain.

Similarly, Bunch et al. (2004) studied various hair and wool sheep and their crosses. They found that when the rate of gain was standardized to daily gain, the Droper X St. croix crosses were higher significantly than the other breed groups with ADG ranging from 340 g/d to 550 g/d with the highest rate of gain in the Callipyge Wool X St. croix lambs.

Gallivan et al (1993) investigated the effect of breed on growth performance of lambs. They compared Finnish Landrace x Targhee (FT) and Romanov x Targhee (RT) lambs. They found no significant differences between the two genotypes in growth traits during the pre-weaning period. On the other hand, RT ewes produced 4.6 ± 1.8 kg more weight of lambs at weaning, the post weaning average daily gain of terminal FT and RT ewes similar. In another study, Hohenboken (1978) compared the effects of crossbred on post weaning growth that resulted from the ewe type breed (Suffolk and Columbia) with ram type breed (North Country cheviot, Dorset, Finnsheep or Romney) and found that Suffolk crosses had higher ADG than Columbia crosses. Mathiak et al. (2000) have shown that genotype of lamb does affect its growth. This result was concluded from the study evaluating growth of lambs of their different breeds which are: Merino land schaf (ML), Rhonschaf (RH) and Graue Gehornte Heidschnucke (HG). The highest daily gain was recorded for the (ML) lambs. Mathiak et al. (2000) reported that ADG were 170.5, 141, and 230 g/d for HG, RH and ML, respectively. Moreover, Suarez et al. (2000) studied birth weight (BW) , weaning weight (WW) and pre-weaning weight gain (PWG) of Corriedale (C) , Pampinta (P) and their F1 crossbred (P X C) lambs. They found that P lambs had the heaviest BW (4.75 versus 4.26

Kg for C and 4.3 Kg for P X C). Means for WW (33.4 Kg) and PWG (295 g/d) of P lambs were higher than those for C lambs (24.6 kg and 218 g/d) and P X C lambs (27.7 Kg and 245 g/d). Stritzke (1984) compared the progeny of purebred Hampshire (H) or Suffolk (S) and their crosses (S X H or H X S) for variability of growth rate. He concluded that purebred – sired lambs were heavier at birth than crossbred sired lambs without differences between crossbred and purebreds over seasons.

2.7.1 Effect of genotype on feed conversion ratio and growth ability

In general feed is one of the most important factors that affect lamb's growth. Increasing feed intake of lambs indicates better weight gain. Feed conversion ratio is an important factor that determines the lamb efficiency. When this ratio is decreased it means that lambs will eat less to increase their body weight by one unit, which decrease cost per kilogram produced.

Hassan et al. (1996) reported that feed conversion ratio was significantly affected by lamb genotype, while feed consumption was not. This result was found by comparing crosses of Chios and Ossimi breeds. Momani et al . (2002) reported that Awassi X Charollais (A X C) and Awassi X Romanov (A X R) had superior feed conversion ratio to pure Awassi lambs. In another study, Bunch et al. (2004) reported that feed conversion ratio differed significantly between St. Croix and Callipyge wool X wool and was found to be 6.87 and 5.20 kg feed / Kg body weight, respectively.

2.7.2 Effect of genotype

Hassan et al. (1996) compared Ossimi (O), Chios (C) breeds and their crosses F1 and B1 F1 has the genotype ½ C ½ o and B1 has 3/4C 1/4O. They found that breed significantly affected carcass weight. Ossimi lambs were the heaviest, (C) lambs were the lightest and crosses were intermediate. Fat over M. Longissimus dorsi muscle (C) was not significantly different among breeds, but it varied significantly between the breeds and the crosses. No significant differences indicating fat were reported among breeds. Noso et al (2000) reviewed the carcass conformation of sheep and reported that muscularity is highly heritable and is positively related to meat yield. Kadim (1988) reported that dressing – out percentage, which is measure of carcass weight relative to live animal weight, depends on number of

factors; the most important ones being the state of maturity, the degree of fatness, breed, sex and alimentary tract content. Bourfia et al. (1993) used three genotypes of sheep (D'man, Beni Guil, and Sardi) and the crosses between sire and dams of these genotypes. They concluded that there was a high significant effect of sire and dam breeds on the carcass weight, with the Sardi crosses being the heaviest and the D'man crosses being the lightest. Interaction effects between sire and dam breeds was found to be significant for dressing % which was lower in lambs of Sardi sires and Beni Guil dams than lambs of Beni Guil sires and Sardi dams. Longissimes muscle area was also found to be significantly affected by sire breed. Kidney fat was highly affected by breed of sire and breed of dam.

Fadili et al. (2000) studied the effect of crossbreeding on carcass composition by crossbreeding D'man (D), Tinmhidte (T), and Merino breeds. Crosses were D x T, M x T and one three – breed cross (M x DT) The results showed that are significant differences between the five genotypes in slaughter and carcass weight and in daily carcass weight gains with the higher values being for crossbred over purebred. A breed effect on fat deposition has been found in that lambs sired by D and T had thinner back fat than those sired by M rams, which have more subcutaneous fat. Fadili et al. (2001) concluded that prolific breeds tend to deposit higher proportion of internal fat and lower proportion of back fat.

Studying the effect of crossbreeding on Romanov carcass, Fahmy (1997) reported that crosses of Romanov were slightly better in muscle size than pure Romanov lambs. Crossing in this study was done between Borolo- DLS and Romanov. Animals slaughtered at 18 months of age showed that Romanv sheep carcasses had higher proportion of shoulder and lower proportion of loin and leg than Booroola – DLS. In case of fat muscle and bone, was similar. Cameron et al. (1984) investigated the carcass composition of different crosses from Oxford, Texel – Oxford, Charollais, Charmois and Meatline rams with crossbred ewes. Carcass weights were not significantly different between sire breed, but weights of Charollais and Texel – Oxford carcasses were significantly heavier than Charmois carcasses. The subcutaneous fat content of the Charmois breed was the highest and that Texel crosses were the lowest. Dressing % was also studied in this experiment and found to be higher in Charmois crosses than Texel, Oxford and Texel – Oxford crosses, Charollais and Meatline crosses were intermediate. A higher total muscle weight and lower total fat weight was

recorded for and Texel crosses had proportionately leaner and less fat than Charollais crosses with the Charollais and Meatline crosses again being intermediate.

In another study, Stanford et al. (1998) used Remanov and Finnish landrace (Finn) as sire breeds and white Romanov ewes as dam breed for out – of season market lamb production. The results of this experiment showed that the dam breed effect on lamb growth and carcass quality was not significant. Finnish Landrace ewes produced lambs with improved leg and shoulder conformation when compared to lambs from Romanov and white Romanov dams. Concerning kidney fat they found that it was lower in white Romanov than Finn and Romanov Lambs Crouse et al. (1981) investigated the breed effect on carcass composition of lambs from Suffolk and Rambouillet – sired rams. The concluded that Suffolk – sired lambs had leaner carcasses than Rambouillet –sired lambs, and had higher leg conformation scores and larger longissimus areas (LA) than Rambouillet – sired lambs.

2.8 Effect of sex

Growth performance was found to be affected sex of the lamb; male lambs have usually higher growth rates and heavier live bode weights. Males also have different carcass characteristics from females. These differences are especially noticed in terms of fat content, subcutaneous fat and internal organs fat (such as kidney fat). These differences may be as a result of hormonal action that differs between the two sexes.

Sex is one the factors that affect most of lamb growth performance. Hammel and Laforest (2000) reported that sex had significant effect on live body weight gains with males having the higher values.

Juma and Alkass (1996) reported that birth weight in Awassi sheep averaged between 3.95 and 5.3 kg for ram lambs, and between 18.9 and 26 kg in ram lambs, and between 17.2 and 22.8 kg in ewe lambs. Momani et al (1996) reported that sex effect on birth weights was not significant but differences in live body weight and weight gain between ewe and ram lambs at the age of 30, 70, and 130 days were highly significant. This result was reached by comparing growth performance of Charollais breed from birth until 130 days of age. Moreover and Tabbaa (1999) concluded that sex of lamb affected body weight significantly at weaning and at marketing (140 to 160 days of age)

2.8.1 Effect of sex on average daily gain and weight gain

Fernández et al (2000) examined the effect of sex on growth performance of lambs using 60 Manchego breed lambs from both sexes with an inital weight of 13 kg. They concluded that sex effect was observed on daily gain and feed conversion rate. Faster growth performance was found in males versus femalse. Female require 12 more days than males to reach the slaughter live weight.

Several studies evaluated the effect of lamb sex on weight gain and average daily gain (52;37;20). All of these studies reported higher weight gain in ram than ewe lambs.

2.8.2 Effect of sex on feed conversion ratio

Hammel (2000) studied the effect of lamb's sex on feed intake and feed conversion ratio. They reported that sex had significantly affected both feed intake and feed conversion ratio with males consuming more feed than females and having better feed conversion ratio. Daily feed intake and feed conversion ratio were 1.3 kg and 3.8 kg feed / kg and 1.2 kg and 4.2 kg feed / kg for males and females, respectively. In addition , Abdullah et al . (1999) reported that there was a significant effect of lamb's sex on feed intake. They found that males consumed significantly more feed than females.

2.8.3 Effect of sex on body composition

Abdullah et al (1999) reported that hot and cold carcass weight, kidney weight, liver weight and heart weight were higher for male lambs compared with female lambs, However, mesenteric fat weght, kidney fat weight total leg fat weight and muscle to bone ratio were lower for male than females. Vergara et al. (1999) found that dressing proportion and conformation were significantly different between females and males. Sex also had a significant effect on body length, tail width, hip height wither and hip width. Dimensions related to width and fat tail were higher for ewe higher for ewe than ram lambs.

2.9 Reproductive traits

Vatankhah (2008) reported that reproductive traits such as fertility, litter size and lamb survival are the most important traits in all systems of sheep production and in all environments. Falconer and Mackay (1996) reported that total weight of lamb weaned per

ewe exposed to breeding provides an overall indication of ewe fertility. maternal performance, and rearing ability as well as lamb survival and growth. Snyman et al. (1997) noted that the total weight of offspring weaned per dam is determined by litter size and survival rate, as well as several other factors such as mothering ability, milk production of the dam and growth potential of the offspring. Ayhan (2010) worked on parameters of reproductive performance and analyzed included: Oestrus rate (ewes oestrus/ewe mated ×100), lambing rate (ewes lambed/ewe mated ×100), infertility rate (infertile ewe/ewes exposed ×100), fecundity (lambs born/ewes mated), litter size (lambs born/ewes lambing) single lambing (single born lamb /lamb born ×100), twin lambing (twin born lamb/lamb born ×100), and survival rate (lamb weaning/lambs born ×100).

2.9.1 Conception and fertility rates

El Fadili et al. (2001) reported that sheep production varies with breeds and management. Abegaz et al. (2002) worked on data collected from Horro sheep in Ethiopia reported a conception rate of 77.2%. Rosa et al. (2007) Fertility reported by several researchers ranges form 96% for Romney Marsh, in portugal.

2.9.2 Fecundity, Prolificacy, and Rearing Ability

Rosa et al. (2007) compared there was variability in fecundity rate between breeds of sheep. Fecundity ranged from 130 to 88% with average about 105.75%. The highest value was in Merino Branco sheep in Portugal. The lowest value was reported byMomani et al. (2010) worked with crossbred sheep (Charollais x Awassi) in Jordan. Prolificacy was also found to vary between sheep breeds. The estimated values for prolificacy averaged 125.82% and ranged from 105% in Malpura sheep breed in India reported by Mishra et al. (2007) to 160% on crossbred sheep (Garole x Malpura) found by the same author. Kridli et al. (2007) Estimates of rearing ability of ewes was as 100, 108, and 116% on the Awassi sheep, crossbred (Charollais x Awassi), and (Romanov x Awassi) respectively. Momani et al. (1998) reported that The aim of this work was to evaluate select reproduction indicators of mutton Charollais breed of sheep imported from France in dependence on age of ewes including the effect of early tupping of gimmers at the age of 9 months and on the year of breeding.

Results of reproduction indicators of the Charollais sheep found in Czech Republic with respect to fertility percentage per ewe of the foundation stock (157.14 %) as well as with respect to fertility percentage per ewe lambed (179.25 %) are very good even when these indicators do not reach the indicators of the country of origin - in France. It is necessary to take into consideration the less favorable conditions of Czech Republic, most of all the average temperature and quantity of precipitations in spring and autumn.
Fertility percentage of all sheep observed during the years 1993 - 1997 reached including gimmers 81.25 % and without gimmers tupped at the age of 8 - 9 months 87.67 %. The effect of the year on the fertilization percentage of ewes was insignificant but the age of ewes proved as statistically significant effect ($P \leq 0.05$), when the highest fertilization percentage was found in ewes at the age of 3 years (91.07 %) and the lowest value in gimmers tupped at the age of 9 months (55.56 %). It is evident from the Tab. 1. The rising tendency of fertilization percentage with successive age of ewes till the age of 5 years. The effect of the year showed up as significant at the fertilization percentage per ewe lambed.

2.9.3 Mortality Rate

Ozcan et al. (2001) noted that pre-weaning mortality of lambs was reported by several authors the average pre-weaning mortality of lambs found in the reviewed literatures was 16.61%, and ranged from 1.9% on crossbred population (GBM X Kivircik) in Turkey. to 32% on Horro sheep in Ethiopia. In addition, some authors reported mortality among lambs at birth (stillbirth) in their study (Matika et al., 2003; Hanford et al., 2005; Hanford et al., 2006). as 16.5, 16.6, and 5.5% respectively. El-Hag et al. (2001) in their study on the desert sheep in sudan, reported 30.2% mortality rate and 14.4% abortion rate among ewes in the study flock. Everett et al. (2005) reported that ewe prolificacy impacts lamb mortality rates. lambs born in triplet litters normally have a greater risk of death between birth and weaning compared to lambs born as singles or twins.

2.9.4 Age Of Dam Effect On Reprodective Trairs

Lewis et al. (1996) noted that ewe age affect fertility, The fertility of ewe lamb is generally lower than fertility in adult ewes. Notter et al. (1980) reported that fertility increased with increasing age till about 6 yr of age and declined in older ewes.

Brash et al. (1994) reported linear and quadratic effects of ewe age on fertility with maximal fertility at 3 yr of age, after which fertility declined steadily in older ewes. The age of dam influence conception rate (Abegaz et al., 2002), fecundity (Matika et al., 2003; Berhan and Van 2006), fertility (Berhan and Arendonk, 2006; Eriz et al., 2005;), lambing rate (Berhan and Arendonk, 2006; Abegaz et al., 2002) significantly. On the other hand, Boujenane (2002) did not find influence for age of dam on fertility and size at weaning.

2.9.5 Year effect on reproductive traits

lambing year have significant effect on conception rate (Abegaz et al., 2002), fecundity (Berhan et al., 2006), fertility (Abegaz et al., 2002; Mukasa et al., 2002; Eriz et al., 2005; Berhan et al ., 2006), lambing rate (Berhan et al., 2006;), prolificacy (Gbangboche et al., 2006), On the other hand, no effect was found for year on fertility and on litter size at birth (Boujenane, 2002).

Eriz et al. (2005) reported that birth type also was found to have significant effect on reproductive traits. Other significant effect on fertility rate was the year and age.

Table (7) conception rate in Charollais sheep breed. Results of performance tests in CR (2011).

CONCEPTION RATE %	2005	2006	2007	2008	2009	2010	2011
KU ČR v %	83.3	85.2	89.1	91.0	89.2	89.9	-

Table (8) Percentage of fertility per ewe lambed, depended on the breed of Charollais Results of performance tests in CR (2011).

Fertility per ewe lambed	20	2006	2007	2008	009	2010	2011
KU CR v %	155.6	158.8	159 7	161.1	164.2	162.3	-

Source: Association of sheep and goats in czech.

3 THESIS OBJECTIVES

The objective of this study was to evaluace production performance of Charollais sheep breed in Czech.

The specific objectives of this study were:

- To evaluate reproductive performance of the Charollais sheep as depending upon the rearing year and ewe age, include the mortality rate of lambs from birth till 5 days of age.
- To evaluate growth performance of the lamb Charollais sheep as depending upon the particular effects

Hypothesis:

- Three years old and older ewes will have better reproduction indicators than younger ewes.
- Lamb growth ability of older ewes will be better than lamb growth of younger ewes.
- Male lamb meat will have better growth ability than female lambs.

4 MATERIALS AND METHODS.

The study was conducted at the farm kostelec, located 16 km from the city of Tabor in south Bohemia. The farm consists of 56 ha of arable farming, the average rainfall in this area by about 615 mm per year and the average of annual temperature air is about 7 ^{o}C. Data of the reproduction performance of 307 ewes were recording from 2005 – 2011 periods, and 195 lambs were observed form birth till 100 days of lambs age. Lambs came from the mating of 3 charollais rams with the ewes of same strain. Reproductive indicators such as the number of ewe exposed, number of parturition ewe, number of lambs born were monitored and recorded.

The evaluation of reproduction characteristics of ewes was based on the following factors: conception rate, fertility rate per exposed ewe and fertility rate per lambed ewe.

Pregnant lambing ewes received hay with an addition of grain by 0.300 g head /day four weeks before the beginning of lambing. The lambs were given hay and grain mix (ad libitum) until the common beginning of grazing commonly on April.

Based on the results obtained, selected reproduction characteristics were assessed (by the STATGRAPHIC program.

Also in the years 2009 , 2010 and 2011 the live weight was determined in 195 lambs at birth and subsequently every 30 days until 100 days of age.

Applying the acquired data the method of linear interpolation was used to convert the live weights of lambs to age 30 and 100 days. Average daily gain (ADG) of lambs from birth to 100 days of lambs was also evaluated.

To terminate the test, the acquired data were processed by a mathematical and statistical program (SAS) according to the model equations with fixed effects by the least squares method.

Model

$$Yijkmnop = \mu + G_i + S_j + L_k + E_l + Wn + e_{ijkmnop}$$

$Yijkmnop$ = live weight of the lamb

μ = overall mean

G_i = effect of the $_i$-th sire (i = Chlost, Chatysel and Chinin)

S_k = effect of the $_k$-th sex ($_k$ = Male and Female)

L_l = effect of the $_l$-type of birth ($_l$ = Single, Twins and Tripl)

E_m = effect of the $_m$-th ewe age ($_m$ = 2 year, 3 year, 4 year, 5 year, 6 year, 7 year and 8 year)

W_n = effect of the $_n$-th year of rearing ($_n$ = 2009, 2010 and 2011)

$e_{ijkmnop}$ = residual errors distribution N (0, σ^2).

Evaluation of the live weight and growth ability of lambs involved the effects of sire of lambs, litter size, sex, year of rearing and ewe age.

4.1 Characteristics of the breed in Tabor (Location and Climate)

Farm is located in a moderately warm climate area, summer there is a long, hot, and dry. The transition period is short with a slightly warm spring and autumn. Winter is short, slightly warm and very dry with a short duration of snow cover. Temperature in the winter months later is around -3 ^{o}C in the summer period are about (16 to 18 ^{o}C), Average rainfall year is 615 mm.

Climatic region	foothills
Production area	potato
Soil type	brown earths
Altitude	550 – 600 m.n.m
The average annual temperature	8.4 C0
The average annual rainfall	592.7 mm
The average duration of sunshine	1591.9 hours

(Meteorological station Tabor), (weather station Tabor)

Accurate figures for individual months are listed below (see Tables 9,10,11) Climatic data for 2010).

Mean Air temperature (Table 9)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	-4.7	-2.0	2.2	8.3	11.7	16.8	20.2	17.0	11.1	6.3	4.7	-5.9
	Winter		Spring			Summer			Autumn			Winter

In year 7.2 (Source: ČHMU, 2011)

Total precipitation (mm) (Tanle 10)

Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
	63.7	15.9	26.3	43.7	86.4	66.4	65.8	131.2	60.6	7.0	45.7	53.0
	Winter		Spring			Summer			Autumn			winter

In year 665.7 mm (Source: ČHMU, 2011)

5 RESULTS AND DISCUSSION

5.1 Reproductive performance of Charollais Sheep

The most important factor influencing profitability is reproductive and growth characteristics. Reproductive success in livestock is essential for the economic livelihood of producers and ultimately affects the consumer cost of meat and other animal products. Reproductive performance of charollais ewes is depending on the breeding year (%) as presenteed in table (1). The overall means for conception rate (%), fertility per ewe lamb (%), fertility per ewe exposed (%) and mortality rate (%) were 100 %, 185.99 %, 185.99 %, 12.08, respecyively as in (Table 1, 2 and graph 4,5).

5.1.1 **Conception rate**

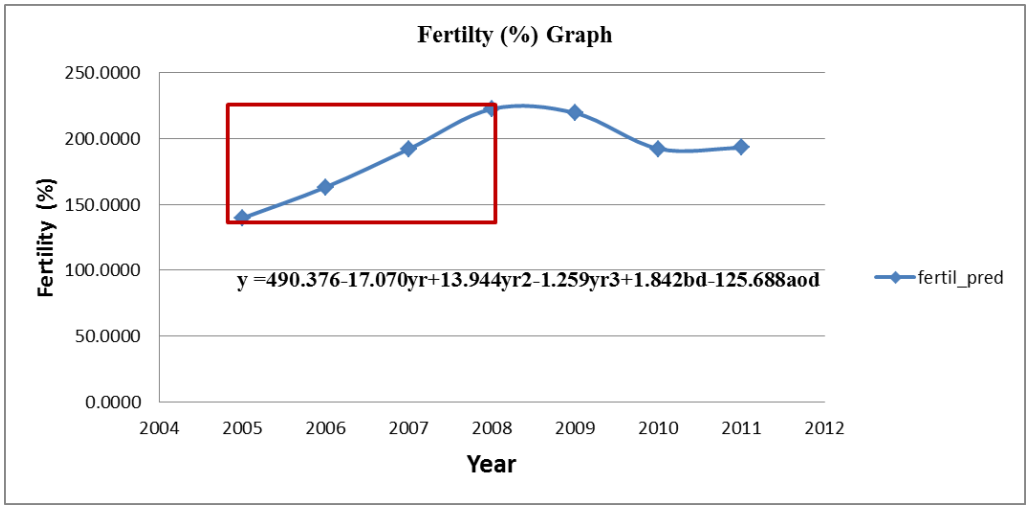
Table (1) show that, the overall mean for conception rate from 2005 to 2011 was 100% . This means that, total values of the conception rate is varied between the years. The same corresponds with the results (see Table 2). Our results are corespendent with the results achieved by Horak et al (2004), which says that, the conception of charollais breed is not less than 95 %. However, Momani et al (1998), states that, during the years 1993 - 1997 that conception rate was 81.25 % in the Charollais sheep which was more than that reported by CAB International (2012) of 80-97%. Fahmy (1990) stated that, the improvement of conception with an advancement of age is a result of an improved rate, uterine capacity and other maternal traits affecting reproductive efficiency of the ewe.

5.1.2 Fertility per ewe lambed and fertility per ewe exposed

That the age of dam and years are important factors that influenced values of this study. Results inTable 1, 2 (see Appendix) and Graph(4,5) gives different values depending on the age of ewes and year of birth.The percentage of fertility per ewe is exposed, % fertility per ewe lambed of the total herd is depending on the breeding year as shown in Table (1) and Graph (4). The effect of year of breeding on the above reproductive indicators was highly statistically significant ($P \leq 0.001$) 185.99 %. the yearly percentages ranged of fertility(fertility per ewe lambed and fertility of ewe exposed) is from142.31% in 2005 to a high of 219.44% in 2009. in 2009 high fertility rate was recordedbecause many factors (e.g. improvements in management and /or nutrition...), as well as age of dam affect on fertility in the same value ($P < 0.001$) 185.99%. The results, found that, the age change of a ewes during

the mating period had a highly significant effect (P<0.001) on the fertility rate of Charollais sheep. The study shows that, ewes from age 2 year during mating period had fertility per ewe lambed and fertility of ewe exposed that was 167.35% and 167.35% respectively. Fertility(fertility per ewe lambed or fertility per ewe exposed) gradually increased during the 6 years by 202.00% and then fell to 171.43% and 162.50% at the age of seven to eight years respectively as showed in table (2) and Garph (5). However, the observing shows that, the age change of a ewes during the mating period has a high significant effect (P<0.001) on the fertility rate of Charollais sheep.t This effect was also evidenced by Momani (1998), (P≤ 0.001), that increase of age from 2 to 6 years improved the reproductive and fertility)(Table1, Graph 4).

Graph (4) Firtility per ewe lambed and fertility of ewe exposed



Momani (1995) states that, fertility per ewe lambed in years 1993 to 1995 was (158.1%, 162.5%, 192.6 %) and fertility of ewe exposed was (137.4%, 152.1%, 175.4 %) respectivly. However, the fertility rate of the Charollais sheep today is higher than values obtained by (Momani et al 1998, 1995) in same breed (Charollais). Horak et al (2004) states, fertility of ewe exposed is thehighest for ewes at 6 years of age. This result agrees with the result reported by Rami et al (2006). However, the study by Younis and Galal (1973) showed that, for each 1 kg increase in mating weight of the yearling ewes.There was an increase of 2.1% in the average lambing percentage, therefore, the age of the ewe at mating is an important factor in determining of the ewes weight. where the presence of the significant effect for year and age of dam on those reproductive traits was detected. According to Berhan and Van Arendonk

(2006), Menz and Herro had the highest age significant ($P < 0.001$) on fertility and conception rates. They also found that, year of mating significantly ($P < 0.001$) affected fertility rate, while conception was affected by year.

5.1.3 Mortality Rate

The overage mortality for lambs within 5 days after birth in the Charollais flock is 12.08% . There were marked year of birth significant effects ($P < 0.001$) on 5 days after birth mortality rate ranging from 4.87% in 2006 to 20.56 % in 2008. (see table 20). Single or twin status had major effects on mortality in the first 5 days. Sawalha et al (2007), evindenced this,with fixed explanatory effects for survival traits estimates mean of mortality rate at birth, by sex, type of birth and age of dam are . In addition to these factors, farm, year, and date of birth within year had significant effect ($P < 0.05$) on viability at birth. The effect of age of dam was significant when comparing the mean mortality rate at birth of lambs from 2year . Sawalha et al (2007) states that, birth type (TB) has significant effect ($P < 0.05$) only on the pre-weaning mortality.

Table(11) Means and F values for mortality from of lambs as depending upon the year.

yearsr	N	Parturition	Numb. lambs born	Mortalities of lambs within 5 days after birth	Mortality rate %
Total	307	307	571	69	12.08
2005 a	52	52	74	9	12.16
2006 b	49	49	82	4	4.87
2007 c	47	47	88	9	10.23
2008 d	41	41	90	18	20.00
2009 e	39	39	79	14	17.72
2010 f	40	40	77	8	10.39
2011 g	42	42	81	7	8.64

* P ≤ 0, 05, ** P ≤ 0, 01, *** P ≤ 0,001

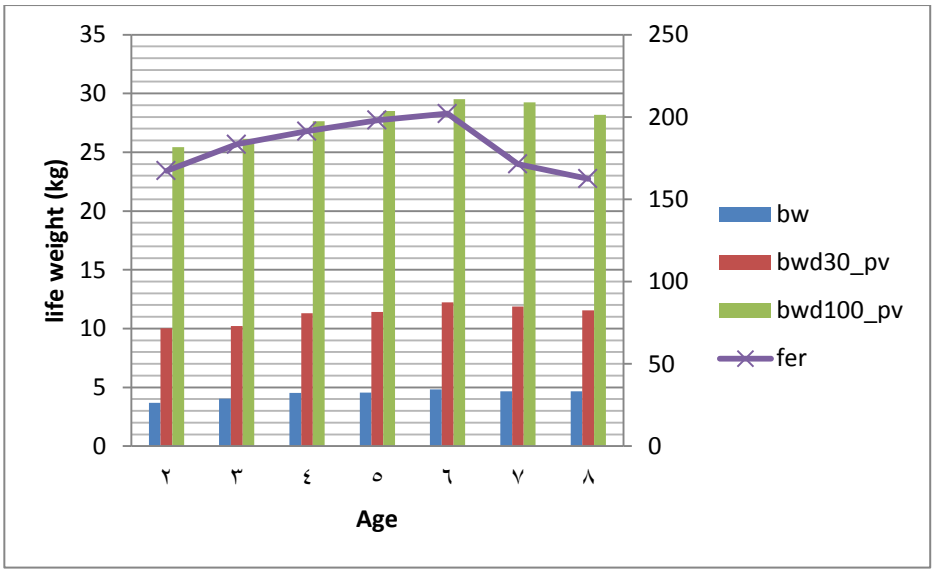
According to table (20), the mortality of lambs and ewes changes with years. the average litter size of ewe lambs is much lower than of adult ewes, the mortality rate of their lambs is greater (in age 7,8 years old had the mortality 25.00%, 26.92% respectively). The changes are attributed to farm management and type of birth.

Table(12).showes Means and F values for mortality from of lambs depending upon the age of dam

Indicator	N	Parturition	N lambs born	Mortalities of lambs within 5 days after birth	Mortality rate %
Total	N	307	571	69	12.08
2 Year a	49	49	74	5	6.01
3year b	60	60	82	10	9.09
4 year c	60	60	88	14	12.17
5 year d	51	51	90	13	12.87
6 year e	50	50	79	11	10.89
7 year f	21	21	77	9	25.00
8 year g	16	16	81	7	26.92

The study shows,the mortalirity differences between individual ewes and lamb is high from birth to 5 days. The study further shows that. there was a decrease in mortality rate from the Second to the sexth year of age, and mortality rate was higher for lambs from the 7 and 8 years of age.

Graph(5): Reproductive performance of ewes as depending on the age of ewes (%) and means live weight at birth, at 30,100 days as depending upon the particular.



5.2 Growth Traits

5.2.1 Birth weight

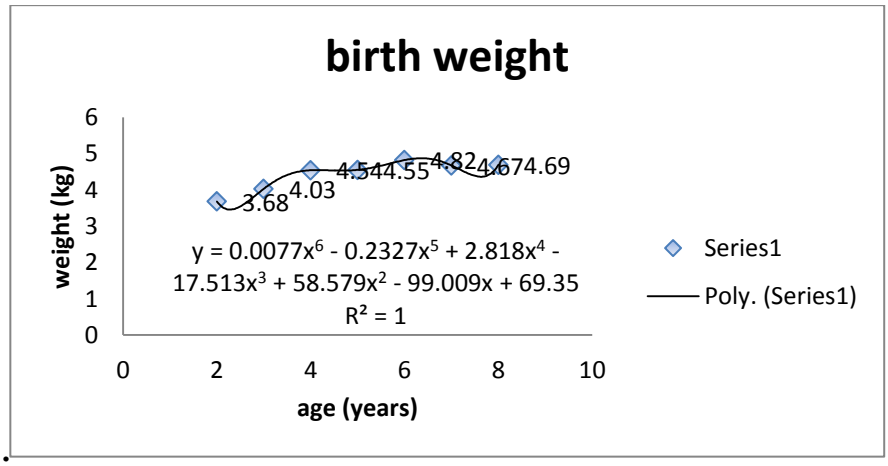
Growtht traits studied include birth weight (BW),. weaning weight (WW) and pre-weaning daily gain (ADG). Birth weight is not affected (P > 0.05) by year of birth, sire, sex, age of dam but was affected significantly by type of birth (P < 0.001) see tabels 13,14,15 and Graph (5).

Table (13) shows values of live weight at birth, from 30 and 100 days depending on dam age

Indicator	N	Birth weight (kg)	Weight at 30 days (kg)	Weight at 100 days (kg)
Age of dam				
F value		2,50	5,85***	5,80***
2 years a	4	3,68	10,12bcdfg	25,45cdefg
3 years b	12	4,03	9,95aefg	26,00cdefg
4 year c	36	4,54	11,53ab	28,00ab
5 years d	46	4,55	11,59ab	28,34ab
6 years e	37	4,82	11,95ab	29,14ab
7 years f	35	4,67	11,98ab	29,68ab
8 years g	25	4,69	11,53ab	28,03ab

Momani et al. (2002) states that, BW is affected significantly by year of birth (P< 0.001), age not affected significantly, sex, type of birth (P < 0.001) and sire (P < 0.01). However, according to Momani (1995) , BW was affected significantly (P<0.001) by type of birth, sire, age of dam, sex and year had no effect on weight at birth. Momani et al (1994) states that, sex and type of birth has significant effect (P<0.01) on BW, but dam age has no effect. Ayhan et al (2010) also states that, dam age has no effect on BW, but year of birth has effect (P < 0.01) on BW and also birth type and sex in Ramlic sheep. The data from the farm of study shows that, there was little or no effect on BW in the years 2009 to 2011.

Graph 6 growth trait measures adjusted for age of dam and age (BW) across years in Charollais sheep (n=195) managed in a Charollais mutton production system from 2009, 2010 and 2011



Table(14) : Shows Live weight at birth and weight from 30 and 100 days of age depending on the particular years effects.

Indicator	N	Birth weight (kg)	Weight at 30 days (kg)	Weight at 100 days (kg)
Year				
F value		0,90	14,48***	15.01***
2009 a	75	4,74	11,60	28,46bc
2010 b	53	4,39	10,75	26,06a
2011 c	67	4,15	11,36	28,90a

* P ≤ 0, 05, ** P ≤ 0, 01, *** P ≤ 0,001

In this study, the male lambs were 4.56 kg heavier than female lambs 4.29 kg at birth. The effect of sex on BW was proved by different authors (Rashidi et al., 2008; Behzadi et al., 2007; Sawalha et al., 2007; Saghi et al., 2007 and Mishra et al., 2007), (Momani et al., 1994,1995,2002,2010). However, according to authors like s (Hassen et al., 2002; EL-Hag et al., 2001; Macit et al., 2001),sex has no effect on birth weight. In this study, it proved that, single lambs were 5.18 kg heavier than twins and triplets (4.60 kg, 3.50 kg respectivly) lambs at birth. Birth type has a significant effect (P<0.001) on BW. This has also been agreed upon by many authors (Momani et al., 1994, 1995, 2002 and 2010), Rashidi et al., 2008; Ayhan et

al., 2010,). Dixit et al. (2001) states that, an increase in the dams weight at lambing by 1 kg resulted in a significant increase in body weight at birth by 29 g. Momani et al (2002) states that, sire has no effect on BW. this is study also found out the same.

Table(15).shows values for live weight at birth, and weight from 30 to100 days depending on the sire effects:

Indicator	N	Birth weight (kg)	Weight at 30 days (kg)	Weight at 100 days (kg)
Sire				
F value		0,80	3,60**	3,80**
Chlost a	47	4,64	12,38bc	30,64bc
Chatysel b	48	4,20	10,36a	26,40a
Chinin c	100	4,23	10,96a	26,39a

* P ≤ 0, 05, ** P ≤ 0, 01, *** P ≤ 0,001

On the other hand,year and age of dam has no effect (P > 0.05)on Birth Weight of Charollais lambs. The non-significant effect of year on BW is also reported by Momani et al (1995) on Charollais sheep in Czech and also by Murat et al (2011) on sheep in the Turkey. But several authors however, reported significant effect of year on BW.(Momani et al., 2002 and 2010) and Katarzyna et al. (2005) using Booroola flock in poland. The non-significant effect of age of dam and sex on BW of Charollais lambs is also proved by different scholars. (Momani et al., 1994, 1995,2002 and 2010), states that, age dam is not significant but sex is significant on BW (P<0.01, 0.001, 0.001 and 0.001) respectivly.

5.2.2 Weaning weight

The main factors significantly contributing to the variation in weaning weight (WW) of Charollais lambs were year, sex, birth type, birth weight age of dam and sire. most authors agrees that, there is a significant differences in WW between years (Rashidi et al., 2008; Mishra et al., 2007; Behzadi et al (2007); Gbangboche et al 2006; Momani et al., 2010 (P< 0.01). In this study found that, year and age of dam, highly affects the weaning weight (p<0.001).

Table(16) Shows values for live weight at birth, and at 30 and 100 days as depending on the litter size:

Indicator	N	Birth weight(kg)	Weight at 30 days (kg)	Weight at 100 days (kg)
Type of birth				
F value		11,69***	8,45***	7,36**
Single a	43	5,18bc	$12,70^{bc}$	$31,31^{bc}$
Twin b	133	4,60ac	$11,35^{ac}$	$27,64^{ac}$
Triple c	19	3,50ab	$9,66^{ab}$	$24,50^{ab}$

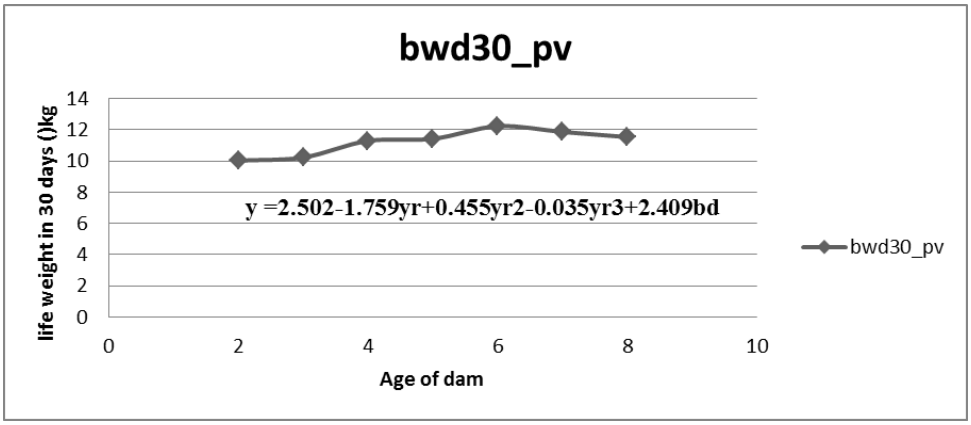
* P ≤ 0, 05, ** P ≤ 0, 01, *** P ≤ 0,001

In this study, no-significant differences in WW were detected between 2009 - 2011(28.46 kg, 28.90 kg) years except the year 2010 the WW was (26.06 kg). The average WW in year 2011 was the highest (28.60 kg). The difference between the years 2009 and 2010 is about 2.4 kg., 2.84 kg between 2010 - 2011, 0.44 kg between 2009 - 2011. The yearly variation in growth traits could partly be associated with the management and distribution pattern which affects forage availability and quality. The WW of lambs born in 2009 was 4.74 kg heavier than WW of lambs born 2011(4.15kg) However, the weaning weight of lambs born 2011 was higher (28.90 kg) than the weaning weight of lambs born in 2009 (28.46kg). The effect of on WW in 2011 could be due to variation in feed availability both in quality and quantity. The WW of male lambs were 1.23 kg heavier than female lambs. There was higher growth rates in male lambs in comparison to female, the higher in male lambs could be due to hormonal differences in their endocrinological and physiological functions (Ebangi et al., 1996). WW of lambs born as single were 3.67 kg heavier than lambs born as twins. WW of lambs born as single were 6.81 kg heavier than lambs born as triplets, WW of lambs born as twin were 3.14 kg heavier than lambs born as triplets. This could be due to the inability of ewes to provide sufficient milk for lambs. According to Villiers et al (2002) competition for resources among the lambs (reduced milk intake in smaller lambs, particularly in litters with low birth weight in the cases of multiple births. (Christley et al., 2003).

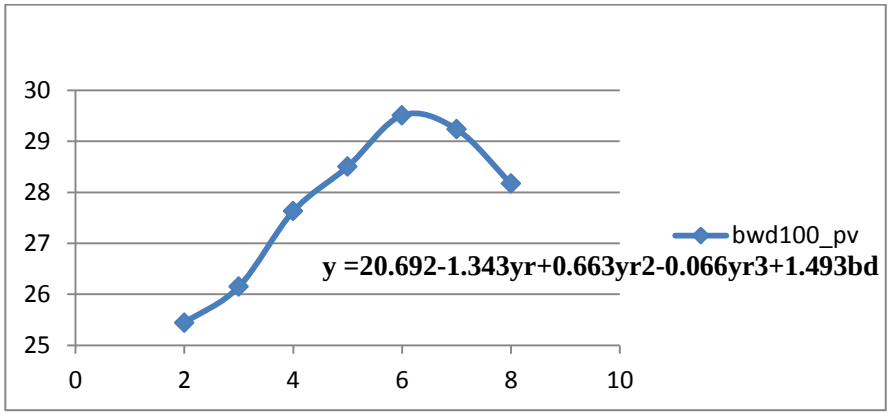
Age of dam at lambing as BWC showed no effect (P>0.05) but effect was significant on WW (P<0.001). This effect of age of dam at lambing on WW complies with the reseacrh by Momani et al. (2010) significantly (P < 0.05). According to Momani et al (2006); Hassan et a (2009); . Cardellino et al (1971); Ayhan et al (2010); Dixit et al (2001), an increase in the

dams weight at lambing by 1 kg resulted in a significant increase in body weight after 3 months by 190 g. Single born lambs are the sole users of their dams milk and the higher weight advantage at birth favors their growth in subsequent periods. The effect of sire ($P < 0.01$) on the WW is proved on Charollais lambs in Czech by Momani et al (2010), (2002); significant ($P< 0.001$). Similar results were recorded by Hassan et al. (1996) and Momani Shaker et al (2002), that crossbreeds had faster growth rate and higher live weight at 140 days of age compared to pure lamb breeds, and Dixit et al (2001), states that superior sires could be used effectively to improve trait of breeds.

Graph(7) shows growth trait measures adjusted for age of dam and age (w 30d) across years in Charollais sheep (n=195) managed in a Charollais mutton production system from 2009, 2010 and 2011.



Greph (8) Shows growth trait measures adjusted for age of dam and age (W 100d) across years in Charollais sheep (n=307) managed in a Charollais mutton production system from 2009, 2010 and 2011.



5.2.3 Average daily weight gain

According to table (4-Appendix), the ADWG during 30 day of growth was 228 g/d and statistically significant (P<0.01), and ADWG until 100 days of growth was 236 g/d and statistically (P < 0.001). this study found out that, Year, sire, type of birth, have significant effects on average daily weigh gain in Charollais lambs (P<0.001) (ADG). Sex has no effect on ADG in the first 30 days of age,however, the effect of sex on dairly weight gain is high at 100 days age.According to results, age of dam has little effect (P < 0.01) on avarage dairly weight gain and birth weight. The ADG ranged from 237 g/d in 2009 to 248 g/d in 2011 with an average of 234 g/d. The ADG of lambs born in 2011was silghtly higher than those born in the 2009 and 2010 respectively.

Table(17). Shows values for average daily weight gain from birth to 30, and 100 days of lambs as depending on the type of birth.

Indicator		N	Growth until 30 days of age (g)	Growth until 100 days of age (g)
Type of birth				
F value			10,10***	5,41*
Single	a	43	251^{bc}	261^{bc}
Twin	b	133	225^{ac}	230^{ac}
Triple	c	19	205^{ab}	210^{ab}

* P ≤ 0, 05, *** P ≤ 0,001

Table(18) Shows Means and F values for average daily weight gain from birth to 30, and 100 days of lambs as depending upon the dam age

Indicator		N	Growth until 30 days of age (g)	Growth until days of age(g)
Age of dam				
F value			2,52*	5,95***
2 years	a	4	215bcdefg	218cdefg
3 years	b	12	197acdefg	220cdefg
4 year	c	36	233abf	235abf
5 years	d		235ab	238abf
6 years	e	46	238ab	243abg
7 years	f	37	244abcg	250abcdeg
8 years	g	35	228abf	233abe

The effect of year on ADG in this study was found to be within 30 days and of weaning ($P < 0.001$) found a clear difference in the values of dairly weight increase between years of schooling (2009,2010,2011) which is shown in table (18), however, Ayhan et al (2010) using different breed of sheep got the results ($P < 0.05$). According to Momani et al (2002) live BW, ADG until weaning and live weight at 15, 30 and 45 days of age were affected by the year of lambing ($P< 0.001$). Rashid et al (2008), also reports that, live BW, ADG until weaning and live weight at 15, 30 and 45 days of age were affected by the year of lambing ($P \leq 0.01–0.001$).

Table (19) shows average daily weight gain from birth to 30, and 100 days of age of lambs as depending upon the particular effects year.

Indicator	N	Growth until 30 days of age (g)	Growth until days of age (g)
Year			
F value		5.90***	5,80***
2009 a	75	229bc	237bc
2010 b	53	212ac	217ac
2011 c	67	240ab	248ab

* P ≤ 0, 05, ** P ≤ 0, 01, *** P ≤ 0,001

The study found out that, sex has high effect on ($P < 0.001$) dairly weight gain.during the experiment, it was observed that the ADG of male lamb was 239g/d (see table 20) which is higher than the average ADG of female lambs 229g/d. See tabel (19)

Table(20) shows values for average daily weight gain from birth to 30, and 100 days of lambs as depending on the sex.

Sex	N	Day until 30 days	Growth until 100 days of age
F value		0.90	7.61***
Male	81	231	239[b]
Female	114	224	229[a]

*** P ≤ 0,001

This results complies with several other scholars like (Momani et al. 1995; Said et al. 2000; Dawson et al. 2002 and Momani Shaker et al. 2002, 2003, 2010).($P < 0.05–0.001$). Momani et al (1995) states the, effect of sex on the ADG of Charollais lambs ($P < 0.05$). Ayhan et al (2010) however, states the. effects of year, age of dam and sex on ADWG were significant ($P <0.05$, $P <0.01$). According to Fadili et al (2001), the lambs body weights were significantly influenced ($P < 0.001$) by lambing year, types of birth or weaning and sex. Dixit et al. (2001) also states that, the ADG of male lambs is high significant ($P<0.001$) 239 g/d higher than those of female lambs. Maria et al (1999) also says, single male lambs a better than expected. According to the study, type of birth has effect on ($P < 0.05$). Single lambs were found to have the highest ADG value (261g/d), twin lambs had 230g/d while triplets had the least ADG value of 210g/d. The effect of type birth on the ADG is (($P<0.05$) the same figure obtained by reseachers using different breeds of sheep (Fadili 2011). According to Fadili (2011), the birth types or weaning types had a large significant effect on lambs ADG10-30 and ADG30-90 during pre-weaning period ($P < 0.001$) (Abdulkhaliq et al 1989; Boujenane 2002; El Fadili et al 2000).

Table(21) shows values f or average daily weight gain from birth to 30, and 100 days of lambs as depending on the sire.

Sire	N	Within 30 day	Growth until 100 days
F value		7.50***	4.99**
Chlost [a]	22	258[bc]	260[bc]
Chatysel[b]	16	205[ac]	222[a]
Chinin[c]	157	218[ab]	222[a]

** P ≤ 0, 01, *** P ≤ 0,001

Effect of genotype of the sire on the average daily gain at 30 days and 100 days, respectively, was (*$P<0.001; P<0.01$*) shows table(21).

6 CONCLUSIONS

The objectives of this study was to analyze and evaluate reproductive performance of the Charollais sheep growth performance of the lamb Charollais sheep as depending upon the particular effects

Evaluate of mutton Charollais sheep breed shows that the breed is suitable for rearing in Czech conditions for below reasons:

- better conception rate,

- better fertility ewes,

- better growth performance of lambs,

- lower mortality of lambs,

on the basis of accomplish experiments it is possible to recommended to use Charollais rams breed in fatherly position for obtaining crossbreds intended for meat production fattening.

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Appendix

Table(1) Reproductive performance of ewes as depending on the breeding year (%).

Indicator	N	N parturition	N Lambs born	Mortalities of lambs within 5 days after birth.	Conception rate (%)	Fertility per ewe lambed (%)	Fertility of ewe exposed (%)	Mortality rate (%)
Total	307	307	571	69	100,00	185.99	185.99	12,08
Reproduction year						***	***	***
2005 a	52	52	72	9	100.00	142,31^{bcdefg}	142,31^{bcdefg}	12,50^{bdeg}
2006 b	49	49	82	4	100.00	167,35^{acdefg}	167,35^{acdefg}	4,87^{acdefg}
2007 c	47	47	88	9	100.00	187,23^{abde}	187,23^{abde}	10,23^{abde}
2008 d	41	41	92	18	100.00	219,15^{abcfg}	219,15^{abcfg}	20,56^{abcefg}
2009 e	36	36	79	14	100.00	219,44^{abcefg}	219,44^{abcefg}	17,72^{abcfg}
2010 f	40	40	77	8	100.00	192,50^{abde}	192,50^{abde}	10,39^{bde}
2011 g	42	42	81	7	100.00	192.86^{abde}	192.86^{abde}	8.64^{bde}

* P≤0.05 Statistically significant, ** P≤0.01 statistically high significant, *** P≤0.001 statistically highly significant.

Teble 2 Reproductive performance of ewes as depending on the ewe age (%).

Indicator		N	N parturition	N Lambs born	Mortalities of within 5 days after birth.	Fecundity (%)	Fertility (%)	Litter size (%)	Survival rate (%)
Total		307	307	571	69	100,00	185.99	185.99	12,08
Ewe age							***	***	***
2 year	a	49	49	82	5	100,00	167.35 ^{bcdef}	167.35 ^{bcdef}	6.01 ^{bcdef}
3 year	b	60	60	110	10	100,00	183.33 ^{acdeg}	183.33 ^{acdeg}	9,09 ^{adfg}
4 year	c	60	60	115	14	100,00	191.33 ^{abfg}	191.33 ^{abfg}	12.17 ^{afg}
5 year	d	51	51	101	13	100,00	198.04 ^{abfg}	198.04 ^{abfg}	12.87 ^{afg}
6 year	e	50	50	101	11	100,00	202.00 ^{abfg}	202.00 ^{abfg}	10.89 ^{afg}
7year	f	21	21	36	9	100,00	171.43 ^{abcde}	171.43 ^{abcde}	25.00 ^{abcdeg}
8 year	g	16	16	26	7	100,00	162.50 ^{bcdef}	162.50 ^{bcdef}	26.92 ^{bcdef}

* P≤0.05 Statistically significant, ** P≤0.01 statistically high significant, *** P≤0.001 statistically highly significant.

Table 3. Means and *F* values for live weight at birth, at 30 and 100 days as depending upon the particular effects

Indicator		N	Birth weight (kg)	Weight at 30 days (kg)	Weight at 100 days (kg)
Mean		195	3,36	11,23	27,81
F value			4,26***	8,86***	8,89***
Sire					
F value			0,80	3,60**	3,80**
Chlost	a	47	4,64	12,38^{bc}	30,64^{bc}
chatysel	b	48	4,20	10,36^{a}	26,40^{a}
Chinin	c	100	4,23	10,96^{a}	26,39^{a}
Type of birth					
F value			11,69***	8,45***	7,36**
Single	a	43	5,18bc	12,70^{bc}	31,31^{bc}
Twin	b	133	4,60ac	11,35^{ac}	27,64^{ac}
Triple	c	19	3,50ab	9,66^{ab}	24,50^{ab}
Sex					
F value			0,10	5,69*	5,84*
Male	a	81	4,56	11,48^{b}	28,42^{b}
Female	b	114	4,29	10,99^{a}	27,19^{a}
Year					
F value			0,90	14,48***	15.01***
2009	a	75	4,74	11,60	28,46^{bc}
2010	b	53	4,39	10,75	26,06^{a}
2011	c	67	4,15	11,36	28,90^{a}

Age of dam					
F value			2,50	5,85***	5,80***
2 years	a	4	3,68	$10,12^{bcdfg}$	$25,45^{cdefg}$
3 years	b	12	4,03	$9,95^{aefg}$	$26,00^{cdefg}$
4 year	c	36	4,54	$11,53^{ab}$	$28,00^{ab}$
5 years	d	46	4,55	$11,59^{ab}$	$28,34^{ab}$
6 years	e	37	4,82	$11,95^{ab}$	$29,14^{ab}$
7 years	f	35	4,67	$11,98^{ab}$	$29,68^{ab}$
8 years	g	25	4,69	$11,53^{ab}$	$28,03^{ab}$

* $P \leq 0,05$, ** $P \leq 0,01$, *** $P \leq 0,001$

Table 4. Means and *F* values for average daily weight gain from birth to 30, and 100 days of age of lambs as depending upon the particular effects

Indicator		N	Growth until 30 days of age (g)	Growth until 100 days of age (g)
Mean		195	228	236
F value			2,63**	4,25***
Sire				
F value			7,50***	4,99**
Chlost	a	22	258^{bc}	260^{bc}
chatysel	b	16	205^{ac}	222^{a}
Chinin	c	157	218^{ab}	222^{a}
Type of birth				
F value			10,10***	5,41*
Single	a	43	251^{bc}	261^{bc}
Twin	b	133	225^{ac}	230^{ac}
Trople c		19	205^{ab}	210^{ab}
Sex				
F value			0,90	7,61***
Male	a	81	231	239^{b}
Female	b	114	224	229^{a}
Year				
F value			5,90***	5,80***
2009	a	75	229^{bc}	237^{bc}
2010	b	53	212^{ac}	217^{ac}
2011	c	67	240^{ab}	248^{ab}

Age of dam				
F value			2,52*	5,95***
2 years	a	4	215^{bcdefg}	218^{cdefg}
3 years	b	12	197^{acdefg}	220^{cdefg}
4 year	c	36	233^{abf}	235^{abf}
5 years	d	46	235^{ab}	238^{abf}
6 years	e	37	238^{ab}	243^{abg}
7 years	f	35	244^{abcg}	250^{abcdeg}
8 years	g	25	228^{abf}	233^{abe}

* $P \leq 0,05$, ** $P \leq 0,01$, *** $P \leq 0,001$