

CONCENTRATED FEEDINGSTUFFS FOR LIVESTOCK IN DENMARK

1960-61 to 1965-66

(Livestock Feed Balance)



Paul W. H. Weightman

Department of Agricultural Economics
Cornell University Agricultural Experiment Station
New York State College of Agriculture
A Statutory College of the State University
Cornell University, Ithaca, New York

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INTRODUCTION

By world standards, the livestock industry of Denmark is intensively developed and highly competitive. It is based on domestic production of feed crops, mainly barley, supplemented by imports of high-protein concentrates and some grains.

It is therefore of more than usual interest to make comparisons of two sets of data relating to livestock production in Denmark. One of these consists of, first, tabulating numbers of various classes of animals for a given period of years, and second, assembling figures on average feeding rates per head for the respective classes. By simple multiplication are obtained amounts of concentrates fed.

The other set of data is derived from other sources, namely, domestic production, stocks, utilization, and imports and exports of grains and other feedingstuffs. These figures provide amounts of such feeds available for livestock. Comparison of the two sets of data, herein referred to as a livestock feed balance, provides a useful perspective of the livestock industry of the country.

OBJECTIVES

The objectives of this study are to:

1. Calculate the various quantities of concentrated feedingstuffs consumed by the various classes of livestock in West Germany in the years 1960-61 to 1965-66.

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2. Calculate the quantities of the various kinds of concentrated feedingstuffs available for livestock in the same time period.

3. Compare the amounts of concentrated feedingstuffs fed to livestock with the amounts available for livestock.

SOURCES OF DATA AND METHODOLOGY

Numbers of Livestock

The Ministry of Agriculture enumerates livestock in July every year in a mandatory census of farming and horticulture. All holdings, irrespective of size, and holdings without crop and pasture land are included so that virtually all the livestock in the country on the census day are counted. Only some sporting horses and a few animals, particularly poultry, kept in towns and cities are not enumerated. The July census returns were used as a basis of the analysis for most classes of livestock. The terminology used by the Danish Ministry of Agriculture was used so that the statistical series are readily identified.

Where the production period was less than one year, other returns were used to enumerate livestock numbers. The numbers of veal calves slaughtered were obtained from official figures of registered slaughterings. Similarly data were obtained for the production of fat pigs, broilers and chickens slaughtered. These data also include an official estimate of animals consumed directly on the farms, but exclude any allowance for death losses occurring before the animals reached maturity. Sows exported alive and slaughtered for meat production are also excluded on the grounds that they are accounted for as part of the breeding herd.

Estimates of the number of calves and young pigs raised as breeding herd replacements were made. The former were obtained by subtracting the slaughterings of veal calves from the total number of calves raised in a given year. The number of pigs raised to compliment the breeding herd was calculated as 40 percent of the reported number of breeding sows.^{1/} This percentage was based on the average replacement requirements of the state demonstration farms between 1960-61 and 1965-66.

Although it is observed that the pigs on these farms are maintained under generally better conditions than is the case on commercial farms, which would tend to reduce the replacement requirements on the demonstration farms, the higher performance of the demonstration farm animals increases their replacement rate. The two considerations are compensating.

1. Excluding gilts to farrow the first time.

Feeding Rates per Head

The national standard of livestock husbandry maintained in Denmark is one of the highest, if not the highest, in the world. The performance of all the major classes of livestock is closely watched and recorded by farmers, their associations and at state controlled testing and demonstration centers. The attention given to feed consumption is both a practical expedient and an economic necessity. It is, therefore, not surprising to find a wealth of information on feeding rates per head of livestock. The small size of the country and the relatively high degree of uniformity found between various farms and regions facilitate the calculation of representative feeding rates. This is in sharp contrast with West Germany where greater geographical and climatic differences coupled with structural differences between various types of farms in various regions create problems of obtaining representative national feeding rates.

The bulk of the feeding rates used in the present study were obtained from two principal sources. Firstly, data were obtained from the annual summary reports of farms recorded by the Landøkonomiske Driftsbureau and, secondly, from the annual results of demonstration farms.^{1/} It is known that the performances obtained on the demonstration farms is typically superior to those on commercial farms, but these differences have been quantified in a recent study. In terms of concentrate feed consumption the performance on the demonstration farms is between 12 and 15 percent better than obtained on commercial farms. Adjustments were made to the demonstration farm results accordingly. Reference to the principal sources used in the analysis are listed at the end of this report.

The concentrates that were fed to the various classes of livestock included cereals, cereal by-products, oilcakes, fish and meat meals, molasses, and milk and whey. The latter two dairy products are included in the feeding rates and are expressed in terms of concentrate equivalent. That is the official estimate of total fodder units supplied by these products plus 25 percent to bring it to an equivalent weight of concentrates (cereals plus oilcakes). Dairy by-products are fed both to young cattle and fattening pigs.

Amount of Concentrated Feedingstuffs Available

All tonnages of concentrated feedingstuffs available for livestock were taken directly from the official estimates published principally in the annual statistical series by the Ministry of Agriculture. These data were found to be consistent between particular sources and also believed to be accurate. Some errors may naturally be expected in the production of particular crops from area and yield per acre estimates. As a result the amount of cereals available for livestock,

1. Det Landøkonomiske Driftsbureau, Undersøgelser over Landbrugets Driftsforhold, Foderomsætning og Fodringseffektivitet, Periodiske Beretninger XVIII, Copenhagen 1963.

which is a residual quantity after all other uses have been accounted for, is subject to some error. This is probably less than 5 percent. Some slight inconsistency is evident between the foreign trade figures that specify shipment of cereals from particular countries, and the aggregate foreign trade (export and imports) as set out in the supply and disposal tables. The disparity is due to differences in the reporting years and the inclusion, or exclusion, of various cereal products.

THE PRODUCTION OF SELECTED LIVESTOCK PRODUCTS IN DENMARK

The importance of livestock production both in Danish Agriculture and in the national economy has been pointed out. In order to more fully appreciate the size of this sector, and to compare the respective sizes of various types of livestock production, the following section reviews the physical output of the livestock industry in Denmark between 1960-61 and 1965-66.

In 1965-66 more than 808 thousand tons of pigmeat, 5,339 thousand tons of milk and almost 90 thousand tons of eggs were produced (table 1). Among the meats, pigmeat was by far the most important commodity both in terms of physical quantity and value. Over 800 thousand tons of pigmeat, mostly bacon, and over 40 thousand tons of edible pig fat were produced in 1965-66. Beef and veal production amounted to about 255 thousand tons in the same year. Beef is essentially a by-product of milk production since the Danish Red and Friesian types, which are the most prevalent breeds of cattle, have both dairy and beef characteristics.

Table 1. PRODUCTION OF SELECTED LIVESTOCK PRODUCTS
IN DENMARK
1960-61 to 1965-66, July-June Years

Year	Beef & veal	Pigmeat	Edible pig fat	Poultry- meat	Mutton lamb horsemeat	Milk	Eggs
Thousand metric tons							
1960-61	240.2	647.6	33.7	57.7	18.1	5,384.3	128.2
1961-62	274.3	683.9	35.6	66.2	10.0	5,480.5	124.1
1962-63	293.5	681.8	35.4	69.8	7.9	5,184.4	107.5
1963-64	259.7	710.8	36.7	70.1	7.4	5,157.1	104.0
1964-65	235.5	779.1	40.3	73.0	6.1	5,322.0	93.6
1965-66	255.5	807.6	41.8	65.4	4.9	5,338.9	89.1

Source: Danmarks Statistik, Landbrugsstatistik 1966.

The poultry industry in Denmark is somewhat restricted by the size of the market both at home and abroad and is also limited by domestic legislation prohibiting some of the more intensive methods of production. The output of all poultry meats, including the meat from hens, ducks, geese, and turkeys was just over 65 thousand tons in 1965-66.

There were significant changes in the level of production of certain livestock products between 1960-61 and 1965-66. The most striking of these was the large increase in pigmeat production; output climbed from just under 650 thousand tons in 1960-61 to almost 810 thousand tons in 1965-66. Egg production, on the other hand, declined from about 128 thousand tons to just less than 90 thousand tons during the six year period. Beef and veal production rose from 240 thousand tons in 1960-61 to a peak of 294 thousand tons in 1962-63, but then fell to 256 thousand tons in 1965-66. A similar trend is apparent in poultrymeat production. Output rose from 58 thousand tons in 1960-61 to 73 thousand tons in 1964-65, but then fell in the next year to 65 thousand tons. Many of the smaller flocks have been forced out of production in a competitive international market.

Milk production was 5,384 thousand tons in 1960-61 and increased slightly in the following year, but then fell to 5,157 thousand tons in 1963-64. Since that time production recovered to just less than 5,340 thousand tons in 1965-66. Although production per cow increased, the dairy herd decreased in size and resulted in the decline in milk output. During the six years under review there was rationalization among the smallest herds and at the same time some of the larger herds were sold. Rising wage levels and unattractive milk prices gave arable production a relatively more favorable position on the larger farms.

Sheep production is of little importance in Denmark. Similarly, few horses are kept on farms. In 1960-61 over 18 thousand tons of mutton, lamb and horsemeat were produced, and the greatest proportion of this was horsemeat. Output declined progressively in the following years so that in 1965-66, only 4.9 thousand tons were produced. Of this quantity, 3 thousand tons were horsemeat.

AMOUNTS OF CONCENTRATED FEEDINGSTUFFS FED TO LIVESTOCK

Many factors determine the demand for livestock feedingstuffs, but of these factors, two are fundamental. These are livestock numbers and feeding rates per head. In this section the quantities of concentrated feedingstuffs consumed by various classes of livestock between 1960-61 and 1965-66 are calculated from product of livestock numbers and feeding rates per head. This approach to the analysis of the demand for concentrates has the advantage that it is straightforward and the two major components of demand are readily identified. The numbers of livestock are easily obtained from the official statistics and, once having established representative feeding rates per head for these classes, the feeding rates may be revised in forthcoming years as and when significant changes occur.

The demand analysis at this stage does not purport to be complete since it is recognized that both the aggregate demand for livestock products and price relationships between all types of feedingstuffs are also important. The relationship between concentrates and other feedingstuffs is discussed in a later chapter. At this point it is pertinent to examine the major components of the demand for concentrated feeds at the farm level.

Numbers of Livestock

Cattle

Between 1960-61 and 1965-66 the number of dairy cows in Denmark declined slightly. In the first year under review 1,438 thousand head were reported at the July census and this number rose to 1,493 thousand in the following year from which time the numbers declined to 1,350 thousand in 1965-66 (table 2). The number of heifers 1 year old and over, but not having calved, increased slightly from 740 thousand to 746 thousand. This latter figure is less than the peak population of 772 thousand reported in 1962-63. A similar trend is evident among bullocks 1 year old and over. Their numbers increased from 55 thousand in 1960-61 to 83 thousand in 1963-64, but fell thereafter to 62 thousand in 1965-66. A more pronounced increase in the number of bulls 1 year old and over was recorded. They increased from 37 thousand in 1960-61 to 85 thousand two years later, but then fell to 35 thousand in 1964-65. There was a slight increase in the following years.

As may be expected from the trend in cow numbers, the number of calves under 1 year of age reared as herd replacements fell from 697 thousand in 1960-61 to 593 thousand in 1964-65. In 1965-66 the trend was reversed when their numbers were reported to have increased to 628 thousand.

The number of veal calves slaughtered increased from 430 thousand in 1960-61 to 511 thousand in 1965-66. These were not the younger type of animal slaughtered shortly after birth, but older calves reared to approximately 300 pounds liveweight.

Pigs

In contrast to the general decline in cattle production, pig production in Denmark increased quite substantially between 1960-61 and 1965-66. The number of pigs slaughtered rose from 8,841 thousand in 1960-61 to 11,546 thousand in 1965-66, or an increase of 2,700 thousand head. This represents an increase of more than 30 percent. The number of replacements reared for the breeding herd increased from 212 thousand in 1960-61 to 318 thousand head in 1965-66. The number of sows and farrowed gilts reported in 1960-61 was some 200 thousand less than in 1965-66 when there was estimated to be 795 thousand head.

Table 2. NUMBERS OF LIVESTOCK BY CLASS IN DENMARK
1960-61 to 1965-66, July Census

Class of livestock	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
	Thousand head					
Cows and heifers (calved)	1,438	1,493	1,464	1,408	1,370	1,350
Heifers 1 year & older (not calved)	740	768	772	726	723	746
Bullocks 1 year & older	55	55	76	83	68	62
Bulls 1 year & older	37	78	85	43	35	48
Calves under 1 year (herd replacements)	697	735	607	563	593	628
Veal calves	430	646	501	520	489	511
Sows and gilts	529	584	622	654	730	795
Boars for service	17	19	21	21	24	27
Pigs for slaughter (July-June year)	8,893	9,622	9,817	10,230	11,361	11,582
Female breeding herd replacements ^{1/}	212	234	249	262	292	318
Sheep	22	24	26	35	33	42
Laying hens and cocks	9,810	9,835	9,090	8,028	7,817	6,951
Pullets	8,708	9,868	7,450	7,127	5,427	4,671
Geese and turkeys, ducks	1,601	2,735	1,572	1,675	2,404	2,724
Horses	171	125	100	81	64	53

1. Calculated from total sow numbers.

Source: Danmarks Statistik, Landbrugsstatistik 1966.

Poultry

The number of laying hens 6 months old and over fell from 9,810 thousand in 1960-61 to 6,951 thousand in 1965-66. This substantial decline is attributed to import levies imposed on Danish poultry products by the European Economic Community and also to the legal barriers preventing the introduction of some intensive methods of poultry keeping. By British and American standards most of the birds are still kept in small flocks. The number of pullets reared for breeding declined from 8,708 thousand in 1960-61 to 4,671 thousand in 1965-66. White Leghorns and crosses with Hampshires are the most common breeds of egg layers in Denmark.

Sheep

In the mid 19th century sheep were of some importance in Denmark, but they have been displaced by more intensive forms of livestock and in recent times they have little significance. There were only 22 thousand breeding ewes reported in 1960-61 and by 1965-66 this number had increased to 42 thousand. Most of these animals are kept on the poorer soils of West Jutland, on the minor islands and in parklands.

Rates of Feeding per Head

Cattle

The weather conditions in Denmark are such that most classes of cattle must be kept indoors for about 200 days per year. During this winter period cattle are typically fed on rations including roots, grass, silage, hay and straw with a supplement of concentrates. Fresh beet tops are fed in the autumn months. Grass is available throughout the summer and often this is supplemented with lucerne and varying quantities of concentrates. Most of the grass is grazed in situ in fields or paddocks, but on some smaller farms animals are tethered.

Feeding practices are known to vary between various sizes of farms and between areas of the country. Relatively more concentrates are fed on the islands than in Jutland where greater emphasis is given to forage crops. In terms of proportions of nutrients fed to all classes of cattle this difference between the two principal areas amounts to between 15 and 20 percent. The most intensively fed animals in 1964-65 as observed from a sample of 167 cost accounted farms were on holdings of between 15 and 30 milk cows.^{1/} Consumption of concentrated feed per animal unit on holdings with less than 8 milk cows was about 2,320 pounds per year, whereas on farms with between 15 and

1. Det Landøkonomiske Driftsbureau, Undersøgelser over Landbrugets Driftsforhold 46. Copenhagen 1966.

30 cows consumption was about 2,800 pounds per year. The amount of concentrates fed per head was slightly less in the 30 to 60 cow size group and on farms with 60 cows or more rather less than 2,400 pounds were fed per year.

When all classes of farms in the principal farming areas in Denmark are considered together, a rising trend in the consumption of concentrated feed per cow was observed between the years 1960-61 and 1965-66. Apart from the year 1961-62 when consumption was at 2,136 pounds, the lowest in the six year period, the quantity of concentrates fed to dairy cows increased each year rising to over 2,750 pounds per head in 1965-66 (table 3). Heifers over one year of age being reared as dairy herd replacements, on the other hand, were fed relatively small quantities of concentrates, or more precisely, about 160 pounds per year throughout the entire period. The dearth of data for this particular class of cattle, does permit more detailed year to year fluctuations arising from such factors as availability of fodder, and weather conditions, to be detected.

A modest, but overall rising, trend in the amounts of concentrate feed fed to bullocks was observed, increasing from 1,540 pounds per head in 1960-61 to 1,617 pounds per head in 1965-66. Only a few pure beef cattle such as Aberdeen Angus, Hereford and Charolais are kept in Denmark. Bulls kept for service, both on farms and at AI stations, are relatively heavy consumers of concentrates. Their consumption was estimated to be 2,400 pounds per year.

Calves under 1 year of age fed on milk and concentrates were reported to be fed over 460 pounds of all concentrates per year. Some substitution of grains for milk occurred, but there was little change in the overall quantities of feed consumed when expressed in terms of concentrates. Veal calves tended to be fed more intensively over the six year period. Their consumption increased from about 1,120 pounds in 1960-61 to 1,210 pounds in 1965-66. These animals are typically kept in confinement and sold for slaughter at 300 pounds liveweight. There has been a decline in the practice of selling very young calves for veal.

Pigs

Feed consumption by sows and gilts with litters increased from just under 3,080 pounds per head per year in 1960-61 to about 3,280 pounds per year in 1965-66. The increased consumption is largely a result of the increased requirement on the breeding herd through a greater output in terms of pigs per litter and litters per year. Some of the increase in demand was offset by improved feed conversion efficiency of the sows. Little change in the feed consumption of boars at about 3,170 pounds per year was observed in the same time period. The amount of concentrates fed to young gilts reared as breeding herd replacements declined, however. In 1960-61 their feed consumption was in the region of 1,590 pounds, whereas by 1965-66 this figure had fallen by 10 pounds. Typically these gilts are reared to bacon weight and then fed for an additional two months before being bred.

Table 3. FEEDING RATES PER HEAD OF LIVESTOCK BY CLASS IN DENMARK
1960-61 to 1965-66

Class of livestock	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
	Pounds per year or fattening period					
Cows and heifers (calved)	2,246	2,136	2,391	2,453	2,647	2,754
Heifers 1 year and older	161	161	161	161	161	161
Bullocks 1 year and older	1,540	1,562	1,584	1,595	1,606	1,617
Bulls 1 year and older	2,420	2,420	2,420	2,420	2,420	2,420
Calves under 1 year (herd replacements)	462	462	462	462	462	462
Veal calves	1,122	1,144	1,166	1,177	1,188	1,210
Sows and gilts (including litters)	3,078	3,122	3,142	3,126	3,234	3,278
Boars	3,168	3,168	3,168	3,168	3,168	3,168
Pigs for slaughter	667	656	656	644	638	655
Breeding herd replacements	1,593	1,582	1,582	1,571	1,564	1,582
Sheep	86	86	86	86	86	86
Laying hens and cocks	92.4	92.4	92.2	92.6	93.7	95.5
Pullets	24.9	25.1	27.1	28.2	26.8	27.3
Chickens for slaughter	9.53	9.37	8.45	8.45	8.45	8.27
Turkeys, ducks and geese	55	55	55	55	55	55
Horses	680	670	660	650	640	630

Pig production in Denmark is centered around the quality bacon market. Canned pigmeat is also important. Very few pigs are slaughtered at less than 180 pounds liveweight, and similarly, apart from sows and boars, only a few pigs are slaughtered at over 220 pounds liveweight. The standards of hog husbandry practiced in Denmark on a national scale is probably unsurpassed anywhere in the world. Progeny testing was initiated as early as 1907 and continues to play a vital role in the improvement of pig production. Since 1960 about 5,000 pigs have been tested annually on a variety of diets. Since the first stations were opened some 50 years ago, feed conversion efficiency has been improved by over 25 percent, body length has been increased by almost 10 percent and the thickness of back fat decreased by almost 40 percent. Most of the breeding is concentrated in 250 pedigree herds which are required to provide groups of pigs for progeny testing. Six experimental stations conduct research into environmental factors, such as the influence of housing and various systems of management on the efficiency of meat production. The results of the work are publicized widely through the use of demonstration farms in various parts of the country. Farmers are alert to important research findings and through the pressures of their highly competitive international market, they are typically ready to adopt cost reducing innovations.

It is hardly surprising, therefore, to find that the concentrate feed consumption per pig reared for slaughter decreased during the six years under review. In 1965-66 feed consumption was 655 pounds per head as opposed to 667 pounds per head in 1960-61. There was no significant change in the average slaughter weight of pigs during this time, and if any, the average weight tended to increase, so that almost all this change is attributable to improved feed conversion efficiency.

Poultry

Feed consumption by laying hens in Denmark held at about 92.5 pounds per bird between 1960-61 and 1963-64, but thereafter increased to reach 95.5 pounds per bird in 1965-66. Some of the increase is attributable to increased egg output per bird and also to some heavier strains of Hampshires crossed with lighter White Leghorns which is the most prevalent breed in the country. Egg production is confined to deep litter and free range flocks, since the caging of birds is prohibited by law. Pullets reared as replacements increased their feed consumption from about 25 to 27 pounds. The feed conversion efficiency of broilers, on the other hand, improved and the amount of concentrates fed to these birds between 1960-61 and 1965-66 decreased from 9.5 to 8.3 pounds per bird. Most of the broilers are produced on farms where there are adequate building facilities, rather than on specialized intensive holdings. The difficult conditions surrounding poultry production in Denmark make this particular type of livestock production relatively unattractive and it does not appear likely that significant improvements will occur. Feeding rates per head are anticipated to remain at about their 1965-66 levels for the next five years.

Sheep

There are but few flocks of sheep in Denmark. These animals receive only modest amounts of concentrates in winter to supplement forages. The average quantity of concentrates fed to ewes estimated to between 80 and 90 pounds per year.

Horses

Horses take a minor part in Danish agricultural production and as consequence of the declining work requirements on these animals, the amount of concentrates fed fell from 680 pounds per year in 1960-61 to 630 pounds per year in 1965-66. Sporting horses are becoming increasingly popular, and these animals have a considerably higher rate of consumption of concentrated feedingstuffs.

Total Amounts Fed to Livestock

The total concentrate requirements for the 16 classes of livestock enumerated in this section were calculated from the product of numbers of livestock in each class and the feeding rates per head.

Cattle

In 1965-66 all cattle were fed 2,256 thousand tons of concentrates and of this total, dairy cows and milking heifers took almost 1,700 thousand tons (table 4). Calves were the next largest consumers and in total they were fed 413 thousand tons, of which 280 thousand tons were consumed by veal calves. Dairy heifers, bullocks, and bulls for service were fed relatively minor amounts; 54 thousand, 46 thousand and 53 thousand tons respectively.

The total consumption by all cattle over the six years 1960-61 to 1965-66 increased by 265 thousand tons, or by about 15 percent. The greatest proportion of the increase was among dairy cows and occurred during a period when their numbers were declining. Veal calves were fed about 220 thousand tons in 1960-61 and by 1965-66, their consumption increased by over 25 percent to 280 thousand tons.

Pigs

Pigs were the largest consumers of concentrated feedingstuffs in Denmark throughout the six years under review. In 1965-66 about 4,900 thousand tons were fed to pigs, and of this total, about 3,450 thousand tons went directly into meat production. An additional 1,184 thousand tons were fed to sows and gilts with litters up to 8 weeks of age. Replacements for the breeding herd and boars used for service consumed 229 thousand tons and 39 thousand tons respectively.

Table 4. AMOUNTS OF CONCENTRATED FEEDINGSTUFFS FED TO VARIOUS CLASSES
OF LIVESTOCK IN DENMARK
1960-61 to 1965-66, July-June Years

Class of livestock	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
	Thousand metric tons					
Cows and heifers (calved)	1,468	1,449	1,591	1,570	1,648	1,690
Heifers 1 year and over	54	56	56	53	53	54
Bullocks 1 year and over	38	39	55	60	49	46
Bulls	41	86	93	47	38	53
Veal calves	219	241	266	278	264	281
Calves under 1 year (herd replacements)	146	154	127	118	125	132
Total concentrates fed to cattle	1,966	2,025	2,188	2,126	2,177	2,256
Sows and gilts	740	829	888	929	1,073	1,184
Boars	24	27	30	30	35	39
Pigs for slaughter	2,696	2,868	2,927	2,995	3,295	3,448
Female breeding herd replacements	153	168	179	187	208	229
Total concentrates fed to pigs	3,613	3,892	4,024	4,141	4,611	4,900
Laying hens and cocks	412	413	381	338	333	302
Pullets	98	112	92	91	66	58
Chickens for slaughter	180	210	227	223	231	192
Ducks, geese, turkeys	40	68	39	42	60	68
Total concentrates fed to poultry	730	803	739	694	690	620
Horses	53	38	30	24	19	15
Sheep	1	1	1	1	1	2
Other livestock	65	68	70	70	76	78
Total concentrates fed to livestock	6,428	6,827	7,052	7,056	7,574	7,871

Among all classes of livestock in Denmark, pigs showed the most spectacular increase in concentrate feed consumption between 1960-61 and 1965-66. The total amount of feed fed rose from 3,613 thousand tons in 1960-61 to 4,900 thousand tons in 1965-66, or an increase of more than 35 percent. This increase was distributed between all classes of pigs. The consumption of sows and gilts increased from 740 thousand tons to 1,184 thousand tons and pigs slaughtered fat increased their consumption from about 2,700 thousand tons to 3,450 thousand tons.

Poultry

In 1965-66, 620 thousand tons of concentrates were fed to poultry. Laying hens and cocks consumed 302 thousand tons, chickens for slaughter 192 thousand tons, pullets 58 thousand tons and ducks, geese and turkeys in total consumed 68 thousand tons. Between 1960-61 and 1965-66 the concentrate consumption of laying hens and cocks decreased by 110 thousand tons, or by over 25 percent. The feed consumption of chickens for slaughter (mainly broilers), on the other hand, increased from 180 thousand tons in 1960-61 to a peak of 231 thousand tons in 1964-65, but then fell slightly to 192 thousand tons in 1965-66. Some improvements in feed conversion efficiency of broilers helped to hold the expansion in feed consumption to a minimum. The amount of concentrates fed to the aggregate class of ducks, geese and turkeys increased from 40 thousand to 68 thousand tons during the six years under review. Turkeys accounted for most of this increase.

Horses

As might be expected the amount of concentrate feed fed to horses declined. In 1960-61 consumption was 53 thousand tons whereas in 1965-66 only 15 thousand tons were estimated to have been fed to farm horses.

Sheep

Only between 1,000 and 2,000 tons of concentrates are estimated to have been fed each year to all sheep in Denmark between the years 1960-61 and 1965-66.

Other Livestock

The amount of concentrates allocated to this last and residual class increased from 65 thousand to 78 thousand tons between 1960-61 and 1965-66. Livestock included in this class are riding horses, mink, goats and other animals not included in the national agricultural statistics. The largest proportion of the feed, however, was consumed by livestock that died or were slaughtered because of disease or accident during the production period and were not recorded in the statistics of livestock or official slaughterings.

All Livestock

Livestock and livestock feeding are vitally important to Danish Agriculture. In terms of Scandinavian fodder units, concentrated feedingstuffs excluding milk and milk by-products are estimated to have supplied almost 46 percent of the nutrient requirements of all livestock in Denmark in 1965-66. Forage crops, including beet tops and straw, are estimated to have provided about 50 percent of the nutrient requirements in the same year. In terms of physical quantities, more than 7.9 million tons of concentrates were fed to livestock in 1965-66. During the six years 1960-61 to 1965-66 the quantity increased 1.4 million tons, or 22 percent.

Among the various classes of livestock, pigs and poultry relied almost entirely on concentrated feedingstuffs, whereas cattle, sheep and horses were able to utilize more roughages. Pigs were the largest single consumers and were fed 4.9 million tons in 1965-66. Cattle followed with an aggregate consumption of 2.3 million tons. Poultry were fed about 0.6 million tons in the same year. The total consumption of concentrates by pigs and cattle increased by about 35 and 15 percent respectively. Poultry, on the other hand, consumed less in 1965-66 than in 1960-61, during which period of time their consumption fell by 15 percent.

Some explanations of the changes have been noted. Highlights of these were the increased demand for pigmeat in the West European market, particularly in Great Britain, where the Danes have a strong position, and the more intensive feeding of dairy cows. The decline in poultry feed consumption is attributed largely to high import duties placed on Danish eggs and poultry meat by the European Economic Community.

AMOUNTS OF CONCENTRATED FEEDINGSTUFFS AVAILABLE FOR LIVESTOCK

Four principal types of concentrated feedingstuffs are available for livestock in Denmark, namely, cereals, cereal by-products, high protein feeds, and milk and its by-products. In addition, there is a relatively minor group of feeds that includes molasses and fodder yeast. Most of the high protein feeds, particularly oilcakes, are imported. In addition, there are significant imports of cereals some of which are used directly in animal feed. Other grains are milled for human food and the by-products become available for livestock.

In this section the domestic production, imports, exports, and utilization of the major cereals are examined. Then in conjunction with an analysis of the supplies of cereal by-products, high protein and other feeds, the total supplies of concentrates available for livestock are calculated for the years 1960-61 to 1965-66.

Cereals

Domestic Production

In 1965-66 some 3.9 million acres of cereals were harvested in Denmark yielding total grain production in excess of 6.2 million tons. This was the largest cereal acreage recorded to that date^{1/} although total grain production was slightly higher in the previous year. In 1960-61 the cereal area was only slightly less at about 3.6 million acres, but the total grain production was substantially smaller at just under 5.0 million tons. This large increase in production was largely achieved through increased yields of the major cereal varieties and also by some changes in the relative acreages of the various types of cereals grown.

Barley is the most important single grain; in 1965-66 some 2,570 thousand acres were grown and the total yield was in the region of 190 million bushels (table 5). In terms of both acreage and production, oats ranked second with a total harvest of 45 million bushels grown on some 500 thousand acres. Three hundred and forty thousand acres of mixed grains yielded a total production of about 24 million bushels in the same year. The combined production of winter and spring wheats was 21 million bushels grown on 312 thousand acres. Some 216 thousand acres of winter and spring rye were grown to yield a total harvest of about 10 million bushels of grain. Most of this was the winter variety.

Between 1960-61 and 1965-66 barley advanced its lead as the most important cereal; the area in this crop increased from just under 1.9 million acres in 1960-61 to about 2.6 million acres in 1965-66. Average yields also increased, rising from 64 bushels per acre in 1960-61 to about 80 bushels per acre in 1965-66. Total production increased by over 45 percent, from 129 million bushels to approximately 190 million bushels. The total wheat area increased from 200 thousand acres to more than 310 thousand acres and with concurrent increases in yield total input climbed from 12 million bushels in 1960-61 to 21 million bushels in 1965-66.

Less striking increases in oat production were evident. The total area sown moved from 490 thousand acres in 1960-61 to 503 thousand acres in 1965-66. Oat yields increased from 92 bushels per acre to about 100 bushels per acre so that total production was raised from 40 million to 45 million bushels. The total production of rye fell from 18 million to 10 million bushels and the production of mixed grains fell from 41 to 25 million bushels between 1960-61 and 1965-66.

Pulse crops are grown on a small scale and are declining to an almost insignificant level in Denmark. In 1960-61 the total production amounted to 20 thousand tons and by 1965-66 production fell to 8 thousand tons.

1. In 1966-67 the cereal area increased by 16,000 acres, but the total production was less than in 1965-66.

Table 5. AREA, YIELD AND PRODUCTION OF WHEAT, OATS,
BARLEY, RYE, MIXED GRAINS AND PULSE CROPS IN DENMARK
1960-61 to 1965-66, Crop Years

Year	Area	Yield	Production
	Thous. acres	Bu. per acre	Million bu.
<u>Wheat</u>			
1960-61	202.8	60.1	11.8
1961-62	260.1	63.5	15.9
<u>Spring wheat</u>			
1962-63	100.3	53.7	4.9
1963-64	106.0	48.8	5.0
1964-65	103.2	55.1	5.3
1965-66	68.7	55.6	3.7
<u>Winter wheat</u>			
1962-63	279.9	69.6	18.8
1963-64	226.5	58.8	13.2
1964-65	213.4	70.1	14.4
1965-66	243.5	72.0	17.0
<u>Oats</u>			
1960-61	489.8	92.3	39.5
1961-62	482.4	89.3	39.7
1962-63	405.1	99.4	35.3
1963-64	458.9	91.6	35.3
1964-65	520.4	102.2	47.6
1965-66	502.6	100.3	45.2
<u>Barley</u>			
1960-61	1,866.8	63.7	128.7
1961-62	1,974.5	66.4	129.0
1962-63	2,049.1	79.6	151.6
1963-64	2,317.6	68.1	156.1
1964-65	2,346.5	81.8	179.2
1965-66	2,572.5	79.8	189.5
<u>Rye</u>			
1960-61	387.1	53.4	17.9
1961-62	451.3	50.9	20.2

Table 5 (continued)

Year	Area	Yield	Production
	Thous. acres	Bu. per acre	Million bu.
<u>Spring rye</u>			
1962-63	25.9	49.3	1.1
1963-64	17.8	39.9	0.7
1964-65	14.1	48.0	0.6
1965-66	8.9	50.4	0.4
<u>Winter rye</u>			
1962-63	403.4	55.2	19.1
1963-64	268.4	48.7	11.9
1964-65	214.6	59.3	10.9
1965-66	207.5	56.6	10.0
<u>Mixed grains</u>			
1960-61	621.5	65.7	40.8
1961-62	626.9	62.2	39.0
1962-63	544.9	71.8	39.1
1963-64	481.9	65.0	31.3
1964-65	459.9	73.4	33.8
1965-66	340.6	73.0	24.9
<u>Pulse crops</u>			<u>Tons</u>
1960-61	20.7		20,000
1961-62	24.9		24,000
1962-63	22.2		14,000
1963-64	18.5		15,000
1964-65	14.8		15,000
1965-66	8.6		8,000

Imports

While over 6,200 thousand tons of grain were produced domestically in Denmark in 1965-66, less than 800 thousand tons of grain were imported. Of these imports, shipments of barley amounted to 390 thousand tons and shipments of maize amounted to approximately 190 thousand tons (table 6). Other imports were oats 76 thousand tons, sorghum 56 thousand tons, rye 26 thousand tons, and wheat 11 thousand tons.

The United States and England were the principal suppliers of barley in 1965-66. In previous years imports were more evenly distributed among a wider number of countries including France, Sweden and Syria. During the six years 1960-61 to 1965-66 imports of barley tended to decline fractionally.

Table 6. IMPORTS OF BARLEY, OATS AND MAIZE INTO DENMARK
BY COUNTRY OF SHIPMENT
1960-61 to 1965-66, August-July Years

Country	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
Thousand metric tons						
<u>Barley</u>						
Argentina	-	2	3	4	2	
Australia	17	14	11	-	-	
England	20	29	6	3	178	
France	55	23	164	110	22	
Sweden	47	5	29	31	8	
Syria	58	55	66	35	3	
Russia	11	-	-	47	1	
United States	99	94	192	186	166	
West Germany	13	3	5	2	-	
Others	115	32	8	4	8	
Total Imports	230	435	257	484	422	388
<u>Oats</u>						
Argentina	66	29	30	42	8	
Australia	8	19	25	24	23	
England		4	1	-	-	
France	-	-	-	-	-	
Sweden	13	4	8	16	23	
Syria	-	-	-	-	-	
Russia	-	-	-	-	-	
United States	4	19	-	-	8	
West Germany	-	-	-	-	-	
Others	12	2	20	2	14	
Total Imports	57	103	77	84	84	76
<u>Maize</u>						
Argentina	5	2	2	2	2	
Australia	-	-	-	-	-	
England	-	-	-	-	-	
France	7	-	4	9	-	
Sweden	-	-	-	-	-	
Syria	-	-	-	-	-	
Russia	-	-	-	-	-	
United States	194	145	113	137	189	
West Germany	-	1	-	-	-	
Others	2	-	7	-	1	
Total Imports	156	208	148	126	148	192

Source: Landbrugministeriets Korn og Licenskontor.

The United States is virtually the only supplier of maize. Shipments varied between about 190 thousand and 110 thousand tons during the six years under review. The United States is also the principal supplier of sorghum (table 7). Shipments declined from 186 thousand tons in 1961-62 to 54 thousand tons in 1965-66. Similarly, imports from Argentina declined from 129 thousand tons to one thousand tons.

Imports of oats remained between 60 and 100 thousand tons during the years 1960-61 to 1965-66. Argentina was the principal source of imported supplies in the early part of the period, but shipments from this country declined to 8 thousand tons in 1965-66.

Imports of wheat remained at very modest levels throughout the six years under review. Shipments ranged from 8 thousand to 35 thousand tons and were supplied principally from France, Argentina and Sweden.

Shipments of rye into Denmark were erratic, ranging from as little as 1 thousand tons in 1962-63 and 1964-65 to 26 thousand tons in 1965-66. Argentina, Sweden and the United States were among the suppliers.

Supply and Utilization

The total supply of wheat on the Danish market was about 680 thousand tons in 1965-66 of which over 560 thousand tons were produced domestically (table 8). During the previous five years supplies of wheat decreased slightly; in 1960-61 supplies amounted to nearly 460 thousand tons.

The greatest proportion of the wheat was used for milling and the utilization was at a fairly uniform rate of about 270 thousand tons per annum. The consumption for animal feed increased from 73 thousand tons in 1960-61 to 186 thousand tons in 1965-66.

Barley is by far the most important cereal in terms of tonnages available. In 1965-66 total supplies were over 4.7 million tons of which 4.1 million tons were home produced (table 9). Five years earlier total supplies were 3.1 million tons of which 2.8 million tons were produced domestically. In 1965-66 almost 3.7 million tons of barley were consumed as animal feed, or about 80 percent of total barley supplies. In the same year approximately 100 thousand tons were consumed for industrial purposes. The demand for barley by industry remained close to this level during the years 1960-61 to 1965-66. The consumption by animals, on the other hand, jumped from 2.5 million tons in 1960-61 to almost 3.7 million tons in 1965-66.

The total supplies of oats in 1965-66 were 900 thousand tons of which 780 thousand tons were produced at home (table 10). The total supplies increased from 760 thousand tons in 1960-61 to a peak of 930 thousand tons in 1964-65. Just less than 80 percent of total supplies or about 700 thousand tons, were

Table 7. IMPORTS OF SORGHUM, WHEAT AND RYE INTO
DENMARK BY COUNTRY OF SHIPMENT
1960-61 to 1965-66, August-July Years

Country	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
Thousand metric tons						
<u>Sorghum</u>						
Argentina		129	22	68	15	1
Australia		-	-	-	-	-
England		-	-	-	-	-
France		-	-	-	-	-
Sweden		-	-	-	-	-
Syria		-	-	-	-	-
Russia		-	-	-	-	-
United States		186	132	78	99	54
West Germany		-	-	-	-	-
Others		7	-	-	-	1
Total Imports	231	322	154	146	114	56
<u>Wheat</u>						
Argentina		2	1	1	2	3
Australia		-	-	-	-	-
England		1	1		2	
France		-	2	14	-	4
Sweden		12	2	6	4	-
Syria		-	-	-	-	-
Russia		-	-	-	-	-
United States		3	2	2	-	1
West Germany		6	-	1	-	2
Others		1	1	11	-	1
Total Imports	31	25	9	35	8	11
<u>Rye</u>						
Argentina		-	-	6	-	6
Australia		-	-	-	-	-
England		-	-	-	-	-
France		-	-	-	-	-
Sweden		13	-	1	1	-
Syria		-	-	-	-	-
Russia		-	-	-	-	-
United States		-	1	8	-	9
West Germany		-	-	-	-	-
Others		1	-	6	-	11
Total Imports	5	14	1	21	1	26

Source: Landbrugsministeriets Korn og Licenskontor.

Table 8.
SUPPLY AND DISPOSAL OF WHEAT IN DENMARK
1960-61 to 1965-66, August-July Years

Year	SUPPLIES				DISPOSALS								
	Production	stocks	Opening	Total	Seed	Milling	Industrial	Animal	feed	Waste	Exports	stocks	Total
							use						
Thousand metric tons													
1960-61	320	107	31	458	19	251	-	73	32	8	75	458	
1961-62	434	75	24	533	28	272	-	90	43	32	68	533	
1962-63	644	68	10	722	24	275	-	180	64	58	121	722	
1963-64	495	121	35	651	23	278	-	160	50	32	108	651	
1964-65	541	108	8	657	23	273	-	143	27	84	107	657	
1965-66	564	107	10	681	17	268	-	186	28	31	151	681	

Source: Danmarks Statistik, Landbrugsstatistik 1965 and 1966.

Table 9. SUPPLY AND DISPOSAL OF BARLEY IN DENMARK
1960-61 to 1965-66, August-July Years

Year	SUPPLIES				DISPOSALS							
	Production	Opening stocks	Imports	Total supply	Seed	Milling	Industrial use	Animal feed	Waste	Exports	stocks	Total disposals
Thousand metric tons												
1960-61	2,801	83	230	3,114	144	3	98	2,506	180	59	124	3,114
1961-62	2,808	124	400	3,332	149	3	96	2,595	281	110	98	3,332
1962-63	3,299	98	262	3,659	169	3	102	2,755	330	80	220	3,659
1963-64	3,399	220	478	4,097	171	3	112	3,241	340	89	141	4,097
1964-65	3,900	141	377	4,418	187	3	106	3,490	195	219	218	4,418
1965-66	4,125	218	397	4,740	200	2	101	3,671	205	278	283	4,740

Source: Danmarks Statistik, Landbrugsstatistik 1965 and 1966.

Table 10. SUPPLY AND DISPOSAL OF OATS IN DENMARK
1960-61 to 1965-66, August-July Years

Year	SUPPLIES				DISPOSALS			
	Production	Opening stocks	Imports	Total Supply	Seed Milling	Industrial use	Animal feed	Final Total
								Exports stocks disposals
Thousand metric tons								
1960-61	681	22	57	760	35	39	-	563 68 19 36 760
1961-62	684	36	87	807	30	43	-	609 68 32 25 807
1962-63	609	25	84	718	34	40	-	511 62 24 47 718
1963-64	671	47	80	798	38	39	-	619 67 13 22 798
1964-65	821	22	87	930	37	42	-	742 41 25 43 930
1965-66	780	43	77	900	42	42	-	703 39 17 57 900

Source: Danmarks Statistik, Landbrugsstatistik, 1965 and 1966.

were consumed as animal feed in 1965-66. The total supplies available for animal feed increased from 560 thousand tons in 1960-61 to 740 thousand tons in 1964-65 and thereafter fell slightly. No oats were used for industrial purposes, but about 40 thousand tons were milled each year.

The total supplies of rye tended to decline throughout the six years under review. In 1961-62, nearly 580 thousand tons were available and this quantity declined to 345 thousand tons in 1965-66 (table 11). Almost all of the rye was produced domestically. The disposals of this grain for animal feed declined from about 220 thousand tons in 1960-61 to 130 thousand tons in 1964-65, but increased slightly to 170 thousand tons in the following year. Disposals for milling also declined, but not as sharply; 127 thousand tons were consumed in 1960-61 as opposed to 114 thousand tons five years later.

The northern location of Denmark does not permit maize to be grown for grain on a commercial scale so that all supplies must be imported. During the six years under review total supplies ranged from about 140 thousand tons to 230 thousand tons (table 12). From 1963-64 imports tended to increase to reach the 1965-66 level of about 200 thousand tons. Of this total 166 thousand tons were used for animal feed and this figure is slightly less than the highest disposal of 205 thousand tons in 1961-62. Twenty thousand tons of maize were used for milling in 1965-66.

Between 1960-61 and 1965-66 the total supplies of sorghum declined from a peak of about 340 thousand tons to 60 thousand tons (table 13). Virtually all of the grain was consumed as animal feed.

The total supply of mixed grains declined from 760 thousand tons in 1961-62 to about 480 thousand tons in 1965-66 (table 14). All of this grain was produced domestically and, apart from seed requirements and waste, all was utilized as animal feed.

High Protein Feeds

Supplies of high protein feeds, principally oilcakes and fish and meat meals, originate from both domestic and foreign sources. Some oilseeds are grown and processed in Denmark along with more substantial supplies of imports. The by-products become available for oilcake and in addition oilcakes are imported as such. Similarly fish and meat meals are supplied as by-products of the Danish fishing and meat industries and from imports. Milk and whey are also important sources of protein for certain classes of livestock, particularly pigs.

Table 11. SUPPLY AND DISPOSAL OF RYE IN DENMARK
1960-61 to 1965-66, August-July Years

Year	SUPPLIES				DISPOSALS										
	Production	stocks	Opening	Imports	supply	Seed	Milling	Industrial		Animal	Waste	Exports	stocks	disposals	Total
								use	feed						
Thousand metric tons															
1960-61	454	22	5	481	33	127	5	218	45	1	52	481			
1961-62	514	52	11	577	31	126	4	255	51	83	27	577			
1962-63	513	27	1	541	21	123	4	212	52	56	73	541			
1963-64	319	73	21	413	17	121	3	174	31	27	40	413			
1964-65	292	40	2	334	16	115	3	131	15	0	54	334			
1965-66	265	54	26	345	8	114	2	169	14	0	38	345			

Source: Danmarks Statistik, Landbrugsstatistik, 1965 and 1966.

Table 12.
SUPPLY AND DISPOSAL OF MAIZE IN DENMARK
1960-61 to 1965-66, August-July Years

[illegible]

Source: Danmarks Statistik, Landbrugsstatistik 1965 and 1966.

Table 13. SUPPLY AND DISPOSAL OF SORGHUM IN DENMARK
1960-61 to 1965-66, August-July Years

Year	SUPPLIES				DISPOSALS			
	Production	Opening stocks	Imports	Total supply	Seed Milling	Industrial use	Animal feed	Final Total
Thousand metric tons								
1960-61	-	23	231	254	-	1	232	254
1961-62	-	21	318	339	-	2	320	339
1962-63	-	17	173	190	-	3	172	190
1963-64	-	15	147	162	-	5	141	162
1964-65	-	15	121	136	-	5	126	136
1965-66	-	5	56	61	-	7	50	61

Source: Danmarks Statistik, Landbrugsstatistik, 1965 and 1966.

Table 14. SUPPLY AND DISPOSAL OF MIXED GRAINS IN DENMARK
1960-61 to 1965-66, August-July Years

Year	SUPPLIES				DISPOSALS							
	Production	stocks	Imports	supply	Seed	Milling	Industrial		Waste	Exports	Final	Total
							use	Animal feed				
Thousand metric tons												
1960-61	727	1	-	728	46	-	-	608	72	0	2	728
1961-62	759	2	-	761	40	-	-	643	76	0	2	761
1962-63	719	2	-	721	35	-	-	610	71	0	5	721
1963-64	619	5	-	624	34	-	-	526	62	0	2	624
1964-65	659	2	1	662	25	-	-	599	33	-	5	662
1965-66	479	5	-	484	22	-	-	434	24	-	4	484

Source: Danmarks Statistik, Landbrugsstatistik 1965 and 1966.

Fish meal

Net supplies of fish meal in Denmark amounted to approximately 70 thousand tons in 1965-66 (table 15). Domestic production was about 110 thousand tons. In addition approximately 30 thousand tons were imported and 68 thousand tons were shipped overseas. Between 1960-61 and 1965-66 net supplies of fish meal increased from 38 thousand to nearly 70 thousand tons. The bulk of this increase originated from domestic production.

Table 15. PRODUCTION, IMPORTS AND EXPORTS OF FISH,
MEAT AND BONE MEAL AND FODDER YEAST IN DENMARK
1960-61 to 1965-66, July-June Years

Year	Production	Imports	Exports	Net supplies
Thousand metric tons				
<u>Fish meal</u>				
1960-61	n.a.	n.a.	n.a.	38.0
1961-62	n.a.	n.a.	n.a.	32.0
1962-63	93.1	11.7	55.1	49.9
1963-64	102.4	13.2	58.0	57.7
1964-65	126.7	18.1	68.3	74.2
1965-66	108.8	28.5	68.3	68.8
<u>Meat and bone meal</u>				
1960-61	n.a.	n.a.	n.a.	69.0
1961-62	n.a.	n.a.	n.a.	78.0
1962-63	78.3	17.8	-	95.6
1963-64	89.9	19.1	0.8	107.5
1964-65	83.1	14.8	0.5	95.5
1965-66	85.8	13.2	1.3	97.8
<u>Fodder yeast</u>				
1960-61	n.a.	n.a.	n.a.	n.a.
1961-62	n.a.	n.a.	n.a.	n.a.
1962-63	0.1	7.3	0.1	7.3
1963-64	0.2	4.7	0.0	4.9
1964-65	0.2	5.6	0.0	5.8
1965-66	0.2	4.9	0.0	6.0

Source: Danmarks Statistik, Landbrugsstatistik 1966.

Meat and Bone Meal

In 1965-66 just less than 100 thousand tons of meat and bone meal were available in Denmark (table 15). The bulk of this was produced domestically and only 13 thousand tons were imported. Net supplies increased from 69 thousand tons in 1960-61 to 108 thousand tons in 1963-64 and declined slightly in the following two years. Production of meat and bone meal increased throughout the six years under review, while imports declined during the same period.

Fodder Yeast

Fodder yeast is of minor importance among the concentrated feedingstuffs for livestock. In 1965-66 net supplies amounted to 6 thousand tons of which about 5 thousand tons were imported (table 15).

Other Concentrates

Molasses

Data are available on the production and foreign trade in molasses for the years 1962-63 to 1965-66. In the latter year net supplies amounted to 64 thousand tons (table 16). Domestic production was 73 thousand tons, imports 3 thousand tons, and approximately 12 thousand tons were exported. The greatest quantity of molasses recorded as available for consumption was in 1963-64 when the net supplies amounted to 75 thousand tons. Molasses production is a by-product of the sugar-beet industry.

Table 16. PRODUCTION, IMPORTS AND EXPORTS OF MOLASSES
IN DENMARK
1960-61 to 1965-66, July-June Years

Year	Production	Imports	Exports	Net supplies
Thousand metric tons				
1960-61	n.a.			n.a.
1961-62	n.a.			n.a.
1962-63	49.3	11.5	7.3	31.2
1963-64	95.6	1.8	22.1	75.3
1964-65	114.8	0.0	40.8	74.0
1965-66	72.9	3.1	11.6	64.4

Source: Danmarks Statistik, Landbrugsstatistik, 1963 and 1966.

Total Amounts of Concentrated Feedingstuffs Available for Livestock

In 1965-66 some 7.7 million tons of concentrated feedingstuffs were available for livestock (table 17). The total supply included 5.4 million tons of cereals, 1.1 million tons of oilcakes, 737 thousand tons of dairy by-products and 233 thousand tons of cereal by-products. Five years earlier the total supplies of all concentrates available for livestock were only 6.4 million tons. The 1.2 million tons, or 19 percent, increase in total supplies between 1960-61 and 1965-66 was largely attributable to the increase in cereals, and particularly in barley. The supplies of high protein feeds, (oilcakes, fish and meat meals) increased by about 200 thousand tons and the supplies of cereal by-products increased by 70 thousand tons.

Among the cereals, and indeed among all concentrates, barley demonstrated the most striking change. Whereas 2.5 million tons were available in 1960-61, almost 3.7 million tons were available in 1965-66.

Wheat also increased in importance; supplies climbed from 73 thousand tons in 1960-61 to 186 thousand tons in 1965-66. A similar trend was apparent in the supplies of oats which rose from 563 thousand tons to 703 thousand tons. Rye, mixed grains and sorghum lost ground during the same time period. Although there were some annual variations in the supplies of maize, the quantity available showed no overall change between 1960-61 and 1965-66.

The substantial increase in barley supplies was largely due to the introduction of new higher yielding varieties, increased fertilization and the relaxation of some rotational restrictions. Similar improvements were evident in wheat production, yet barley is preferred as a feed grain for most classes of livestock. Oats are more tolerant of unfavorable soil and climatic condition, but forfeit some of this advantage through their characteristic of the relatively high proportion of less nutritious husks.

The supply of cereal by-products available for livestock moved somewhat erratically. After maintaining a level of approximately 165 thousand tons in 1960-61 and 1961-62, supplies declined in the following year, but then jumped to about 200 thousand tons in 1963-64 and again to 312 thousand tons in 1964-65. In the following year, supplies fell to about 230 thousand tons.

The supply of oilcakes declined slightly in the first two years under review, but then established an upward trend, rising from a low of about 860 thousand tons in 1961-62 to 1,067 thousand tons in 1965-66. The greatest proportion of these oilcakes originated overseas and were imported into Denmark as either oilseeds for processing, or as oilcakes. Soybean cake and cottonseed cake are the two most important oilcakes on the market and together they made up about 80 percent of total supplies in 1965-66.

The supplies of fish and meat meals demonstrated an upward trend throughout the first five years under review, but more recently the increase was

Table 17. AMOUNTS OF CONCENTRATED FEEDINGSTUFFS AVAILABLE FOR LIVESTOCK
IN DENMARK
1960-61 to 1965-66, July-June Years

Types of concentrated feedingstuffs	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
Thousand metric tons						
Wheat	73	90	180	160	143	186
Rye	218	255	212	174	131	169
Barley	2,506	2,595	2,755	3,241	3,490	3,671
Oats	563	609	511	619	742	703
Mixed grains	608	643	610	526	599	434
Maize	160	205	144	116	144	166
Sorghum	232	320	172	141	126	50
Pulses	6	7	6	6	5	4
Total cereals and pulses	4,366	4,724	4,590	4,983	5,380	5,383
Fodder meal, groats	40	44	25	54	190	115
Wheatbran	84	76	78	104	75	78
Rye bran & other cereal by-products	36	48	33	44	47	40
Total cereal by-products	160	168	136	202	312	233
Oilcakes	953	859	868	1,028	1,046	1,067
Fishmeal	38	32	49	58	74	69
Meat & bone meal	69	78	96	107	96	98
Total high protein feeds	1,060	969	1,013	1,193	1,216	1,234
Molasses ^{1/}	35	35	31	75	74	64
Fodder yeast ^{1/}	5	5	7	5	6	5
Milk & whey (concentrate equivalent) ^{2/}	795	792	744	747	735	737
Total	835	832	782	827	815	806
Total concentrated feedingstuffs	6,421	6,693	6,521	7,205	7,723	7,656

1. 1960-61 and 1961-62 estimated.

2. Official estimate of fodder units supplied by milk and whey plus 25 percent.

Source: Danmarks Statistik, Landbrugsstatistik 1966.

steadied. Both by-products are largely dependent on the activity of either the fishing industry or the level of meat production. These meals form an essential part of nutritionally balanced rations for pigs and poultry.

Skim milk, and whey are made available as by-products of the dairy manufacturing industry and they provide a valuable source of protein for livestock, particularly for pigs. Occasionally, limited supplies of whole milk are surplus to requirements and are also fed. When expressed in terms of concentrate equivalent the supply of dairy by-products amounted to just less than 800 thousand tons in 1960-61. The supplies declined in each of the following years. It is to be remembered that milk production in Denmark showed no overall change between 1960-61 and 1965-66.

Proportions of Concentrated Feedingstuffs

The most striking feature of the relative proportions of concentrated feedingstuffs is the dominant role of cereals. When considered together with cereal by-products, these two groups represented about 73 percent of the tonnage of all concentrates available for livestock in Denmark in 1965-66 (table 18). High protein feeds, excluding dairy by-products, amounted to a further 16 percent. Among the individual feedingstuffs, barley is dominant and supplied almost 48 percent by weight of the supply of all concentrates in 1965-66. Oilcakes ranked second and contributed about 14 percent of all supplies in the same year. Dairy products supplied about 10 percent of the total quantity of concentrates available.

Although cereals dominated the supply throughout the six years, they tended to increase their share of the market. This was at the expense of high protein concentrates. The magnitude of the percentage changes between these major groups of feeds was small, however. The substantial increase in the contribution of barley, 39 percent to 48 percent, was the most important trend.

Technical developments in animal nutrition will probably permit the further substitutes of cereals for high protein feeds. The absolute level of protein concentrates on the market is unlikely to decline, however. While further increases in barley production are likely, it is also probable that more wheat will be used in livestock feeding.

AMOUNTS OF CONCENTRATED FEEDINGSTUFFS FED TO AND AVAILABLE FOR LIVESTOCK

The third objective of this study is to compare for each of the six years of the period under review the calculated quantities of total concentrates fed to livestock with the calculated amounts available for livestock. It is to be remembered that each set of calculations was made from independent sources of data. These yearly comparisons are referred to as livestock feed balances.

Table 18. PROPORTIONS OF CONCENTRATED FEEDINGSTUFFS AVAILABLE
FOR LIVESTOCK IN DENMARK
1960-61 to 1965-66, July-June Years

Type of concentrated feedingstuffs	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
	Percent					
Wheat	1.1	1.3	2.8	2.2	1.9	2.4
Rye	3.4	3.8	3.3	2.4	1.7	2.2
Barley	39.1	38.8	42.2	45.0	45.0	47.9
Oats	8.7	9.1	7.8	8.6	9.6	9.2
Mixed grains	9.5	9.6	9.4	7.3	7.8	5.7
Maize	2.5	3.1	2.2	1.6	1.9	2.2
Sorghum	3.6	4.8	2.6	2.0	1.6	0.6
Pulses	0.1	0.1	0.1	0.1	0.1	0.1
Total cereals and pulses	68.0	70.6	70.4	69.2	69.6	70.3
Fodder meal, groats	0.6	0.7	0.4	0.8	2.4	1.5
Wheatbran	1.3	1.1	1.2	1.4	1.0	1.0
Rye bran & other cereal by-products	0.6	0.7	0.5	0.6	0.6	0.6
Total cereal by-products	2.5	2.5	2.1	2.8	4.0	3.1
Oilcakes	14.8	12.8	13.3	14.2	13.5	13.9
Fish meal	0.6	0.5	0.7	0.8	1.0	0.9
Meats and bone meal	1.1	1.2	1.5	1.5	1.3	1.3
Total high protein feeds	16.5	14.5	15.5	16.5	15.8	16.1
Molasses	0.5	0.5	0.5	1.0	1.0	0.8
Fodder yeast	0.1	0.1	0.1	0.1	0.1	0.1
Milk and whey	12.4	11.8	11.4	10.4	9.5	9.6
Total	13.0	12.4	12.0	11.5	10.6	10.5
Total concentrated feedingstuffs	100.0	100.0	100.0	100.0	100.0	100.0

In only two of the six years, 1963-64 and 1964-65, the amounts available exceeded the amounts fed to livestock. The difference was about 150 thousand tons (table 19). In three years, 1961-62, 1962-63 and 1965-66, the amounts fed to livestock exceeded the quantities available. At a maximum the difference was 531 thousand tons. In the first year under review, 1960-61, there was a close balance between calculated feed usage and availability. Considering the six years in the light of possible sources of error, and the quantities of concentrates involved, agreement between the two sets of calculations are more striking than the differences (figure 1).

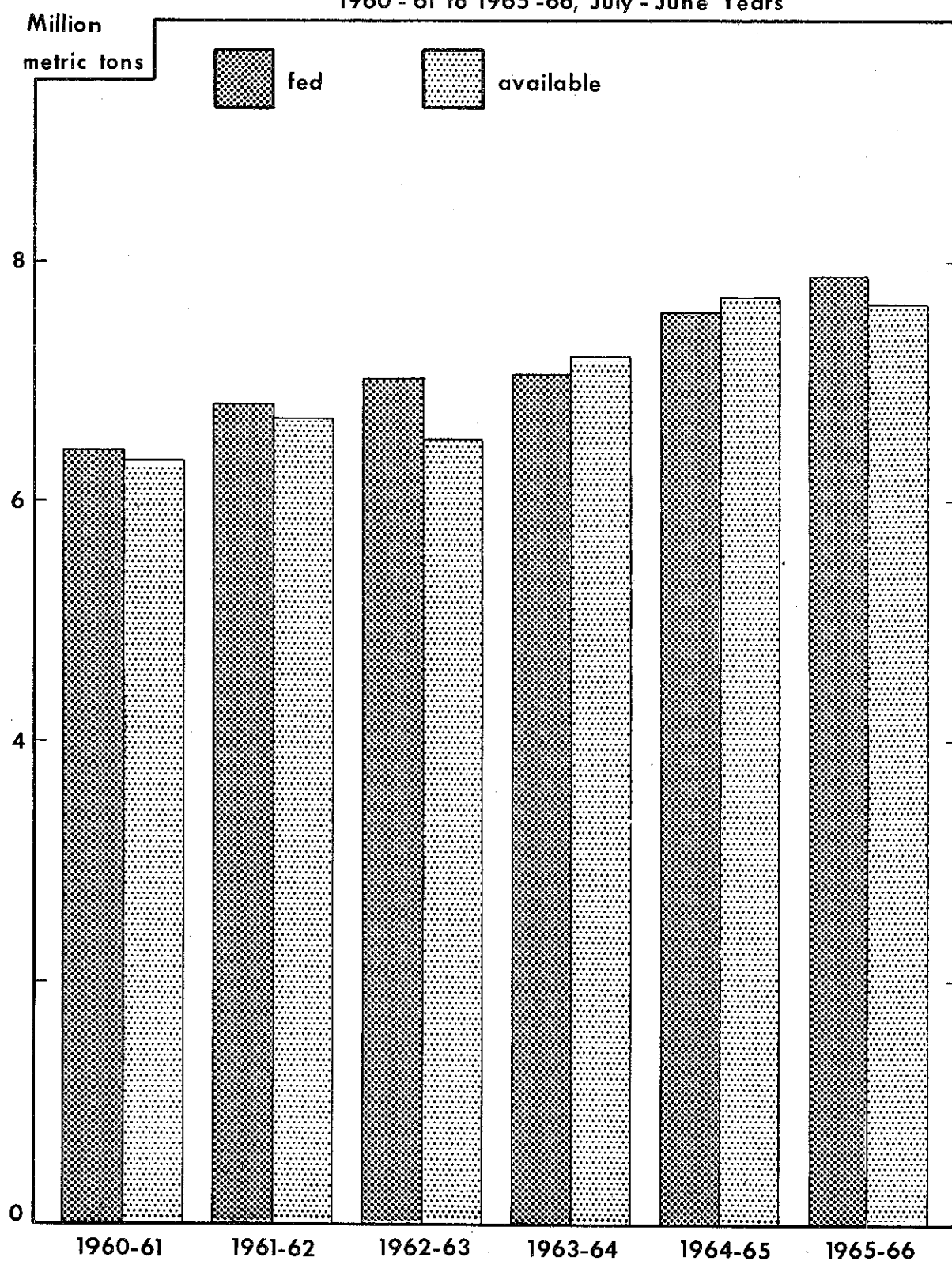
Table 19. AMOUNTS OF CONCENTRATED FEEDINGSTUFFS
AVAILABLE FOR AND FED TO LIVESTOCK IN DENMARK
1960-61 to 1965-66, July-June Years

Year	Concentrated feedingstuffs		Difference between amount available and amount fed
	Fed to livestock	Available for livestock	
Thousand metric tons			
1960-61	6,428	6,415	-13
1961-62	6,827	6,693	-134
1962-63	7,052	6,521	-531
1963-64	7,056	7,205	149
1964-65	7,574	7,723	149
1965-66	7,871	7,656	-215

The livestock feed balances support the proposition that the basic agricultural statistics of the country are dependable. On one hand the analysis relies on the enumeration of livestock numbers and feeding rates per head to determine total feed fed and on the other, use is made of production, utilization and foreign trade data to determine the supplies of concentrates available. The two approaches are complimentary in that the first specifies the total amount of concentrates fed to various classes of livestock, while the second approach provides data on the quantities of particular types of feed fed.

Figure 1.

AMOUNTS OF CONCENTRATED FEEDINGSTUFFS
AVAILABLE FOR AND FED TO LIVESTOCK IN DENMARK
1960 - 61 to 1965 - 66, July - June Years



SUMMARY AND CONCLUSIONS

The objectives of study were firstly to calculate the quantities of concentrated feedingstuffs consumed by the various classes of livestock in the years 1960-61 to 1965-66. A second objective was to calculate the quantities of the various kinds of concentrated feedingstuffs available for livestock in the same time period. The analysis of feed consumption was based on the product of livestock numbers and feeding rates per head of livestock. The estimates of total consumption of all classes of livestock were then compared with the supplies of concentrates available for consumption in each year as determined from production, foreign trade and utilization statistics.

Data on the number of livestock were obtained from various statistical series published by the Danish Ministry of Agriculture. Rates of feeding were collected from a wide variety of sources but principally from the summary reports of farms recorded by the Bureau of Agricultural Economics and from the results of demonstration farms. Adjustments were made to the demonstration farm results in order to bring the data into line with commercial experience.

In an examination of the physical quantities of the major livestock products produced in Denmark between 1960-61 and 1965-66, the relative importance of cattle, pig and poultry products were highlighted. In 1965-66 over 8 million tons of pigmeat and 2.6 million tons of beef and veal were produced. Poultry production was a relatively smaller enterprise; total production amounted to only 65 thousand tons in the same year. The cattle sector also produced about 5.4 million tons of milk. Between 1960-61 and 1965-66 there was a substantial increase in the output of pigmeat which rose from 6.5 million tons to over 8 million tons. Beef and veal production climbed from 2.4 million tons in 1960-61 to a peak of 2.9 million tons in 1962-63 but thereafter declined slightly. A similar trend was evident in poultrymeat production which reached a peak of 73 thousand tons in 1964-65 but declined in the following year. There was little change in the total production of milk between the first and last years under review.

The standards of livestock production in Denmark are high, and their products are competitive in international markets. Production methods are generally intensive and as a measure of this, the quantity of nutrients supplied by concentrated feedingstuffs may be used. In 1965-66 concentrated feedingstuffs provided about 46 percent of the nutrients supplies of all classes of livestock, and bulk feeds, including grass, ensilage and fodder crops provided about 50 percent of the supplies. The balance of approximately 4 percent was supplied from milk and its by-products. Five years earlier in 1960-61 concentrates provided about 38 percent, and bulk feeds 57 percent, of the total supplies of livestock nutrients.

There were significant changes in the number of livestock in Denmark between the years 1960-61 to 1965-66. The slaughterings of all pigs increased from 8.9 million to 11.6 million, but the annual increase was relatively smaller in the final years under review. There were corresponding increases in the

number of sows and gilts and female breeding herd replacements. The cattle sector, on the other hand, tended to decline. The number of cows and heifers decreased by about 100 thousand head during the same time period. The poultry flock also diminished; the number of laying hens declined from 9 million in 1962-63 to just less than 7 million in 1965-66.

The feeding rates per head of cattle tended to increase slightly while those of pigs and poultry declined over the six years under study. Cows and heifers were fed approximately 2,250 pounds per head in 1960-61 and, as a result of a greater intensification in milk production, this quantity increased to 2,750 pounds per head in 1965-66. The rate of feeding of steers also moved up rising from 1,540 pounds per head to almost 1,620 pounds per head. Little or no change was evident in the feeding of concentrates to stock reared as herd replacements.

Improved feed conversion efficiency, achieved through the pig herd breeding and testing efforts and through better standards of livestock husbandry on commercial farms, led to a reduction in the quantity of concentrates fed to pigs for slaughter. The input fell from 667 pounds per head to 655 pounds per head during the six years under review. In contrast to this, the concentrate input of breeding sows, including their litters at foot, increased from 3,078 pounds in 1960-61 to 3,280 pounds in 1965-66. The greater demands placed on the sows as a result of their increased output of young pigs per year, more than offset their improved feed conversion efficiency. Breeding herd replacements, on the other hand, took slightly less concentrates (1,593 pounds as opposed to 1,582 pounds).

Although the concentrate feed input of chickens for slaughter declined by more than one pound per bird between 1960-61 and 1965-66, the quantity fed to laying hens and cocks increased. Slightly heavier strains of laying birds are believed to be the cause. Intensive "factory type" production units are not permitted in Denmark.

The total quantity of concentrates fed to all classes of livestock as calculated from the product of livestock numbers and feeding rates per head, moved up from about 6.4 million tons in 1960-61 to 7.9 million tons in 1965-66, or an increase of over 20 percent. Most of this increase was attributable to the expanded output of pigmeat. All classes of pigs were fed 3.6 million tons in the first year but by 1965-66 their input was as high as 4.9 million tons, or an increase of 36 percent. The input of the cattle sector only moved up by 15 percent, (from approximately 2.0 million tons to about 2.3 million tons), while that of poultry fell by 15 percent (from 730 thousand tons to 620 thousand tons).

On the supply side, the most significant feature was that the increased quantities of concentrates available for consumption by livestock were derived almost entirely from an expanded domestic production. The production of barley increased dramatically from 2.8 million tons in 1960-61 to over 4.1 million tons in 1965-66. There were also modest increases in the production of oats and wheat from 680 thousand tons to 780 thousand tons and from 320 thousand tons to

560 thousand tons respectively. Imports of grains, on the other hand, failed to maintain their already small proportion of the total supplies throughout the six year period. Imports of all grains amounted to less than 760 thousand tons, or 12 percent of domestic production in 1965-66, whereas five years earlier their proportion was over 14 percent of domestic production. Grain sorghum, maize and barley were the principal grains imported and the United States was the leading supplier.

In quantity terms, cereals and their by-products accounted for about 73 percent of the total supplies of concentrates available for livestock in 1965-66. High protein feeds such as oilcakes, and fish, meat and bone meals supplied just over 16 percent of the total weight of concentrates available in the same year. During the six years under review the contribution of cereals and their by-products increased. Milk and whey were also a particularly important source of nutrients throughout the six year period, but also tended to decline. When expressed in terms of concentrate equivalent the proportionate contribution of milk and whey amounted to 12.4 percent in 1960-61 and 9.6 percent in 1965-66. These percentages are only slightly less than the contribution of oilcakes which supplied between about 13 and 15 percent of the total concentrates available for livestock. In absolute terms the supply of oilcakes available for livestock amounted to just 1 million tons in 1965-66, and approximately one-third of this was produced domestically. The annual supplies of fish meat and bone meals were typically in the region of 150 thousand tons, or about 2 percent of the total supplies of all concentrates. Most of these high protein feeds were produced domestically.

When the total quantities of concentrates fed to livestock as calculated from the product of livestock numbers and feeding rates per head were compared with the total supplies of concentrates available for consumption, fairly close similarity between the two sets of calculations was found. In four years the quantity fed exceeded the quantity available; the differences were at a minimum of 13 thousand tons, or less than half of one percent of total supplies, and at a maximum, 531 thousand tons, or about 8 percent of total supplies. In two years the quantity available exceeded the quantity fed by approximately 150 thousand tons. Apart from one year, 1962-63, when the 8 percent difference was evident, the balances or the agreement between the two sets of calculations, are considered satisfactory. This in turn lends support to the accuracy of the national statistics and implies that the estimates of feeding rates per head of livestock are reasonably representative for the majority of classes. Typically these estimates are obscure, or difficult to obtain, but are of considerable value in the estimation of the future concentrate requirements of livestock.

A knowledge of livestock numbers and feeding rates is in itself only a limited guide to future trends in concentrate feed consumption in Denmark. The historical pattern of concentrate input indicates a rising trend throughout the early and mid sixties. During the six years under review the total quantity available increased by about 19 percent, but in the last year of the six, the growth was checked and resulted in a slight decline. While it is believed that further decreases in the total concentrate input are unlikely, little further growth under

present conditions may be expected. The uncertainties surrounding the markets for Danish livestock products, particularly in the European Economic Community largely preclude any further expansion of the livestock industry. Markets for both cattle and pig products are affected, but will probably most influence the cattle industry where further contraction is expected. The poultry sector is also expected to decline. With the strongly rising trend in the domestic production of grains, and the levelling of the demand for concentrated feeding-stuffs it is likely that imports of grains and oilcakes and particularly grains will decline in the future.

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