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Survey of the different chicken housing systems and accumulating form of manure / slurry for the derivative of a standardised form of veterinary drug decomposition in expositions scenarios

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**Survey of the different chicken housing
systems and accumulating form of
manure/slurry for the derivative of a
standardised form of veterinary drug
decomposition in expositions scenarios**

by

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On behalf of the Federal Environment Agency (Germany)

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16. Abstract The Federal Statistical office recorded in 2007 75.829 farms with more than 3.000 chickens. In Total 72.883 of these farms kept laying hens and 8.680 chickens for meat production. Altogether 114.625.484 chickens were kept in Germany in 2007. In May 2007, 38.463.704 laying hens, 16.940.069 pullets and 59.221.711 broilers were registered in Germany. In Germany, the average size of chicken stock per farm in May 2007 was 760,2 laying hens and 6.822,8 broilers respectively. One third of the German laying hen stock was found in Lower Saxony. Just over half of the German broilers were also kept in Lower Saxony. In 2007, 66,1 % of the laying hens were kept in cage systems, 17 % in barn systems, 10,9 % in free range systems, 1,5 % in small group housing systems and 4,4 % on organic farms. In the modern intensive broiler husbandry the animals are kept indoors the entire year. In Germany broilers are housed predominately on farms with big stocks in barn systems. The largest laying hen stocks in 2005 were found in the following EU member states: France, Spain, Germany, Great Britain and Poland. Europe-wide most laying hens were still kept in cages. Only 25 % of the animals were kept in alternative systems, i.e. 15 % in barn systems, 8 % in free range systems and 2 % on organic farms. The largest broiler stocks in 2005 were found in France, Great Britain, Spain, Germany and Italy. Barn systems were with almost 100 % the predominant housing systems in all member states. It is impossible to calculate the amount of manure and/or dry excreta for the German chicken because it depends on various factors like housing system, litter material, dry matter content, feeding stuff, breed, size of chickens etc. The amount of slurry can be neglected. The questionnaire survey results in the following conclusions. In summary it can be said that sawdust is the predominant litter material on conventional farms and straw the predominant litter material on organic farms. Straw and sawdust are the most often used litter materials in all housing systems. Dry manure is the predominant type of manure / slurry in all lines of production. On conventional farms with meat production dry manure is the only type of manure / slurry that accumulates. Slurry accrues only on one conventional farm, which still keeps laying hens in battery cages. It was not possible to calculate the average amount of accumulating manure per laying hen or broiler, because there were great discrepancies between the filled in amounts.		
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16. Kurzfassung Das Statistische Bundesamt hat 2007 insgesamt 75.829 Betriebe mit mehr als 3.000 Hühnern erfasst. Von diesen Betrieben halten 72.883 Legehennen und 8.680 Masthühner. Insgesamt wurden 2007 114.625.484 Hühner in Deutschland gehalten. Im Mai 2007 waren in Deutschland 38.463.704 Legehennen, 16.940.069 Junghennen und 59.221.711 Masthühner registriert. Der durchschnittliche Geflügelbestand pro Betrieb in Deutschland betrug im Mai 2007 760,2 Legehennen bzw. 6.822,8 Masthühner. Ein Drittel der deutschen Legehennen ist in Niedersachsen aufgestellt. Gut die Hälfte der deutschen Masthühner wird ebenfalls in Niedersachsen gehalten. 2007 wurden 66,1 % der Legehennen in Käfigen, 17 % in Bodenhaltung, 10,9 % in Freilandhaltung, 1,5 % in Kleingruppen und 4,4 % in ökologischen Haltungsverfahren gehalten. Die ganzjährige Stallhaltung ist die Haupthaltungsform in der modernen und intensiven Masthühnerhaltung. Diese erfolgt in Deutschland überwiegend in großen Tierbeständen in Bodenhaltung. Die größten Legehennenbestände gab es 2005 in der EU-27 in folgenden Mitgliedsstaaten: Frankreich, Spanien, Deutschland, Großbritannien und Polen. 2007 wurden die meisten Legehennen in der EU immer noch in Käfigen gehalten. Nur 25 % der Tiere wurden alternativ gehalten, d.h. 15 % in Bodenhaltung, 8 % in Freilandhaltung und 2 % in ökologischen Haltungsverfahren. Die größten Masthühnerbestände gab es 2005 in Frankreich, Großbritannien, Spanien, Deutschland und Italien. In allen Mitgliedsstaaten dominiert die Bodenhaltung mit einem prozentualen Wert von fast 100 %. Es ist unmöglich den Mist- bzw. Kotanfall für den deutschen Hühnerbestand genau zu berechnen, da es zu viele Einflussfaktoren gibt. Die Haupteinflussfaktoren sind unter anderem Haltungsform, Einstreumaterial, Trockensubstanzgehalt, Fütterungsart, Hühnerrasse und Größe der Hühner. Die anfallende Menge Gülle kann vernachlässigt werden. Die durchgeführte Fragebogenumfrage hat zusammenfassend folgende Ergebnisse gebracht: Sägespäne sind das von konventionellen Betrieben am häufigsten verwendete Einstreumaterial und die meisten ökologischen Betriebe nehmen Stroh. Stroh und Sägespäne sind in allen Haltungsformen die meist genutzten Einstreumaterialien. Trockener Mist ist die vorherrschende Form von Mist und Gülle in allen Produktionszweigen. Bei konventionellen Hühnermästern ist es die einzige anfallende Mistform. Nur in einem konventionellen Betrieb mit Legehennenhaltung in konventionellen Käfigen fiel Gülle an. Es war aufgrund der stark schwankenden Angaben nicht möglich, anhand der Fragebögen die anfallenden Mistmengen zu errechnen.		
17. Schlagwörter Hühnerhaltung, Legehennen, Masthühner, Haltungsformen, Einstreumaterialien, Hühnermist, Gülle, Geflügelkot		
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1. Abbreviations

AT = Austria

BE = Belgium

BG = Bulgaria

CH = Switzerland

CY = Cyprus

CZ = Czech Republic

DK = Denmark

DE = Germany

EE = Estonia

ES = Spain

FI = Finland

IE = Ireland

FR = France

HU = Hungary

GR = Greece

IT = Italy

LV = Latvia

LT = Lithuania

LU = Luxemburg

MT = Malta

NL = Netherlands

NO = Norway

PL = Poland

PT = Portugal

RO = Rumania

SE = Sweden

SI = Slovenia

SK = Slovakia

UK = United Kingdom

HHP = Hennenhaltungsplätze / number housing spaces of laying hens per farm

LH = laying hen

m = male

n. s. = not specified

a. n. s. = amount not specified

TS = dry matter content

OS = organic substances

w = female

Zuw. = increase (Zuwachs)

2. Introduction

This study gives an overview about the current status of chicken husbandry in Germany and the most important member states of the European Union. The aim of this work is to determine the predominant housing systems in Germany and the EU as well as the most common form of manure and slurry.

In first part of the main section one can find information about the legal basis of chicken husbandry in the European Union. Due to Directive 1999/74/EC and 2007/43/EC there is an ongoing structural change in the chicken husbandry throughout the EU. The first part also includes the identification of the predominant housing systems in Germany and the relevant member states. These were identified with the help of official statistics from various sources like the German Federal Statistical Office and Eurostat. One also attempted to get detailed information from the appropriate authorities.

The second part of the main section deals with the most common form of accumulating manure and slurry. "Länderkammern", chicken breeding associations and other institutions were contacted to gather information about the accumulation of slurry and manure. None of the asked authorities or institutions could give exact particulars about this subject. The literature also provides very little information about the accumulation of slurry and manure. Therefore we developed a questionnaire to gather practically and relevant data.

3. Main section Part 1 chicken husbandry

Legal basis of chicken husbandry

A few years ago, a structural change in the laying hen husbandry and egg production started amongst other things. This rethinking can be ascribed to the amendment of the German "Tierschutz-Nutztierhaltungsverordnung" in 2006. Since 01.01.2009 the keeping of laying hens in battery cages is prohibited in Germany. Livestock husbandry of laying hens in battery cages will be banned from 2012 throughout the EU. This ban is consistent with the Council Directive 1999/74/EC of 19 July 1999 which is laying down minimum standards for the protection of laying hens. Directive 1999/74/EC will come into force as from 01.01.2012. According to a report of the EU-Commission independent studies argues for a change to "enriched" cages or alternative systems (free range or barn systems). Directive 1999/74/EC orders that laying hens, which are not kept in barn or free range systems, must be held in enriched cages. The EU-Commission had asked the European Food Safety Authority (EFSA) before to determine the impacts of the different husbandry systems on the health and welfare of the chickens. In November 2004 the EFSA concluded, that the keeping of laying hens in battery cages increased not only the risks of diseases, bone fractures and lesions, but also the incidence of behavioural disorders and the mortality rate. These results were verified through other research projects.

Directive 1999/74/EC has an influence on accumulating slurry and manure respectively. Pure chicken faeces will no longer accrue through the ban of battery cages because, in all other husbandry systems, litter is mandatory. Litter is defined in Article 2 of Directive 1999/74/EC as follows: any friable material enabling the hens to satisfy their ethological needs. However, a Dutch business concern already offers enriched cages with artificial turf as litter. Furthermore, this Directive shall ensure that at least 250 cm² of littered area are available for every laying hen in alternative systems (barn and free range systems). The litter shall occupy at least one third of the ground surface. The member states shall ensure that, from 1 January 2012, the stocking density must not exceed nine laying hens per m² of usable area. The member states can allow a stocking density of 12 laying hens per m² of usable area until 2012. Directive 1999/74/EC also defines the minimum standards for the keeping of laying hens in enriched cages. Member states shall ensure that all enriched cages comply at least with the following requirements: at least 750 cm² of cage area per hen, 600 cm² of which shall be useable; a nest; litter so that pecking and scratching are possible and appropriate perches allowing at least 15

cm per hen. Directive 1999/74/EC does not apply to establishments with fewer than 350 laying hens and establishments rearing breeding laying hens. Such establishments shall, however, continue to be subject to the relevant requirements of Directive 95/58/EC.

Directive 2007/43/EC, lay down minimum rules for the protection of chickens kept for meat production, was adopted in June 2007 by the European Council of Ministers for agriculture and fisheries. This Directive does not apply to holdings with fewer than 500 chickens; holdings with only breeding stock of chickens, hatcheries, extensive indoor and free range chicken [Commission Regulation (ECC) No. 1538/91] and organically reared chickens [Council Regulation (ECC) No. 2092/91]. According to Directive 2007/43/EC, the allowed maximum stocking rate throughout the EU shall be 20 broilers per m² housing area (33 kg/m²) from 30. June 2010. However, this Directive enables the establishments to increase the maximum stocking rate up to 39 kg/m² and up to 42 kg/m², if the owner or keeper complies with the additional requirements set out in Annex II and Annex V respectively. So far German holdings adhered to a voluntary maximum stocking rate of 35 kg/m², i.e. therefore German farms can fatten more broilers than ever. Annex I (requirements applicable to holdings) of Directive 2007/43/EC regulates, that all chickens shall have permanent access to litter which is dry and friable on the surface. Those parts of buildings, equipment or utensils which come in contact with the chickens shall be thoroughly cleaned and disinfected every time after the broilers are removed and before a new flock is introduced into the house. All litter must be removed, and clean litter must be provided.

Chicken husbandry in the German federal states

Within the scope of this study, it was tried to collect data from the German federal states on chicken husbandry and on accumulating slurry and manure. One attempted to get detailed information from the appropriate authorities. However, this was not possible for all federal states; so that one had to rely on data of the German Federal Statistical Office and the ZMP (see chicken husbandry in Germany). The “Landwirtschaftskammern” use either data of the ZMP or the German Federal Statistical Office. Only the “Landwirtschaftskammer für das Saarland” possessed its own data about laying hens in the Saarland, which they kindly provided. The “Zentralverband der Deutschen Geflügelwirtschaft e.V.” (ZDG) uses data from the ZMP. Data about housing systems for laying hens in the federal states could be extracted from various publications of the different “Statistischen Landesämter”, the “Ministeriums für

Landwirtschaft, Umwelt und ländliche Räume Schleswig-Holstein“ and the “Niedersächsischen Landesamts für Verbraucherschutz und Lebensmittelsicherheit“ .

It was not possible to gain accurate information about the accumulation of slurry and manure from various authorities and institutions. Within the scope of the livestock census, carried out by the German Federal Statistical Office in 2007, due to a specific question, the “Landwirtschaftskammer Schleswig-Holstein“ gave a certain percentage of slurry in laying hen husbandry. Surprisingly, this survey revealed, that in 25 % of the farms slurry still occurred. According to information of the ZDG, slurry should no longer occur in chicken husbandry, only “dried chicken excreta“ or “dried manure“ should accumulate.

Chicken husbandry in Brandenburg

The “Landesamt für Verbraucherschutz, Landwirtschaft und Flurneuordnung“ (LVLF) provided us with detailed data (base year 2008) about chicken husbandry in Brandenburg. However, the LVLF does not register organic farms separately because it makes no difference in chicken diseases whether chickens are kept organically or not.

There are seven farms rearing breeding laying hens (table1). In total 395.000 breeding laying hens are kept in 20 buildings in barn systems.

Table 1: number of breedingstock

Chickens	Number of farms according to size of farm			
	5.000-49.999	10.000-19.999	20.000-30.000	30.000-40.000
Farms	4	-	1	2

450.000 pullets are reared on three farms (1x 8.000, 1x 150.000 and 1x 275.000 hens) in 21 buildings. Information about different types of housing systems was not available, but it is likely that barn systems are predominant. The difference of 17.000 between hens per farm and the total number cannot be explained, as the numbers were provided in this form by the LVLF.

Overall 3.537.400 laying hens (for egg production) are kept in Brandenburg on 40 farms in 227 buildings. Of these 2.795.800 laying hens are kept in cages on 15 farms in 124 buildings, 727.800 laying hens in barn systems on 19 farms in 81 buildings and only 13.900 laying hens are in free range systems on 6 farms in 20 buildings (table 2). This means that the most laying

hens in Brandenburg are still kept in cage systems. Information about the different cage systems (unenriched and enriched) was not available, because this information was not important for the LVLf.

Table 2: Size of laying hen stock

Number of farms according to farm size categories						
Chickens	250-4.999	5.000-9.999	10.000-49.999	50.000-99.999	100.000-499.999	500.000 or more
<u>Farms:</u>						
Cage	4	1	4	3	-	3
Barn	12	3	1	2	-	1
Free range	6	-	-	-	-	-

There are three farms each keeping 42.000, 105.000 and 112.000 chickens which breed chickens for meat production in Brandenburg. Thus overall 259.000 breeding chickens for meat production are kept in 36 buildings in barn systems.

3.265.900 broilers are kept in Brandenburg on 26 farms in 151 buildings in barn systems (table 3).

Table 3: number of livestock (meat production)

Number of farms according to farm size categories					
Chickens	500-4.999	5.000-49.999	50.000-99.999	100.000-499.999	500.000 or more
Farms	3	5	11	6	1
					(935.000 animals)

Laying hen husbandry in Thuringia

At 1 December 2006 holdings keeping laying hens had 2,2 million spaces for hens. At that time 57 % of laying hens were still kept in cages. In 2006, barn and free range systems amounted to a total of 43 %, but these are on the increase. Ten years ago, merely every eleventh laying hen was kept in barn or free range systems. (Source: Thüringer Landesamt für Statistik – Pressemitteilung; Erfurt, 26. März 2007 - Nr. 091)

Laying hen husbandry in Saxony-Anhalt

According to the "Statistisches Monatsheft Sachsen-Anhalt" (3/2007; 18. Jahrgang), a huge structural change in keeping laying hens took place over the past years. Ten years ago, cage

systems were predominant with a ratio of 81,5 % (2000 = 59,6 %). 1,8 million laying hens were kept in 2006 by 32 agricultural holdings with a capacity of more than 3000 laying hens. The maximum housing capacity at that time was 2,0 million laying hens. The number of laying hens in cages systems was 35,7 % (728.500 housing spaces). 64.3 % of the laying hens were kept in alternative systems: 33,5 % in barn systems (683.900 housing spaces) and 30,8 % in free range systems (627.700 housing spaces). Laying hens were predominantly kept in specialised agricultural holdings. Therefore 60 % (1,2 million hens) of laying hens in Saxony-Anhalt were kept in six holdings, which had a capacity of 100.000 or more laying hens.

Laying hen husbandry in Saxony

At 1 December 2006, 44 agricultural holdings with a capacity of more than 3000 laying hens per farm were registered in Saxony. Three housing systems (cage, barn and free range systems) were assigned to the laying hen husbandry. Whereas 32 farms used only one housing system, 12 farms used two housing systems. In Saxony cage systems were the predominant housing system, 84,1 % (with 3,4 million housing spaces) of the laying hens were kept in cages. Only 7,8 % (with 294.000 housing spaces) of the laying hens were kept in barn systems and 7,2 % (with 351.100 housing spaces) were free range.

Laying hen husbandry and number of accordant holdings in Baden-Württemberg

In December 2007, 48,1 % of the laying hens in Baden-Württemberg were kept in cages, 37,9 % in barn systems and 11,6 % were in free range or intensive free range systems. Only 2,4 % of the hens were housed on organic farms.

Table 4: housing systems and housing capacities of farms with 3000 and more laying hens in Baden-Württemberg, December 2007

Housing systems	token	Housing capacity from ... to... laying hens				total
		3.000 to 5.000	5.000 to 10.000	10.000 to 30.000	30.000 or more	
Cages-, battery cages	farms	15	20	26	13	74
	housing spaces	40.638	101.204	296.524	504.669	943.035
Aviary/ barn systems	farms	28	29	32	10	99
	housing spaces	85.616	143.956	34.280	171.810	741.662
Free range systems/intensive free range keeping	farms	4	10	14	6	34
	housing spaces	6.892	26.950	91.192	102.910	227.944
Organic keeping	farms	-	-	-	-	8
	housing spaces	-	-	-	-	46.010

Source: Statistisches Landesamt Baden-Württemberg, Stuttgart, 2008.

Laying hen husbandry in Lower Saxony

In Lower Saxony, traditionally the largest manufacturer of eggs for consumption, over 78 % of laying hens in 2007 still kept in cage systems (on 440 farms with nearly 12 million laying hens). 1,58 million were kept on 231 farms in barn systems, and 1,33 million hens were housed on 190 farms in free range systems. Only 361.000 laying hens were kept on 96 organic farms.

Laying hen husbandry in Rhineland-Palatinate

In 2006, 68 % of laying hens (627.000 housing spaces) in Rhineland Palatinate were still kept in cages. 27 % of the housing capacities were barn systems and 5 % free range systems. Figure 1 shows the decrease of cage systems over the last 10 years in Rhineland-Palatinate. The main reason of this decrease is the ban of battery cage systems from 1 January 2009.

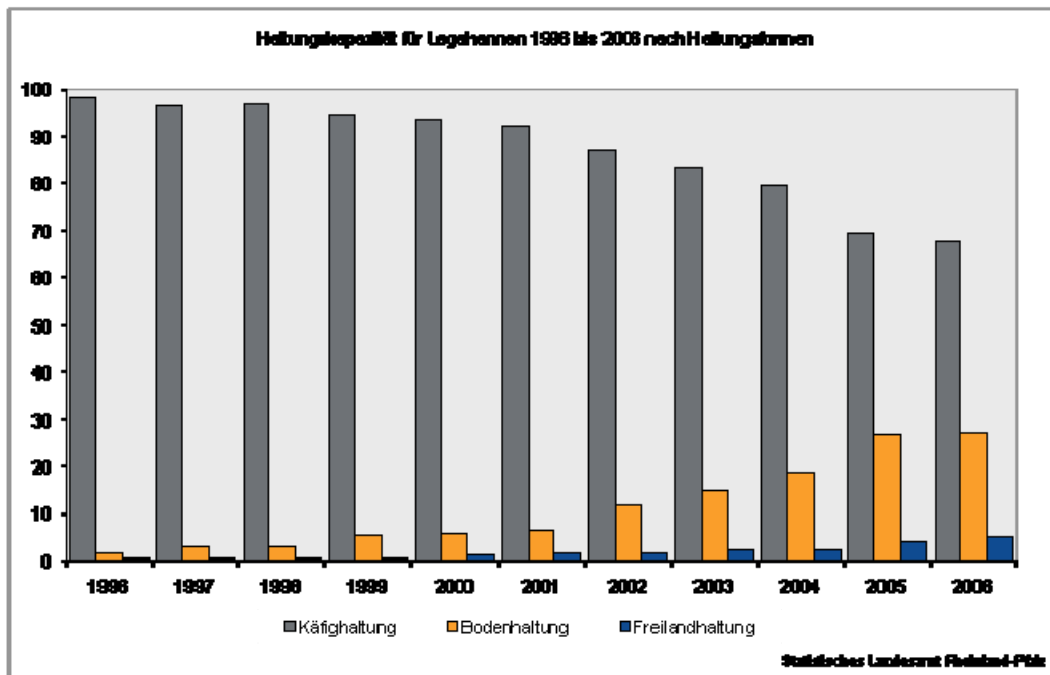


Figure 1: laying hen capacity per housing systems

Laying hen husbandry in Saarland

According to Mr. Bauer of the “Landwirtschaftskammer für das Saarland”, there are overall 29 registered farms, which keep laying hens in the Saarland. Some farms have more than one housing system and some change the housing system according to season (table 5).

Table 5: laying hen husbandry in Saarland, status October 2008

	Number of farms	Number of laying hens
organic	2	1.190
free range	13	45.235
barn	13	45.570
cage	14	56.708
total flock		141.033*
total farms	29*	

* please note that some laying hens can be registered twice due to seasonal changing housing systems and that farms which use more than one housing system can also be registered twice

Source: Landwirtschaftskammer für das Saarland, Abt. D2, Reinhold Bauer

Laying hen husbandry in Schleswig-Holstein

There have been immense structural changes of laying hen husbandry on farms with more than 3.000 hens in Schleswig-Holstein since 2000. The percentage of laying hens kept in battery cages has decreased from 90 % to 59 % in 2006 – the national average was 70 % in

2006. However, battery cage systems are still predominant. Eggs, which are sold to the food industry or are exported, are mainly produced in battery cage systems. 31 % of laying hens were kept in barn systems, including aviary systems (national average 15 % in 2006). 11 % of laying hens were housed in free range systems (national average 14 % in 2006).

Table 6: laying hen husbandry in Schleswig-Holstein

Schleswig-Holstein				
Year	Farms	Ratio in %	Barn spaces	Ratio in %
Cage system				
2003	43	88	816.016	75
2004	41	85	795.618	72
2005	38	81	754.892	70
2006	34	69	642.418	59
2007	33	67	618.204	56
Barn system including aviary				
2003	18	37	190.427	18
2004	23	48	213.343	19
2005	28	60	231.527	21
2006	27	55	335.993	31
2007	28	57	355.364	32
Free range systems including intensive free range keeping				
2003	15	31	76.561	7
2004	16	33	89.776	8
2005	18	38	97.626	9
2006	20	41	115.284	11
2007	15	31	101.955	9
Layer hens all systems				
2003	49	100	1.046.229	100
2004	48	100	1.063.670	100
2005	47	100	1.087.923	100
2006	49	100	1.093.695	100
2007	49	100	1.097.563	100

Source: Ministerium für Landwirtschaft, Umwelt und ländliche Räume Schleswig-Holstein

Comparison of laying hen husbandry in the Federal States

In contrast to Saxony, Brandenburg, Lower Saxony and Rhineland Palatinate, where battery cages are clearly predominant (84,1 %, 79 %, 78 %, and 68 % respectively), two-thirds of laying hens in the Saarland were kept already in alternative housing systems. 45.708 birds were kept

in barns systems and 45.570 were free range. But only 1.190 hens were housed on organic farms.

In 2006, in Saxony-Anhalt there were only 35,7 % of laying hens kept in cage systems, 33,5 % in barn systems and 30,8 % were free range. In this Federal State alternative systems were also more common.

Baden-Württemberg had the highest percentage (51,9 %) of alternative systems in 2007, i.e. 48,1 % of laying hens were kept in enriched cage or battery cage systems

In Thuringia and Schleswig-Holstein, cage systems are the most common form of housing systems for laying hens, with a percentage of 57 % and 56 % respectively. Just over 50 % of the chicken housing spaces are in cages systems.

Chicken husbandry in Germany

This chapter gives a review about the total German chicken stock. The laying hen stock and the broiler stock were surveyed separately.

German chicken stock, 03. May 2007

The German Federal Statistical Office registered in 2007 75.829 farms which kept chickens. These are 5,7 % farms fewer than in May 2005 (table 7). Of these farms, 72.883 kept laying hens (6,0 % fewer than in 2005) and 8.680 kept broilers (11,6 % fewer than in 2005). Altogether 114.625.484 chickens (without counting turkeys, guinea fowls and bantan) were kept in Germany in 2007, in comparison to May 2005 this is an increase of 6,9 %. Of these birds, 16.940.069 were chicks and hens younger than 6 month destined as laying hens (11,8 % more than 2005); 38.463.704 laying hens (6,2 % more than 2005) and 59.221.711 broilers as well as other cocks, including chicks bred for this purpose (4,3 % more than 2005). On the basis of this data one can see that the number of chickens kept in Germany has increased, but the number of farms keeping chickens has decreased.

Most farms, which keep laying hens, are in Bavaria (29.079), Baden-Württemberg (13.342) and Lower Saxony (6.762). 13.387.828 laying hens or one third of the 38.463.704 German laying hens are kept in Lower Saxony. The second largest laying hen stock with 3.759.635 laying hens was kept in Bavaria and North Rhine Westphalia, which had the third largest stock with 3.257.749 laying hens. If one surveys this data, one will notice that the number of farms does

not correlate with size of laying hen stock. One can find more information about this topic in chapter "Average size of stock per farm".

Most of the farms which keep broilers, are located in Lower Saxony (1.845 farms), in North Rhine Westphalia (1.145 farms) and in Bavaria (866 farms). Just over half of the German broilers (31.586.145) were kept in Lower Saxony. The second largest broiler stock (5.026.954) was found in Mecklenburg-Vorpommern and Bavaria kept the third largest broiler stock (4.719.273).

Table: 7: chicken stock by Federal States, May 2007

Country	Year ¹⁾ Unit ²⁾	Farms with chickens			Total chickens	Laying hens		broilers as well as other cocks including chicks
		Total	Laying hens	Broiler		½ year and older	chicks and hens younger than ½ year	
Germany	2005	80.400	77.600	9.800	107.267.400	36.157.100	14.347.800	56.762.500
	2007	75.829	72.883	8.680	114.625.484	38.463.704	16.940.069	59.221.711
	%	-5,7	-6,0	-11,6	6,9	6,4	18,1	4,3
Baden-Württemberg	2005	15.400	15.200	1.200	3.827.100	2.297.900	529.200	1.000.100
	2007	13.544	13.342	599	3.815.817	2.296.618	553.715	965.484
	%	-12,1	-12,1	-49,0	-0,3	-0,1	4,6	-3,5
Bavaria	2005	29.200	28.900	500	9.008.500	3.546.300	1.095.600	4.366.600
	2007	29.396	29.079	866	9.476.676	3.759.635	997.768	4.719.273
	%	0,7	0,6	73,2	5,2	6,0	-8,9	8,1
Berlin	2005	0	0	-	800	800	-	-
	2007	7	-	-	779	-	-	-
Brandenburg	2005	1.500	1.400	500	5.672.800	2.315.300	400.400	2.957.100
	2007	1.590	1.502	468	6.639.342	2.579.674	807.622	3.252.046
	%	4,9	5,5	-8,4	17,0	11,4	101,7	10,0
Bremen	2005	-	-	-	-	-	-	-
	2007	42	-	-	4.278	-	-	233
Hamburg	2005	-	-	-	-	-	-	-
	2007	43	34	17	3.363	2.979	264	120
Hesse	2005	6.300	6.200	1.000	1.420.800	1.092.900	258.600	69.300
	2007	5.282	5.060	811	1.501.951	1.219.895	192.011	90.045
	%	-16,7	-18,0	-16,6	5,7	11,6	-25,7	29,9
Mecklenburg-Vorpommern	2005	1.000	900	300	7.315.600	1.950.500	496.500	4.868.600
	2007	993	907	301	7.425.550	1.908.396	490.200	5.026.954
	%	3,5	4,7	-5,3	1,5	-2,2	-1,3	3,3
Lower Saxony	2005	8.400	7.500	2.100	47.212.600	11.717.600	5.081.000	30.414.000
	2007	7.769	6.762	1.845	50.901.928	13.387.828	5.927.955	31.586.145
	%	-7,8	-9,3	-13,4	7,8	14,3	16,7	3,9
North Rhine Westphalia	2005	8.000	7.400	1.500	8.837.500	3.711.900	2.140.500	2.985.200
	2007	6.778	6.251	1.145	8.557.771	3.257.749	2.380.979	2.919.043
	%	-15,0	-16,0	-24,8	-3,2	-12,2	11,2	-2,2
Rhineland-Palatinate	2005	2.500	2.400	600	1.552.500	612.800	903.900	35.900
	2007	2.509	2.405	527	1.648.446	656.450	959.584	32.412
	%	1,0	-0,5	-5,0	6,2	7,1	6,2	-9,7
Saarland	2005	300	300	100	160.700	114.400	45.600	600
	2007	329	316	73	166.180	112.905	50.773	2.502
	%	28,0	24,9	23,7	3,4	-1,3	11,2	417,0
Saxony	2005	2.400	2.400	700	7.761.600	3.419.100	1.109.600	3.232.900
	2007	2.720	2.650	749	9.175.451	3.232.814	-	-
	%	11,4	10,6	14,7	18,2	-5,4	-	-
Saxony-Anhalt	2005	800	800	100	8.086.500	2.527.200	1.147.000	4.412.400
	2007	846	790	185	8.903.391	3.094.102	1.729.509	4.079.780
	%	2,9	4,5	85,0	10,1	22,4	50,7	-7,5
Schleswig-Holstein	2005	2.700	2.500	600	2.128.400	907.400	111.200	1.109.800
	2007	2.395	2.189	563	2.738.258	1.023.720	171.682	1.542.856
	%	-12,1	-11,2	-7,6	28,7	12,8	54,4	39,0
Thuringia	2005	1.800	1.700	700	4.273.500	1.934.800	1.028.800	1.309.800
	2007	1.586	1.550	517	3.666.303	1.927.405	1.144.449	594.449
	%	-11,2	-9,7	-25,5	-14,2	-0,4	11,2	-45,4

Note:1) These data display the increase and decrease (-) respectively from May 2007 toward May 2005.

2). Data of the representative census in 2007 and 2005 respectively as well as increase and decrease rounded up to hundred

Source: Statistisches Bundesamt, Wiesbaden 2008 (slightly modified)

Average size of stock per farm

For most Federal States the data about the number of farms and the size of laying hen stock show no correlation. For example, there are 29.079 farms keeping laying hens, but there are only 3.759.635 laying hens in Bavaria. However, there are only 6.762 farms and 13.387.828 laying hens in Lower Saxony. The reasons for these data are the differences in the average size of stock per farm.

In Germany, the average size of chicken stock per farm in May 2007 was 760,2 laying hens and 6.822,8 broilers respectively (table 8).

Table 8: average size of stock per farm in May 2007

Country	Year	Layer hens	Broiler
Germany	2001	603,2	4.542,6
	2003	635,5	5.030,1
	2005	651,2	5.778,5
	2007	760,2	6.822,8
Baden-Württemberg	2005	186,3	851,1
	2007	213,6	1.611,8
Bavaria	2005	160,6	8.578,9
	2007	163,6	5.449,5
Brandenburg	2005	1.907,1	5.786,9
	2007	2.255,2	6.948,8
Hesse	2005	219,1	71,3
	2007	279,0	111,0
Mecklenburg-Vorpommern	2005	2.825,7	15.309,9
	2007	2.644,5	16.700,8
Lower Saxony	2005	2.252,7	14.278,9
	2007	2.856,5	17.119,9
North Rhine Westphalia	2005	786,6	1.961,4
	2007	902,1	2.549,4
Rhineland Palatinate	2005	627,5	64,7
	2007	671,9	61,5
Saarland	2005	632,7	10,8
	2007	518,0	34,3
Saxony	2005	1.889,3	4.950,8
	2007	1.798,2	-
Saxony-Anhalt	2005	4.860,0	-
	2007	6.105,8	22.052,9
Schleswig-Holstein	2005	413,4	1.822,3
	2007	546,1	2.740,4
Thuringia	2005	1.726,1	-
	2007	1.981,8	1.149,8
City states (Berlin, Bremen, Hamburg)	2005	-	-
	2007	100,3	-

Source: Statistisches Bundesamt, Wiesbaden 2008

However, there was a huge spread in the average size of stock per farm between the Federal States. Thus the highest number of laying hens per farm was found in Saxony-Anhalt with an average stock of 6.105,8 animals. The average size of laying hen stock per farm was also large in Lower Saxony with an average stock of 2.856,5 animals, and in Mecklenburg-Vorpommern average stock size was 2.644,5. In Bavaria, by contrast, with an average stock of 163,6 animals, only a few laying hens were kept per farm. In Baden-Württemberg und Hesse there were also only few laying hens (213,6 animals and 279,0 animals respectively) per farm.

There are even larger differences of the average broiler stock size per farm between the Federal States. The most broilers per farm were also kept in Saxony-Anhalt with an average stock of 22.052,9 animals. The average size of the broiler stock per farm was also big in Lower Saxony with an average stock of 17.119,9 animals, and Mecklenburg-Vorpommern average stock of 16.700,9 animals. These numbers stand in great contrast to the average stock size in the Saarland, where the average farm only kept 34,3 broilers. Also only few broilers were kept in Rhineland Palatinate and Hesse (average broiler stock size per farm 61,5 and 111,0 respectively).

Laying hen husbandry in Germany

In Germany 38.463.704 laying hens and 16.940.069 hens younger than 6 months were kept on 75.829 farms. In 2007, the German Federal Statistical Office had for the first time registered all farms with laying hens, i.e. stocks starting from one laying hen (table 9 and 10). In the previous years, only farms with more than 3.000 chickens were included in the official statistics. The main reason for the inclusion of all chickens is the threat of avian influenza. Because of the thread of a flu pandemic all holdings and private persons keeping one or more chickens had to be registered.

One third of the German laying hen stock was found in Lower Saxony (13.387.828 LH). The decrease in egg production of the other Federal States was as follows: Bavaria (3.759.635 LH), North Rhine Westphalia (3.257.749 LH), Saxony (3.232.814 LH), Saxony-Anhalt (3.094.102 LH), Brandenburg (2.579.674 LH), Baden-Württemberg (2.296.618 LH), Thuringia (1.927.405 LH), Mecklenburg-Vorpommern (1.908.396 LH), Hesse (1.219.895 LH), Schleswig-Holstein (1.023.720 LH), Rhineland Palatinate (656.450 LH), Saarland (112.905 LH) and the City states (6.513 LH).

According to the statistical yearbook 2008, the majority of farms in all Federal States kept only one to 49 laying hens (table 9 and 10). The percentage of farms of this size of all farms was between 76 % in North Rhine Westphalia and 96 % in Bavaria. Most farms with one to 49 laying hens were located in Bavaria. Bavaria was followed by Baden-Württemberg with 11.613 farms (188.620 LH) and Lower Saxony with 5.488 farms (79.081 LH). The smallest laying hen farms, apart from the City states, could be found in the Saarland. The biggest farms with 100.000 or more laying hens were situated in Lower Saxony. There were 29 Farms with 100.000 or more laying hens that kept in total 5.826.523 laying hens. With seven farms and 2.284.826 laying hens kept on these Saxony-Anhalt had the second largest number of farms with more than 100.000 chickens.

Table 9: agricultural establishments with laying hens (½ year and older) in Mai 2007 according to stock size (part 1)

State	Total		1 - 49		50 - 99		thereof farms with: 100 - 199		200 - 499		500 - 999	
	farms	animals	farms	animals	farms	animals	farms	animals	farms	animals	farms	animals
Baden-Württemberg	13.342	2.296.618	11.613	188.620	675	42.645	304	39.501	283	83.537	120	85.666
Bavaria	29.079	3.759.635	27.066	415.618	1.073	65.284	262	32.797	244	70.490	132	93.454
Brandenburg	1.502	2.579.674	1.346	21.810	74	4.694	19	2.651	25	7.446	8	5.828
Hesse	5.060	1.219.895	4.504	65.092	236	14.899	78	10.070	92	25.247	44	29.960
Mecklenburg-Vorpommern	907	1.908.396	784	12.047	45	2.682	13	1.739	13	3.488	4	2.373
Lower Saxony	6.762	13.387.828	5.488	79.081	336	21.328	167	22.029	169	48.740	96	66.199
North Rhine Westphalia	6.251	3.257.749	4.760	68.984	392	25.436	239	31.869	278	85.166	178	124.551
Rhineland Palatinate	2.405	656.450	2.023	31.120	113	7.239	67	9.029	79	23.348	34	24.805
Saarland	316	112.905	260	4.669	18	1.105	-	-	9	2.909	4	3.200
Saxony	2.650	3.232.814	2.258	42.306	261	16.383	42	5.775	24	6.687	11	7.449
Saxony-Anhalt	790	3.094.102	674	10.688	51	3.145	12	1.630	11	3.600	-	-
Schleswig-Holstein	2.189	1.023.720	1.828	26.029	120	7.262	62	7.962	67	20.397	32	22.265
Thuringia	1.550	1.927.405	1.404	22.427	77	4.839	23	2.639	11	3.240	3	1.950
City states (Berlin, Bremen, Hamburg)	80	6.513	68	1.021	4	244	-	-	3	840	-	-

Source: Statistisches Bundesamt, Wiesbaden 2008

Table 10: agricultural establishments with laying hens (½ year and older) in Mai 2007 according to stock size (part 2)

State	thereof farms with:											
	1.000 – 2.999		3.000 – 4.999		5.000 – 9.999		10.000 – 49.999		50.000 – 99.999		100.000 or more	
	farms	animals	farms	animals	farms	animals	farms	animals	farms	animals	farms	animals
Baden-Württemberg	214	373.902	46	172.629	47	313.654	-	-	-	-	-	-
Bavaria	144	246.166	52	193.581	51	331.175	41	853.261	9	653.225	5	804.584
Brandenburg	8	14.163	3	12.277	4	27.022	8	188.651	3	233.896	4	2.061.236
Hesse	48	82.919	23	89.459	18	117.729	11	221.429	3	200.835	3	362.256
Mecklenburg-Vorpommern	7	12.100	-	-	-	-	27	531.533	5	298.973	5	1.016.514
Lower Saxony	120	213.387	49	194.855	80	579.715	204	4.640.678	24	1.695.293	29	5.826.523
North Rhine Westphalia	225	389.128	70	260.694	43	304.904	-	-	-	-	-	-
Rhineland Palatinate	56	95.160	9	36.169	10	74.537	-	-	-	-	-	-
Saarland	-	-	4	15.500	-	-	3	63.957	-	-	-	-
Saxony	10	18.263	6	24.832	11	77.349	18	391.042	4	302.182	5	2.340.546
Saxony-Anhalt	6	10.034	-	-	4	28.464	14	374.207	6	366.648	7	2.284.826
Schleswig-Holstein	39	71.996	7	27.648	15	111.809	15	297.426	-	-	-	-
Thuringia	7	14.180	4	14.313	-	-	10	213.796	8	543.449	3	1.106.572
City states, (Berlin, (Bremen, Hamburg)	-	-	-	-	-	-	-	-	-	-	-	-

Source: Statistisches Bundesamt, Wiesbaden 2008

Table 11: farms per housing system and capacity at 1. December 2007 in Germany (farms with 3.000 or more HHP)

Housing capacity	Total		Cage systems		Barn systems		Free range systems		Organic production ²⁾	
	farms	HHP ¹⁾	farms	HHP	farms	HHP	farms	HHP	farms	HHP
under 30.000	958	9.889.587	505	4.157.218	472	3.177.832	186	1.542.308	99	1.012.229
30.000 or more	275	30.104.868	207	22.879.726	97	3.622.804	69	2.833.288	11	769.050
total	1.233	39.994.455	712	27.036.944	569	6.800.636	255	4.375.596	110	1.781.279

Note:

1) HHP = number housing spaces of laying hens per farm

2) Registered for the first time in 2007, until 2006 these farms were registered as free range systems.

Source: Statistisches Bundesamt, Wiesbaden 2008

Table 12: farms with laying hen stock¹⁾ per laying periods, housing capacities and housing systems in Germany (farms with 3.000 and more HHP)

year	laying period ²⁾ altogether		hereunder: 1. laying period ³⁾		housing capacity							
					fewer than 30.000				30.000 or more			
					Laying period ²⁾ altogether		hereunder: 1. laying period ³⁾		Laying period ²⁾ altogether		hereunder: 1. laying period ³⁾	
	farms ⁴⁾	laying hens	farms ⁴⁾	laying hens	farms ⁴⁾	laying hens	farms ⁴⁾	laying hens	farms ⁴⁾	laying hens	farms ⁴⁾	laying hens
number												
Laying hens in all housing systems												
2005	1.244	32.256.838	1.168	30.038.512	988	7.953.344	924	7.168.759	256	24.303.494	244	22.870.023
2006	1.220	32.527.963	1.192	30.955.285	968	8.367.508	945	7.643.346	252	24.160.455	247	23.311.939
2007	1.193	32.697.002	1.157	31.198.427	929	8.154.126	900	7.471.591	264	24.542.876	257	23.726.836
Laying hens kept in cage systems												
2005	567	21.275.081	534	19.706.204	398	3.042.694	372	2.624.330	169	18.232.387	162	17.081.874
2006	690	22.048.615	664	20.930.454	502	3.459.887	479	3.013.107	188	18.588.728	185	17.917.347
2007	678	21.924.619	647	20.897.285	480	3.225.825	456	2.906.403	198	18.698.794	191	17.990.882
Laying hens kept in barn systems⁵⁾												
2007	549	5.710.783	526	5.384.538	457	2.674.831	440	2.446.550	92	3.035.952	86	2.937.988
Laying hens kept in free range systems⁵⁾												
2007	244	3.478.221	232	3.364.102	180	1.342.630	170	1.232.313	64	2.135.591	62	2.131.789
Laying hens kept on organic farms⁵⁾												
2007	108	1.583.379	106	1.552.502	97	910.840	95	886.325	11	672.539	11	666.177

Note:

1) Laying hen stock including laying hens in moult.

2) Including laying hens in the first and second moult.

3) Without laying hens in moult.

4) Including farms that have temporally removed their animals.

5) Registered for the first time in 2007.

Source: Statistisches Bundesamt, Wiesbaden 2008

Figure 2 shows the distribution of housing systems for laying hens in Germany. In 2007 the ZMP (figure 2) shows, in contrast to the German Federal Statistical Office (table 11), the registration of small group housing systems separately for the first time.

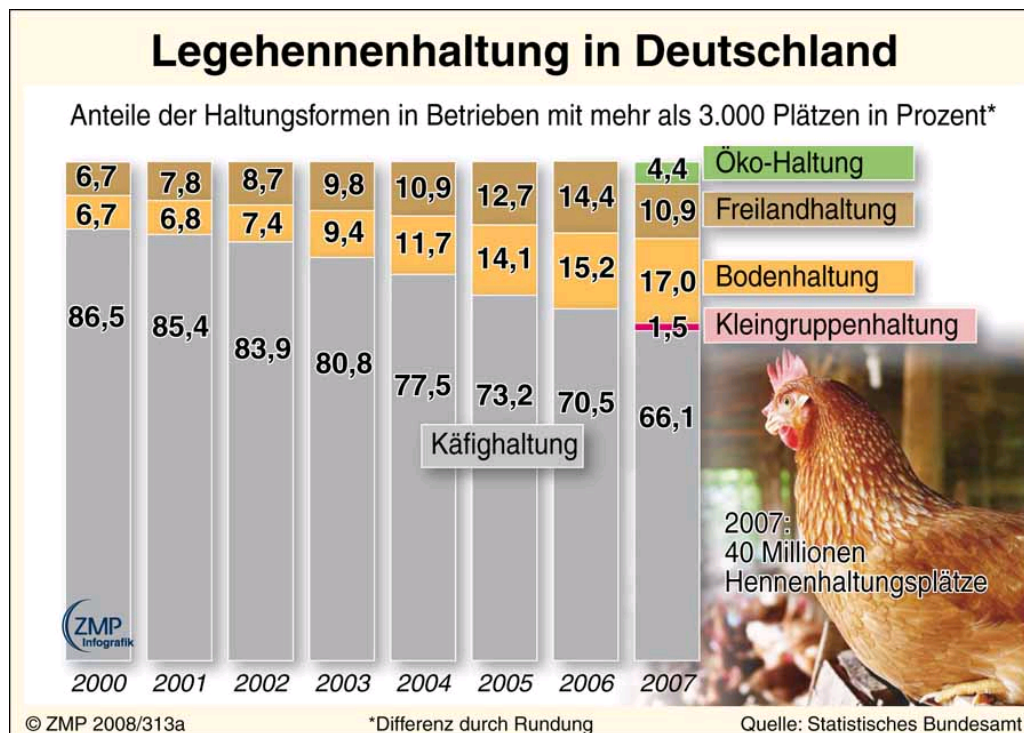


Figure 2: housing systems of laying hens

Cages for the small group housing systems have at least 2,5 m² of cage area, so that the cage area per laying hen is definitely bigger than in battery cage systems. In this housing system, hens live in small groups of approx. 30 animals. Due to the small groups, the hens can cultivate a nearly natural hierarchy. The hens do walk on wire nettings. They must have perches allowing at least 15 cm per hen, a nest and litter so that pecking and scratching are possible. In 2007, the small group housing system was for the first time registered. They accounted for only 1,5 % of laying hen husbandry. It is likely that this will increase because of the ban of battery cages from the 31.12.2008. The percentage of unenriched cages in Germany decreased from 86,5 % in 2000 to 66,1 % in 2007. This has to be examined against the background of the ban of battery cages. However, the ZMP (figure 2) does not distinguish battery cages from enriched cages. The percentage of barn systems has nearly tripled since 2000. In 2007, 17 % of the laying hens were kept in barn systems. The percentage of free range systems fell from

14,4 % in 2006 to 10,9 % in 2007. One reason for this decrease was that in 2007, organic farms were registered separately for the first time. In previous years, organic farms were added onto the percentage of free range systems. 4,4 % of laying hens were kept on organic farms in 2007.

The German Federal Statistical Office registered 1.233 farms with 3.000 and more laying hens in 2007. These farms had in total a capacity of 39.994.455 housing spaces for laying hens (HHP). 712 of these farms kept laying hens in cages (27.036.944 HHP), of which 207 farms had a capacity of 30.000 and more laying hens (22.879.726 HHP). 569 farms kept laying hens in barn systems (6.800.636 HHP); of which 97 farms had a capacity of 30.000 and more laying hens (3.622.804 HHP). 255 farms kept their laying hens in free range systems (4.375.596 HHP), the percentage of these farms with a capacity of 30.000 und more laying hens was 69 % (2.833.288 HHP). 110 farms kept their animals in organic systems (1.781.279 HHP); of which 11 farms had a capacity of 30.000 and more laying hens (769.050 HHP). These data show that 84 % of the laying hens kept in cages were housed on farms with a capacity of 30.000 and more animals. Anyway still 65 % of the free range laying hens were kept on farms with a capacity of 30.000 and more hens. The percentage of laying hens kept on farms with a capacity of 30.000 and more was 54 % of hens housed in barn systems and 53 % for organic laying hens.

According to the German Federal Statistical Office, there were 1.249 farms with more than 3.000 laying hens and 39.657 housing spaces for laying hens. In January 2007 (table 13). The utilized capacity in Germany was 81,7 %. In January 2007 Mecklenburg-Vorpommern (92,9 %) had of, all Federal States, the highest degree of capacity utilisation and Hesse (74,0 %) the lowest.

In June 2007, 1.237 farms with more than 3.000 laying hens and 39.481 housing spaces were registered in Germany. At this time, the utilised capacity in Germany was 80,2 %. In June 2007, Schleswig-Holstein (84,0 %) had of all Federal States the highest degree of capacity utilisation and Rhineland Palatinate (76,0 %) the lowest of all Federal States.

In December 2007, 1.233 farms with more than 3.000 laying hens and overall 39.994 housing spaces were registered in Germany. In December 2007 the utilised capacity in Germany was 80,2 %. In December 2007 Mecklenburg-Vorpommern (89,3 %) had the highest degree of capacity utilisation and Hesse (73,3 %) the lowest of all Federal States. No Information about

the degree of capacity utilisation throughout the whole year was available for Brandenburg, the Saarland and the City States

Table 13: selected results capacity utilisation per months and federal states in 2007

area	farms	HHP ¹⁾	Laying hens ²⁾		utilised capacity
			first day of the month	monthly average	
	numbers		numbers in 1.000	-	%
January					
Germany	1.249	39.657	32.406	32.512	81,7
Baden-Württemberg	154	2.033	1.603	1.620	78,8
Bavaria	155	3.527	2.863	2.845	81,2
Brandenburg	-	-	-	-	-
Hesse	67	1.589	1.176	1.200	74,0
Mecklenburg-Vorpommern	40	1.740	1.617	1.604	92,9
Lower Saxony	389	13.522	11.303	11.475	83,6
North Rhine Westphalia	215	3.791	2.951	2.941	77,8
Rhineland Palatinate	44	606	410	442	67,6
Saarland	-	-	-	-	-
Saxony	47	4.078	3.261	3.248	80,0
Saxony-Anhalt	32	2.047	1.713	1.744	83,7
Schleswig-Holstein	49	1.088	976	939	89,7
Thuringia	24	2.209	1.727	1.664	78,2
City States, (Berlin, (Bremen, Hamburg)	-	-	-	-	-
June					
Germany	1.237	39.481	31.647	31.577	80,2
Baden-Württemberg	152	1.997	1.576	1.559	78,9
Bavaria	155	3.526	2.692	2.665	76,3
Brandenburg	-	-	-	-	-
Hesse	67	1.585	1.229	1.167	77,5
Mecklenburg-Vorpommern	40	1.720	1.398	1.446	81,3
Lower Saxony	384	13.506	11.238	11.132	83,2
North Rhine Westphalia	211	3.638	2.885	2.928	79,3
Rhineland Palatinate	43	587	446	445	76,0
Saarland	-	-	-	-	-
Saxony	47	4.080	3.172	3.215	77,7
Saxony-Anhalt	32	2.051	1.621	1.733	79,0
Schleswig-Holstein	49	1.095	920	949	84,0
Thuringia	24	2.240	1.762	1.702	78,6
City States, (Berlin, (Bremen, Hamburg)	-	-	-	-	-
December					
Germany	1.233	39.994	32.697	32.807	81,8
Baden-Württemberg	140	1.959	1.693	1.674	86,4
Bavaria	153	3.598	3.038	3.014	84,4
Brandenburg	-	-	-	-	-
Hesse	67	1.586	1.163	1.217	73,3
Mecklenburg-Vorpommern	46	1.786	1.595	1.604	89,3

area	farms	HHP ¹⁾	Laying hens ²⁾		utilised capacity
	numbers		first day of the month	monthly average	
			numbers in 1.000		%
Lower Saxony	385	13.547	11.024	11.138	81,4
North Rhine Westphalia	208	3.718	3.035	3.027	81,6
Rhineland Palatinate	43	594	464	457	78,2
Saarland	-	-	-	-	-
Saxony	51	4.085	3.475	3.423	85,1
Saxony-Anhalt	33	2.273	1.839	1.844	80,9
Schleswig-Holstein	50	1.098	963	939	87,8
Thuringia	24	2.232	1.769	1.783	79,3
City States, (Berlin, Bremen, Hamburg)	-	-	-	-	-

Note:

1) at full capacity utilisation of all available HHP.

2) Including young laying hens and laying hens in moult.

Source: Statistisches Bundesamt, Wiesbaden 2008

Chickens kept for meat production, Germany

In 2007, 8.680 farms (with more than 3.000 chickens) kept 59.221.771 broilers in Germany, where over 50 % of these animals (31.586.145 broiler) were housed in Lower Saxony. The decrease of the other Federal States in chicken meat production was as follows (table 7): Mecklenburg-Vorpommern (5.026.954 broiler), Bavaria (4.719.273 broiler), Saxony-Anhalt (4.079.780 broiler), Brandenburg (3.252.046 broiler), North Rhine Westphalia (2.919.043 broiler), Schleswig-Holstein (1.542.856 broiler), Baden-Württemberg (965.484 broiler), Thuringia (594.449 broiler), Hesse (90.045 broiler), Rhineland Palatinate (32.412 broiler), Saarland (2.502 broiler), Bremen (120 broiler) und Hamburg (120 broiler). There were no farms with broilers in Berlin. Data about the broilers kept in Saxony were not available for the year 2007. 3.232.900 broilers were kept in Saxony in 2006.

In the statistics for the year 2007 of the German Federal Statistical Office, all farms that kept broilers were registered, i.e. stocks starting from one broiler (table 14 and 15). In previous years, only farms with more than 3.000 chickens were included in the official statistics. The main reason for the inclusion of all farms is the avian influenza. Because of the threat of an influenza pandemic, all holdings and private persons keeping one or more chickens were registered.

As one can see in the tables 14 and 15, the majority of farms kept only very small broiler stocks. However, approx. 60 % of the broilers were kept in very big stocks (more than 50.000 birds). With 59 farms with more than 100.000 birds and 145 farms with 50.000 to 99.999

animals, most of the big farms were located in Lower Saxony. Many big farms were also located in Bavaria (14 farms with more than 100.000 broilers) and in Saxony-Anhalt (11 farms with more than 100.000 broilers).

In the modern intensive broiler husbandry the animals are kept indoors the entire year. In Germany broilers are housed predominately on farms with big stocks in barn systems. In addition to intensive housing systems, some Broilers, normally only on organic farms or farms with small stocks, are kept in extensive barn systems or free range systems. In the survey, separate data about housing of broilers on organic farms are not available. According to ZMP, 300.000 broilers were kept in 2003 on organic farms in Germany. That was below 1 %. The main differences between the keeping of broilers on conventional and organic farms lie in the stocking density and the number of animals per housing unit. On conventional farms the stocking density shall not exceed 35 kg/m². According to the Council Regulation on organic production in barn systems, a maximum stocking density of 21 kg/m² (no more than 10 animals/m²) is allowed. In mobile housing systems the stocking density shall not exceed 30 kg/m² (no more than 16 animals/m²). New conventional broiler housing systems normally accommodate 20.000-30.000 animals. In organic farming, the number of animals per house unit is limited to 4.800 broilers. Organic broilers must moreover have access to an outdoor area and a chicken run with grassland.

Breeding stocks were kept on conventional and organic farms also in barn systems. Four to six broiler breeders are kept per square metre barn area. Cocks are housed together with hens, usually one cock for ten hens.

Table 14: farms with broilers per stock size, May 2007 (part 1)

State	Total		Thereof farms with:									
	farms	animals	1 - 49 farms animals	50 - 99 farms animals	100 - 499 farms animals	500 - 999 farms animals	1.000 – 2.999 farms animals					
Baden-Württemberg	599	965.484	458	3.215	38	2.150	46	9.700	10	6.040	8	11.450
Bavaria	866	4.719.273	542	6.945	88	5.383	107	18.518	10	6.670	14	25.184
Brandenburg	468	3.252.046	436	1.574	6	347	-	-	-	-	-	-
Hesse	811	90.045	753	4.244	29	1.736	19	3.365	-	-	-	-
Mecklenburg-Vorpommern	301	5.026.954	226	956	8	532	-	-	3	2.002	-	-
Lower Saxony	1.845	31.586.145	1.157	4.816	24	1.408	31	6.752	7	4.080	18	31.756
North Rhine Westphalia	1.145	2.919.043	909	4.388	-	-	80	16.155	8	4.790	-	-
Rhineland Palatinate	527	32.412	488	2.045	12	868	20	3.713	-	-	-	-
Saarland	73	2.502	-	-	-	-	-	-	-	-	-	-
Saxony	749	-	729	1.842	6	331	7	1.696	-	-	-	-
Saxony-Anhalt	185	4.079.780	154	648	-	-	4	590	-	-	-	-
Schleswig-Holstein	563	1.542.856	496	2.444	33	2.112	13	2.070	-	-	-	-
Thuringia	517	594.449	504	1.162	4	240	4	824	-	-	-	-
City States (Berlin, Bremen, Hamburg)	31	-	-	-	-	-	-	-	-	-	-	-

Source: Statistisches Bundesamt, Wiesbaden 2008

Table 15: farms with broilers per stock size, May 2007 (part 2)

State	3.000 – 4.999		5.000 – 9.999		Thereof farms with: 10.000 – 49.999		50.000 – 99.999		100.000 or more	
	farms	animals	farms	animals	farms	animals	farms	animals	farms	animals
Baden-Württemberg	4	17.500	6	45.500	-	-	-	-	-	-
Bavaria	-	-	-	-	71	1.924.973	13	879.600	14	1.815.000
Brandenburg	-	-	-	-	4	149.855	10	746.219	6	2.343.201
Hesse	-	-	-	-	3	63.500	-	-	-	-
Mecklenburg-Vorpommern	-	-	5	40.646	14	493.597	34	2.140.447	6	2.339.872
Lower Saxony	6	21.991	11	78.894	387	11.386.443	145	9.723.395	59	10.326.610
North Rhine Westphalia	-	-	12	83.290	82	2.335.110	-	-	-	-
Rhineland Palatinate	-	-	-	-	-	-	-	-	-	-
Saarland	-	-	-	-	-	-	-	-	-	-
Saxony	-	-	-	-	-	-	-	-	-	-
Saxony-Anhalt	-	-	-	-	7	258.533	6	426.551	11	3.389.050
Schleswig-Holstein	-	-	-	-	6	185.000	6	403.000	6	935.000
Thuringia	-	-	-	-	-	-	-	-	-	-
City states, (Berlin, (Bremen, Hamburg)	-	-	-	-	-	-	-	-	-	-

Source: Statistisches Bundesamt, Wiesbaden 2008

Chicken husbandry throughout the EU

Data of the year 2003

In the EU 460,8 million laying hens (including pullets) were kept in 2003. The largest laying hen population was located in France (26,0 % of the EU-25), in Germany (12,1 %), in Poland (11,2 %) and in Great Britain (10,5 %). Thus nearly two-thirds of all European laying hens were kept in these five countries.

There were broad differences in the structure of laying hen husbandry throughout the EU. Whereas only nearly half of the new member states kept the animals on farms with 30.000 or more chickens two-thirds of the EU-15 kept their animals on farms of this size. A notably large number of chickens were kept in the Czech Republic (90,2 %), Spain (76,9 %), Portugal (73,3 %) and Italy (77,1 %) on farms with stocks of at least 30.000 animals. In this regard, Germany lay with 69,7 % slightly over the EU-15 average. The largest farms measured by average stock size were in the Netherlands und Great Britain. Germany showed, with an average stock size of 630 laying hens, an above-average figure in comparison with EU-15.

In 2003, 9,1 million tonnes of chicken meat was produced by the EU-15. The most important countries of origin were: France with 2,1 million tonnes, Great Britain with 1,6 million tonnes, Spain with 1,3 million tonnes and Italy as well as Germany each with 1,1 million tonnes. After an increase from 2000 to 2003 the production of chicken meat was reduced in 2003 by 317.000 tonnes or 3,4% . The reason for this decrease was the reduced production in France, the largest chicken meat producer in the EU (-860.000 tonnes compared to 2002). The reduction of meat production in the Netherlands by 183.000 tonnes was due to avian influenza.

Data of the year 2005

The largest chicken stocks (laying hens and broilers) in 2005 were found in the following member states (table 16): France (202.520.000 chickens), Great Britain (160.490.000 chickens), Spain (156.950.000 chickens), Poland (131.860.000 chickens), Italy (126.510.000 chickens) and Germany (107.260.000 chickens).

The largest laying hen stocks in 2005 were found in the following member states (table 16): France (77.210.000 LH), Spain (59.980.000 LH), Germany (50.500.000 LH), Great Britain (49.010.000) and Poland (48.580.000).

In 2005 lots of farms with more than 30.000 laying hens were located in the following member states (table 17): France (720 farms), Netherlands (490 farms), Spain (400 farms), Germany and Italy respectively (310 farms) and Poland (210 farms).

The largest broilers stocks in 2005 were kept in the following member states (table 16): France (125.360.000 broilers), Great Britain (111.480.000 broilers) und Germany (56.760.000 broilers).

Table 16: Chickens kept throughout the EU, Eurostat 2005

	BE	BG	CZ	DK	DE	EE	IE	GR	ES	FR	IT	CY	LV	LT
chicken (1.000 birds)	34.380	17.130	25.280	17.030	107.260	2.100	10.540	31.450	156.950	202.520	126.510	4.230	3.920	8.370
broilers (1.000 birds)	21.070	7.950	16.170	11.910	56.760	980	8.080	21.540	96.970	125.360	90.390	3.380	1.170	4.020
Laying hens (1.000 birds)	13.310	9.180	9.110	5.120	50.500	1.120	2.460	9.910	59.980	77.210	36.120	750	2.750	4.350

	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	NO	CH
Chicken stock (1.000 birds)	80	25.730	1.050	92.920	11.310	131.860	27.400	61.340	2.780	11.640	10.020	14.260	160.490	13.590	7.090
Broilers (1.000 birds)	10	9.770	580	44.500	5.580	83.280	18.120	16.560	1.710	7.380	5.470	7.500	111.480	8.880	5.060
Layer hen (1.000 birds)	70	15.960	470	48.420	5.730	48.580	9.280	44.780	1.070	4.260	4.550	6.760	49.010	4.710	2.030

Table 17: Number of farms and number of live stock according to laying hens, Eurostat 2005

Live stock	BE	BG	CZ	DK	DE	EE	IE	GR	ES	FR	IT	CY	LV	LT
1-99	3.590	368.590	18.660	2.830	72.410	12.100	8.230	316.970	186.510	130.340	64.650	8.810	58.740	163.160
100-999	110	340	80	130	4.060	130	60	1.900	740	1.440	460	100	100	160
1.000-2.999	40	90	20	20	1.020	0	40	120	100	370	370	0	0	10
3.000-4.999	50	50	10	30	310	0	20	90	50	370	150	0	0	0
5.000-9.999	110	10	10	70	350	10	70	140	260	850	60	0	0	0
10.000-29.999	220	30	20	90	400	0	30	60	510	880	460	10	0	0
30.000 or more	160	30	50	40	310	0	20	20	400	720	310	0	0	20

Live stock	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	UK	NO	CH
1-99	570	351.980	920	290	58.730	1.144.410	173.560	3.005.040	43.620	42.710	790	4530	29.750	1.650	14.620
100-999	20	3.710	40	170	1.240	10.210	180	2.020	160	70	210	150	4.200	150	770
1.000-2.999	0	110	20	100	520	470	0	80	20	10	270	60	480	360	230
3.000-4.999	0	40	10	110	160	240	0	20	10	0	110	40	260	100	80
5.000-9.999	0	40	10	260	130	350	0	20	0	0	130	60	370	290	70
10.000-29.999	0	40	10	670	70	310	70	30	10	10	100	120	570	30	30
30.000 or more	0	40	0	490	20	210	70	40	0	30	20	60	310	20	0

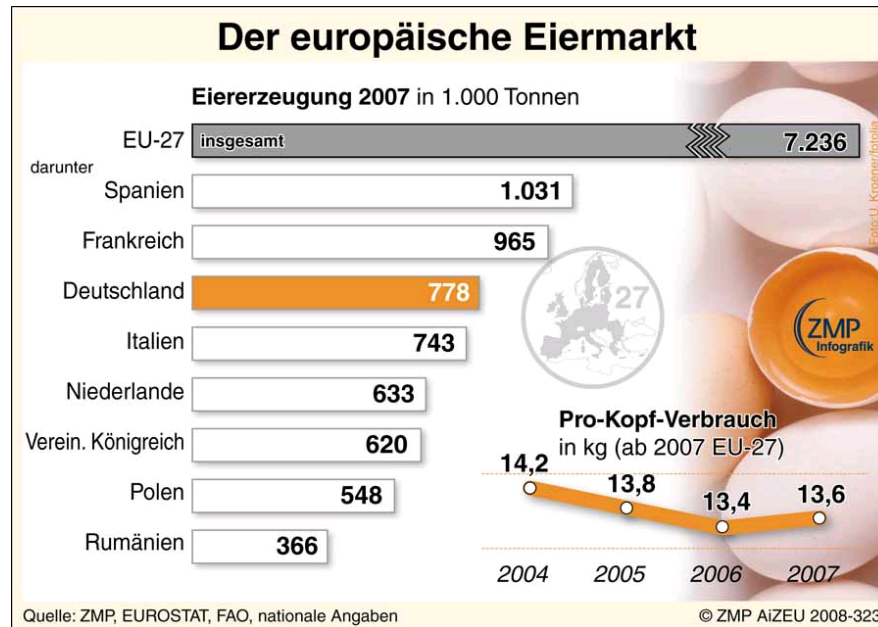


Figure 3: the European egg market

Laying hens throughout the EU

Europe-wide most laying hens were still kept in cages as one can see on the basis of figure 4. Only 25 % of the animals were kept in alternative systems, i.e. 15 % in barn systems, 8 % in free range systems and 2 % on organic farms. Austria isn't among the major European egg producers (figure 3), but it is the member state, which keeps most laying hens in alternative systems. Battery cages are banned since 01.01.2009 in Austria as well as in Germany.

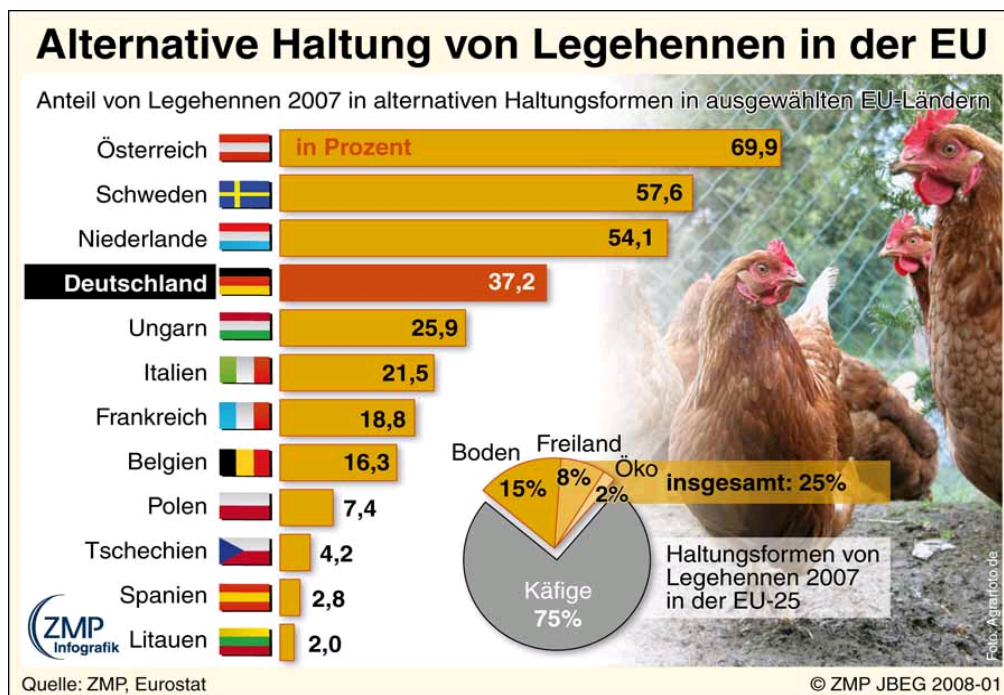


Figure 4: alternative systems throughout the EU

However, in Spain, the major European egg producer (figure 4), 97,2 % of the laying hens were still kept in battery cages. In France, the second major European egg producer, 81,8 % of the hens were housed in battery cages. The percentages of laying hens kept in cages in other member states, which are also important egg producers, are: Germany (62,8 % cage systems), Italy (78,5 % cage systems), the Netherlands (45,9 % cage systems), Great Britain (63 % cage systems) and Poland (92,6 % cage systems). In 2007, in Germany as well as in all other major egg producing member states, cage systems were the predominant housing system. However, there were differences in the percentages of laying hens kept in cages. 97,2 % of the laying hens in Spain were kept in cages as opposed to only 45.9 % in the Netherlands.

The percentages of laying hens kept in battery cages will change considerably due to the early ban of battery cages in Germany and some other member states since January 2009. Overall

the percentage of small group housing systems will increase. There are already considerations that eggs out of small group housing systems should carry a code so that the consumer can distinguish between battery cage and small group eggs. Till now small group eggs carry a „3“. This is the category of eggs produced in cage systems, including battery cage eggs. One can also count on a further increase of barn systems, whereas, due to the avian influenza, an increase of free range systems is unlikely.

There are big differences in the structure and the size of farms in the member states. 32,1 % of the laying hens in the Netherlands are kept on farms with 10.000 to 29.999 animals, and 23,5 % of the laying hens are kept on farms with 30.000 or more birds. The following member states also keep large numbers of laying hens on farms with 30.000 and more animals: France (720), Spain (400), Germany (310), Italy (310), Great Britain (310) and Poland (210). However, some member states, like Latvia and Luxemburg, have only small farms with a maximum stock size of 999 birds.

Broiler husbandry in the EU

The chicken meat production in the EU-27 added up to 11,28 million tonnes in 2007 (figure 5), this equates to approx five billion slaughtered broilers. The most important producers were France with 16 %, Great Britain with 13 %, Spain as well as Germany each with 11 % and Italy with 9 %.

In comparison to the laying hen husbandry there are no appreciable differences in the broiler industry throughout the EU. Barn systems were with almost 100 % the predominant housing system in all member states.

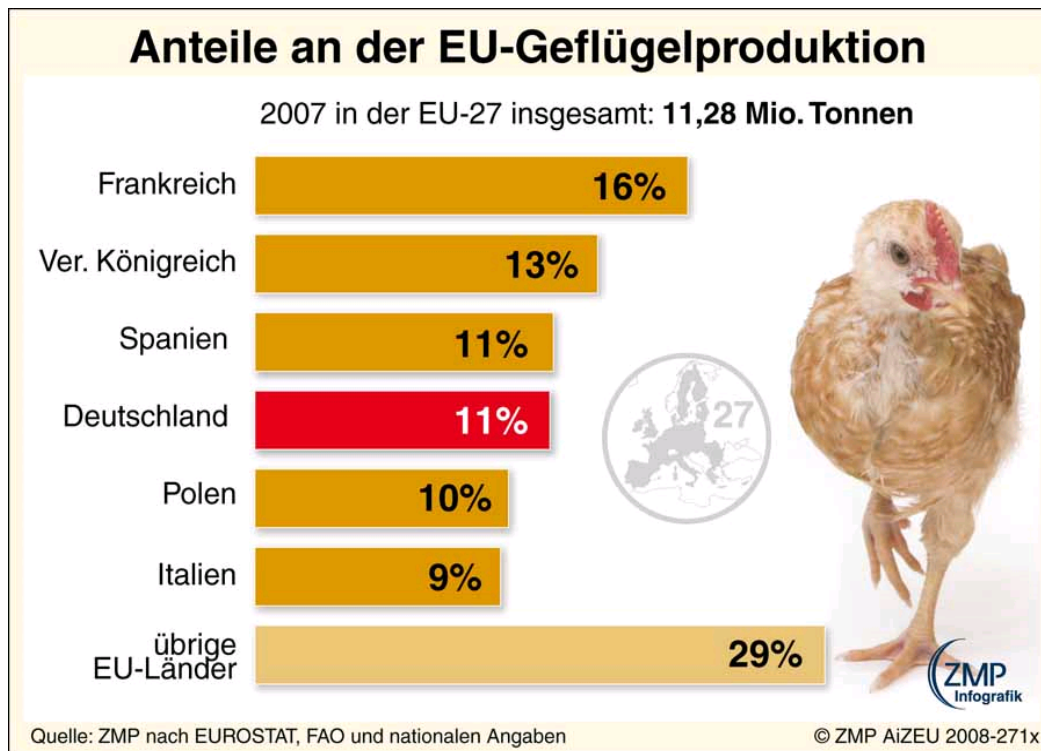


Figure 5: EU-chicken meat production

Poultry in Great Britain

In Great Britain the majority of laying hens were kept in cage systems (63%). With 5 % barn systems played only a minor part. 32 % of the British laying hens were kept in free range systems with an agreed maximum stocking density of 2.500 hens per hectare. But the most free range hens are kept under the “Freedom Food Scheme” of the RSPCA (Royal Society for the Prevention of Cruelty to Animals), which allows a maximum stocking density of 1.000 animals per hectare.

Table 18: chicken stock in Great Britain, 1 June 2007

	June 2006	June 2007
Total egg production (1.000 animals)	38.257	36.257
Laying hens(1.000 animals)	28.632	27.321
pullets (1.000 animals)	9.625	8.936
Total breeding stock (1.000 animals)	9.273	12.255
Laying hens (1.000 animals)	1.740	2.316
broiler (1.000 animals)	5.531	8.226
cocks (1.000 animals)	407	423
Broiler (1.000 animals)	110.672	108.753

Source: Defra June Survey of agriculture and horticulture, October 2008

Approx. 98,5 % of the broilers were kept in barn systems, usually 25.000 per building, but there are also barns with spaces for 50.000 birds. A medium-size farmer, who keeps chicken for fattening, has approx. 140.000 animals in different buildings on one holding. The stocking density adds up to 38 kg per m², this corresponds to 19 broilers (each 2 kg) per m². The litter most used seems to be sawdust and straw.

According to Chambers and Smith (1998), 4 million tonnes of manure are produced by the British chicken stock (broilers and laying hens) per year.

Laying hen husbandry in the Netherlands

In 2007, 9.400 million eggs for consumption were produced in the Netherlands. 51,6 % of these eggs were produced on farms with alternative housing systems. 3.491 million eggs for consumption (37 %) originated from barn systems, 1.229 million (13 %) from free range systems and 152 million (1,6 %) from organic farms.

In barn system a maximum stocking density of 9 hens per m² is already in force, even though it will not become a regulation by Directive 1999/74/EC till January 2012.

Broiler husbandry in Sweden

Sweden has restricted the maximum stocking density of broilers to 25 kg/m² and lies herewith far below stocking densities defined by Directive 2007/43/EC.

4. Part 2 manure/slurry

Introduction

“Länderkammern”, chicken breeding associations and other institutions were contacted to gather information about the accumulation of slurry and manure. None of the asked authorities or institutions could give exact particulars about this subject. The literature also provides very little information about the accumulation of slurry and manure. Therefore we developed a questionnaire to gather practically and relevant data.

Definition of manure, dried chicken excreta and slurry

The term “chicken excreta” includes the mixture of faeces and urine excreted through the cloaca. This mixture also contains undigested feeding stuff, desquamated intestinal epithelium,

residues of secretion, microorganism out of the intestinal flora, metabolites excreted with the urine as well as exogen components (e.g. feather, egg leftovers).

Chicken excreta are dried chicken excreta, fresh chicken excreta or chicken manure with a low grade of litter. Dried chicken excreta are accruing fresh chicken excreta without litter or with a very low ratio of litter that are dried as fast as possible after defecation in deep pit or on manure belt, so that the dry matter content is over 50 %. Dry chicken excreta can contain a low amount of crop litter and remains of feeding stuff or nitrogen content above 11 kg N/t fresh matter.

Fresh chicken excreta are fresh excreta without litter and drying. Chicken manure with a low ratio of litter are dried chicken excreta or fresh chicken excreta with a low ratio of litter, normally this includes boiler manure.

Excrements of laying hens kept in cage and barn systems are classified particularly as chicken excreta because they have none or only a little ratio of crop litter. A classification as solid manure can singly be established by the conformation of the required crop litter and the shortfall of the nitrogen contents. The later mix in of crop litter in chicken excrements does not result in the classification as solid manure. Mixing of chicken excrements with pig, cattle, horse and sheep manure or manure, of other animal species, does not lead to the classification as solid manure.

Manure is a mixture of faeces and urine of animals as well as crop litter, usually straw and/or sawdust. Manure can contain remains of feeding stuff, cleaning water and run-off rain water. Solid manure is equated to chicken excreta that originate from chicken, turkey, duck, geese or other poultry fattening and have technological conditioned a high ratio of crop litter (≥ 7 kg litter per day per 3 t increase of biomass per year) or nitrogen content under 11 kg N/t fresh matter. Forced off solid digestates off the fermentation of farm fertilisers and renewable resources are treated as solid manure.

Stable manure is a stackable mixture of faeces, urine and litter (apart from: poultry manure with a low grade of litter). In Addition stable manure can contain remains of feeding stuff, cleaning water and run-off rain water. The contents vary highly depending on animal species, housing system and litter amount.

Chicken slurry: There are various data about the dry matter content (TS) of chicken slurry, which range between 10-29 %. The nutrient content of chicken slurry depends on the percentage of dry matter content. Approximate values of the nutrient content are displayed in table 19 and 20.

Due to a specific question, the “Landwirtschaftskammer Schleswig-Holstein” has determined, within the scope of livestock census, carried out by the German Federal Statistical Office in 2007, the percentage accumulation of slurry in laying hen husbandry. Surprisingly, this survey revealed that in 25 % of the farms slurry still occurred. According to information of the ZDG, slurry should no longer occur in chicken husbandry, only “dried chicken excretas” or “dried manure” should accumulate.

Table 19: Guideline for nutrient contents in chicken slurry

species	TS %	N	thereof Ammonium-N	P ₂ O ₅	K ₂ O	MgO	CaO
laying hen	10	6,0	4,2	3,6	2,9	1,3	12,5
laying hen	12	7,2	5,1	4,4	3,5	1,5	15,0
laying hen	14	8,4	5,9	5,1	4,1	1,8	17,5

Contents of chicken excreta

Fresh chicken excreta contain the following nutrients: water 56 %, OS 26 %, N 1,6%, P₂O₅ 1,5 % and K₂O 0,9 %. The nitrogen compounds consist of 60 % uric acid, 2 % urea, 6 % total ammonical nitrogen and 32 % nitrogen residues (decomposition products of protein). The nitrogen content of chicken excreta can be reduced by 10 to 20 % through needs-based feeding.

The nutrient contents of farm fertiliser originating from different poultry species are displayed in table 20 and 21. These data can add to determine the drug decomposition excreta of other poultry species.

Table 20: nutrient contents of farm fertiliser

Kind of fertiliser	Density (t/m ³)	TS%	OS%	N-total *	N-min*	P ₂ O ₅ *	K ₂ O*	MgO *	Na ₂ O *	S*
Chicken slurry	1,04	11,0	8,2	8,4	5,4	5,9	4,3	1,3	0,9	0,9
Dry chicken excreta	0,50	50,0	35,0	28,6	10,9	23,0	20,1	7,7	1,5	2,4
Dried chicken excreta	0,40	70,0	51,3	32,1	11,0	30,9	21,8	7,9	3,0	3,0
Chicken manure	0,50	55,0	40,0	28,0	15,0	21,0	23,0	6,0	4,2	3,3
Fresh chicken excreta	0,77	28,0	19,0	17,1	3,0	10,9	8,3	4,0	1,5	3,6
Source: Ratgeber Pflanzenbau und Pflanzenschutz, Landwirtschaftskammer Nordrhein-Westfalen Ausgabe 2007										
Chicken slurry	1,04	14,0	9,4	9,2	6,5	7,0	5,0	1,8	0,9	0,9
Dry chicken excreta	0,50	45,0	33,0	24,0	10,0	17,0	14,0	5,0	1,5	2,4
Dried chicken excreta	0,40	70,0	51,3	35,0	14,0	26,0	22,0	7,0	3,0	3,0
Chicken manure	0,50	60,5	39,9	28,0	12,0	21,0	23,8	4,0	4,2	3,3
Fresh chicken excreta	0,77	23,0	16,9	13,0	6,0	8,0	7,0	2,0	1,5	3,6
Source: www.nutrinorm.nl										

*content in kg/t

The pollution degree of litter (defecation in other words) and the nutrient content of litter are affected by the following factors: litter material, litter quantity; composition of feeding staff, housing system, barn ventilation, water, animal health, stocking density and slaughter age of broiler. The environmental temperature has an influence on the nutrient excrement of chickens. If the temperatures are high, the chickens excrete an enhanced amount of phosphor and potassium. The reason therefore is the increased excretion of phosphor and potassium with the urine due to heat stress. The evaporation of nitrogen in form of ammonia depends on temperature and humidity.

Litter and housing system have an influence on the percentage of inorganic material in the manure. Laying hens kept in free range systems carry the soil from the chicken run into the

barn so that the mineral content of manure is increased. On some farms the mineral content of the manure can be 70 %.

Omeira et al. (2006) examined laying hen and broiler manure, each out of intensive housing and free range systems. Laying hen manure had a lower bioburden as broiler manure. The chemical properties of chicken manure of both lines of production and housing systems were compared on the basis of pH-value, electric conductivity, carbon, nitrogen, phosphor, potassium, cadmium and zinc. The biggest pH-value was exhibited by manure from broilers kept in free range systems. The electric conductivity in laying hen manure (intensive and extensive housing) was larger than in broiler manure (intensive and extensive housing). Chicken manure out of intensive housing systems has a higher ratio of nitrogen content as manure out of free range systems. The lowest total phosphor content was determined in manure of broilers kept in free range systems, whereas the lowest potassium content was found in manure of broilers kept in intensive housing systems. The zinc content is by tendency higher in laying hen manure than in broiler manure.

Comparison of the nutrient content in farm fertiliser from different poultry species

Table 21 displays the nutrient contents of farm fertilisers coming from different poultry species.

Table 21: farm fertilisers coming from poultry husbandry

Geflügel				Kg pro 100 gemästete Tiere		
				N	P ₂ O ₅	K ₂ O
Eier- erzeugung	Junghennenaufzucht, 3,3 kg Zuwachs	4 Phasen	Standardfutter	28,6	20,2	12,8
		5 Phasen	N-/P-reduziert	24,4	13,1	12,3
	Legehennenhaltung, 17,6 kg Eimasse		Standardfutter	78,6	47,7	36,0
			N-/P-reduziert	75,4	34,0	36,0
Hähnchen- mast	Mast 40 Tage Mastdauer, 2,2 kg Zuw./Tier, 14,7 Zuw./Platz		Standardfutter	46,9	24,5	23,9
			N-/P-reduziert	40,3	18,4	23,9
	37 bis 40 Tage Mastdauer, 2,0 kg Zuw./Tier, 14,2 Zuw./Platz		Standardfutter	39,2	21,3	21,3
			N-/P-reduziert	33,3	15,8	21,3
	37 Tage Mastdauer, 1,7 kg Zuw./Tier, 13,8 Zuw./Platz		Standardfutter	31,9	18,1	18,9
			N-/P-reduziert	26,6	13,1	18,9
Entenmast	Peking- Enten	13,4 kg Zuw./Tier, Mast bis 26 Tage, 13 Durchgänge		148	83,4	89,3
	Flugenten	15,4 kg Zuw./Platz und Tier (2,7 kg w., 5kg m.), 1:1 m:w, 4 Durchgänge		58,8	37,6	34,2
Putenmast	Hähne	56,8 kg Futtermittelverbrauch u. 20,4 kg Zuw./Tier, 22 Wochen Mastdauer	Standardfutter	97,3	65,0	50,3
			N-/P-reduziert	91,0	34,9	50,3
			teils P-reduziert	97,3	51,9	50,3
	Hennen	27,9 kg Futtermittelverbrauch u. 10,9 kg Zuw./Tier, 17 Wochen Mastdauer	Standardfutter	56,4	33,7	27,0
			N-/P-reduziert	53,3	19,7	27,0
			teils P-reduziert	55,6	27,5	27,0
Gänsemast	Schnellmast		5,0 kg Zuw./Tier	18,3	11,5	11,6
	Mittelmast		6,8 kg Zuw./Tier	55,4	31,0	26,5
	Spätmast / Weidemast		7,5 kg Zuw./Tier	104	33,5	83,9

Source: LLH – AG DüV-Leitfaden Hessen

Amount of accumulating slurry and manure

Standardised data about the accumulation of slurry and manure in different lines of production could not be found. The following list displays information about the accumulation of manure and slurry from different sources:

- Approx. 65 kg fresh excreta (20 to 25 % TS) accumulate annually per laying hen kept in a barn system.
- The “Gut Mennewitz GmbH” in Baasdorf near Köthen runs two farms each with 35.000 chicken, where 25.000 tonnes chicken excreta accumulate per annum (source Berliner Morgenpost).
- Accumulation of farm fertilisers for 6 month and barn space in m³ various dung removal systems (source Lebensministerium Österreich): chicks and pullets for egg production (pumpable 0,012 / dry excreta 0,009); laying hens, cocks (pumpable 0,033 / dry excreta 0,016); chicks for meat production and broiler (dry excreta 0,006).
- Accumulation of excreta laying hens: fresh excreta (TS 10%) 13t/100 hens annually; dry excreta (TS 50%) 3t /100 hens annually.
- solid manure (TS 60%) 0,6t/100 broiler per year
- A barn with 20.000 broilers produces approx. 140 tonnes manure per annum.
- Manure accumulation in m³ per barn space and year: pullet (rearing) 0,006; laying (17,6kg egg mass) 0,009; broiler (fattening, 2 kg increase/animal) 0,006.
- Account of the accumulation of farm fertilizer for 6 month (annual average occupied barn space) / dry excreta per animal in m³: chicks and pullets up to 6 months old 0,009; laying hens 1/2 year and older as well as cocks 0,016; chicks for meat production and broiler 0,006; bantams and quails 0,003; geese 0,029; ducks 0,014; turkeys 0,03 // slurry per animal in m³: chicks and pullets up to 1/2 year 0,012; laying hens 1/2 year and older 0,033
- The average size hen also produces 1 cubic foot of manure every six months.

- The estimated values of manure accumulation vary highly according to Coufal et al. (2006); amongst others the amount of accumulating manure is dependent on the size of chicken. On a farm with small animals 1,07 t manure/1.000 broiler accumulate. If the animals are bigger 1,65 t manure/1.000 broiler accumulate. The average accumulation is 1,0 t manure/1.000 Broiler (range 0,7 up to 2,0). The weight unit of these data is US-tonnes. 907,18474 kg are one US-tonne.
- The feed intake is reduced by hot weather which leads to a decrease of excreta.

The amount of the manure depends also on the type of feeding stuff (table 22). Nitrogen and phosphor reduced feeding stuff has little influence on the amount of excreta. Mainly this feeding stuff reduces the nutrient content of the manure.

Table 22: accumulation of manure depending on feeding stuff

Tierart	Produktionsverfahren	Beschreibung	Anfall dt/m ³	N (kg/E)	P ₂ O ₅ (kg/E)	K ₂ O (kg/E)	Dungart
Eierzeugung							
Junghennenaufzuchtplatz							
Standardfutter, 4 Phasen							
<i>Eierzeugung; Junghennenaufzucht 3,3 kg Zuwachs; Standardfutter, 4 Phasen</i>							
			0,02	0,286	0,202	0,128	Geflügelgülle
			0,06	0,286	0,202	0,128	Trockenkot
N-/P-reduziert, 5 Phasen							
<i>Eierzeugung; Junghennenaufzucht 3,3 kg Zuwachs; N-/P-reduziert, 5 Phasen</i>							
			0,02	0,244	0,131	0,123	Geflügelgülle
			0,05	0,244	0,131	0,123	Trockenkot

Tierart	Produktionsverfahren	Beschreibung	Anfall dt/m³	N (kg/E)	P ₂ O ₅ (kg/E)	K ₂ O (kg/E)	Dungart
Legehennenplatz							
	Standardfutter	<i>Eiererzeugung; Legehennenhaltung 17,6 kg Eimasse; Standardfutter</i>	0,06	0,786	0,477	0,36	Geflügelgülle
			0,13	0,786	0,477	0,36	Trockenkot
	RAM	<i>Eiererzeugung; Legehennenhaltung 17,6 kg Eimasse; RAM</i>	0,06	0,754	0,34	0,36	Geflügelgülle
			0,13	0,754	0,34	0,36	Trockenkot
Geflügelmast							
Hähnchenmastplatz							
	Aufzucht Elterntiere	<i>Hähnchenmast; Aufzucht Elterntiere, 0-16 Wochen</i>	0,1	0,41	0,21	0,19	Geflügelmist
	Elternhähne	<i>Hähnchenmast; Elternhähne</i>	0,2	1,15	0,43	0,4	Geflügelmist
	Elternhennen	<i>Hähnchenmast; Elternhennen</i>	0,23	1,17	0,5	0,5	Geflügelmist
	Standard, bis 33 Tage	<i>Hähnchenmast; Standard bis 33 Tage</i>	0,06	0,225	0,124	0,163	Geflügelmist
	Standard, bis 37 Tage	<i>Hähnchenmast; Standard bis 37 Tage</i>	0,07	0,26	0,14	0,182	Geflügelmist
	Standard, bis 40 Tage	<i>Hähnchenmast; Standard bis 40 Tage</i>	0,07	0,292	0,151	0,196	Geflügelmist
	Standard, über 40 Tage	<i>Hähnchenmast; Standard über 40 Tage</i>	0,08	0,325	0,165	0,211	Geflügelmist
	RAM, bis 33 Tage	<i>Hähnchenmast; RAM bis 33 Tage</i>	0,06	0,205	0,103	0,163	Geflügelmist
	RAM, bis 37 Tage	<i>Hähnchenmast; RAM bis 37 Tage</i>	0,07	0,235	0,115	0,182	Geflügelmist
	RAM, bis 40 Tage	<i>Hähnchenmast; RAM bis 40 Tage</i>	0,07	0,264	0,126	0,196	Geflügelmist
	RAM, über 40 Tage	<i>Hähnchenmast; RAM über 40 Tage</i>	0,08	0,294	0,137	0,211	Geflügelmist

Excreta composition in dependency on sample location

In a study, excreta samples were taken from a manure belt, a deep pit and a scratching area. These samples had a huge variability related to their contents. The range of variation can be traced back to the degree of freshness of excreta as well as feeding stuff composition, age of hens and foreign substances. The influence of the sample location (manure belt or deep pit) was marginal. The excreta contents showed no correlation to the age of hens or the laying period in which the samples were taken. The dry matter and raw ash content of excreta from the deep pit was 2 % higher; the nitrogen, phosphor and potassium content were lower.

There were differences between the litter samples (mixture of excrements, litter, remains of feeding stuff etc.) out of the scratching area and the conservatory relating to the contents. The litter from the conservatory material had higher dry matter and raw ash (sand) contents, but was poorer in trace elements.

The amount of excreta produced in the chicken run can be considerable. In studies on a group of 400 laying hens kept in an aviary house were approx. 15 to 25 % of the total excreta in the chicken run. The nutrients remain predominantly in the chicken run because there is often no nutrient removal from this area, or the nutrient input is bigger than the potential decomposition through the vegetation. During heavy rain and snowmelt, excreta can be washed down into the water and lead to a nutrient burden of surface waters. The effects of a single nutrient entering the grounds vary significantly in accordance of areas of water supply management. Whereas entries of nitrogen (N) and phosphor (P) have a negative effect on the water quality, potassium (K) and magnesium (Mg) don't contaminate water. According to studies of Nesser (2000) the NH_3 -loss in barn systems was 38,5 % of the total amount of nitrogen of excreta, in aviary and cage systems only 22,8 % and 18,2 % respectively.

Due to a more intense use of the chicken run flocks with less than .2000 laying hens caused a higher nutrient entry into the soil than big groups with more than 10.000 laying hens.

The nitrogen content increased mainly in the area around the barn (10 to 25 m distance from the barn). In areas far from the barn the nitrogen contents were explicitly lower as in the areas near the barn.

Influence of drying on laying hen excreta

Preisemann (1991) examined the influence of drying on the storage of laying hen excreta. Thereby he determined that the proportion of uric acid in ventilated and nonventilated excreta differed after fortnightly storage in the barn. The proportion of uric acid in ventilated excreta varied marginal, but only 50 % of the initial uric acid concentration could be detected in nonventilated excreta after 14 day of storage. Simultaneously, it increased the ammonium proportion continuously in nonventilated excreta. After 14 days the ventilated excreta (50 % dry matter) was clearly dryer as nonventilated excreta (30 % dry matter).

Flügge also (1996) reported a distinctly increased ammonia emission by the storage of nonventilated excreta. He calculated a 90 g ammonia emission per hen and per year in nonventilated excreta and 30 g ammonia emission per hen and per year in ventilated excreta. These values only apply for the ammonia emission out of the barn.

Conventional systems for the drying of excreta in the barn work with intensive excreta ventilation and obtain, according to information of manufacture, dry matter content from 60 to 85 %.

The emissions increase from cage systems to aviary systems to barn systems.

Reduction of water content in chicken excreta

There are large individual differences in laying hen husbandry in the water content of excreta, which can be traced back to excessive water intake. The water intake of laying hens varies from 120 up to 600 ml. The water content of the excreta increases by a high water intake. The large variation of the water intake cannot be explained through variations in energy demands.

There are also individual differences in water content of broiler excreta. In Addition the water content depends on the humidity in the barn and the ventilation.

Litter materials

Various litter materials, like sawdust, straw, shredded paper, wood shavings, husk, leaves, refused tea and paddy husk, are described in the literature. Sand, gravel and soil were also often used as litter. The best litter material should be dry, have a high water binding capacity and should emit absorbed moisture quickly.

Questionnaire

We developed a questionnaire (figure 6), because the statistics provided none and the literature only a few data about the accumulation of manure and slurry. Even less information could be gathered about the use of litter materials. The questionnaire was sent per email, fax or mail to 680 farms. The farms were selected with the help of various lists on public domains on the internet, listings in the yellow pages or their homepages. Here are some examples of the lists used: "Liste der zum innergemeinschaftlichen Handelsverkehr mit Geflügel und Bruteiern von Geflügel zugelassenen Betrieben gemäß Richtlinie 90/539/EWG (6. August 2008)"; "Bekanntmachung der zugelassenen Betriebe für das gewerbsmäßige Herstellen, Behandeln und Inverkehrbringen von Eierprodukten sowie der registrierten Handelsbetriebe in der Bundesrepublik Deutschland (BAHz. Nr. 173a)"; TA European Pollutant Emission Register (poultry); list „Gutes vom Land“ (nationwide) and lists of farms with organic seal (e.g. Bioland).

In developing this questionnaire it was important, that only the most important information was requested and the questionnaire could be quickly filled in. If the questionnaire would be too long or too detailed, the willingness of the farms to fill in and send back the questionnaire would be even lower as it already was. The questionnaires could be posted anonymous to improve the readiness for participation.

Figure 6: questionnaire

Produktionsart	konventionelle Produktion		
	ökologische Produktion		
Produktionszweig	Eierproduktion		
		Elterntiere	
		Junghennenaufzucht	
	Mast	Legehennen	
		Elterntiere	
	Mast		
Haltungsform	Käfighaltung		
		konventionell	
		ausgestaltet	
	Bodenhaltung		
	Freilandhaltung		
Zahl der im Jahresdurchschnitt gehaltenen Tiere*			
Besatzdichte			
Einstreumaterialien	Stroh		
	Sägespäne		
	Erde		
	Keine		
	Andere**		
Anfallende Menge Mist/Gülle in dt oder m ³ *** / Jahr	Gülle		
	Mist		
		feucht (über 50% TS)	
	trocken (unter 50 % TS)		
	Trockenkot		
Wie oft im Jahr entmisten Sie? ☀			
Durchschnittliche Lagerdauer der Gülle bzw. des Mists in Monaten ☀			

*Bitte einzeln angeben falls in dem Betrieb Junghennenaufzucht und Legehennenhaltung vorhanden sind.

**Bitte angeben welche Materialien verwendet werden:

*** Bitte angeben welche Einheit verwendet ☐ m³
☐ dt

☀ Der Fragebogen wurde nach dem Gespräch mit Frau Klein-Goedicke um diese zwei Punkte erweitert

Table 23: Conventional farms, egg production

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year				manure removal per year	period of storage manure month
						cages			barn	free range		slurry	manure		dry excreta		
						battery	enriched	small group					moist	dry			
1	80	n. s. ¹⁾			x					x	straw	n. s.	n. s.	n. s.	n. s.	8	12
2	700	n. s.			x					x	chaffed straw, wood shavings			x a. n. s.		1	none
3	1.500	n. s.			x					x	sawdust		30 m ³			1	1
4	4.000	5			x				x		straw, sawdust, soil	n. s.	n. s.	n. s.	n. s.	2 x per week	6
5	6.000	10	x						x		spelt husk		260 m ³			1 (excre- ment pit)	n. s.
6	12.500 to 13.000	n. s.			x	x			x		sawdust			600 t		40	4
7	15.000	n. s.		x			x (aviary)				straw, sawdust	550 m ³				2 x per week	5 - 6
8	18.750	17/cage		x		x					none			160 m ³		34	4
9	18.000	10		x					x		gravel		total:			n. s.	none
9	12.400	8			x				x		gravel		1.200 dt			n. s.	none
10	22.000	7			x				x		sawdust				1.200 m ³	50	0,25
11	38.000	n. s.		x					x		sawdust			X Total:	x 2.550 dt	every 4-5 days	5
12	70.000	n. s...			x	x					n. s.			1.150 t		- ²⁾	-
13	50.000	n. s.			x	x					none				total:	-	-
13	70.000	n. s.			x				x		sawdust, wood shavings				40.000 dt	-	-
14	80.000	9		x					x		sawdust			6.000 dt		2,1	n. s.
15	100.000	15		x					x		straw			5.000 dt		2	none

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year				manure removal per year	period of storage manure month
						cages			barn	free range		slurry	manure		dry excreta		
						battery	enriched	small group					moist	dry			
16	160.000	n. s.			x	x			x		straw, sawdust, soil			x total:	X 3.500 t	80	n. s.
17	200.000	n. s.		x			x (aviary)		x		sawdust				600 t	3	4
18	221.000	n. s.			x		x		x		sawdust, none				x a. n. s.	-	-
19	340.000	n. s.		x					x		straw, sawdust				x a. n. s.	-	-
87	55.000	n. s.		30.000	25.000	n. s.	n. s.	n. s.	n. s.	n. s.	sawdust			650 m ³		n. s.	n. s.
88	30.000	Small group 890 cm ² free range 1110 cm ²		x	x			x		x	straw			x total:	x 305 t	1x every week	3
89	40	0,4			x					x	Soil (bran) sawdust (chicken run)			X ca. 1200 kg		1x every week	n.s.

1) n. s. = not specified

2) a. n. s. = amount not specified

3) - = questionnaire without this item (old version)

Table 24: Conventional farms, meat production

farm Nr.	stock size	stocking density animals per m ²	breeders	broilers	housing systems					litter material	accumulating amount of manure/slurry per year			manure removal per year	period of Storage manure month	
					cages			barn	free range		slurry	manure				dry excreta
					battery	enriched	Small group					moist	dry			
20	25.000	6,5	x					x		straw			650 m ³	1	2	
21	30.300	7	x					x		straw			5.200 dt	1,1	6	
22	39.000	n. s. ¹⁾		x				x		sawdust			280 t	24	none	
23	94.000	n. s.		x				x		straw			900 t	7	1,5	
24	210.000	35 kg/m ²		x				x		straw			22.500 dt	7-8 (after finishing)	6	

1) n. s. = not specified

Table 25: Organic farms, egg production

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year				manure removal per year	period of storage manure month
						cages			barn	free range		slurry	manure		dry excreta		
						battery	enriched	Small groups					moist	dry			
25	10	n. s. ¹⁾			x					x	straw	n. s.	n. s.	n. s.	n. s.	- ²⁾	-
26	10	n. s.			x					x	straw, soil		0,1 dt			-	-
27	15	n. s.			x				x	x	straw, sawdust			600 dt	x a. n. s.	12	n. s.
28	15	n. s.			x					x	straw				X a. n. s.	-	-
29	15	15	x	x	x					x	sawdust				3 m ²		
30	20	n. s.			x					x	straw				x a. n. s.	n. s.	n. s.
31	20	3/barn, 0,25/free range			x				x	x	straw, spelt husk			x a. n. s.		-	-
32	20-25	n. s.			x					x	straw, sawdust	n. s.	n. s.	n. s.	n. s.	-	-
33	25	n. s.			x					x	grass from meadow				6 m ³	4	n. s.
34	30	50 m ² per hen			x					x	straw			10 m ³	150 l	-	-
35	35	n. s.		15	20					x	straw			x a. n. s.	x a. n. s.	-	-
36	50	n. s.			x					x	straw				8 dt	-	-
37	50	10 m ² per animal			x					x	straw			5 m ³		-	-
38	60	n. s.		20	40					x	straw, sawdust			4 m ³		26	6
39	60	n. s.			x					x	straw			5 m ³		-	-
40	60	n. s.			x					x	straw			x a. n. s.		-	-

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year				manure removal per year	period of storage manure month
						cages			barn	free range		slurry	manure		dry excreta		
						battery	enriched	Small groups					moist	dry			
41	80	n. s.			x				x	x	straw, sawdust, chaff		x total:	x 8 m ³		3	none
42	80	3			x					x	straw			4-5 m ³		-	-
43	80	n. s.			x					x	Miscan- thus			30 dt		-	-
44	80	1			x					x	soil			2 m ³		-	-
45	90	n. s.			x					x	straw, sand			2 m ³		-	-
46	95	n. s.			x					x	sand			20 dt		-	-
47	100	1,6			x				x		straw				5-7 m ³	-	-
48	100	3,3			x					x	straw			7 m ³		-	-
49	120	n. s.			x					x	straw		60 dt			-	-
50	150	2/barn, 13 m ² per animal chicken run			x					x	sand, granula- tion up to 8 mm			35 dt, including litter (Estrich- sand)		repeated -ly	-
51	160	n. s.			x				x		straw, spelt husk		x a. n. s.	x a. n. s.	X a. n. s.	1	12
52	160	5			x					x	straw		50 dt			-	-
53	170	3 groups of 70 chickens			x				x		straw, sawdust			60 m ³		Multiple data ³⁾	6
54	200	n. s.			x					x (mobile house)	straw	n. s.	n. s.	n. s.	n. s.	-	-
55	200	n. s.			x					x	straw			15 m ³		-	-
56	220	3			x					x	straw, “Baum- schnitt- häcksel“			30 m ³	6 m ³	1 dry excreta, 3 dry manure	n. s.

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year				manure removal per year	period of storage manure month
						cages			barn	free range		slurry	manure		dry excreta		
						battery	enriched	Small groups					moist	dry			
57	240	n. s.			x				x		straw, sawdust			20 ?		-	-
58	250	5 m ² per animal			x					x	straw, spelt husk			x a. n. s.		-	-
59	260	n. s.			x					x	straw	n. s.	n. s.	n. s.	n. s.	35	6
60	300	n. s.			x					x	straw		10 m ³	70 m ²		-	-
61	350	3			x					x	straw, spelt husk			250 dt		-	-
62	350	5,5			x					x	straw, sawdust			12 m ³		-	-
63	360	5			x					x	straw, wood chips	n. s.	n. s.	n. s.	n. s.	-	-
64	400	3			x					x	sawdust			250 m ³		-	-
65	500	3 (barn) 5			x					x	straw	20 m ³		50 dt		-	-
66	800	5			x					x	straw, sawdust (barn), none (mobile house)		250 dt			7	Up to 2,5 (barn)
67	900	4,8			x					x	straw, sawdust, spelt husk			30 m ³		-	-
68	1.000	4 (barn) plus aviary			x					x	coarse sand			30 m ³	50 m ²	-	-
69	1.050	4,7			x					x	straw			60 m ³		1	12

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year				manure removal per year	period of storage manure month
						cages			barn	free range		slurry	manure		dry excreta		
						battery	enriched	Small groups					moist	dry			
70	1.450	5			x					x	straw, lava sand, wood chips, sand			50 m ³	50 m ³	-	-
71	1.800	n. s.			x					x	straw, sawdust, spelt husk			x a. n. s.		-	-
72	2.000	4,5			x					x	lava rock meal		60 m ³			1-2 per week (barn), 2 (excreta storage)	8
73	2.876	n. s.			x					x (aviary)	straw, gravel				X a. n. s.	every 5 days (aviary), 4 (conser- vatory)	6
74	6.000	n. s.			x					x	straw	60 m ³	x a. n. s.			25	12
75	9.000	5			x					x	straw		3.600 dt			-	-
76	9.000	n. s.			x					x	sand, gravel				1.350 dt	136 days/ year	3
77	13.000	13		x					x ⁴⁾		straw (barn), sand (canpied run)				1.190 dt	2	6

farm Nr.	stock size	stocking density animals per m ²	breeders	pullets	laying hens	housing systems					litter material	accumulating amount of manure/slurry per year			manure removal per year	period of storage manure month	
						cages			barn	free range		slurry	manure				dry excreta
						battery	enriched	Small groups					moist	dry			
78 ⁵⁾	70 includ- ing broilers	n. s.			x					x	straw			5 m ³ including broilers	X a. n. s.	-	-
79 ⁵⁾	40	40 m ² per hen	x	x	x					x	straw, sawdust			0,2 dt including broilers		-	-
80 ⁵⁾	80	n. s.			x					x	spelt husk			5 m ³ including broilers		-	-
81 ⁵⁾	300	n. s.	20	100	180					x	sawdust, hay			60 dt including broilers		-	-
82 ⁵⁾	150	n. s.			x					x	straw			x a. n. s.		-	-
83 ⁵⁾	500 includ- ing broilers	n. s.			x				x	x	straw			30 m ³ including broilers		-	-
84 ⁵⁾	1.300 includ- ing broilers	n. s.			x				x	x	straw, sawdust		x total:	x 350-400 dt including broilers		12	6
85 ⁵⁾	2.000	4			x					x	straw			250 m ³ including broilers		2	3

1) n. s. = not specified

2) a.n.s. = amount not specified

3) - = questionnaire without this item (old version)

4) Canopied chicken run: three times a year; group 1 and 2 whole scratching area: weekly to fortnightly; group 3 1/3 scratching area: weekly to fortnightly, deep pit once a year

5) Barn system with deep pit and elevated perches, canopied chicken run

6) Farms with egg and meat production

Table 26: Organic farms, meat production

farm Nr.	stock size	stocking density animal per m ²	breeders	broilers	housing systems					litter material	accumulating amount of manure/slurry per year			manure removal per year	Period of storage manure month	
					cages			barn	free range		slurry	manure				dry excreta
					battery	enriched	small group					moist	dry			
78 ³⁾	70 Including laying hens	n. s. ¹⁾		x					x	straw			x 5 m ³ including laying hens	x a. n. s.	- ²⁾	-
79 ³⁾	50	40 m ² per animal		x					x	straw, sawdust			0,2 dt including laying hens		-	-
80 ³⁾	3 x 60	n. s.		x					x	spelt husk			5 m ³ including laying hens		-	-
81 ³⁾	120	n. s.	20	100					x	sawdust, hay			60 dt including laying hens		-	-
82 ³⁾	100	n. s.		x					x	straw			x a. n. s.		-	-
83 ³⁾	500 including laying hens	n. s.		x				x	x	straw			30 m ³ including laying hens		-	-
84 ³⁾	1.300 including laying hens	n. s.		x				x	x	straw, sawdust		x total:	x 350-400 dt including laying hens		12	6
85 ³⁾	1.200	8		x					x	straw, sawdust			250 m ³ including laying hens		3	3

farm Nr.	stock size	stocking density animal per m ²	breeders	broilers	housing systems					litter material	accumulating amount of manure/slurry per year			manure removal per year	Period of storage manure month	
					cages			barn	free range		slurry	manure				dry excreta
					battery	enriched	small group					moist	dry			
86	800	n. s.		x				x	x	straw, sawdust			approx. 300 dt	8-10	3-4	

1) n. s. = not specified

2) - = questionnaire without this item (old version)

3) Farms with egg and meat production

Analysis of questionnaire

89 questionnaires were returned. 27 questionnaires were send back by conventional farms and 62 by organic farms. 22 farms of the 27 conventional holdings kept laying hens and 5 farms broilers. 53 farms of the 62 organic holdings kept laying hens, 8 farms laying hens as well as broilers and 1 farm broilers.

Stock size

Table 27: livestock size

	1-49	50-99	100-499	500-999	1.000-4.999	5.000 - 9.999	10.000-49.999	Over 50.000
Conventional farms egg production n = 22	1	1		1	2	1	7	9
Conventional farms meat production n = 5							3	2
Organic farms egg production n = 61	12	13	20	4	8	3	1	
Organic farms meat production n = 9		2	3	1 1 including laying hens	1 1 including laying hens			

There are great differences in the livestock size between conventional and organic farms (table 27). The most obvious discrepancies can be found between organic and conventional farms with meat production. The conventional farms have livestocks of 25.000 to 210.000 broilers, whereas the organic farms have livestocks of 50 to 1.200 broilers. The same tendency can be seen on farms that keep laying hens. 9 conventional farms with laying hens have more than 50.000 animals (50.000 to 340.000), but there was only one organic farms of this size. Only one organic farm falls in the category of 10.000 to 49.999 laying hens, whereas 7 conventional farms have a livestock size of 10.000 to 49.999 laying hens. The most organic farms (45) have a livestock size of 1 to 499 laying hens. Only two conventional farms fall in this category.

Housing systems

Table 28: housing systems

Type of farm	laying hens				broiler	
	battery cages	enriched cages	barn	free range	barn	free range
conventional n = 27 ¹	5	4	14	5	5	
organic n = 62* ¹			10	56	3	9

* 8 farms kept laying hens and broilers

¹ please note that some laying hens can be registered twice due to seasonal changing housing systems and that farms which use more than one housing system can also be registered twice

9 conventional farms keep their laying hens in cages. 5 of these farms still had battery cages, but have to reorganise their housing systems, because battery cages are banned in Germany since the 1st January 2009. Cage systems are not allowed on organic farms, so this housing system does not exist on organic holdings. On organic farms free range systems are the predominant housing system, whereas only 5 conventional farms keep their laying hens in free range systems. In comparison to the other conventional farms with egg production (4.000 to 340.000 animals) of these 5 farms 4 farms are very small (40 to 1.500 laying hens). In the future barn systems will be the dominant housing system because of the ban of battery systems. The good half of the conventional farms with egg production already keeps their laying hens in barn systems. A minority of the organic farms keeps the laying hens also in barn systems but these hens must have access to a conservatory or chicken run. In the chicken meat production on conventional farms, barn systems are already the predominant housing system. All boilers are kept in barns systems. Again, a minority of the organic farms, 3 farms in the questionnaire survey, keep their broilers in barn systems; these animals must also have access to a conservatory or chicken run. Most of the organic broilers are kept in free range systems.

Litter material**Table 29: litter and line of production, please note some farms use more than one litter material**

litter	conventional farms				organic farms			
	breeder n = 3	layer n = 15	pullet n = 10	broiler n = 3	breeder n = 3	layer n = 60	pullet n = 5	broiler n = 9
straw	2	4	4	2	1	48	4	7
sawdust		9	6	1	3	15	3	5
soil		3				2		
sand						5	1	
coarse sand						1		
lava sand						1		
Lava rock meal						1		
spelt husk	1					7		1
none		2	1			1		
gravel		1	1			2		
wood shavings		2						
wood chips						2		
grass from meadow						1		
hay					1	1		1
chaff						1		
Miscanthus						1		
chaffed straw		1						
„Baumschnitt-häcksel“						1		
not specified		1						

Conventional farms, which keep breeders, have straw and spelt husk as litter. The predominant litter on conventional farms with laying hens is sawdust (9 farms). Straw (4 farms) and soil (3 farms) were also often ticked on the questionnaire. In addition the following materials are used as litter: none (2 farms), wood shavings (2 farms), gravel (1 farm) and chaffed straw (1 farm). Furthermore, most of the pullets are kept on sawdust (6 farms) or straw (4 farms). Gravel (1 farm) and none (1 farm) were also used as litter for pullets. Conventional farms with meat production use straw and sawdust as litter. Most of the organic farms that keep breeders use sawdust as litter (3 farms); straw (1 farm) and hay (1 farm) are also used. Straw is the most used litter material on organic farms with egg production (48 farms). Sawdust (15 farms), spelt husk (7 farms) and sand (5 farms) are also frequently occurs

as litter. In addition, the following materials are used as litter: soil (2 farms), gravel (2 farms), wood chips (2 farms), coarse sand (1 farm), lava sand (1 farm), lava rock meal (1 farm), none (1 farm), grass from meadow (1 farm), hay (1 farm), chaff (1 farm), Miscanthus (1 farm) und “Baumschnitthäcksel” (1 farm). On organic farms pullets are kept on straw (4 farms), sawdust (3 farms) or soil (1 farm). Straw (7 farms) and sawdust (5 farms) are the most often used litter materials for the keeping of organic broilers. One farm keeps their broilers on spelt husk and another on hay.

In summary it can be said that sawdust is the predominant litter material on conventional farms and straw the predominant litter material on organic farms.

Table 30: litter and housing systems, please note some farms use more than one litter material

litter	laying hens and pullets				broiler	
	battery cage	enriched cage	barn	free range	barn	free range
straw		2	13	45	7	7
sawdust		2	14	15	3	5
soil			2	3		
sand			1	5		
coarse sand				1		
lava sand				1		
lava rock meal				1		
spelt husk			3	6		1
none	3	1		1*		
gravel			2	2		
wood shavings			1	1		
wood chips				2		
grass from meadow				1		
hay				1		1
chaff			1	1		
Miscanthus				1		
chaffed straw				1		
„Baumschnitt-häcksel“				1		
not specified	1					

*Mobile house

Table 30 shows the correlation of used litter materials and housing systems. There is no litter in battery cages. Straw (2 farms) and sawdust (2 farms) are used as litter for enriched cages. One farm had no litter in their enriched cages, though litter is mandatory according to Directive 1999/74/EC. The most common litter materials in barns systems for laying hens are sawdust (14 farms) and straw (13 farms). Spelt husk (3 farms), soil (2 farms) and gravel (2 farms) were also often ticked on the questionnaire. Straw (45 farms) is the predominant litter material used for laying hens kept in free range systems. In addition, the following materials are often used as litter in this housing system: sawdust (15 farms), spelt husk (6 farms), sand (5 farms), soil (3 farms), gravel (2 farms) and wood chips (2 farms). Straw is the most often used litter material for broilers kept in barn systems (7 farms) as well as in free range systems (7 farms). The other important litter material in the meat production is sawdust.

In summary it can be said that straw and sawdust are the most often used litter materials in all housing systems.

Accumulating amount of manure and slurry

Table 31: accumulation of manure / slurry

Type of farm	Slurry	Manure moist	Manure dry	Dry excreta	Not specified
Conventional egg production*	1	3	11	8	2
Conventional meat production			5		
Organic egg production*		12	41	15	5
Organic meat production*		1	9	1	

*Some farm farms had more than one type of manure

Dry manure is the predominant type of manure / slurry in all lines of production. On conventional farms with meat production dry manure is the only type of manure / slurry that accumulates.

Slurry accrues only on one conventional farm, which keeps laying hens in battery cages. Two organic farms that house laying hens in free range systems ticked slurry on the questionnaire, but can't have slurry, because in free range systems only manure or dry excreta accumulate.

In total dry manure is the predominant form of manure /slurry. It most frequently accumulated on conventional and organic farms with egg and meat production. Dry excreta and moist manure also often occur.

Manure / slurry storage

Table 32: storage time of manure / slurry

Type of farm	1-3 month	4-6 month	7-9 month	10–12 month	None	Not specified*
Conventional egg production	3	6		1	3	9
Conventional meat production	2	2			1	
Organic egg production	3	6	1	3	1	46
Organic meat production	1	1 + 1 (3-4 month)				6

*The first version of the questionnaire did not include this question

The first version of the questionnaire did not include question about the storage period of manure and slurry, so that 47 farms couldn't answer this question. Most of the farms store their manure over a period from 1 to 6 month. 4 farms didn't store manure at all and 5 farms stored manure over a period of 67 months.

Accumulating amount of manure / slurry

It was not possible to calculate the average amount of accumulating manure per laying hen or broiler, because there were great discrepancies between the filled in amounts (tables 21-24). For example one organic farm with 15 laying hens had 600 dt dry manure, one organic farm with 150 laying hens had 35 dt dry manure (including sand as litter), one organic farm with 350 laying hens had 250 dt dry manure, and one organic farms with 500 laying hens had 50 dt dry manure. Furthermore, a conventional farm with 160.000 laying hens (barn system and battery cages) produced 3.500 t dry manure and dry excreta, and another conventional farm (barn system and enriched cages) with 200.000 laying hens produced only 600 t dry excreta.

Calculation of the accumulating amount of manure

The amount of slurry can be neglected. In the questionnaire survey only one farm, which keeps laying hens in battery cages, produced slurry. Due to the ban of battery cages in Germany this farm has to establish another housing system and therefore slurry will no longer occur on this farm. According to the asked institutions slurry should no longer accumulate in laying hen husbandry.

It is impossible to calculate the amount of manure and/or dry excreta for the German chicken stock because it depends on various factors like housing system, litter material, dry matter content, feeding stuff, breed, size of chickens etc. In May 2007, 38.463.704 laying hens, 16.940.069 pullets and 59.221.711 broilers were registered in Germany. This data is the basis for a rough calculation of the accumulating manure/dry excreta.

38.463.704 German laying hens produce 5.000.281,52 dt dry excreta per year (basis 0,13 dt/laying hen and year), 1.230.838,528 m³ dry excreta per year (basis 0,016 m³/laying hen in 6 months), 1.153.911,12 t dry excreta per year (basis 3t/100 hens annually) or 5.000.281,52 t fresh excreta (basis 13 t/100 hens).

The 16.940.069 German chicks for egg production and pullets produce 1.016.404,14 dt dry excreta per year (basis 0,06 dt/pullet annually) or 304.921,242 m³ dry excreta per year (basis 0,009 m³/pullet in 6 months).

According to the calculation 59.211.711 German broilers produce 355.330,266 m³ manure per year (basis 0.006 m³ manure per broiler and year), 355.330,266 t per year (basis 0,6 t solid manure/100 broiler per year), 3.553.302,66 dt manure per year (basis 0,06 dt/broiler per year) or 4.145.519,77 dt manure per year (basis 0,07 dt/broiler per year).

5. Summary

The legal foundations for chicken husbandry in the European Union are Directive 1999/74/EC (laying down minimum standards for the protection of laying hens), Directive 98/58/EC (the protection of animals kept for farming purposes) and Directive 2007/43/EC (laying down minimum rules for the protection of chickens kept for meat production). According to Directive 1999/74/EC, the use of unenriched cage systems will be illegal as from 2012. In Germany and some other member states, conventional cage systems are banned from January 2009.

Throughout the EU, corresponding to Directive 2007/43/EC, the stocking density for broiler husbandry will be 33.kg/m² from 30th July 2010 onward. However, the new Directive allows, under compliance of additional obligations, a stocking density of 39 kg/m² and. 42 kg/m² respectively.

The Federal Statistical office recorded in 2007 75.829 farms with more than 3.000 chickens. In Total 72.883 of these farms kept laying hens and 8.680 chickens for meat production. Altogether 114.625.484 chickens (without counting turkeys, guinea fowls and bantan) were kept in Germany in 2007. In May 2007, 38.463.704 laying hens, 16.940.069 pullets and 59.221.711 broilers were registered in Germany. In Germany, the average size of chicken stock per farm in May 2007 was 760,2 laying hens and 6.822,8 broilers respectively.

In 2007, the German Federal Statistical Office had for the first time registered all farms with laying hens, i.e. stocks starting from one laying hen. In the previous years, only farms with more than 3.000 chickens were included in the official statistics. The main reason for the inclusion of all chickens is the threat of avian influenza.

One third of the German laying hen stock was found in Lower Saxony (13.387.828 LH). According to the statistical yearbook 2008, the majority of farms in all Federal States kept only one to 49 laying hens. The percentage of farms of this size of all farms was between 76 % in North Rhine Westphalia and 96 % in Bavaria. The biggest farms with 100.000 or more laying hens were situated in Lower Saxony. There were 29 Farms with 100.000 or more laying hens that kept in total 5.826.523 laying hens. With seven farms and 2.284.826 laying hens kept on these Saxony-Anhalt had the second largest number of farms with more than 100.000 chickens.

The percentage of cages systems in Germany decreased from 86,5 % in 2000 to 66,1 % in 2007. In 2007, the small group housing system was for the first time registered. They accounted for only 1,5 % of laying hen husbandry. It is likely that this will increase because of the ban of battery cages from the 31.12.2008. The percentage of barn systems has nearly tripled since 2000. In 2007, 17 % of the laying hens were kept in barn systems. The percentage of free range systems fell from 14,4 % in 2006 to 10,9 % in 2007. One reason for this decrease was, that in 2007, organic farms were registered separately for the first time. In previous years, organic

farms were added onto the percentage of free range systems. 4,4 % of laying hens were kept on organic farms in 2007.

Most of the farms which keep broilers, are located in Lower Saxony (1.845 farms), in Nordrhein-Westfalen (1.145 farms) and in Bavaria (866 farms). Just over half of the German broilers (31.586.145) were kept in Lower Saxony. The second largest broiler stock (5.026.954) was found in Mecklenburg-Vorpommern and Bavaria kept the third largest broiler stock (4.719.273). The majority of farms kept only very small broiler stocks. However, approx. 60 % of the broilers were kept in very big stocks (more than 50.000 animals). In the modern intensive broiler husbandry the animals are kept indoors the entire year. In Germany broilers are housed predominately on farms with big stocks in barn systems. In addition to intensive housing systems, a few Broilers, normally only on organic farms or farms with small stocks, are kept in extensive barn systems or free range systems.

The largest laying hen stocks in 2005 were found in the following member states: France (77.210.000 LH), Spain (59.980.000 LH), Germany (50.500.000 LH), Great Britain (49.010.000 LH) and Poland (48.580.000 LH). Europe-wide most laying hens were still kept in cages. Only 25 % of the animals were kept in alternative systems, i.e. 15 % in barn systems, 8 % in free range systems and 2 % on organic farms.

The chicken meat production in the EU-27 added up to 11,28 million tonnes in 2007, this equates to approx five billion slaughtered broilers. The most important producers were France with 16 %, Great Britain with 13 %, Spain as well as Germany each with 11 % and Italy with 9 %. In comparison to the laying hen husbandry there are no appreciable differences in the broiler industry throughout the EU. Barn systems were with almost 100 % the predominant housing system in all member states.

The term “chicken excreta” includes the mixture of faeces and urine excreted through the cloaca. This mixture also contains undigested feeding stuff, desquamated intestinal epithelium, residues of secretion, microorganism out of the intestinal flora, metabolites excreted with the urine as well as exogen components (e.g. feather, egg leftovers). Chicken excreta are dried chicken excreta, fresh chicken excreta or chicken manure with a low grade of litter. Dried chicken excreta are accruing fresh chicken excreta without litter or with a very low ratio of litter that are dried as fast as possible after defecation in deep pit or on manure belt, so that

the dry matter content is over 50 %. Dry chicken excreta can contain a low amount of crop litter and remains of feeding stuff or nitrogen content above 11 kg N/t fresh matter. Manure is a mixture of faeces and urine of animals as well as crop litter, usually straw and sawdust. Manure can contain remains of feeding stuff, cleaning water and run-off rain water. Solid manure is equated to chicken excreta that originate from chicken, turkey, duck, geese or other poultry fattening and have technological conditioned a high ratio of crop litter (≥ 7 kg litter per day per 3 t increase of biomass per year) or nitrogen content under 11 kg N/t fresh matter.

Fresh chicken excreta contain the following nutrients: water 56 %, OS 26 %, N 1,6%, P_2O_5 1,5 % and K_2O 0,9 %. The nitrogen compounds consist of 60 % uric acid, 2 % urea, 6 % total ammonical nitrogen and 32 % nitrogen residues (decomposition products of protein). The nitrogen content of chicken excreta can be reduced by 10 to 20 % through needs-based feeding. Litter and housing system have an influence on the percentage of inorganic material in the manure. Laying hens kept in free range systems carry the soil from the chicken run into the barn so that the mineral content of manure is increased. On some farms the mineral content of the manure can be 70 %.

We developed a questionnaire, because the statistics provided none and the literature only a few data about the accumulation of manure and slurry. Even less information could be gathered about the use of litter materials. The questionnaire was sent per email, fax or mail to 680 farms. 89 questionnaires were returned. 27 questionnaires were send back by conventional farms and 62 by organic farms. 22 farms of the 27 conventional holdings kept laying hens and 5 farms broilers. 53 farms of the 62 organic holdings kept laying hens, 8 farms laying hens as well as broilers and 1 farm broilers. Five of conventional farms still had battery cages. Cage systems are not allowed on organic farms, so this housing system does not exist on organic holdings. On organic farms free range systems are the predominant housing system, whereas only 5 conventional farms keep their laying hens in free range systems. The good half of the conventional farms with egg production keeps their laying hens in barn systems. In the chicken meat production on conventional farms, barn systems are already the predominant housing system. Almost all boilers are kept in barns systems. In summary it can be said that sawdust is the predominant litter material on conventional farms and straw the predominant litter material on organic farms. Straw and sawdust are the most often used litter materials in all housing systems, but there are also many other used litter materials like spelt husk, soil and

hay. Dry manure is the predominant type of manure / slurry in all lines of production. On conventional farms with meat production dry manure is the only type of manure / slurry that accumulates. Slurry accrues only on one conventional farm, which keeps laying hens in battery cages. Two organic farms that house laying hens in free range systems ticked slurry on the questionnaire, but can't have slurry, because in free range systems only manure or dry excreta accumulate. It was not possible to calculate the average amount of accumulating manure per laying hen or broiler, because there were great discrepancies between the filled in amounts.

It is impossible to calculate the amount of manure and/or dry excreta for the German chicken stock because it depends on various factors like housing system, litter material, dry matter content, feeding stuff, breed, size of chickens etc. The amount of slurry can be neglected. In the questionnaire survey only one farm, which keeps laying hens in battery cages, produced slurry. Due to the ban of battery cages in Germany this farm has to establish another housing system and therefore slurry will no longer occur on this farm. According to the asked institutions slurry should no longer accumulate in laying hen husbandry.

6. Zusammenfassung

Die gesetzlichen Grundlagen für die Hühnerhaltung in der Europäischen Union sind die Richtlinie 1999/74/EG (über Mindestanforderungen zum Schutz von Legehennen), die Richtlinie 98/58/EG (über den Schutz landwirtschaftlicher Nutztiere) und die Richtlinie 2007/43/EG (über Mindestvorschriften zum Schutz von Masthühnern). Gemäß der Richtlinie 1999/74/EG ist die Haltung von Legehennen in konventionellen Käfigen ab 2012 verboten. In Deutschland und einigen anderen Mitgliedsstaaten gilt dieses Verbot bereits ab 2009. Nach der neuen Regelung dürfen spätestens ab dem 30. Juni 2010 EU-weit nur noch 20 Masthähnchen pro m² Stallfläche gehalten werden (33 kg/m²). Allerdings erlaubt die neue Regelung unter Einhaltung zusätzlicher Auflagen eine Besatzdichte von bis zu 39 kg/m² bzw. 42 kg/m².

Das Statistische Bundesamt hat 2007 insgesamt 75.829 Betriebe mit mehr als 3.000 Hühnern erfasst. Von diesen Betrieben halten 72.883 Legehennen und 8.680 Masthühner. Insgesamt wurden 2007 114.625.484 Hühner (ohne Truthühner, Perlhühner und Zwerghühner) in Deutschland gehalten. Im Mai 2007 waren in Deutschland 38.463.704 Legehennen, 16.940.069

Junghennen und 59.221.711 Masthühner registriert. Der durchschnittliche Geflügelbestand pro Betrieb in Deutschland betrug im Mai 2007 760,2 Legehennen bzw. 6.822,8 Masthühner.

In den Statistiken des Statistischen Bundesamts für das Jahr 2007 wurden alle Betriebe mit Hühnerhaltung erfasst, d. h. Betriebe ab einem Huhn. In den Vorjahren wurden nur Betriebe mit mehr als 3.000 Tieren in die Statistik aufgenommen. Hintergrund hierfür dürfte die aviäre Influenza sein, da im Rahmen ihrer Bekämpfung alle Betriebe sowie auch Privatpersonen mit Hühnerhaltung registriert werden mussten.

Ein Drittel der deutschen Legehennen ist in Niedersachsen aufgestellt (13.387.828 LH). Laut dem Statistischen Jahrbuch 2008 hält ein Großteil der Betriebe in allen Bundesländern nur 1 bis 49 Legehennen. Der prozentuale Anteil der Betriebe dieser Größenordnung an der Gesamtbetriebszahl liegt zwischen 76 % in Nordrhein-Westfalen und 96 % in Bayern. Die meisten sehr großen Betriebe mit 100.000 und mehr Legehennen befinden sich in Niedersachsen. Dort gibt es 29 Betriebe mit 5.826.523 Legehennen in der Größenordnung 100.000 und mehr Legehennen. Sachsen-Anhalt ist mit 7 Betrieben und 2.284.826 Legehennen das Bundesland mit den nächst meisten Betrieben in dieser Größenordnung.

Der prozentuale Anteil der Käfighaltung sank in Deutschland von 86,5 % im Jahr 2000 auf 66,1 % im Jahr 2007. Die Kleingruppenhaltung wurde 2007 zum ersten Mal als eigenständige Haltungsform registriert. Ihr Anteil betrug nur 1,5 %, es ist aber davon auszugehen, dass dieser Anteil aufgrund des Verbots der konventionellen Käfighaltung ab dem 31.12.2008 stark ansteigen wird. Der prozentuale Anteil der in Bodenhaltung gehaltenen Legehennen hat sich seit 2000 fast verdreifacht. 2007 wurden 17 % der Legehennen in Bodenhaltung gehalten. Der Anteil der Freilandhühner sank von 14,4 % in 2006 auf 10,9 % in 2007. Der Hauptgrund für diesen Rückgang ist, dass ökologische Betriebe 2007 zum ersten Mal gesondert in den Statistiken aufgeführt wurden. In den Vorjahren wurden diese Betriebe bei der Freilandhaltung mit eingerechnet. 2007 wurden 4,4 % der Legehennen in ökologischen Betrieben gehalten.

Die meisten Betriebe mit Masthuhnhaltung findet man in Niedersachsen (1.845 Betriebe), in Nordrhein-Westfalen (1.145 Betriebe) und in Bayern (866 Betriebe). Gut die Hälfte der deutschen Masthähnchen (31.586.145) wird in Niedersachsen gehalten. Den zweit größten Masthuhnbestand gibt es in Mecklenburg-Vorpommern (5.026.954) und den dritt größten in Bayern (4.719.273). Die Mehrzahl der Tierhalter hält sehr kleine Bestände. Jedoch etwa 60 %

der Masthühner werden in sehr großen Beständen (mehr als 50.000 Tiere) gehalten. Die ganzjährige Stallhaltung ist die Haupthaltungsform in der modernen und intensiven Masthühnerhaltung. Diese erfolgt in Deutschland überwiegend in großen Tierbeständen in Bodenhaltung. Neben der intensiven Bodenhaltung werden Masthühner selten, meist nur in ökologischen Betrieben oder bei kleinen Tierbeständen, in Haltungsformen mit extensiver Bodenhaltung im Stall oder in Freilandhaltung gehalten.

Die größten Legehennenbestände gab es 2005 in der EU-27 in folgenden Mitgliedsstaaten: Frankreich (77.210.000 LH), Spanien (59.980.000 LH), Deutschland (50.500.000 LH), Großbritannien (49.010.000 LH) und Polen (48.580.000 LH). 2007 wurden die meisten Legehennen in der EU immer noch in Käfigen gehalten. Nur 25 % der Tiere wurden alternativ gehalten, d.h. 15 % in Bodenhaltung, 8 % in Freilandhaltung und 2 % in ökologischen Haltungsverfahren.

Die Geflügelfleischproduktion der EU-27 betrug 11,28 Millionen Tonnen im Jahr 2007. Das entspricht etwa 5 Milliarden geschlachteten Masthühnern. Die größten Erzeugerländer waren Frankreich mit einem Anteil von 16 %, Großbritannien mit einem Anteil von 13 %, Spanien sowie Deutschland mit einem Anteil von jeweils 11 % und Italien mit einem Anteil von 9 %. Im Gegensatz zur Legehennenhaltung gibt es bei der Masthühnerhaltung in der EU keine nennenswerten Unterschiede. In allen Mitgliedsstaaten dominiert die Bodenhaltung mit einem prozentualen Wert von fast 100 %.

Der umgangssprachlich gebrauchte Begriff „Geflügelkot“ umfasst das durch die Kloake ausgeschiedene Exkrementegemisch aus Kot und Harn. Dieses Gemisch enthält außerdem unverdaute Futterbestandteile, abgestoßene Darmepithelien, Rückstände von Sekreten, Mikroorganismen aus der Darmflora, im Harn ausgeschiedene Stoffwechselprodukte sowie exogene Bestandteile (z.B. Federn, Eierreste). Geflügelkot ist Geflügeltrockenkot, Geflügelfrischkot oder einstreuarmer Geflügelmist. Im Einzelnen ist Geflügeltrockenkot anfallender Frischkot ohne (oder mit sehr geringen Anteilen von) Einstreu, der nach dem Absetzen in Kotkellern oder auf Kotbändern möglichst schnell auf einen Trockensubstanzgehalt von über 50 % getrocknet wird. Geflügeltrockenkot darf technologisch bedingt einen geringen Umfang von pflanzlicher Einstreu und Futterresten oder einen Stickstoffgehalt von mehr als 11 kg N/t Frischmasse enthalten. Festmist ist ein Gemisch aus Kot und Harn von Tieren sowie

pflanzlicher Einstreu, welche in der Regel aus Stroh oder Sägespänen besteht. Festmist kann Futterreste sowie Reinigungs- und Niederschlagswasser enthalten. Dem Festmist sind Geflügelexkremente gleichgestellt, die in den Haltungsverfahren Hähnchen-, Puten-, Enten-, Gänse- und sonstiger Geflügelmast bzw. -zucht technologisch bedingt einen hohen Anteil pflanzlicher Einstreu (≥ 7 kg Einstreu pro Tag je 3 t Lebendmassezunahme im Jahr) oder einen Stickstoffgehalt von weniger als 11 kg N/t Frischmasse enthalten.

Frischer Hühnerkot hat folgende Zusammensetzung an Hauptnährstoffen: Wasser 56 %, OS 26 %, N 1,6%, P_2O_5 1,5 % und K_2O 0,9 %. Die Stickstoffverbindungen setzen sich wiederum aus 60 % Harnsäure, 2 % Harnstoff, 6 % Ammoniumstickstoff und 32 % Reststickstoff (Abbauprodukte aus Protein) zusammen. Der Stickstoffgehalt in den Exkrementen kann durch bedarfsgerechte Fütterung in der Legehennenhaltung um 10 bis 20 % vermindert werden. Einstreumaterialien und Haltungsform haben Einfluss auf den anorganischen Anteil des Geflügelmists. So tragen Freilandhühner Sand vom Auslauf in den Stall und erhöhen somit den Mineralgehalt im Mist. Bei einigen Betrieben beträgt der anorganische Anteil des Mistes 70 %.

Da wir in den Statistiken und der Literatur kaum Angaben zum Anfall der Hühnerkotmenge und noch weniger Angaben zur Verwendung von Einstreumaterialien entnehmen konnten, haben wir einen Fragebogen entwickelt. Der Fragebogen wurde an 680 Betriebe per Email, Fax und Post versendet. Davon wurden 89 Fragebögen zurückgeschickt. 27 Fragebögen wurden von konventionellen Betrieben und 62 Fragebögen von ökologischen Betrieben ausgefüllt. 22 der konventionellen Betriebe hielten Legehennen und 5 Masthühner. Von den 62 ökologischen Betrieben hielten 53 Legehennen, 8 Legehennen und Masthühner sowie 1 Betrieb nur Masthühner. 5 konventionelle Betriebe hielten immer noch Legehennen in konventionellen Käfigen. Da die Käfighaltung in der ökologischen Landwirtschaft nicht erlaubt ist, existiert diese Haltungsform nicht in den ökologischen Betrieben. Dort wurde die Mehrzahl der Hennen im Freiland gehalten, wohingegen nur 5 konventionelle Betriebe Legehennen in Freilandhaltung hatten. Gut die Hälfte der konventionellen Betriebe hielt ihre Legehennen in Bodenhaltung. Alle konventionellen Masthähnchen wurden in Bodenhaltung gehalten. Zusammenfassend kann gesagt werden, dass Sägespäne das häufigste verwendete Einstreumaterial in konventionellen Betrieben und Stroh das häufigste verwendete Einstreumaterial in ökologischen Betrieben ist. Stroh und Sägespäne sind die in allen Haltungssystemen am meisten verwendeten Einstreumaterialien. Allerdings werden auch viele andere Materialien

wie z.B. Dinkelspelzen, Erde und Heu als Einstreu genutzt. Trockener Mist ist die vorherrschende Form von Mist und Gülle in allen Produktionszweigen. Bei konventionellen Hühnermästern ist es die einzige anfallende Mistform. Nur auf einem konventionellen Betrieb mit Legehennenhaltung in konventionellen Käfigen fällt Gülle an. Zwei ökologische Betriebe mit Freilandhaltung haben auf dem Fragebogen Gülle angekreuzt, jedoch kann bei dieser Haltungsform keine Gülle sondern nur Mist oder Geflügelkot anfallen. Es war aufgrund der stark schwankenden Angaben nicht möglich anhand der Fragebögen die anfallenden Mistmengen zu errechnen.

Es ist unmöglich den Mist- bzw. Kotanfall für den deutschen Hühnerbestand genau zu berechnen, da es zu viele Einflussfaktoren gibt. Die Haupteinflussfaktoren sind unter anderem Haltungsform, Einstreumaterial, Trockensubstanzgehalt, Fütterungsart, Hühnerrasse und Größe der Hühner. Die anfallende Menge Gülle kann vernachlässigt werden. Bei der Fragebogenumfrage hatte nur ein Betrieb Gülle, da dieser seine Legehennen noch in konventionellen Käfigen ohne Einstreu hielt. Aufgrund des Verbots der Käfighaltung in Deutschland muss dieser Betrieb jedoch umgerüstet werden und somit wird auch hier keine Gülle mehr anfallen. Entsprechend der Auskunft der befragten Einrichtungen sollte in Deutschland keine Geflügelgülle mehr anfallen.

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