Bundesforschungsanstalt für Landwirtschaft

Aus dem Institut für Betriebswirtschaft, Agrarstruktur und Ländliche Räume

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Environmental and Social Standards in Crop and Chicken Production in Brazil and Germany
- The Impact on Production Costs -

Manuskript, zu finden in www.fal.de

Braunschweig
Bundesforschungsanstalt für Landwirtschaft (FAL)
2000

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International Farm Comparison Network

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Environmental and social standards in crop and chicken production in Brazil and Germany:

The impact on production costs

FAL Braunschweig, Germany

Please note: This report forms the farm level part of a project that IFCN performed in co-operation with the Centre of Development Research (ZEF) at the University of Bonn and the Centre for Advanced Studies in Applied Economics (CEPEA) at the University of São Paulo, Piracicaba, Brazil. The project has been financed by the German Federal Ministry of Agriculture. The complete report has been published by ZEF.

Content

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1 Introduction

International trade with agricultural goods has been rapidly increasing in the last decades. After the failure of the negotiations in Seattle to introduce a new WTO-Round, the process of trade liberalization is interrupted for the time being. Some of the reasons for the failure of Seattle were dissension between member states and different stakeholders on the extent of liberalization in the agricultural sector as well as on the definition and assessment of environmental and social standards.

Agricultural entrepreneurs in Germany and other European countries fear that their international competitiveness is restricted by comparably high environmental standards. It is assumed that countries with less restrictive environmental and social conditions have a competitive advantage because they can sell their goods produced at the expense of the environment and the agricultural workers for a lower price on the world market. Differences between environmental and social standards are therefore denounced as unfair, and industrialized countries ask developing states to raise their standards to their own level. Empirical proof for this hypothesis in the agricultural sector has not been found so far.

The following report is an attempt to quantify the impact of environmental and social standards in agricultural production with the help of case studies. Selected countries are **Germany** and **Brazil**. Selected products for comparison are:

- **Soya** in Brazil and **rape-seed** in Germany
- **Corn** in Brazil and **wheat** and **barley** in Germany
- **Chicken** in Brazil and Germany

The report is divided into two parts. The first part in chapter 2 deals with a detailed description of the production systems of the products mentioned above. The second part (chapter 3) provides a cost of production analysis and explanations for cost differences using the harmonised standards of IFCN. The main part of chapter 3 is dedicated to the identification and description of environmental and social standards in Brazil and Germany and the analysis of their effects on production cost. It should be mentioned that chapters 2 and 3 of this report are equivalent to chapters 5 and 6 of the ZEF-report.

The report is the first IFCN-report that explicitly deals with the question of which impact legislative framework conditions have on agricultural production. In the following years, it is planned to conduct further research on this topic within IFCN.

2 Production Systems

In this chapter, after a short description of the data basis (2.1) the production systems of the products investigated are described (2.2 and 2.3). Chapters 2.4 and 2.5 describe the environmental situation and the expansion potential of the typical farms in Brazil and Germany, respectively.

The description of the systems in chapters 2.2 and 2.3 is done in chronological order of activities undertaken. The start and ending points are shown in Table 2.1.

Table 2.1: Definition of starting and ending points of analysis

	Production	
	Start	End
Corn Wheat Barley Soybean Rape-Seed	Post-Harvest Tillage	Harvest
Chicken	Purchase of chicks	Sale of chicken
Source: IFCN illustration		IFCN, DEBLITZ (1999)

It should be noted that the systems described are not representative for all production systems in the countries considered. Despite their importance for some regions, transportation costs between farm gate and processing plants could not be considered in a systematic way because the differences between individual farms and industries vary significantly.

2.1 Data base

The data basis for the case studies had to meet the following requirements:

- It should provide a realistic illustration of the situation in the countries considered
- It should be as much as possible up to date (Prices, Legislation)
- It should allow the illustration of the physical procedures of the farm activities (Influence of the production system on production cost)
- It should allow a differentiation of financial figures into their physical and their price part (for assessment of the cost components influenced by standards).
- It should provide the possibility generalise the results as much as possible.

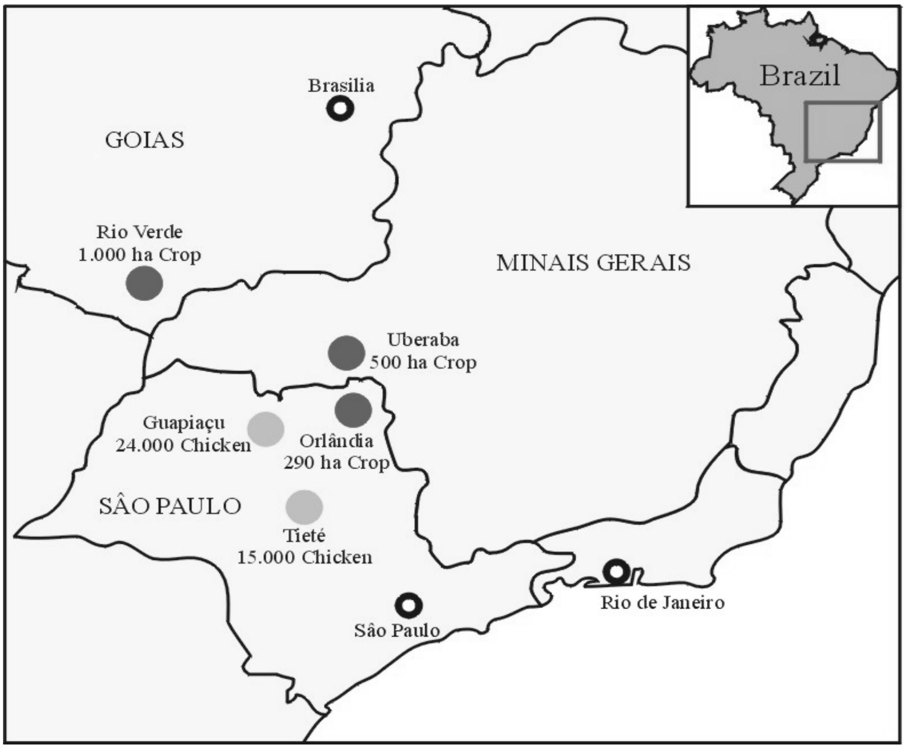
Against the background of these requirements, the use of statistical averages or individual farm data were not appropriate. Instead, the concept of typical farms was used and own surveys to generate the data basis were conducted. The surveys and the farm level analysis took place within the framework of the International Farm Comparison Network (IFCN).[1]

For arable production, 3 typical farms in Brazil and 4 typical farms in Germany were selected. For chicken production, data from 2 typical farms in Brazil and from 1 typical farm in Germany were available. The data were collected on spot in close co-operation with farmers and advisors. Maps 2.1 and 2.2 show the location of the typical farms in Germany and Brazil.

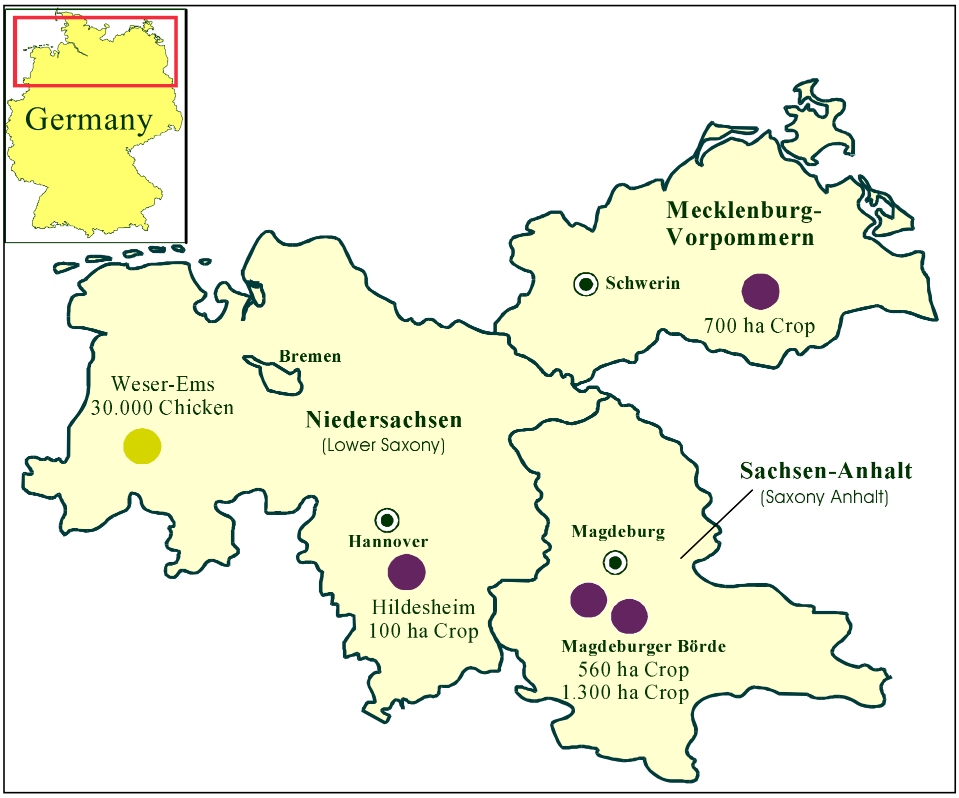
The Brazilian farms are located in the states São Paulo, Minas Gerais and Goias. The German arable farms are located in the regions South Hanover (Hildesheimer Börde), Saxony-Anhalt (Magdeburger Börde) und Mecklenburg-Vorpommern. The chicken farm is in the north west of Germany (Weser-Ems). It is clear that the farms can not be representative for Brazil or Germany but the reflect the present situation and technology of arable and chicken farms in the regions considered. A detailed description of the farms and the production systems is given in the following sections.

[1] For details on the concept and first results of IFCN see DEBLITZ et al (1998) and the IFCN-Homepage in the Internet at: http://www.fal.de/bal/ifcn.html

Map 2.1: Location of the typical farms selected for Brazil



Map 2.2: Location of the typical farms selected for Germany



2.2 Production systems for selected oil and grain crops in Brazil and Germany

In this report, soybean (Brazil) and rape-seed (Germany) were selected for comparing oilseed production. Corn (Brazil) as well as winter-barley and winter-wheat (Germany) were selected for comparing grain production.

Production of soybean and corn in Brazil as well as production of wheat, barley and rape-seed in Germany typically takes place in the same farms and in the same crop rotation. Hence, natural and legislative conditions for production of these crops are the same. For these reasons, the production systems of the crops selected are described for all crops in one country together.

A detailed description of the production systems is provided in Tables 2.2 and 2.3. The sections following summarise parts of the Tables and provide additional information not covered by the Tables.

Table 2.2: Comparative description of soybean production systems in Brazil and rape-seed in Germany (to be continued)

		Brazil - Soybean			Germany - Rape-Seed
		Orlândia	Uberaba	Rio Verde	Mecklenburg-Vorpommern Brandenburg
Systems					
Seasonality		Summer crop	Summer crop	Summer crop	Winter Crop
Crop rotations		Soybean - Corn (+ Safrinha in same year)	Soybean - Corn (+ Cover Crop in same year)	Soybean - Corn (+ Safrinha in same year)	1. Canola-Wheat-Barley 2. Canola-Wheat-Wheat-Barley
Tillage system		Conventional	No tillage	No tillage	Conventional
Harvest	No./year Month(s)	1 Feb or Apr	1 Mar	1 Feb or Apr	1 Aug
Yields	t/ha	2,4	2,4	3,2	3,6 - 4,0
Seed preparation and seeding					
Post-Harvest Tillage	Month No. of operations Operations	Oct 4 4 x Tillage	none	none	Jul/Aug 3 2 x Tillage 1 x Ploughing
Seeding/Planting	Month No. of operations Operations	Nov 1 Seed bed preparation including seeding	Nov 1 Seed bed preparation including seeding	Nov 1 Seed bed preparation including seeding	Aug 1 Seed bed preparation including seeding
Fertilising					
N-Fertiliser	No. of applications Type of fertilisers Total nutrient kg/ha	none	none	none	3 Ureas 220
P-Fertiliser	No. of applications Type of fertilisers Total nutrient kg/ha	1 Formulated N - P - K with Zn 70	1 Formulated N - P - K with Zn 70	1 Formulated N - P - K with Zn 70	1 [2)] Mono-Ammonphosphate 60
K-Fertiliser	No. of applications Type of fertilisers Total nutrient kg/ha	1 Formulated N - P - K with Zn (together with P) 70	1 Formulated N - P - K with Zn (together with P) 70	1 Formulated N - P - K with Zn (together with P) 63	1 [2)] Potassium-Magnesium 75

Table 2.2: Comparative description of soybean production systems in Brazil and rape-seed in Germany (continued)

		Brazil - Soybean			Germany - Rape-Seed
		Orlândia	Uberaba	Rio Verde	Mecklenburg-Vorpommern Brandenburg
Plant protection					
Herbicides Grass weeds	No. of applications	1	2-3	2-3	1
	Brand names	Roundup or Trifluralen (AgrEvo, Defensa, Nortox)	Round up + DMA 806 BR (if Comelina vengalensis) / Gramoxone / Verdict + mineral oil	Round up + DMA 806 BR (if Comelina vengalensis) / Gramoxone / Verdict + mineral oil	Fusilade or Gallant Super or Agil [3] 90 % Rape Oil / 10 % Parraffine as adhesive medium
Herbicides Broadleaves	No. of applications	1	2	2	1-2
	Brand names	Cobra + Classic	Cobra + Classic / Roundup (killing soybean leafs before harvest)	Cobra + Classic / Gramoxone or Gramocil (killing soybean leafs before harvest)	Butisan Top 90 % Rape Oil / 10 % Parraffine as adhesive medium
Fungicides	No. of applications	2	2	2	2
	Brand names	Vitavax-Thiram 200 SC + (Cobalt + Mylebdenium) / Derosal 500 SC	Vitavax-Thiram 200 SC + (Cobalt + Mylebdenium) / Derosal 500 SC	Vitavax-Thiram 200 SC or Vetran + (Co + Mo) / Benlate 500 or Derosal 500 SC	Folicur or Caramba
Growth Regulators	No. of applications	1	1	1	1 [6]
	Brand names				CCC-720
Insecticides	No. of applications	2-3	2-3	2-3	3
	Brand names	Nuvacron 400 / Curacron / Sulfluramide	Tamaron / Thiodan CE / Sulfluramide	Thiodan CE (prophylaxe) / Dimilin + Decis 25 CE (if necessary) / Sulfluramide (spot treatment)	Mesurol / Fastac SC
Harvest and post-harvest					
Harvest	Activities	1	1	1	July/Aug (Straight Cut Harvesting)
	Machine	Combine	Combine	Combine	Own Combine with Canola headder
Transport	Activities	1	1	1	July/Aug
	Machine	15 ton truck or a trailer	15 ton truck or a trailer	15 ton truck or a trailer	Own Tractor + Trailers
Drying	Share of Harvest to be dried (%)	100	0	100	33
	Water content before drying (%)	15		18	11
	Tolerated water content (%)	13	13	14	9
	Period	right after harvest		right after harvest	Aug
	Technology used	Coops drier		Coops drier	Own Stationary Drier / Aireation
	Energy source	heating fuel/propane		heating fuel/propane	heating fuel / propane
Storage / Marketing	Type of storage	Coops storage	Coops storage	Coops storage	Mostly on farm bin or flat storage
	Percentage stored %	100	100	100	100
	Period of Storage	depends	depends	depends	August-October
	Marketing	depends	depends	depends	25% contracted

1) together with Nitrogen
2) Once in a three year rotation **or** twice in a four year rotation
3) One of the three products
4) Every second year 3l/ha Round up Ultra
5) Thistle - shot; mostly just selected spots
6) Combined with first or second Fungicide Application
7) Combined with Fungicide Application in the same month
8) Borrowed spreader
9) i.e. flower used for coockies
10) based on 9 % water content
11) based on 15 % water content

Source: IFCN surveys and calculations — IFCN, DEBLITZ (1999)

Table 2.3: Comparative description of corn production systems in Brazil and wheat and barley in Germany

2.2.1 Brazil

Details on the natural conditions and the crop rotations systems are provided in Tables 2.4 and 2.5. The typical production system in the regions investigated is a crop rotation system with soybean and corn. While in the Orlândia region the *conventional* system with ploughing and tillage prevails, in Uberaba and Rio Verde *no-tillage* can be considered as being the typical system.

Table 2.4: Natural conditions of the typical arable farms in Brazil

Characteristics	Orlandia BR290OR	Uberaba BR500UB	Rio Verde BR1000RV	Tiête BR15TI	São José Rio Preto (Guapiaçu) BR24GU
Soil Class	very good	good	medium	n.r.	n.r.
Annual Rainfall mm	1.583	1.334	1.708	1.122	1.450
Rainfall Distribution	mainly October - March	mainly October -March (118 days/year)	mainly October - March	mainly October - April	mainly October - March
Average Temperature ° C (min - max)	22,3 (17 - 34)	21,9 (16 - 29)	22,5 (20 - 23,6)	21,6 (17 - 30)	23,5 (20,1 - 25,6)
End of Vegetation	May	April	April	May	May
Beginning of Vegetation	Oct/Nov	Oct/Nov	Oct/Nov	Sep/Oct	Oct/Nov

n.r.: not relevant for the study
Source: Own Survey
IFCN, DEBLITZ (1999)

Concerning costs the no-tillage system has less machinery and labour cost but higher herbicide costs compared to the conventional system. An advantage of the no tillage system is permanent and better cover of the top soil preventing evaporation and reducing erosion after heavy rains. Yields of no-tillage systems are reportedly the same or higher than conventional systems if the soil conditions (structure, organic matter and nutrient content) have been optimised before starting the no-tillage system.

To further avoid erosion, farmers use contour planting as the prevailing system. Planting follows the horizontal contour lines of the landscape and 'terraces' are established before planting by piling up soil in strips following the contour line up to 1 m height with a special machine. Distances between terraces vary between 10 m and up to 100 m depending on the slope. Establishment of the terraces must be done usually once in a few years but more often after particularly heavy rains.

Table 2.5: Land use and crop mix of the typical arable crop farms in Brazil

		Orlândia BR290OR	Uberaba BR500UB	Rio Verde BR1000RV
Total Farm Acreage	ha	290	500	1000 1)
Cropping system		Conventional	No tillage	No tillage
Share of Soybean in Crop Mix	%	80	60	70
Share of Corn in Crop Mix	%	20	40	30
Share of Safrinha 2) in soybean acreage	%	100 % corn	-	60 % Corn
Share of cover crop in soybean acreage	%	-	100 % Oats	20 % Beans, Turnips, Millet 20 % open land
Share of Safrinha in total corn production	%	80	-	42
Soybean yields	t/ha	2,4	2,4	3,2
Corn yields	t/ha	5,8 (3,0) 3)	6,0	6,9 (4,5) 3)

1) Plus 700 ha extensive beef pasture
2) Safrinha = Small Harvest = Second crop in one harvest year
3) Yield for Safrinha crop

Source: Own survey

IFCN, DEBLITZ (1999)

Climatic conditions in Orlândia and Rio Verde allow growing a second crop in one season whereas in Uberaba the dry conditions in winter time only support a cover crop (mainly oats) that is not harvested. The system of planting a second crop is called *Safrinha* (small harvest). If possible, farmers plant corn as Safrinha crop but also millet and sorghum and with less importance sunflower and beans are common. The decision on which crop is used as a Safrinha crop mainly depends on the market situation and the rain fall at the end of the growing season of the previous crop which is mainly soybean. However, it can be said that in the Orlândia region nearly all of the Safrinha is made of corn. With the low share of corn of only 20 % of the main crops, 80 % of the corn comes from Safrinha. In the Rio Verde region, the share of corn in Safrinha is about 60 % but only 40 % of the total corn production comes from Safrinha.

2.2.2 Germany

The German farms selected for analysis are located in areas with different natural potentials determined by soil types and climatic conditions (see Table 2.6). In addition to agricultural policy, the latter factors do not only influence the potential and the stability of physical yields but even the kind of production system applied. Details of the production systems are provided in Tables 2.2 and 2.3. In this section, a more general description of the prevailing production systems is given.

Table 2.6: Natural conditions of the typical arable farms in Germany

Characteristics	Weser-Ems-Kreis D28WE	Südhannover D100HI	Magdeburger Börde D560MD / D1300MD	Mecklenburg-Vorpommern D700MV
Soil Class	poor - medium	good - very good	very good	medium
Annual Rainfall mm	685	650	500	600
Rainfall Distribution	Well distributed	Well distributed	Shortage during May, early June, August and September	Shortage during May
Average Temperature ° C	9,6	8,3	8,9	8,1
End of Vegetation	End of November	End of November	Mid of October	End of October
Beginning of Vegetation	Beginning of March	Beginning of March	End of February	Mid of March
Source: IFCN Survey			IFCN	IFCN, DEBLITZ (1999)

The 100 ha farm is located in a very fertile region south to Hanover which is the traditional area of sugar-beet production in north western Germany. The traditional and typical crop rotation consists of beets and wheat (see Table 2.7). For reasons of field work organisation (especially during harvest time) and risk management, some farms do have barley in that area as well.

Under the current European agricultural policy sugar-beets generate highest gross margins among all crops that are politically influenced. The individual farms' sugar-beet acreage is primarily determined by its quota endowment. Contrary to the other German farms and areas analysed, South Hanover is in a comparably favourable situation in this respect and has high rotational share of beets (25 % vs. 8 % in Magdeburg and 4 % in Mecklenburg Vorpommern). Hence, rape seed in this area is of marginal importance only, whereas the three farms in eastern Germany have to grow rape seed as rotational substitute for beets (see Table 2.7)

In Mecklenburg Vorpommern rape seed is dominantly grown in a three year rotation with wheat and barley. In Magdeburg, the production of peas and a higher sugar-beet quota endowment reduce the percentage of rape seed grown compared to Mecklenburg. A four year rotation with wheat, wheat after wheat (or rye) and barley characterises the oilseed cropping system of the 1.300 and 560 ha farm in the Magdeburger Börde.

Poor up to middle class soils and a shortage of rainfall during spring time (May) allow for growing wheat after wheat in Mecklenburg to a small extent only. Yields decrease by 15 % up to 20 % in comparison to wheat after rape seed despite higher nitrogen and fungicide input.

Table 2.7: Land use and crop mix of the typical arable farms in Germany

		Südhannover	Magdeburger Börde	Mecklenburg-Vorpommern	Magdeburger Börde
Total Farm Acreage	ha	100	560	700	1.300
Share of Wheat in Crop Mix	%	60	42	31	42
Share of Wheat after Beets	%	40	19	13	19
Share of Wheat after Rape-seed	%	-	52	82	52
Share of Wheat after Wheat	%	60	29	5	29
Share of rape-seed in Crop Mix	%	-	15	27	15
Share of Barley in Crop Mix	%	7	10	22	10
Rape-seed Yields	t/ha	-	3,9	4,0	3,9
Barley Yields	t/ha	8,8	7,2	7,0	7,2
Wheat yields (weighted average)	t/ha	9,0	7,6	8,0	7,6
Source: IFCN survey				IFCN	IFCN, DEBLITZ (1999)

The coincidence of good soil and well distributed amounts of rainfall, comparably mild winters and early start of vegetation enables farmers in South Hanover to grow wheat after wheat with almost no shortfall in yields.

Growing cereals after cereals is done by conventional tillage on all selected German farms. Reduced tillage (without ploughing) is applied when wheat is grown after oilseed rape and in about 50 % of the cases after beets. The latter practice saves machinery and labour costs. Besides rotational restrictions, this is an important fact to be considered if the decision to grow rape or continuos wheat or any other cereal is to be made. This especially holds true for the large farms in eastern Germany as the whole farm long term labour and machinery organisation can be affected.

2.3 Chicken production in Brazil and Germany

A detailed description of the production systems is provided in Table 2.8. The following sections summarise parts of the Table and provides additional information not covered by the Table.

2.3.1 Brazil

Brazilian chicken production in 1998 was at 4,5 Mio. tons, i.e. ten times as much as Germany. The majority of the production takes place in the south and south-east of the country. The most important single state in 1998 was São Paulo with a production of 800.000 tons.

Two locations in São Paulo were selected for closer investigation (see Map 2.1):

- **Tiête**, close to Piracicaba
- **Guapiaçu**, close to São José do Rio Preto

The typical system of chicken production in Brazil and in the regions considered is integrated production. Farmers work on a contract basis for the processing company, follow the production pattern and use the technology imposed by the company. Typically, chicken is one enterprise amongst others (mainly corn, soybean, dairy and/or beef), providing only low margins but a permanent cash income. In the integrated system, farmers receive chicks, feed, medicine and veterinary services as well as extension service from the company.

Typical farms in the **Tiête** region have one barn (120 m * 10 m = 1.200 m²) with 15.000 chicken. The 60 days cycle (45 days fattening and 15 days break) results in 5,5 cycles per year. Average weight of the chicken is 2,2 kg Life weight. The comparably low average stocking density (12,5 chicken/m²) is aiming to reduce risk and losses at high variations of temperatures and humidity and is demanded by the industry.

Table 2.8: Comparative description of chicken production systems in Brazil and Germany

		Brazil		Germany
		Tiête	São José do Rio Preto (Guapiaçu)	North West (Emsland)
Fattening programme				
Fattening system	Short, Medium ...	Medium	Medium	Medium
Fattening period	Days	45	45	42
Final weight	g live weight	2.200	2.300	2.000
Cycles	No./ year	5,5-6	5,5-6	6,5
Barn				
Barn type	closed, open ...	Open (Louisiana)	Open (Louisiana)	Closed
Barn size	Lenght x Width (m)	120 * 10 m (1.200 m²)	132 * 12 m (1.584 m²)	80x16 (1.280 m²)
Chicken per barn	Number	15.000	24.000	30.000
Animal density	Number of chicken per m²	12,50	15,15	23
Housing				
Bedding	Type of material	Sawmeal and shavings from pinetrees (90 %) Rice skin (10 %)	Sawmeal and shavings from pinetrees (90 %) Rice skin (10 %)	Wheat straw, rye straw or shavings
	Quantity (kg/m²)	1,5	1,5	1,2-1,5
	Frequency	Once per cycle 3 times per year piling 1)	Once per cycle	Once per cycle
Feeding and Drinking				
Starter feeding	Duration of feeding period (days)	10 (1-10)	10 (1-10)	10 (1-10)
	Type of feed	59 % corn (8,4 % PB) 34 % Soybean (46 % RP) 5 % Animal meal 2 % Minerals and Premix	59 % corn (8,4 % PB) 34 % Soybean (46 % RP) 5 % Animal meal 2 % Minerals and Premix	Starter feed
	Amount (g per chicken)	276	315	235
	Use of water (ml per chicken)	588	588	576
	Means & Equipment	Manual feeding	Automatic feeding	Automatic feeding
Feeding-period 2	Duration of feeding period (days)	12 (11-22)	12 (11-22)	20 (11-30)
	Type of feed	59 % corn (8,4 % PB) 33 % Soybean (46 % RP) 4 % Animal meal 2 % Vegetable oil 2 % Minerals and Premix	59 % corn (8,4 % PB) 33 % Soybean (46 % RP) 4 % Animal meal 2 % Vegetable oil 2 % Minerals and Premix	Conventional or RAM-feed + 10-20 % whole corn wheat
	Amount (g per chicken)	916	996	1.638
	Use of water (ml per chicken)	1.537	1.684	3.170
	Means & Equipment	Manual feeding	Automatic feeding	Automatic feeding
Feeding-period 3	Duration of feeding period (days)	20 (23-43)	20 (23-43)	2 (31-32) / 8 (31-38) 2)
	Type of feed	66 % corn (8,4 % PB) 26 % Soybean (46 % RP) 4 % Animal meal 2 % Vegetable oil 2 % Minerals and Premix	66 % corn (8,4 % PB) 26 % Soybean (46 % RP) 4 % Animal meal 2 % Vegetable oil 2 % Minerals and Premix	Conventional or RAM-feed + 10-20 % whole corn wheat
	Amount (g per chicken)	2.681	2.956	252 / 1.104
	Use of water (ml per chicken)	3.876	4.034	461 / 1.969
	Means & Equipment	Manual feeding	Automatic feeding	Automatic feeding
Feeding-period 4	Duration of feeding period (days)	3 (43-45)	3 (43-45)	4 (39-42)
	Type of feed	67 % corn (8,4 % PB) 25 % Soybean (46 % RP) 3 % Animal meal 5 % Minerals and Premix	67 % corn (8,4 % PB) 25 % Soybean (46 % RP) 3 % Animal meal 5 % Minerals and Premix	Final feed
	Amount (g per chicken)	480	538	648
	Use of water (ml per chicken)	625	705	1.099
	Means & Equipment	Manual feeding	Automatic feeding	Automatic feeding
Medicine and Vaccination				
Performance Promoters	Names	not known		Zincbacitracine (TMPS, Baytril, Dicural)
Deseases	Names	1) Coccidiosis 2) Gumboro (Infectuous. Bursitis) 3) ND (Newcastle Desease) 4) IB (Infectuous Bronchitis) 6) Prophylaxis		1) Coccidiosis 2) Gumboro (Infectuous. Bursitis) 3) ND (Newcastle Desease) 4) IB (Infectuous Bronchitis) 5) ORT 6) Prophylaxis
Medicine	Type (Brand name or ingredient)	1) Prophylaxis 2) Vaccination 3) Vaccination 4) Treatment if outbreak 6) not known		1) Monensin-NA, Diclazuril 2) Vaccination 3) Vaccination 4) Treatment if outbreak 5) Treatment if outbreak 6) Mentofin 4,07 l, Oreganum Colipur, Fruit Vinegar
Cleaning and desinfection				
Manure removal	Frequency	Every second cycle 1)	Every cycle	Once after each circle
	Amount of manure (kg/m²)	20	20	
	Means & Equipment	Shovels, packed in 32 kg bags Costs: 5 R$/t for packing, 10 C/bag	Removal with tractor Put on trucks manually	Tractor Spread on the fields
Cleaning	No. of people	1	1	1
Desinfection	Total time required (h)	3 times per year one day each time	After each cycle 1 day each time	After each cycle 1 day each time
	Means & Equipment	High pressure cleaning machine Fog with Ammonia and Formaline	High pressure cleaning machine Fog with Ammonia and Formaline	High pressure cleaning machine

1) The litter is used two cycles. For the first cycle, fresh material is used for the young chicken. After the chicken are removed, the litter is piled in the middle of the barn and fermented. After that it is spread again and covered with fresh material. After the second cycle all remaining litter is removed.
2) 25 % of the chicken are removed and slaughtered after 32 days

Source: IFCN surveys and calculations

IFCN, DEBLITZ (1999)

The typical equipment consists of 2 lines with manual feeding. The bedding is used for 2 cycles. After the first cycle, the litter is piled with a tractor and fermented for a few days. After that, it is spread on the ground and supplement with fresh bedding. The collection of the bedding is done manually by the cattle feeder and the litter is put into bags.

Like in Tiête, typical farms in the **Guapiaçu** region have one barn which however is bigger (132 m*12 m = 1.584 m²) and holds 24.000 chicken. At average life weights of 2,3 kg per chicken the stocking density is at 15,15 chicken/m² higher than in Tiête but still lower than in German systems. Higher stocking rates were tested in the past and it was found that the chicken compete too much on food and water, thereby climbing and picking on each other with resulting skin damages. Carcasses with skin damages have been rejected by consumers. Like in Tiête, farmers realise 5,5 cycles per year with the same periods of fattening and breaks.

The typical equipment is a 3 line system with automatic feeding. Unlike in Tiête, the bedding is used only once and then removed with a tractor for the next cycle. Litter in this system is handled as a bulk product and not put into bags.

Both Brazilian farm hire half a person permanently plus occasional workers for picking the chicken. The farmers themselves usually helps during the first 15 days of each cycle.

The litter consists of saw-meal and shavings from the wood industry (sometimes + 10 % rice skins). Compared to Germany, an important characteristic in both regions is the sale of the litter to the cattle industry instead of spreading it as a fertiliser on the fields. The use the litter as a protein source and mix it with other feed components. The price is approximately DM 50 per ton (see also chapter 3.6.2.1).

2.3.2 Germany

The majority of German chicken production and processing takes place in the north of the country, in particular in the north west. Out of the 422.000 tons total chicken production in 1998 (ZMP, 1999), the majority was produced in the region Weser-Ems in the west of Lower Saxony. This region has a long tradition in producing pigs, eggs and chicken on a large scale. The typical chicken farm selected from this region has 27.000 chicken places (see Map 2.2).

The typical system of chicken production in the region considered is a non-integrated system. This means that farmers buy chicks, feed, medicine and veterinary services themselves, albeit in close co-operation and usually following advice from the chicken companies.

There are three main chicken production systems varying in terms of sale weights (LANDWIRTSCHAFTSKAMMER WESER-EMS, 1998):

- *Short term fattening* in a period of between 32 to 34 days, producing chicken with a life-weight of 1.500 g, mainly sold frozen as whole birds. Chicken density is between 22-24 animals per m², equivalent to a life-weight of 34 to 36 kg life-weight per m² at the end of the fattening period.
- *Medium term* fattening in a period of approximately 42 days, producing chicken with a life-weight of 2.000 to 2.300 g, mainly sold fresh as whole birds or in pieces. Chicken density is between 18-20 animals per m². In some cases, the medium term system is extended towards a *long term* system. In this case, the flock is divided by sex and stalled separately in the building. After 40-45 days the female chicken are removed at weights between 2.200-2.500 g and the male chicken are finished for another 10-15 days, using the whole building space and reaching life-weights up to 3.500 g.
- The *splitting system* is a mixture between short term and medium term fattening. After 32 to 34 days 20-25 % of the chicken is removed and the remaining chicken are finished in the medium term system, having more barn space available.

The **medium term** system is the most common and expectations are that its importance will increase. Because of the importance and because it can be best compared with the Brazilian system, the medium term system has been selected for comparison.

The typical farm realises 7 cycles per year in the medium term system. The average density is approximately 19 chicken per m². Chicken are typically housed in a conventional (closed) concrete barn with measures of 80 x 18 m (1.440 m²). The typical equipment is a four line feeding system with automatic feeders.

Amount and nutrient levels of **feeding** is usually adjusted to the life-weight of the animals and is divided three sections (starter feed day 1-10, fattening feed day 11-30, finishing feed day above > day 30). So-called RAM-feed with reduced protein- and phosphor-content is becoming increasingly important and leads to a reduction of the nitrate (up to 20 %) and phosphor-content (up to 35 %) in the manure.[2] Good experiences have been made with mixing about 20 % of wheat plus little stones into the rations.

Bedding is typically done with hard straw (rye or wheat) or shavings. The litter is removed after each cycle and immediately removed from the farm if possible. Contrary to Brazil, litter may not be fed to ruminants or other animals. Because of high livestock densities in the region Weser-Ems, the manure is sometimes transported over significant distances to arable farms further east who buy the manure as a fertiliser. Most of the manure is however spread on own or rented land. Farms with problems to meet the requirements of the "Düngeverordnung" (i.e. when there is a lack of land to spread all manure), usually sell the manure to a manure utilisation co-operative at a price of between DM 20 to DM 25 per ton. The contract usually has a duration of 10 years. The co-operative again contracts the manure against grains from East Germany. The same procedure is done in some cases with feed mills. In this case the farmer buys his grains exclusively from the feed mill that takes his manure.

Medicine and **veterinary** services is provided by local veterinarians. The veterinary is responsible for a start prophylaxis and provides a guarantee on the health status of the chicken. The typical diseases are basically the same as in Brazil (ND; Gumboro, Coccidiosis) plus some additional diseases of the respiratory tract. Most of the diseases are prevented by vaccination and provision feed additives, part of which are natural ingredients such as vinegar or ethereal oils.

Labour requirements are about 720 hours per year and barn and is mostly done by the farmers themselves. Additional casual labour is hired for picking the chicken.

2 Besides reduction of Ammonia (NH_3) in the air of the barn, the main advantage of reduced nutrient levels in the chicken manure is that less acreage for spreading the manure is needed. The total nutrient amount per ha is restricted by the "Düngeverordnung" (see chapter 3.4.1.2).

2.4 Environmental situation and expansion potential of production systems

Chapters 2.2 and 2.3 focused on the description of the existing production systems. In this chapter, the on-farm situation and the expansion potential of the farming systems investigated will be examined. Information was mainly gained from the meetings with farmers and advisors and is repeated here. As a consequence, the section does not claim for completeness.

2.4.1 Brazil

Orlândia

Orlândia farmers considered conventional tillage the most typical system in their region. However, like in other regions the no tillage system is gaining in importance and has some advantages such as reducing erosion of soils and number of machine operations.

Environmental issues mentioned by farmers further detailed below are:

(a) Legal Reserve and Permanent Preservation Areas (PPA)

(b) Discharge of pesticide packages

(c) Soil erosion

(d) Fire regulations and accidental fire in swamp areas.

(a) Legal Reserve and Permanent Preservation Areas – PPA

The farmers consider the Legal Reserve as the environmental law affecting them most. They know it is established with the objective to keep at least 20 % of native vegetation in the property. They also know about the extension of the original law to reforest at least 20 % of farmland when they do not have forest areas anymore. This set aside area must be registered by a notary public, the process called "averbação". Farmers must not do any action on that area without previous approval of the environmental agency in charge.

About the PPA, farmers know they must preserve the forest along the rivers. They know that in some cases this set aside area must extend to a strip of 30 meters from the stream. It is also known that PPA's reforestation must be done with native species.

As regards enforcement, farmers said that Legal Reserve holds in farms with areas where native areas still exist. They only preserve existing extensions of natural vegetation. In general, no one does reforestation for Legal Reserve proposes.

They suppose that existing Legal Reserve and Permanent Preservation Areas add to no more than 5 % of total land of that region. Total cost of reforestation is unknown for them. The adviser estimates them at about R$ 0,20 to R$ 3,00 for each seedling of native trees, depending on the species selected. About 1000 to 1800 plants are required per hectare, resulting in total planting cost of between R$ 200 and R$ 5.400.

Forest Police, the State Department of Natural Resource Protection (DEPRN) and the Federal Environmental Agency (IBAMA) make inspections in the region. These agencies have been drawing up written charges on farmers, commonly when there are indictments of neighbours. In these cases farmers have to pay a fee and usually must recompose the area with native species. The most common indictment cases in Orlândia are related to Permanent Preservation Areas. Whenever that happens a large control and inspection process is installed in the region.

Reforestation of PPA vegetation has been generally implemented in sugarcane areas because it has been usual that sugarcane is cultivated near the river and water streams edges.

(b) Disposal of chemical packages

People know that it is recommended to rinse the chemical packages at least three times before they are disposed. Some farmers follow these instructions, rinsing the packages just after the chemical application and returning this water into the sprayer and apply it to the crop. Concerning the treatment of the empty packages, the single recycling factory they know is far away and it would result in high transportation costs if they delivered these packages for recycling., As a consequence, they generally burn what is possible despite it is forbidden or store metal packages in some place of farm, waiting for a solution. They heard about a viability study for using a refund system for taking packages back to chemical industry.

(c) Soil erosion

Farmers consider erosion an issue under control in the region because they use contour planting and the region topography is plain. Orlândia has some areas cultivated in no tillage system and people do know about its advantages on eliminating erosion risks.

(d) Fire regulations

Fire regulations are well known and most discussions are about sugarcane production. Comments were made about the fact that if somebody, not the land owner, sets fire somewhere, the land owner is responsible too for the losses and for the reforestation of the destroyed area.

Expansion potential

Farmers believe that Orlândia's expansion potential depends on the development of the sugar and alcohol industry. It is likely that the importance of sugar production in this region will decrease in the future because of the following reasons:

- The pre-harvest burning of sugar cane will be banned in locations with a slope of less than 12 %. This will increase harvest costs. Steeper slopes can not be harvested with machines.
- There is already a move of sugar cane to the north west where land prices are lower, land is flat and mechanization is more profitable.

Probably, if sugarcane plantations leave Orlândia, grain crops will grow up. They expect that any increases in corn/soybean areas will be based on the no tillage system. Since almost all areas were already deforested, any expansion of grain crops will not cause additional negative environmental effects compared to the present situation.

However, also corn and soybean production is already expanding to Minas Gerais, Goias, Maranhão, Bahia and other States (Mato Grosso and Mato Grosso do Sul), i.e. towards north and center-west direction.

Uberaba

As in Orlândia, farmers are aware of problems related to Legal Reserves, PPA, packages of chemicals and fire regulations. There is only a weak inspection on environmental issues. Problems for farmers occur usually under indictments. Anyway, inspection agents make visits in the areas, sometimes watch them by helicopters.

Environmental agencies acting in that region, responsible for controlling and providing approvals are the State Forest Institute (IEF), IBAMA and the Forestry Police.

(a) Legal Reserve and PPA

Native forest along the rivers is scarce, even considering the large Rio Grande margins. About this PPA, farmers know they must conserve forest along the rivers. They know that the strip preserved must be 100 meters or 30 meters depending on the size of rivers.

Farmers do not reforest the 20 % that the Legal Reserve law requires and they do not recompose the marginal areas of rivers and other water streams either. Costs estimates to reforest with native vegetation amount to US$ 2500 per hectare (approx. 4.600 DM). However, farmers stated they preserve the still existing forest areas. Authorization approvals are required by environmental agencies even to cut eucalyptus and for any action they wish to do in forest preservation areas. With regard to the future enforcement of reforestation, state laws are being discussed that permit the use of (less productive or forest) areas outside their farms to comply with the Legal Reserve requirements. This is the main reason why enforcement is not yet done in a strict way.

Farmers commented about some Environmental Protection Area (APA) projects for Uberaba region. The APA is a special area for preservation of natural vegetation and biodiversity, covering several counties.

They have not heard about juridical processes concerning environmental issues in that region.

(b) Disposal of chemical packages

Three times rinsing of packages were proposed a long time ago but it is not clear if it is applied by all farmers. Some farmers burn packages, others throw them away on the roads, and others still hold them in the property, waiting for another solution like some kind of recycling processing plant be built in the region and take these packages away.

They consider that the importance of wearing appropriate clothes during chemical application should be better explained to people, mainly to workers. Even in cases they have the suitable clothes, workers do not wear them because they do not fully understand the health risks they are exposed to.

(c) Soil erosion

Increasing no tillage system, the most common case in Uberaba crop farming, has effects on decreasing erosion levels. On the conventional system construction of terraces is not enough to prevent erosion caused by water and wind in this region. Erosion leads to two kinds of economic losses:

- causing damages in harvest in areas deeply eroded
- yield reduction caused by fertiliser run-off.

Avoiding these disadvantages and gaining others (like reduction of machine use) provides incentives to further increase the no tillage system in region. Farmers also pointed out that after expansion of the no tillage system animal and bird population has increased.

Expansion potential

Farmers expect that the no tillage system will further expand, unless some problems occur such as, for example, any increase of weeds.

Expansion expectation is mainly related to increasing yields but they stressed it is necessary to invest in seeds and production technology. There is a chance that eucalyptus and pasture areas can be converted to grains. They believe the North direction frontier will expand only with financial help.

Rio Verde

Like in the two other areas, main environmental concerns are Legal Reserve and PPA, discharge of chemical packages and soil erosion.

(a) Legal Reserve and PPA

Farmers reported that total preservation area in Rio Verde is about 26 % of the land, including PPAs. Generally, farmers have managed to cut the trees and only preserving the 20 % minimum native vegetation determined by Law.

In general, inspection happens mainly on Legal Reserve. Native vegetation areas to be preserved still exist to a small extent in the Rio Verde region. Legal Reserve specially becomes a problem for farmers whenever they want to sell or buy the land.

So far, using areas outside the actual farm area for legal reserve or commonly use of areas dedicated to Legal Reserve has not been supported by public power but these issues are presently under discussion in Congress and other decision-making forums.

Reforestation has not been done yet and is explained by the fact of a poor enforcement and because there are not enough seedlings available to supply the potential areas. Costs of reforestation are very high, not only measured by the cost of planting and maintenance but also in terms of opportunity cost such as foregone income of presently cultivated land (like soybean and corn) or because farmers may not explore reforested land later.

In addition, farmers have mentioned that the cost to register the Legal Reserve with a notary public which is R$ 2,80 per hectare.

(b) Disposal of chemical packages

Inspection on chemicals packages disposal exists and farmers expect a package recycling system until next season.

Farmers consider three times rinsing and package transport as a farmer's responsibility. Although farmers interviewed utilise three washing methods, and after that store the packages until a better solution is found, they know that some people still burn that material. This is a concern not only for producers but for companies too.

Processing of the packages are not expensive but today the transportation cost is the biggest and limiting problem.

(c) Soil Erosion

No tillage system is typical for soybean and corn in Rio Verde and contributes to reduction of soil erosion problems (see above).

Expansion potential

From the farmers point of view, it is likely that more conventional areas change to no tillage system for next season.

Asked if they had to leave Rio Verde what would be their destination, farmers chose North Brazil. But like the Uberaba farmers they think that the best alternative now is increase yields and farm sizes in the region. They expect a fusion process through which small properties will be incorporated by larger ones and the average farm size will grow.

Farmers consider price relations between product prices and prices paid are the most important factor guiding production investments.

Tietê

Chicken farming is one farm enterprise amongst others in the Tietê region. In most of the cases, the other activities are sugarcane and beef cattle production. Therefore, farmers not only referred to chicken production in their statements.

Farmers reported Tietê is an intensively supervised region because it belongs to an Environmental Protection Area (APA) since 1986 which lead to a more strict control and many regulations about preservation of marginal areas along the rivers and control of garbage disposal along the rivers by industries.

Many types of environmental approvals are required from IBAMA, for example construction works requiring earth movements of more than 100 cubic meters, to extract sand along the river, or the treatment of effluents from cleaning water tanks.

Pump installations to pump up water from rivers and other streams are not controlled. Farmers do not know any laws about water resource management. They have already heard about a study investigating charges for water use in the agricultural sector.

Building embargoes occur also in urban areas and not only in rural ones. Besides the fee that is charged, construction is interrupted.

(a) Legal Reserve and PPA

Inspection on Legal Reserve occurs mainly under indictments and is conducted by the Forestry Police. The impression of Tietê farmers is that it is not an important problem as in other regions.

Farmers are not supported to cultivate or use the area in a strip 100 meters wide along the river banks. This is accordance to Brazilian Forest Code dispositions about

PPAs. In Tietê they are respecting this law. Just a few cases are known about reforestation forced by court but farmers know that it must be done with native species and even when they cut eucalyptus, they need a permission to do so.

(b) Disposal of chemical packages

The main issue pointed out by farmers was the garbage thrown out in the river and in theirbanks. Punishment for these cases is severe.

Regarding chemical packages, it is usual to burn them for there is no recycling process available in region. The city of Sorocaba close to Tietê established a scheme in which farmers may buy inputs only if they present empty packages and agronomic receipts. Then these materials are collected and send to the recycling mill in Piracicaba. However, according to one of the advisors, the plant is closed at the moment.

(c) Disposal of dead chicken

Disposal of dead chicken is the most important problem the farmers have in the chicken farm.

Some farmers still throw them away at any place, without much concern about the pollution this may create for water resources or land. Normally they build 4 meter deep holes to dispose the chickens, where they remain for about 6 years, at costs of R$ 45,00 per meter of depth. Place and building specifications are important in this construction in order to avoid pollution and contamination with diseases.

Recently, some farmers began to use a new method to dispose the dead chicken. It consists in preparing an organic fertilizer with layers of dead chickens and manure, that after about 60 days is ready to be spread in crops or pastures. The method was developed and is being estimulated by the technician of State Agriculture Secretary in Tietê.

In shed building, farmers follow specifications given them by the industry. A building permission is required by law but according to the farmers that law is not enforced.

Expansion potential

Expansion keeps occurring in Tietê region since farmers are building more sheds. First, they consider that poultry industry wants them to increase, in order to press prices down and second because chicken is an alternative of additional income better than other crops.

They think that if the sugarcane or dairy sectors were in crisis and left that region, the tendency would be investing more in chicken production. On the other hand, farmers do not see perspectives of migration to other places out of Tietê region.

Guapiaçu

(a) Forestry questions

Planting trees around the sheds has been done in Guapiaçu chicken farms because it helps to reduce high temperatures by providing shade. They use to plant eucalyptus or "leucena", a local legume close to the sheds. They use about 1000 eucalyptus seedlings per shed, and it costs, since replanting until the seedlings effectively grow, about R$ 2000,00 per shed.

Farmers are aware that is forbidden to cut more than 20% of new forest areas and that an authorisation is necessary before any tree is cut.

Larger farms are more subjected to inspections and the fees imposed by Forestry Police are very high.

Farmers and advisers believe that the farmers attitude has changed because farmers do not interfere in marginal river areas.

(b) Disposal of dead chicken

In 1998, an industry started to take dead chicken to prepare fat. Nevertheless, most of people burn the animals or bury them in ground holes. The biggest concern is the risk of water contamination. The holes are usually 3 meters deep. One criticism to this method is related to bad smelling. Some farmers carelessly throw dead animals at any place in the farm.

"Frango Sertanejo" (a company from the region) is trying a method to produce organic fertiliser with dead chickens and manure by alternating layers based on a method they know is being used in South Brazil.

(c) Fire regulations

The Environmental Sanitation Agency of São Paulo(CETESB) is an executive and fiscalisation agency that belongs to the Environmental State Secretary and is very active in Guapiaçu, especially watching activities alongside the rivers. This agency also plays an important role in giving advice to farmers. The most common problem has been with the Fire Elimination Plan (PEQ), a schedule for reduction of burning of sugarcane areas. CETESB is controlling the delivered sugarcane in industry to avoid illegal fire areas.

(d) General information

From the farmers point of view, the chicken business does not involve large environmental problems. As they usually have other crops or cattle in the farm, they commented that planting control to better soil conservation is being stimulated.

They also pointed that recently they observe that native animals coming back, like "Siriemas" (*Cariama cristata)***,*** "Capivaras" (*Hydrochoerus hydrochoeris*) and others that used to inhabit those areas before.

For chicken production they use only few chemical products. However, it should be noted that feed and medicine (usually via feed) is provided by the industry and it is not always known to the farmers what they actually use. The only packages they have to discharge are vitamins and mineral complement ones**.** Usually they bury or burn packages because selective collection is not available. Other products they use in farm come now in returnable packages. Sometimes farmers take the packages to urban garbage areas but it happens only when the farm is near the cities.

Expansion potential

Farmers made clear that if government policies favour production, the future trend will be to increase shed numbers and the capacity of sheds, leading to an average farm size of 60.000 chicken. Chicken is an attractive business for diversification purposes. Orange, cattle, sugarcane and coffee (that are increasing recently) are some of crops they also have in Guapiaçu. Substitution by chicken does not occur.

Chicken manure is applied on other crops and provides improvement in yields of sugarcane for example. It can be also used as a complement in cattle feeding.

Probably an increase in the integrated system will be observed with a further reduction of independent farmers.

Outside the region, it is in general expected that chicken production will follow the move of the feed crops – soybean and corn. This means that sooner or later chicken will move more towards the Centre-West. It was mentioned, however, that still there is a transportation problem due to the lack of roads and railways and that big investments in processing plants are required to make chicken production in these regions more profitable.

2.4.2 Germany

2.4.2.1 Arable production in South Hanover, Magdeburg region and Mecklenburg-Vorpommern

Environmental situation

The environmental situation for the arable farms selected for the study are similar and will therefore be discussed for all farms together. In the regions considered there are the following impacts from environmental regulations on production:

- In some areas there are water protection sites with restrictions on land use which are in many cases compensated. The typical farms are, however, not affected.
- Cutting of single trees has to be approved by the local authorities. Usually cutting is only permitted for trees struck by diseases.
- Soil, product and harvest residuals (in particular relevant for sugar-beet) on public roads and tracks across the fields must be removed, otherwise the farmer will be fined. This is however, not an environmental regulation in a strictest sense and the regulation goes back mainly to safety reasons.
- The ploughing up of tracks between own fields ("private Flurbereinigung") is not permitted or has to be approved because in Germany most of the tracks may be used by the public.
- There are some restrictions on fertilising, pesticide use and construction of buildings.
- The ban of the herbicide Isoproturon would lead to increased cost in most cases, because replacement herbicides are significantly more expensive at present.
- The number and the total budget of (voluntary) environmental programmes according to regulation 2078/92 in the three Länder considered is relatively low compared to other regions in Germany. The typical farms do not participate in

the schemes because they are not profitable. However, as the programmes are voluntary, they can not be considered as an environmental (binding) standard in the sense of this report.

From a first view, the restrictions of environmental standards on the typical arable farms investigated appear to be relatively low. In chapter 3.4.2, an attempt will be made to quantify the impacts of the most important environmental standards on production cost.

Expansion potential

As regards the expansion potential of production, the total land available for agricultural production in Germany and in the regions considered is more or less fixed. Hence, expansion means increasing the acreage of certain crops at the expense of others and/or increasing yields of existing production systems. The main crops relevant for the expansion discussion are wheat, rape-seed and sugar-beets.

In **South Hanover**, sugar-beets are the leading crop. The presently high profitability of sugar-beet production has the following main effects:

- Purchase and rental price levels are extremely high as a result of the sugar-beet quota rent. This effect is amplified by a strong non-agricultural demand for land in the region.
- As a result of the profitability of sugar-beets, farm sizes providing a sufficient family farm income can be smaller than in other areas. Structural change in terms of small farms will most likely only happen with the generation change. Moreover, in particular some medium-sized farms generate extra-income providing machinery services to smaller farmers. Finally, survivability of the farms is probably rather high due to a relatively high share of equity in total capital resulting from the high protection times in both sugar-beet and cereal production.

The expansion potential mainly depends on the future of the market regulation for sugar-beet. If the regulation persists in the future, (a) the share of crops in crop mix will basically remain unchanged and (b) individual farm-size growth in the region will probably be slower than in other regions. In this case, farm size growth will be most likely realised beyond individual farm gates in terms of co-operation between farmers and management contracts. Examples are:

- Machinery co-operation. This may reduce the machinery cost. In cases where bigger machines are used, labour cost might be reduced, too.

- Partnerships between single farmers (share of machinery, joint management of land, common purchase of inputs and marketing of products).
- Exchange of land and common use of land to improve land structure and reduce operating cost.

In case of a partly or fully liberalisation of the sugar market, the share of wheat and barley could increase at the expense of sugar-beet, depending on the extent of liberalisation and assuming that the price relation between rape-seed and cereals remains about the same. It can be expected that if the price-relation between rape-seed and cereals becomes bigger than 2:1, profitability of rape seed becomes higher than for cereals and rape-seed acreage will increase.

In the **Magdeburg** region, the present situation is different from the South Hanover region:

- Relatively moderate purchase and rental prices for land.
- Low share of own land in total agricultural land, leading to a higher fluctuation of land in the long term.
- Relatively high share of small land owners generating their main income from outside agriculture and potentially willing to rent out or sell land. At present, a certain trend towards selling land rather than renting out land can be observed with small land owners.
- The BVVG (Bodenverwertungs- und –verwaltungs GmbH) rents or sells out big adjacent lots of formerly state-owned land in Eastern Germany, providing the potential of large scale expansion in one step. This is, however, al long-term option and becomes in most cases only relevant after termination of ongoing rental contracts for BVVG-land of presently 12 years (e.g. earliest in 2003).
- Based on the law EALG (Entschädigungs- und Ausgleichslastengesetz), former land owners have a right to opt for purchasing land at reduced prices (Vorkaufsrecht zu begünstigten Preisen). At 30.12.1998, this type of land purchase has been suspended (ausgesetzt) for the time being because it is not compatible with EU-legislation. The future is not clear yet. In any case, ongoing rental contracts will be at disposition in 2003 only.
- An extension of ongoing rental contracts by 6 years with the present tenant is likely if the tenant claims for it. However, a decision of the BVVG will be made in every single case.

As regards future expansion of the crops considered, the following conclusions can be drawn:

- Based on the present situation it is likely that the importance of rape-seed production will increase under the Agenda 2000 as a result of the expected abolishment of the Blairhouse-restriction (Blairhouse-Restriktion). The reason is that the so called “Abschneidegrenze” (which is the percentage that oilseeds may have in the total subsidised crop acreage of a farm) in 1999 was only 8,5 % in the Magdeburg region (Saxony-Anhalt) compared to 15,6 % in Mecklenburg-Vorpommern and the set-aside land has only been planted at a rate of approx. 50 % with non-food rape-seed. This means that there is a relatively high potential for expansion of rape-seed production.
- The extent of rape-seed expansion depends mainly on the price-relation between rape-seed, cereals and protein plants like peas. Up to a level of 25 % share in crop rotation (i.e. 22 % of the arable acreage if the share of set aside and sugar beet remain the same) it can be expected that yield levels of rape-seed will remain stable. This view is supported by the future introduction of hybrid varieties and progress in conventional breeding.
- It is likely that cereal acreage will not be extended.
- Conditions for individual farm expansion are better than in South Hanover but legislative questions with regard to the BVVG are still unclear. Farm growth will take place in terms of renting and purchasing land.
- Like in South Hanover, co-operation of farms and partnerships will play a certain role in non-individual farm growth.

In **Mecklenburg-Vorpommern**, the present situation is basically the same as in the Magdeburg region. As regards the expansion potential, the following conclusions can be drawn:

- It is unlikely that changes in the present land use pattern occur because the prevailing rotation rape-seed & wheat & barley has proven successful and fits very well to the location. The present wheat yields can only be sustainably achieved in this rotation because wheat after wheat is yielding much lower than wheat after rape-seed and peas are not an alternative to rape-seed due to their fluctuating yields.
- Wheat after wheat could become more relevant if the new seed-treatment (Beize) against root-rot (Schwarzbeinigkeit) proves successful and the yields can be stabilised on a high level. However, expansion of wheat will most likely take place at the expense of barley and replace rape-seed only in case of very low rape-seed prices.

- Contrary to the Magdeburg region, rape-seed (food and non-food) is already planted at the limit of the crop-rotation restrictions (about 25 %) and can therefore most likely not be extended.
- Barley will probably keep its share because it fits well into the labour organisation and as a preceding crop for rape-seed (early harvest).
- Like in South Hanover and Magdeburg, co-operation of farms and partnerships will play a certain role in non-individual farm growth.

With the information available it can not be concluded that the possible expansion paths of arable production will have a significant effect on the environmental situation in the production regions considered.

2.4.2.2 Chicken production in Weser-Ems

Environmental situation

The Weser-Ems region is characterised by a particularly high livestock density as a result of intensive pig, egg, chicken and turkey production. Environmental problems are mainly caused by the huge volumes of pig slurry and chicken manure as well as smell emissions from the production units.

A study of THOMANN (1997) shows that in the so-called OBE-region (covering the counties of Bentheim, Emsland, Cloppenburg, Osnabrück and Vechta) there is a nutrient surplus of phosphorus that can not be compensated by plant growth anymore and which originates mainly from the counties Vechta and Cloppenburg.

Farmers operating in the area need sufficient land (Flächennachweis) for spreading the slurry and manure according to the limits presently set by the fertiliser regulation (Düngeverordnung) (see chapter 3 and chapter 3.4.1.2). Farmers with insufficient land have to transport the slurry or manure outside the region, e.g. into arable regions in East Germany (details see chapter 2.3.2).

Another problem that can be blamed to the high livestock intensity is a relatively high likelihood of highly infectious livestock pests and diseases. In the years 1993 to 1995, hundreds of thousands of pigs had to be killed after the outbreak of the classical swine fever (CSF) (Schweinepest) in the southern Weser-Ems region.

As regards chicken production, there are many environmental regulations affecting the approval as well as the operation of new and existing production units. Standards are mainly related to reduction of emissions and animal welfare. The relevant regulations are explained in chapter 3 and intensive analysis on the economic effects of environmental standards is provided in chapter 3.6.2. It can already be concluded that most farmers see the bigger problem of the regulations in prevention of production rather than in the cost effect of standards.

Expansion potential

Table 2.9 shows that in the years 1997/1998 farmers applied for a significant number of approvals to build livestock barns in the OBE-region considered. The Table shows that in case of approval there would be in short term a significant increase of livestock numbers compared to the present situation. In particular, chicken numbers would increase by almost 40 %.

Table 2.9: Volume of barn space applied for approval in the years 1997/1998 in the OBE-region (numbers, by livestock type)

	Number of barn spaces applied for in the OBE-region						**Short term**
	Bentheim	Emsland	Cloppenburg	Osnabrück	Vechta	Total	**increase in %**
Pigs (fattening)	11.980	87.083	91.300	74.220	59.500	324.083	**20,3%**
Sows (breeding)	5.060	19.931	17.606	8.921	5.900	57.418	**16,2%**
Hens (eggs)	73.500	52.263	196.600	2.800	141.000	466.163	**4,4%**
Chicken (fatt.)	586.933	2.654.531	2.386.420	296.847	253.000	6.177.731	**38,6%**
Turkeys	-	29.800	450.316	6.156	37.000	523.272	**20,8%**

Source: Windhorst (1999) — IFCN, DEBLITZ (1999)

The following assessment of the expansion potential of chicken production in the OBE-region is mainly based on WINDHORST (1999). He identifies the environmental situation of the high intensity livestock production and the outbreak of CSF in the autumn 1997 in the southern Netherlands as the main reasons for the high number of applications in the OBE-region. As a consequence of the disastrous outbreak of the disease (11 million pigs were killed), a general discussion about intensive livestock production has started in the Netherlands. The discussion is very controversial and not yet finished but for the next years a significant reduction of livestock numbers and density can be expected, both for environmental and hygienic reasons. This will create problems for the Dutch processing industry that is already looking for alternative supply sources to make full use of their capacities. The German regions close to the Dutch border obviously appear to be well suited for closing the gap.

It might be that based on the present legislative framework conditions on building approval, a big share of the approvals will be realised. With the livestock density in the region already very high, competition with other agricultural and non-agricultural land use alternatives, environmental problems with regard to slurry and manure and the potential for outbreak of livestock pests will most likely increase even more. Whether by this like in the Netherlands the limits of expansion will be reached, remains to be seen.

3 Production cost, environmental and social standards

In this chapter the results of the production cost analysis are presented. In chapter 3.1 some remarks on the method of cost calculation will be made. The following two chapters deal with the cost comparisons of rape-seed and soybean (3.2) as well as grains and corn (3.3). Based on the results achieved, chapter 3.4 describes the cost relevance of environmental and social standards on oilseed and grain production and quantifies some of their impacts. Chapter 3.5 provides a summary and conclusions on the arable section. In chapter 3.6 the procedure described for arable crops takes place for chicken production. Finally, chapter 3.7 gives an overall assessment on the relevance of the findings.

3.1 Method of cost calculation

3.1.1 Explanation of cost components

The cost calculations are based on the crop or the chicken enterprise. Figure 3.1 shows the cost positions considered and their aggregation into cost groups used for analysis.

The analysis results in a comparison of total cost per unit produced. Total cost consist of expenses from the profit and loss account (cash cost, depreciation, etc.), and opportunity cost for farm-owned factors of production (family labour, own land, own capital). The estimation of these opportunity cost must be considered carefully because the potential income of farm owned factors of production in alternative uses is difficult to determine. In the short run, the use of own production factors on a family farm can provide flexibility in case of low returns when the family forgoes income. However, in the long run opportunity cost must be considered because the potential successor of the farmer will make a decision on the alternative use of the production factors, in particular his own labour input, before taking over the farm.

For the estimation and calculation the following assumptions are made:

- **Labour cost**: for hired labour, cash labour cost currently incurred are used. For unpaid family labour, the average wage rate for a qualified full-time worker in the respective region is used.
- **Land cost**: for rented land, rents currently paid by the farmers are used. Regional rent prices provided by the farmers are used for owned land.

Figure 3.1: Cost groups and cost positions used for production cost analysis

Cost groups	Cost Positions

Direct Cost	Seed
	Fertiliser
	Plant protection
	   Herbicides
	   Fungicides
	   Insecticides
	   Growth regulators
	Other
	   Crop Insurance, MPCI
	   Crop advisory service

Operating cost	Maintenance machinery
	Fuel and lubrication
	Depreciation machinery
	Dryer/Aeration
	   Maintenance
	   Energy
	   Depreciation
	   Insurance
	Custom work
	Equipment liability insurance
	Wages
	Unpaid labour

Overhead cost	Land improvement Maintenance Buildings Depreciation Buildings Farm insurance Farm taxes and duties Energy, Water, Advisor costs Accountant legal fees Phone & Utilities Other Overheads
Interest cost	Paid interest Unpaid interest for equity
Land cost	Paid rent for land Unpaid rent for owned land

Source: IFCN — IFCN — IFCN, DEBLITZ (1999)

- **Capital cost**: own capital is defined as assets, without land, plus circulating capital. For borrowed funds and owner's capital, the real interest rate is used in both countries.
- **Depreciation**: machinery and buildings are depreciated by using a straight line schedule on repurchase prices less residual values provided by the participants of the panels.
- **Adjustment** for protein and oil content for rape and soybeans.
- **Adjustment of VAT**: all cost components and returns are stated without value added tax (VAT).
- **Conversion of currencies**: The Brazilian financial figures are converted from Real into DM by using the exchange rate of the Brazilian planting season 1998 (for more details see chapter 3.1.3).

The cost groups shown in the table will be used for all the production cost analysis. Overhead cost and interest cost will be merged into one group because interest cost are relatively low and do not justify a separate group.

3.1.2 Reference System for calculating the impact of standards

In the first step the production cost are calculated **‚as observed'** in 1998. The reasons for cost differences are different **prices** of the production factors and different levels of factor **productivity**.

As long as prices are a result of different market situations and differences in productivity are a result of different natural or structural conditions, they can not be considered as a result of legislative framework conditions such as environmental and social standards. However, also prices and structural conditions may result from different legislative framework conditions, e.g. if (a) a tax is imposed on fertiliser or fuels (higher price) or if (b) structural conditions such as scattered and small fields result from the prevailing heritage system (low labour productivity, higher labour and machinery cost). Whilst the former type of conditions will be reflected in this study, the latter does not belong to environmental and social standards and will not be considered.

To identify the cost differences caused by environmental and social standards, a reference system must be defined. In the case of Germany and Brazil, one country must be used as reference and cost must be brought to a level comparable with the other country. The analysis in chapter 3 has shown that there are more and higher cost-relevant environmental and social standards in Germany than in Brazil. To identify the size of environmental and social standards in production cost, in principle the following options exist:

1. Using Germany as a reference system and adding the cost effects of the German standards to Brazilian cost of production.

   Firstly we consider the status quo situation in Brazil (relatively few standards and regulations) and secondly we simulate the most likely cost-effects of a situation with German standards in Brazil. The main problem is to estimate the prices for investment goods (e.g. buildings and equipment) and means of production such as pesticides which do not exist in Brazil. Moreover, applying the German standards to Brazil would only make sense if the environmental situation, problems and scarcities could be compared. As this is mostly not the case, this method will be excluded.

2. Using Brazil as a reference system and deducting the cost effects of German standards from the calculated cost of production of the German farms.

   Firstly we look at the status quo situation in Germany (relatively high level of standards and regulations) and secondly simulate the cost without the German standards. The question to be answered here is *How would an optimised production system look like without having to meet the standards*? This can be done for example by comparing price lists for different buildings and equipment (e.g. ventilators for chicken barns) that meet different requirements. It was possible to get sufficient information on the hypothetical (or the past) situation without standards. Therefore, this option was chosen to quantify the impact of environmental and social standards on production cost.

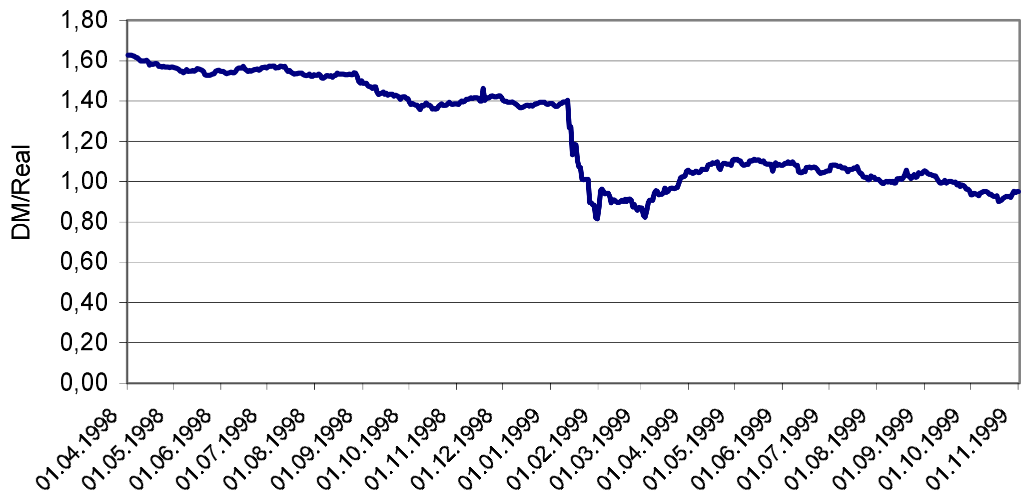
3.1.3 Exchange rates

For the cost comparisons the Brazilian currency (Real R$) has been converted into DM to make results comparable. In general, the exchange rate has a big influence on the level of production cost expressed in foreign currencies. Devaluation of the R$ against the DM leads c.p. to a decrease of Brazilian production cost expressed in DM - hence an improvement of the country’s competitive position - and vice versa.

The relevant period for the production cost analysis is April 1998 (planting of the main crops and safrinha crop) to March 1999 (harvest of main crops). Figure 3.2 shows the changes of the R$ compared to the DM for April 1998 to November 1999 based on daily values. As the Figure shows, there has been a relatively slight decline during 1998, a sharp devaluation of the R$ in January 1999, a certain recovering in the second quarter and a stabilisation at around parity of both currencies in the third quarter of 1999.

For the cost comparisons between Germany and Brazil the exchange rate at the planting period of the main crop in Brazil (October-November 1998) has been applied - which was 1,40 DM/R$. The reason for this is that at that time farmers expected exchange rates to remain stable and made their decisions based on this assumption. If they had been able to foresee the sharp decline of their national currency in the beginning of 1999, they would probably have reduced the use of imported inputs like fertiliser and pesticides as it can be observed in the current planting season 1999/2000.

Figure 3.2: Development of exchange rates between DM and R$ 1998-1999

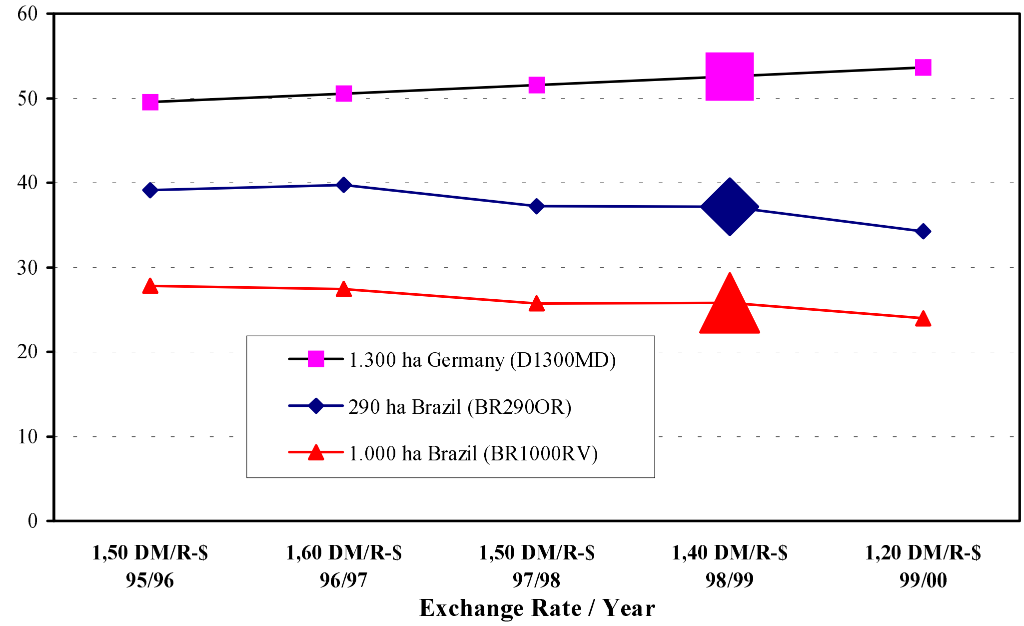


Source: The Currency $ite, Olson and Associates (1999) in the Internet at http://www.oanda.com

IFCN, DEBLITZ (1999)

To indicate the strong influence of exchange rates on production cost comparisons, Figure 3.3 shows the effect of the exchange rate developments for the period 1996 to 2000 based on the yearly average exchange rates on cost of production of rape-seed and soybean production. For this, the physical figures have been kept constant and for the German farms an overall inflation of 2 % per year has been applied. For Brazil, an inflation rate of 6 % p.a. has been assumed. Moreover, as pesticide prices in Brazil highly depend on the exchange rate to the US$, pesticide cost have been corrected, reflecting the effect of the change of the R$ to the US$. The year 1999 represents the cost situation found during the surveys. For the years 1996 to 1999, the exchange rates reflect the development that has taken place whereas for the year 2000 an exchange rate of 1,2 DM/R$ has been assumed.

Figure 3.3: Effects of exchange rates on cost development of rape-seed and soybean production 1996-2000 (DM/100 kg)



Source: Own calculations

IFCN, DEBLITZ (1999)

The Figure illustrates that the relative competitive position of soybean production in Brazil was worse in 1996/97 compared to 1998/99 and improved significantly in 1999 and further on due to the devaluation of the R$.

3.2 Production cost of oilseed production in Germany and Brazil

Total cost of production are stated on a per unit basis (per 100 kg) and per ha. Before analysing the cost differences and their reasons, a few remarks on the comparability of the figures are necessary.

Oil and protein contents of soybean and rape-seed are different. The oil content of soybean is around 19 %, the protein content around 36 %. The corresponding figures for rape-seed are 41 % for oil and 20 % for protein. As both crops are processed into oil with the residual meals used as protein sources, the production cost should be readjusted to reflect the oil and protein content as well as their prices.

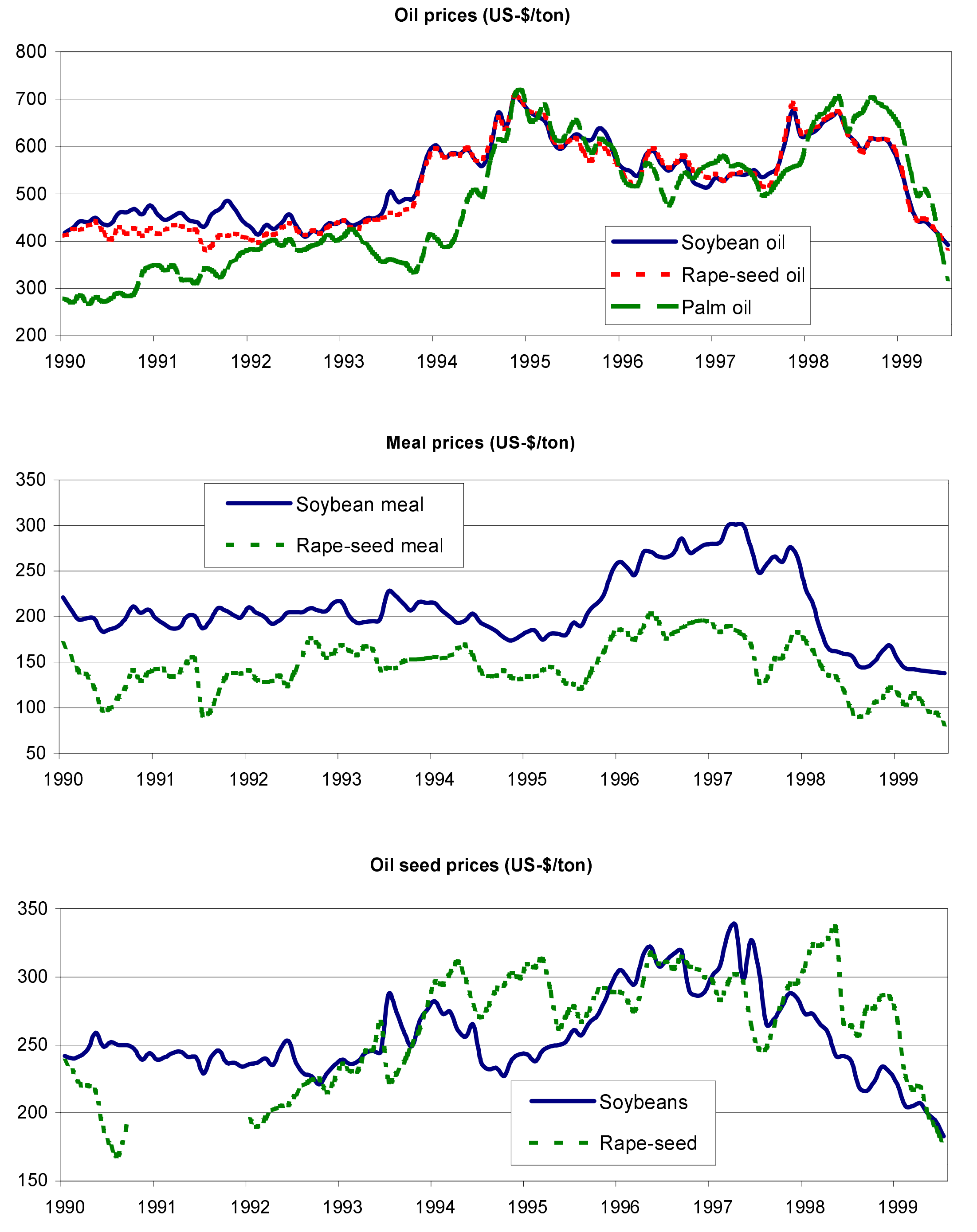
This is done by weighing the content of oil as well as protein (including residuals less proportional humidity which is all sold as meal) and the prices for the oil and the meal of both crops. The prices were taken from the period March 1998 to February 1999 which reflect the harvest year 1998/1999 in Brazil. The average cif-price for soybean oil was US$ 590 per ton and US$ 154 per ton for soybean-meal. The corresponding prices for rape-seed is US$ 590 per ton for oil and US$ 112 per ton of rape-seed meal (see Figure 3.4).

Due to its high oil content and the wide relation between oil and protein price (84:16), around 78 % of the rape-seed value is determined by the oil price. Due the lower oil content and a similar proportion between oil and protein price (79:21), only 47 % of the soybean value is determined by the oil price.

Adding the values of both components leads to a total oil and protein value per ton of rape-seed and soybean with a higher value of rape-seed. Setting the rape-seed value at 1, the respective soybean value is only 0,77 of the rape-seed value. This relation was taken to recalculate the unit production cost of soybean to a rape-seed equivalent by multiplying the cost of production for soybean by the inverted value 1,3.

The result of the calculation with and without adjustment of the Brazilian cost to rape-seed equivalents is shown in Figure 3.5. This type of figure will be used for all further cost analysis, showing the German farms on the left hand side and the Brazilian farms on the right.

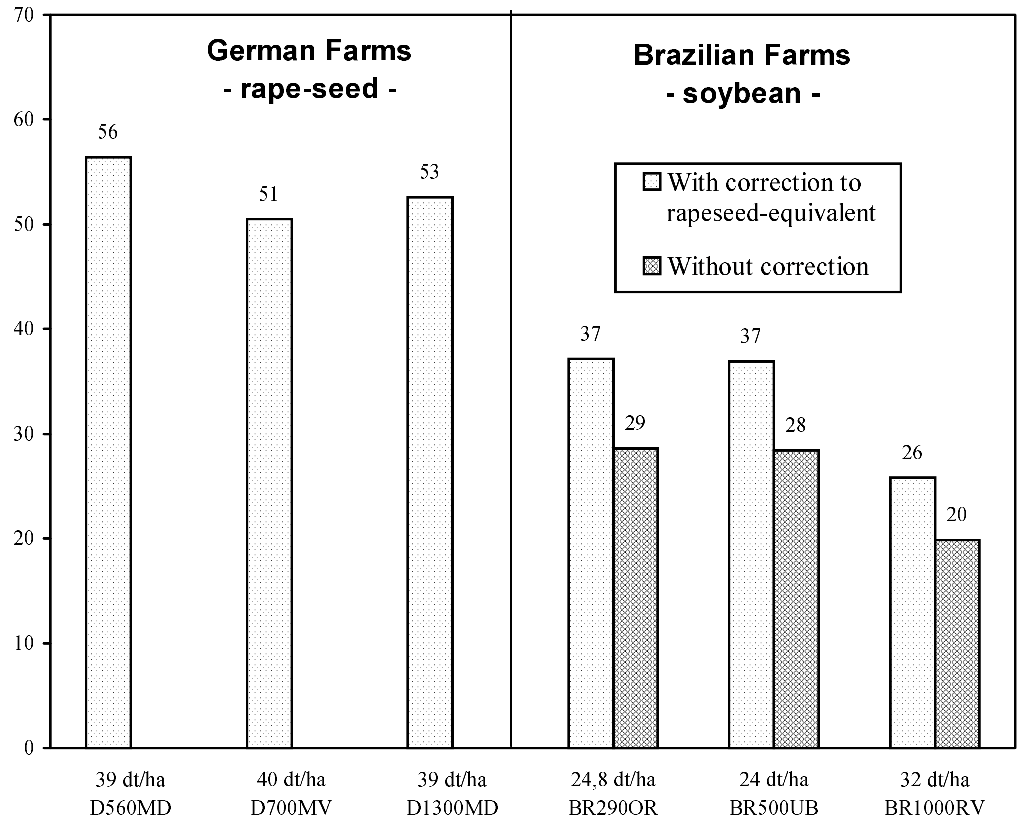
Figure 3.4: Prices for soybean, rape-seed and palm products 1990-1999 (US$ cif North Sea harbours)



Source: Uhlmann (1999)

IFCN, DEBLITZ (1999)

Figure 3.5: Total cost of rape-seed and soybean production 1998/99 in Germany and Brazil – with and without correction to rape-seed equivalent (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Using adjusted cost for cost comparisons is more appropriate than neglecting the differences in oil and protein content of the crops and, hence, their values from the point of view of the buyers. Adjusted cost will therefore be used for all following calculations and analysis. However, it should be noted that (a) the adjustment factor varies with changes of content and price relations between oil and protein and (b) cost calculated in this way can only provide an approximation for the value of seeds for the processing industry. Apart from the lack of information about exact processing cost and possible mixed price calculations for different oil products, the following facts indicate that from a German perspective and in short term the demand for different oil seeds is rather inelastic to slight changes in production cost:

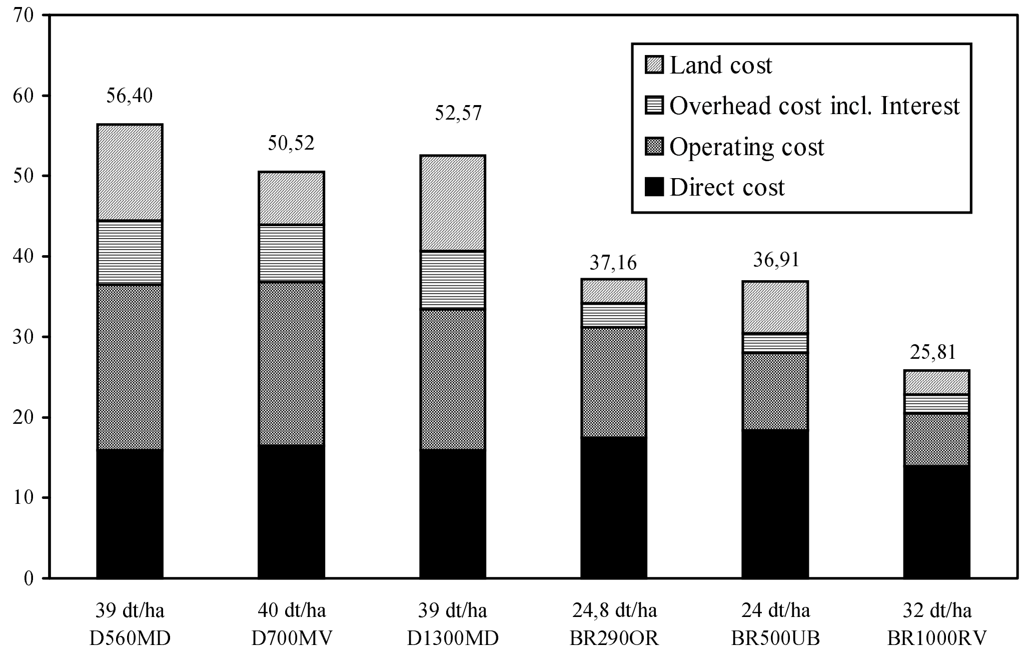
- *Specialisation of processing mills into hard or soft seeds*. Mills for soft seeds (i.e. for rape-seed) have a two step processing (pressing and extracting) while hard seed mills (i.e. for soybeans) only use extraction. This means that profitable soft seed processing can only be done in soft seed plants while hard seeds could be processed in both types of plants. Processing capacities of oil mills in Germany are around 7 to 7,5 million tons per year. Half of the mills are suited for hard seeds only. As a consequence, short term replacement of the different seed types in case of changes in their price relations are difficult to realise.
- *Future market contracts*. International companies often use future contracts to buy and sell commodities. These contracts maybe rather long-term, e.g. in August 1999 soybean oil from the upcoming harvest in 2000 may already be contracted for sale in December 2000. This means that switching from rape-seed to soybean and (vice versa) under these conditions will create cost that may well offset price advantages.
- *Domestic transport cost*. Even if being technically possible, switching processing from rape-seed to soybean may not be profitable because of domestic transport cost. For instance, transporting imported soybean from the North Sea coast to mills in the middle of Germany can be more expensive than processing local rape-seed even at favourable cif-prices for soybeans.

Figure 3.6 shows the total cost of rape-seed production in Germany and of soybean in Brazil. Cost for Germany are given including the share of rape-seed in set-aside cost.

Total cost for the three typical German farms vary between DM 50 and DM 56 per 100 kg. Cost for the three typical Brazilian farms are in the range of between DM 25 and DM 37 per 100 kg. Thus, Brazilian cost of production are between 46 to 73 % of the cost of the German farms. Differences between the Brazilian farms are bigger than between the German farms. The main reason is that the large Brazilian farm (BR1000RV) realises a significantly higher yield compared to the two smaller farms. Economies of size only play a minor role for these differences.

Direct cost are rather the same or even slightly higher in Brazil compared to Germany. Share of direct cost in total cost is around one third in Germany and 50 % in Brazil (Figure 3.7). The direct cost structure of the three German farms is the same with fertiliser cost contributing 43 % of the direct cost. The cost of the Brazilian farms mainly show differences in the herbicide cost, resulting from the different cropping systems. Herbicide cost of the small farm with the conventional cropping system (BR290OR) are only one third compared to the cost of the two other farms with no tillage system, the latter requiring higher herbicide inputs due to the absence of mechanical weed treatment.

Figure 3.6: Total cost of rape-seed production in Germany and soybean production in Brazil 1998/99 (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

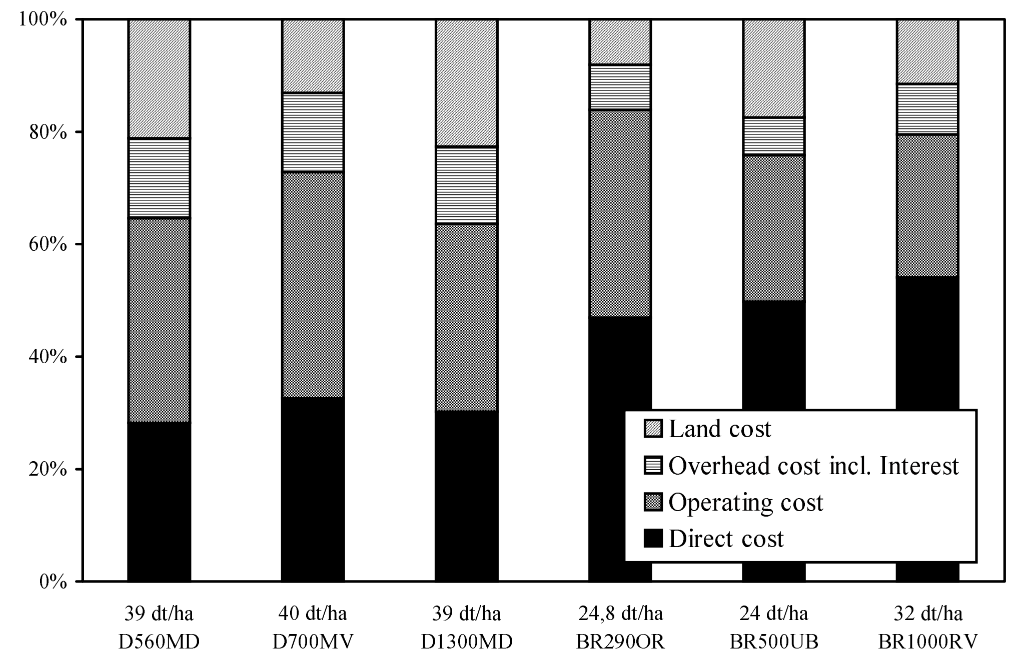
IFCN, DEBLITZ (1999)

Operating cost are between DM 17 and DM 21 per 100 kg for the German farms with a certain size effect when comparing the small farm (D560MD) with the large farm (D1300MD). Operating cost for the small Brazilian farm (BR290OR) are at DM 14 per 100 kg and DM 10 (BR500UB) and DM 7 (BR1000RV) for the larger farms. Main international cost differences result from depreciation for machinery and from wages paid.

Fuel cost for the small and medium sized Brazilian farm are up to twice the cost of the German farms due to the relatively low yields whereas the fuel cost of the large Brazilian farm are at the lower end of the German farms (DM 1,37 to DM 1,66). In Brazil, the lower cost of the medium sized and the large farm can again be explained by the no tillage system which requires less machinery input resulting in less fuel and depreciation. Differences between the large farm and the medium farm result mainly from the yield differences but also indicate a size effect. The share of operating cost in total cost is between 35 % and 40 % for the German farms and the small Brazilian farm and only 25 % for the medium sized and large Brazilian farm (Figure 3.7).

Overhead cost including interest for the German farms are up to seven times higher than for the Brazilian farms, mainly because in Brazil depreciation for buildings is very low and insurance, taxes and duties are not existent or negligibly low. The share of overhead cost in total cost is 14 % for the German farms and 7-9 % for the Brazilian farms. Total interest cost are basically the same for all farms considered, varying between DM 1,50 and DM 2,00 per 100 kg.

Figure 3.7: Percentage share of total cost of rape-seed production in Germany and soybean production in Brazil 1998/99 (% of DM/100 kg)



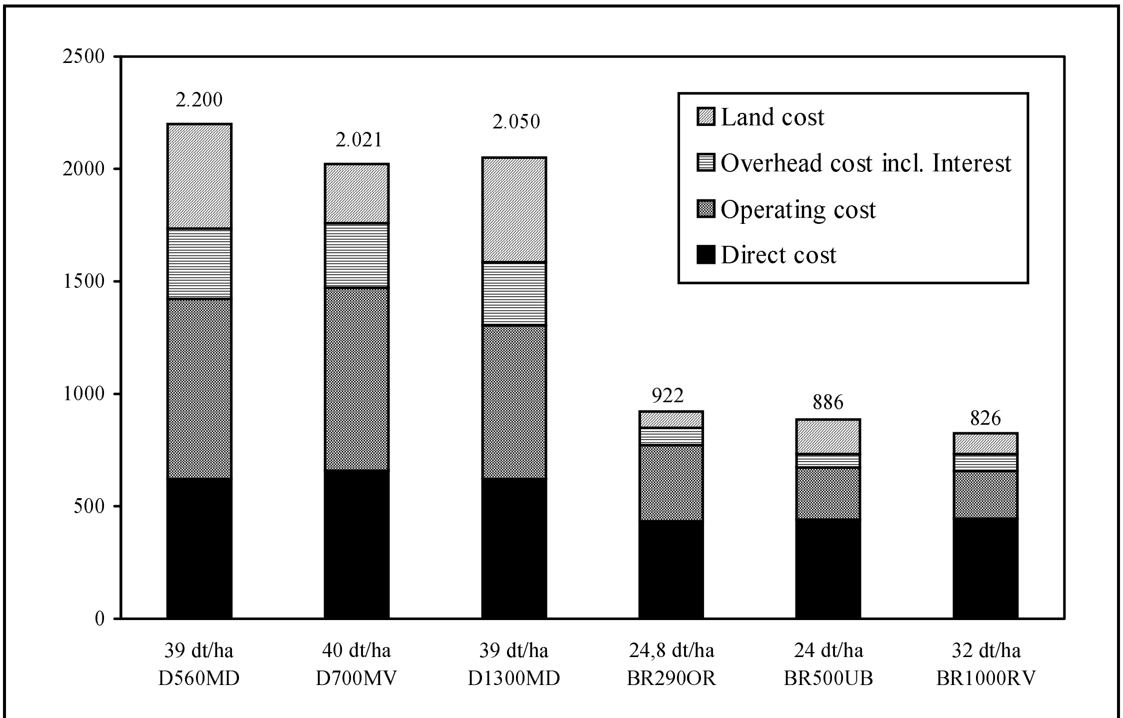
Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Land cost have been calculated by applying the rental price for rented land and by imputing opportunity cost for owned land. Based on these calculations land cost in Germany are up to four times higher than in Brazil. However, land cost of the medium sized Brazilian farm (BR500OR) are nearly as high as the cost for the medium sized German farm (D700MV) which has the lowest rental price of all German farms (DM 248/ha). Particularly high land cost occur for the medium German farm (D560MD) and the large German farm (D1300MD) as a consequence of the high level of rent prices (DM 440/ha). Share of land cost in total cost is between 13-21 % for the German farms and 8-17 % for the Brazilian farms.

Figure 3.8 shows that **cost per hectare** are between 2,1 to 2,7-times higher in Germany than in Brazil. Cost differences per ha are higher than per 100 kg due to the higher yields of the German farms. Comparing the per ha cost within the countries, differences are only around 10 %. With the exception of the large Brazilian farm (BR1000RV), these differences could also be found when comparing cost on a per 100 kg basis.

Figure 3.8: Total cost of rape-seed production in Germany and soybean production in Brazil 1998/99 (DM/ha)



Exchange rate DM/Real: 1,4 Source: Own calculations	IFCN, DEBLITZ (1999)

3.3 Total cost of grain production in Germany and Brazil

For comparison of grain products, an additional farm in Germany has been added. It is a 100 ha farm South of Hanover (D100SH) which was not considered for rape-seed because it only grows sugar beets, wheat and barley.

In the following, focus of cost analysis will be on feed barley in Germany and corn in Brazil. Because all German farms grow significant amounts of winter-wheat, it will also be considered even if it is largely sold as milling-wheat. However, as production cost of milling-wheat and feed-wheat are very similar, the analysis will provide an indication of the cost situation of feed-wheat.

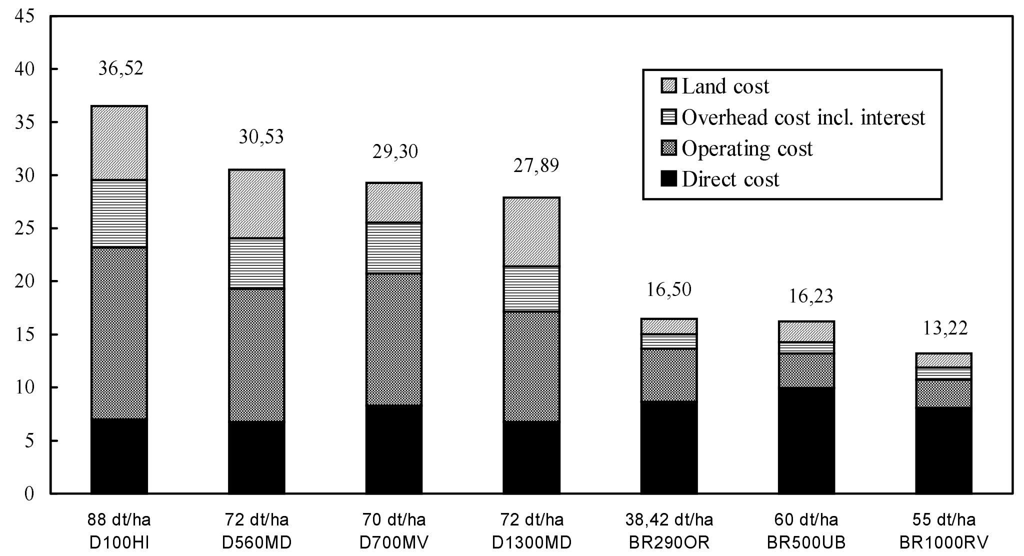
Unlike rape-seed and soybean, the differences in protein content of corn, barley and wheat are much less and vary between 8 % (corn) and 14 % (milling-wheat). For this reason, production cost were not readjusted.

For the small and large Brazilian farm (BR290OR, BR1000RV) the Safrinha (second harvest) of corn has been taken into account in terms of yields and cost weighed with the acreage of the Safrinha crop and added to the main corn crop. This explains the yield differences between the Brazilian farms because the second corn crop is yielding much lower than the first (see Table 2.5 in chapter 2.2.1). For the medium sized Brazilian farm (BR500UB) the cost of the intermediate crop (oats) have been allocated to corn and soybean according to their total share in land use.

Figures 3.9 and 3.10 show the cost comparison of winter-barley and winter-wheat production in Germany with corn production in Brazil. Cost for Germany are given including the share of wheat and barley in set-aside cost.

Total cost for barley and wheat production for the selected German farms vary between DM 25 and DM 37 per 100 kg. Cost of wheat production are up to DM 5 lower than cost of barley production. Total cost of corn production for the selected Brazilian farms are in the range of DM 13 to DM 17 per 100 kg. This means that Brazilian cost are only between 30 % and 67 % of the cost of the German farms. Cost differences between German farms are bigger than between Brazilian farms because the small German farm has particularly high cost of DM 37 per 100 kg despite the very high yields. The reasons will be explained further down. The other German farms are in the range of DM 25 to DM 30 per 100 kg. Corn cost for the small and the medium sized Brazilian farms are comparable whereas the cost for the large farm are almost 20 % lower, mainly because of the comparably high yields of the main and the second crop with specifically low cost of the latter.

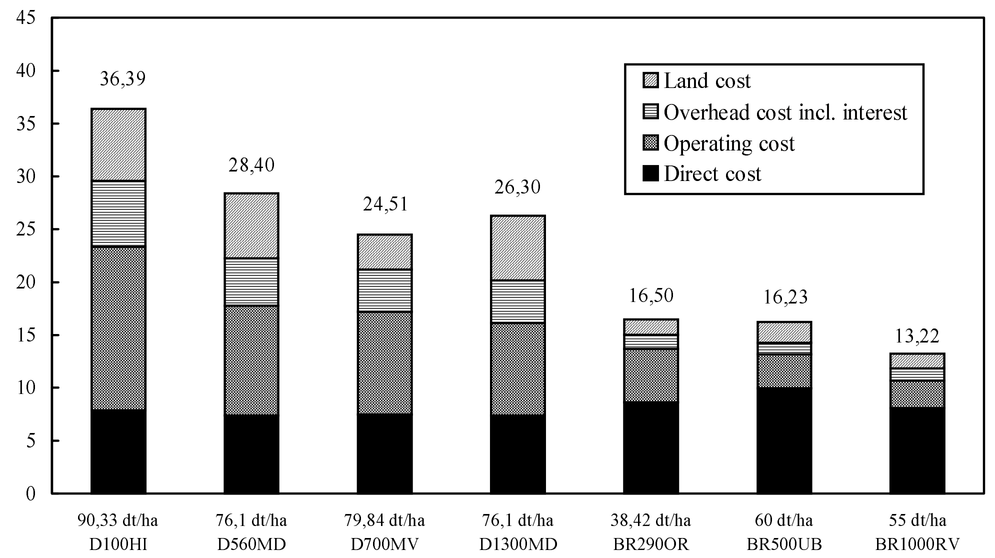
Figure 3.9: Total cost of winter-barley production in Germany and corn production in Brazil 1998/99 (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

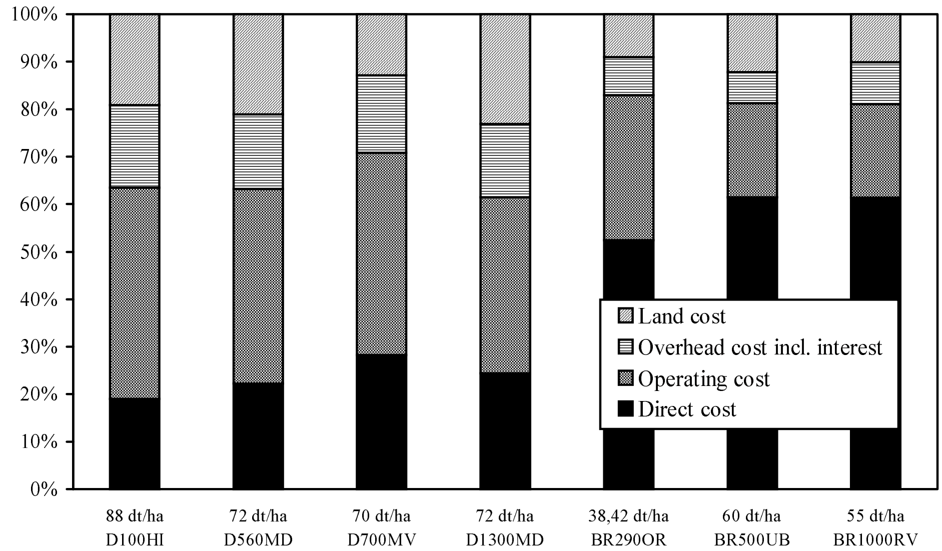
Figure 3.10: Total cost of winter-wheat production in Germany and corn production in Brazil 1998/99 (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

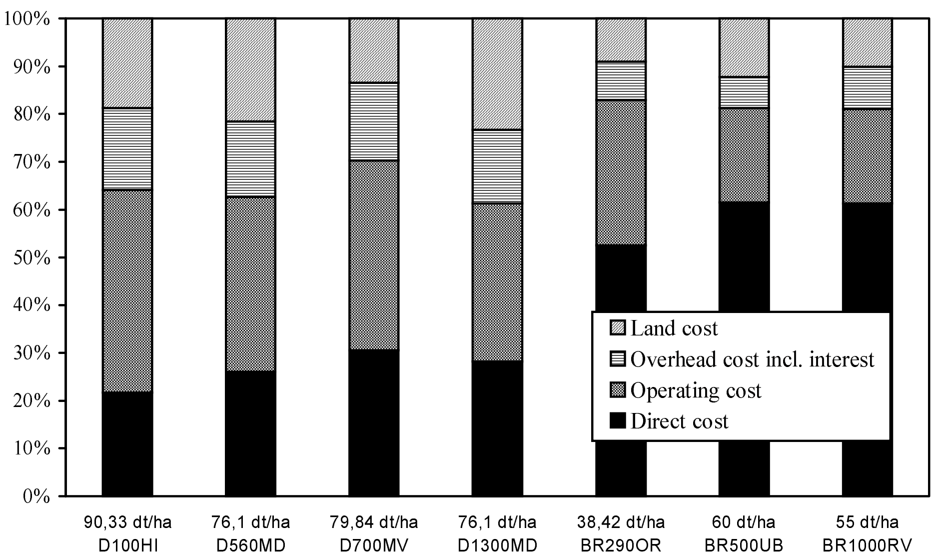
Figure 3.11: Percentage share of total cost of winter-barley production in Germany and corn production in Brazil 1998



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Figure 3.12: Percentage share of total cost of winter-wheat production in Germany and corn production in Brazil 1998



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Direct cost for the Brazilian farms are higher than for the German farms. In Brazil, share of direct cost is between 52 % and 61 % of the total cost, i.e. higher than in soybean production (Figure 3.11 and 3.12) . This can be attributed to higher fertiliser cost, in particular for nitrogen. The percentage cost structure of barley and wheat in Germany is rather the same with maximum differences of 4 % between the crops (Figures 3.11 and 3.12). Comparing farms, the direct cost share in total cost varies between 19 % (D100HI barley) and 31 % (D700MV wheat). Despite lower input levels, fertiliser cost for the Brazilian farms are higher than for the German farms. The reasons are higher fertiliser nutrient prices and lower yields in Brazil. Main differences between the direct cost of the Brazilian farms are fertiliser and herbicide cost, the latter of which can be explained by the different cropping systems of the conventional (BR290OR) and the no tillage system (BR500UB, BR1000RV).

Operating cost in Germany are between 2 and 6 times higher than in Brazil. The small German farm has particularly high operating cost, mostly resulting from labour cost up to twice as high as for the other German farms as well as from high machinery depreciation and maintenance. Operating cost of the three Eastern German farms are only 2/3 to 3/4 of the small West German farm. Differences between the Brazilian farms are again mainly attributable to the conventional and the no tillage system, the latter showing less fuel and machinery cost (maintenance and depreciation). Considering the lower yield of the large Brazilian compared to the medium-sized farm, the lower operating cost indicate a certain size effect. Share of operating cost in total cost is between 37 % and 44 % (D100HI) for the German farms and 20 % to 30 % (BR290OR) for the Brazilian farms.

Overhead cost including interest in Germany are much higher than in Brazil because of very low building cost and rather zero cost for insurance, taxes and duties. In Brazil, figures are even lower for corn than for soybean because yields are about twice as high as for soybean. The share of overhead cost in total cost is around 16 % for the German farms and around 8 % for the Brazilian farms. Interest cost are relatively low for all farms and between DM 0,80 and DM 1,10 per kg.

Land cost have been calculated by applying the rental price for rented land and for imputing opportunity cost for owned land.[3]

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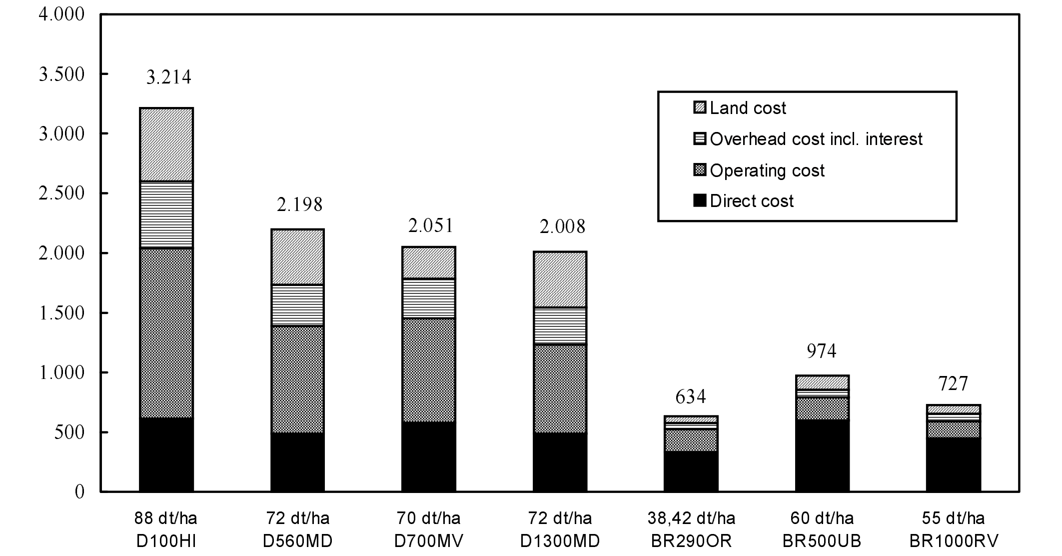
[3] It should be noted that the rent price in the region South Hanover is influenced by the sugar beet production and the related quota. Land with sugar beet quota on it is more expensive. Thus, rent prices in regions and farms with a high share of sugar beet production are often higher than elsewhere. Imputing these prices on crops other than sugar beet might overestimate the land cost of these crops. For this reason, the sugar beet margin has been deducted from the rent prices.

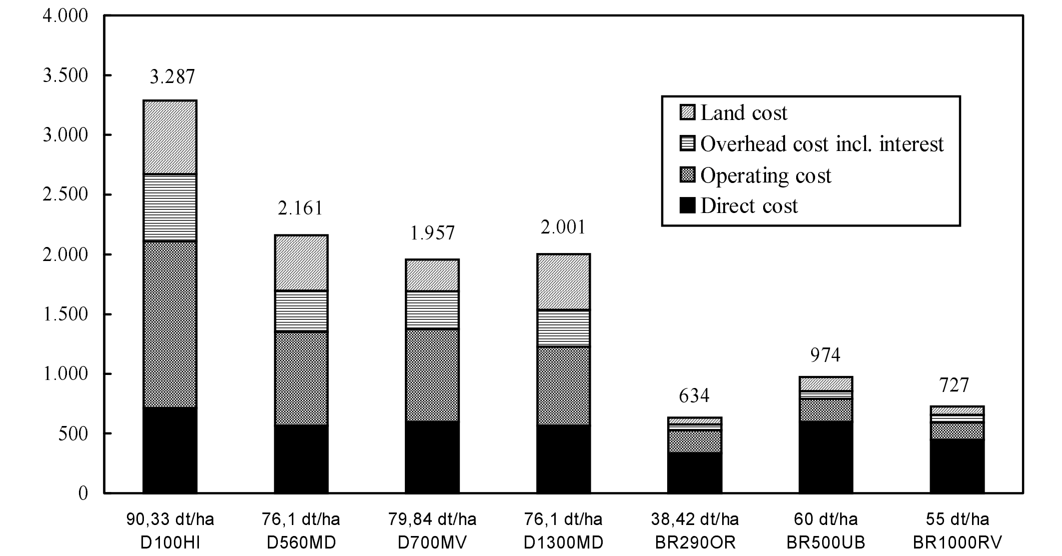
Figure 3.13: Total cost of winter-barley production in Germany and corn production in Brazil 1998/99 (DM/ha)



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Figure 3.14: Total cost of winter-wheat production in Germany and corn production in Brazil 1998/99 (DM/ha)



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Based on these calculations land cost in Germany are almost five times higher than in Brazil when compared to the small German farm (D100HI) which has very high rent prices of DM 790 per ha. The share of land cost in total cost is between 13 % (D700MV) and around 23 % in Germany and only around 10 % in Brazil.

With the exception of the small German farm, cost on a **per ha** basis are slightly lower for wheat than for barley (Figures 3.13 and 3.14). Compared to corn production in the Brazilian farms, German cost are two to six times higher. This disadvantage can be partly compensated by high yields. Comparing per ha cost within the countries, the small German farm again appears as certain exception with cost of DM 3.200 per ha about 60 % higher as the other German farms (around DM 2.000 per ha). Differences between the Brazilian farms are higher than for soybean production because the Safrinha crop has been taken into account. Highest per ha cost in Brazil shows the medium sized farm (BR500BR) which does not have Safrinha but relatively high yields.

3.4 Effects of environmental and social standards on cost of oil and grain production in Germany and Brazil

Because standards and their effects are basically the same for oil and grain crops, their effects on the cost of these crops will be discussed jointly in one chapter.

This chapter aims to identify those cost that are affected by environmental and social standards in the countries of investigation. For each cost group it will be discussed whether

- the regulations or standards have a minor or major impact on production cost
- and if it makes sense to quantify them within the scope of this study.

Selected standards and regulations will then be quantified for each cost item separately. At the end of this chapter all cost effects will be aggregated to show the total cost effect of standards and regulations.

It should be noted that only such environmental and social standards that directly affect agricultural production will be considered. These are for example restrictions on pesticide use related to environmental reasons or buildings and installations to protect the environment against emissions or effluent of dangerous substances. In the chicken section animal welfare aspects are also considered because they have an effect on building design and equipment which again can be closely related to pollution control.

3.4.1 Direct cost

3.4.1.1 Seed

There is no evidence that seed cost in Germany and Brazil are affected in different ways by environmental and social standards.

Genetically modified soybean seeds are an issue of dispute in Germany. In Brazil there is also a discussion about this topic but farmers do not yet have the permission to plant GMOs. Possible effects on cost reductions under Brazilian conditions are not known yet. The farms under investigation did not use GMO, either.

As a consequence, no additional calculations on seed cost are made.

3.4.1.2 Fertiliser

Table 3.1 shows the crop specific fertiliser levels for the selected farms in Germany and Brazil. It is obvious that on a per ha basis fertiliser levels are significantly lower in Brazil than in Germany. Taking the yields into account, P, K and Ca fertiliser efficiency of rape-seed appears to be higher than for soybean (figures expressed as kg nutrient per 100 kg yield).[4] Nitrogen efficiency of corn appears to be higher compared to wheat and barley whereas for the other nutrients the relations are the other way round.

Table 3.1: Fertiliser levels and fertiliser efficiency on the selected farms in Germany and Brazil

	Nitrogen		Phosphorus		Potash		Calcium	
	kg/ha	kg/100kg Yield	kg/ha	kg/100kg Yield	kg/ha	kg/100kg Yield	kg/ha	kg/100kg Yield
Typical German farms								
D100HI								
Barley	180	2,0	65	0,7	55	0,6	300	3,4
Wheat	238	2,6	65	0,7	55	0,6	300	3,3
D560MD								
Rape-seed	200	5,1	55	1,4	120	3,1	230	5,9
Barley	160	2,2	65	0,9	55	0,8	180	2,5
Wheat	207	2,7	65	0,9	55	0,7	227	3,0
D700MV								
Rape-seed	250	6,3	70	1,8	70	1,8	540	13,5
Barley	240	3,4	70	1,0	70	1,0	540	7,7
Wheat	218	2,7	70	0,9	70	0,9	540	6,8
D1300MD								
Rape-seed	200	5,1	65	1,7	120	3,1	230	5,9
Barley	160	2,2	65	0,9	55	0,8	180	2,5
Wheat	207	2,7	65	0,9	55	0,7	227	3,0
Typical Brazilian farms								
BR290OR								
Soybean	-	-	70	2,9	70	2,9	418	17,4
Corn - main crop	83	1,4	83	1,4	83	1,4	418	7,2
Corn - Safrinha	41	1,4	40	1,3	40	1,3	-	-
BR500UB								
Soybean	-	-	70	2,9	70	2,9	220	9,2
Corn - main crop	94	1,6	100	1,7	100	1,7	220	3,7
BR1000RV								
Soybean	-	-	70	2,2	70	2,2	310	9,7
Corn - main crop	100	1,4	80	1,2	80	1,2	310	4,5
Corn - Safrinha	19	0,4	48	1,1	48	1,1	-	-

Source: IFCN-calculations — IFCN — IFCN, DEBLITZ (1999)

[4] Being a nitrogen fixating plant, the nitrogen efficiency of soybean can not be compared to rape-seed.

In Brazil, the Agricultural Law (Lei Agrícola) provides some regulation on fertiliser use to prevent soil and water contamination. Basically the farmers must have the orientation of an agronomist to get advice on the proper use of fertiliser. It was, however, not possible to extract the cost of the advice related to this topic because the advisor provides his services, anyway.

In Germany, a fertiliser regulation based on the Ordinance (EC) 76/116, forms the basis for production and distribution of fertiliser but does not directly affect farm level production. Ordinance (EC) 91/676 (Nitratrichtlinie) contains regulations on use of mineral and organic nitrogen fertilisers and is transferred into German law by the so called Fertiliser Regulation (Düngeverordnung). The most important regulations are (see FREDE and DABBERT, 1999, p. 388 f.):

- An upper level of **organic** nitrogen of 170 kg N/ha on arable land and 210 kg/ha on grassland must not be exceeded.
- Liquid **organic** fertilisers like slurry must not be spread in the period between the 15th of November and the 15th of January. Thus, livestock farms have to build storage tanks that can hold organic fertiliser for the relevant period.
- Slurry and sewage have to be incorporated into the soil immediately after application. Application and incorporation is often done in one working step in order to save cost.
- Fertiliser levels must be adjusted to a level regarding nutrient supply in the soil and expected requirements of the plants. If the nutrient content in the soil is determined by taking **soil samples**, the cost on the typical German farms are at DM 4 per ha.
- Farms with more than 10 ha land under operation are obliged to produce an annual **nitrogen balance statement** showing the input and output of nitrogen based on a field balance or a farm gate balance. For phosphorus and potash a three yearly statement has to be produced.

As regards regulations on **organic** fertiliser, the selected arable farms are not affected because they do not keep livestock, don't use organic fertiliser or are far below the limits set by the ordinance. Thus, no cost are inhered by meeting the requirements on organic fertilisers.

Soil sampling and producing nutrient statements creates cost as described above. On the other hand, knowledge about the nutrient levels can also lead to certain cost reductions through more efficient adjustments of fertiliser levels to the soil conditions and the plants' needs. Moreover, producing (and using) nutrient records can be a valuable management tool. The regulation can therefore not be considered as a general disadvantage for German farms. However, to reflect cost of nutrient management to some extent, cost for soil sampling have been deducted from the other direct cost of the German farms to provide an indication of their relevance for total cost of production.

Abandoning soil testing leads c.p. to a cost reduction of approx. DM 0,05 per 100 kg for grains and DM 0,10 per 100 kg for rape-seed which is in both cases less than 1 % of the total cost. However, the results of this calculation will be taken into account for the calculations of the total effects of environmental and social standards in chapter 3.5.

3.4.1.3 Plant Protection

This section aims to clarify whether there are regulations on approval, application, storage and disposal of pesticides (and their packages) that have an effect on production cost. Before that and even though not referring to the farm level, a quick view shall be spend on the development and approval period of pesticides.

Cost of developing and approving pesticides

Both development and approval of pesticides are influenced by different legislative framework conditions. On EU-level the most important is the 'Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market'. Up to now there is no centralised and harmonised procedure for approval of pesticides throughout the EU, i.e. the approval procedures remain with the member states. As a consequence, out of the list of presently around 800 approved active substances almost none of them are approved throughout the whole EC. For example, in Germany less than 300 of them have approval. The basis for pesticide approval in Germany is the German Law on Plant Protection (Pflanzenschutzgesetz, PflSchG). The Federal Biological Research Centre for Agriculture and Forestry (BBA) is the responsible institution for approval of pesticides.

BASSERMANN (1999, p. 122) estimates the research and development period for a new active substance at 8 years plus 2 years of approval, resulting in total cost of approx. 290 million DM. The approval fees of the BBA vary roughly between 21.000-88.500 DM if the pesticide contains only active substances that are already listed in the annex of Directive 91/414/EEC and between approximately 61.500-250.000 DM if the new pesticide contains at least one active substance not listed in the annex (BBA, 1999).

Irrespective of whether this estimation is realistic or not, it is reasonable that the cost for development and approval of a new pesticide will to some extent appear in the final product price. However, prices for pesticides are determined by their total cost of production including research and development cost, different marketing activities of the chemical industry, the wholesale and the retail trade, services provided, regular checks by authorities as well as mixed price calculations across different products (see also BASSERMANN, 1999, p.195 f.). Due to the fact that industry and trade in general are not prepared to provide reliable and detailed data on how the price calculations are done, it is impossible to isolate the part that environmental standards have on the price of a given pesticide.

Application of pesticides

Of particular interest is the question whether pesticides that are approved in one country are used in another country. Table 3.2 to 3.5 show a list of pesticides and their active substances that are used in the production systems investigated.

For **German** pesticides (Tables 3.2 and 3.4) information is provided whether they are approved **in Brazil**, what the corresponding brand names in Brazil are and whether the active substances are covered by the list of the PIC-procedure (for further information on PIC see box below).

For **Brazilian** pesticides (Tables 3.3 and 3.5) information is provided whether they are approved or banned **in Germany**, what the corresponding brand names in Germany are and whether the active substances are covered by the list of the PIC-procedure.

Comparing the use of pesticides in the different crop production systems leads to the following results (compare Tables 3.2 to 3.5)

- As regards **soybean** production in Brazil, two active substances in herbicides (Clethodim, Haloxyfop-methyl) not approved in Germany are still used in at least one of the typical farming system investigated in Brazil. Additionally, three insecticides that have never been approved or are banned in Germany are still in use in Brazil (Profenofos, Monocrotophos, Endosulfan). Monocrotophos is also the only substance not allowed above a certain concentration by the PIC-procedure (Table 3.3).
- In **corn** production in Brazil, three active substances in herbicides (Acetochlor, Atrazine, Simazine) and one active substance in insecticides (Triflumuron) are used that are banned or not approved in Germany. None of the pesticides in use is mentioned in the list drawn up under the PIC-procedure (Table 3.5).

- None of the pesticides used in **barley** and **wheat** production in Germany is listed under the PIC-procedure. There is a number of pesticides used in Germany but not approved in Brazil (Table 3.4). Based on the information available, in most cases this does not necessarily mean that they have been banned in Brazil but that they have not (yet) been taken to the approval procedure. The main reasons are probably that (a) most substances are rather new developments specifically suited for grain production under European conditions, (b) there is no need to use them in Brazil (e.g. growth regulators) and (c) there has been no need to replace old pesticides by new developments under pressure of regulations or bans (example: Simazine is still used in Brazil and has been replaced by Isoproturon in Germany after the ban of Simazine).
- As regards **rape-seed** production in Germany, the situation is similar as for grains. Again, none of the substances in use is listed under the PIC-procedure. Some of the pesticides are not approved in Brazil. The reasons are the same as described for the grain crops (Table 3.2).

The PIC-Procedure on Pesticides (FAO, 1999)

Both Brazil and Germany participate in the so-called **PIC-procedure** (**Prior Informed Consent**). The „Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in the International Trade" aims at establishing an information system on dangerous and forbidden pesticides amongst the participating countries. This shall help to protect health of farmers, producers and consumers, in particular in developing countries. Countries that have banned the use or the import of certain substances and participate in the PIC-procedure will not be allowed to produce or to export these substances. The PIC-members have produced an initial list of 22 pesticides and 5 industrial chemicals (see Annex A.1). 61 States have signed a convention on the PIC-procedure and the list has been sent for approval to the headquarters of the UN in Nairobi. Pesticides being or becoming part of the PIC-list must be forbidden or strongly restricted in at least one country out of two PIC-regions.

As the list shows, the PIC procedure at present is at its very beginning. Most chemicals listed are rather outdated and can be or have been replaced by more environmentally friendly and more effective chemicals. The only chemical listed by PIC and still used in the systems investigated in this report is the insecticide Monocrotophos (but only above a certain concentration). However, the PIC procedure can be a starting point towards international harmonisation of pesticide use and ban of dangerous substances in participating countries.

The **consequences** of these findings for the study are:

- There is no need to do additional calculations for the Brazilian farms because there is no evidence that any pesticide not approved in Brazil but used in Germany has been banned or rejected from approval because of environmental or safety reasons.
- The possibilities and the benefit of additional calculations for German farms by simulating the use and the cost effects of pesticides banned in Germany but still used in Brazil are limited because different crops are compared.
- However, for Atrazine and Simazine direct comparisons can be made. This will be done in two steps. In the first step, an example-calculation is given for replacing the presently used herbicides in corn production in Southern Germany by Atrazine. The calculation data are based on engineering data taken from the local advisory services. In the second step, the replacement of the herbicides presently used in barley and wheat production on the typical farms by Simazine is simulated and the effect on the cost shown.

Table 3.2: Pesticide use in German rape-seed production

Type of pesticide	Brand names in Germany (2)	Active substances (2)	Approved in Brazil (1)	Brand names in Brazil (1)	Allowed by PIC-Procedure (3)
Herbicides	Fusilade	Fluazifop-p-butyl (125 g/l)	yes	Fusilade 125 (125 g/l), Fusiflex	not listed
	Gallant Super	Haloxyfop-R (104 g/l)	yes	Verdict-R (120 g/l) Gallant 240 BR (240 g/l)	not listed
	Agil	Propaquizafop (100 g/l)	yes	Shogun 100 CE (100 g/l)	not listed
	Butisan Top	Metazachlor (375 g/l) + Quinmerac (125 g/l)	no no	- -	not listed not listed
Fungicides	Folicur	Tebuconazol (250 g/l)	yes	Folicur CE (250 g/l), Folicur PM (250 g/kg)	not listed
	Caramba	Metconazol (60 g/l)	no	-	not listed
Growth regulators	CCC-720	Chlormequat-chlorid (720 g/l)	no	-	not listed
Insecticides	Mesurol	Methiocarb (20g/kg)	no	-	not listed
	Fastac SC	Alpha-Cypermetrin (100g/l)	yes	Arrivo 200 CE (200 g/l), Cymbush, Ripcord u.a.	not listed

Explanations:
1) Complete ban
2) Substance has never been approved
3) At present no pesticide with the substance on the market
4) Approval expired

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Sources:
(1) ORGANIZAÇÃO ANDREI EDITORA LTDA. (1996): Compêndio de Defensivos Agrícolas.
RODRIGUES, B.N; ALEMEIDA DE, FERNANDO SOUSA (1995): Guia de Herbicidas. (Herbizidführer)
(2) Biologische Bundesanstalt: Verzeichnis der zugelassenen Pflanzenschutzmittel
(3) FAO (1999)

IFCN, Deblitz 1999

Table 3.3: Pesticide use in Brazilian soybean production

Type of pesticide	Brand names in Brazil (1)	Active substances (1)	Approved in Germany (2)	Brand names in Germany (at 19.8.1999) (2)	Allowed by PIC-Procedure (3)
Herbicides	Roundup	Glyphosate (360 g/l)	yes	Roundup Ultra (360 g/l)	not listed
	DMA 806 BR	2,4 D (670 g/l)	yes	U 46 D-Fluid (500 g/l) / Aaherba Combi (250 g/l) / Duplosan KV Combi (160 g/l)	not listed
	Furore	Fenoxaprop-Ethyl (120 g/l)	no 4)	-	not listed
	Podium	Fenoxaprop-P-Ethyl (110 g/l)	yes	Depon Super (63,6 g/l) Ralon Super (66 g/l)	not listed
	Select 240 CE	Clethodim (240 g/l)	no 2)	-	not listed
	Cobra	Lactofen (240 g/l)	no 2)	-	not listed
	Trifluralin	Trifluralin (445 g/l)	yes	Elancolan K SC (240 g/l) / Stefes Trifluralin (460 g/l) / Triflurex (480 g/l)	not listed
	Classic	Chlorimuron Ethyl (250 g/kg)	yes	no applications	not listed
	Verdict	Haloxyfop-methyl (240 g/l)	no 2)	-	not listed
	Gramocil	Paraquat (200 g/l) + Diuron (100 g/l)	yes	Gramoxone Extra (100 g/l) + 13 Brand names for Diuron	not listed
Fungicides		Cobalt+Mylebdenium (Seed)	no 3)		not listed
	Vitavax-Thiram 200 SC	Carboxin (200 g/l)	yes	Arbosan GW (225 g/l) / Abavit UF (400 g/l) / Abavit UT (479 g/l) / Prelude UW (333 g/l)	not listed
		+ Thiram (200 g/l) (Seed)	yes	Tutan (500 g/l)	
	Vetram	Thiram (700 g/kg) (Seed)	yes	Tutan (500 g/l)	not listed
	Derosal 500 SC	Carbendazim (500 ml/l)	yes	Aagrano UW 2000 (300 g/l) / Derosal flüssig (360 g/l) / Harvesan (125 g/l) / Sportak Alpha (80 g/l)	not listed
	Benlate	Benomyl (500 g/kg)	yes	Du Pont Benomyl (524 g/l)	not listed
Insecticides		Sulfluramid	not listed	no applications	not listed
	Curacron 500	Profenofos (500 g/l)	no 2)	-	not listed
	Nuvacron	Monocrotophos (400 g/l)	no 2)	-	no (Formulat. > 600 g/l)
	Dimilin	Diflubenzuron (250 g/kg)	yes	Dimilin 80 WG (800 g/l)	not listed
	Thiodan CE	Endosulfan (350 g/l)	no 4)	-	not listed
	Tamaron BR	Methamidophos (600 g/l)	yes	Tamaron (600 g/l)	not listed

Sources and explanations: See Table 3.2

IFCN, Deblitz 1999

Table 3.4: Pesticide use in German grain production

Type of pesticide	Brand names in Germany (2)	Active substances (2)	Approved in Brazil (1)	Brand names in Brazil (1)	Allowed by PIC-Procedure (3)
Herbicides	Hora Flo	Isoproturon (IPU 500 g/l)	no	-	not listed
	Round up Ultra	Glyphosate (360 g/l)	yes	Roundup (360 g/l) u.a.	not listed
	Foxtril Super	Bifenox (250 g/l)	no	-	not listed
		+ Ioxynil (76,6 g/l)	yes	Totril (250 g/l)	not listed
	Duplosan KV	Mecoprop-P (600 g/l)	no	-	not listed
	Starane 180	Fluroxypyr (180 g/l)	yes	Starane 200 (200 g/l)	not listed
	Aaherba-M	MCPA (500 g/l)	yes	Agritrin SC (231 g/l)	not listed
Fungicides	Pronto plus Bravo 500	Tebuconazol (200 g/l)	yes	Folicur CE (250 g/l); Folicur PM (250 g/kg)	not listed
		+ Fenpropidin (300 g/l)	no	-	not listed
		+ Chlorthalonil (500 g/l)	no	-	not listed
	Amistar	Azoxystrobin (250 g/l)	no	-	not listed
	Juwel Top	Epoxiconazol (125 g/l)	no	-	not listed
		+ Kresoxim-methyl (125 g/l)	no	-	not listed
	Sportak Alpha	Carbendazim (80 g/l)	yes	Bendazol (500 g/l) Derosal 500 SC (500 ml/l)	not listed
		+ Prochloraz (300 g/l)	yes	Sportak 450 CE (450 g/l)	not listed
	Harvesan	Carbendazim (25 g/l) + Flusilazol (250 g/l)	yes	Bendazol (500 g/l) Derosal 500 SC (500 ml/l)	not listed
	Caramba	Metconazol (60 g/l)	no	-	not listed
Growth regulators	CCC-720	Chlormequat-chlorid (720 g/l)	no	-	not listed
	Terpal C	Chlormequat-chlorid (305 g/l) + Ethephon (155 g/l)	no	-	not listed
	Camposan-Extra	Etephon (660 g/l)	no	-	not listed
Insecticides	Fastac SC	Alpha-Cypermetrin (100g/l)	yes	Arrivo 200 CE (200 g/l), Cymbush, Ripcord u.a.	not listed

Sources and explanations: See Table 3.2

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IFCN, Deblitz 1999

Table 3.5: Pesticide use in Brazilian corn production

Type of pesticide	Brand names in Brazil (1)	Active substances (1)	Approved in Germany (2)	Brand names in Germany (at 19.8.1999) (2)	Allowed by PIC-Procedure (3)
Herbicides	Kadett	Acetochlor (840 g/l)	no 2)	-	not listed
	Roundup	Glyphosate (360 g/l)	yes	Roundup Ultra (360 g/l)	not listed
	DMA 806 BR	2,4 D (670 g/l)	yes	U 46 D-Fluid (500 g/l) / Aaherba Combi (250 g/l) / Duplosan KV Combi (160 g/l)	not listed
	Gramoxone	Paraquat (200 g/l)	yes	Gramoxone Extra (100 g/l)	not listed
					not listed
	Primestra SC	Metolachlor (200 g/l)	yes	Harpun (300 g/l) / Stentan (125 g/l) / Gardoprim plus (333 g/l)	not listed
		+ Atrazine (300 g/l)	no 1)	-	not listed
	Sanson 40 SC	Nicosulfuron (40 g/l)	yes	Nisshin (40 g/l) / Motivell (40 g/l)	not listed
	Primatop SC	Atrazine (250 g/l)	no 1)	-	not listed
		+ Simazine (250 g/l)	no 3)	-	not listed
	Afalon 500 BR	Linuron (450 g/l)	no 2)	-	not listed
Fungicides	None	None			
Insecticides	Decis 25 CE	Deltamethin (25 g/l)	yes	Decis flüssig (25 g/l)	not listed
	Alsystin	Triflumuron (250 g/kg)	no 3)	-	not listed
	Karate	Lambdacyhalothrine (50 g/l)	yes	Karate (50 g/l)	not listed
		Sulfluramid	no 2)	no applications	not listed
	Dimilin	Diflubenzuron (250 g/kg)	yes	Dimilin 80 WG (800 g/kg)	not listed
	Piredan	Permethrine (384 g/l)	yes	Ambush (250 g/l) / Ribinol N (250 g/l)	not listed
	Furadan	Carbofuran (350 g/l)	yes	Carbosip Granulat (50 g/l)	not listed
	Semevin	Thiodicarb (350 g/l)	yes	Skipper (40 g/l)	not listed
	Futur 300	Thiodicarb (300 g/l) + ZnO (250 g/l) + Mo (10 g/l) + Bo (2 g/l)	yes	Skipper (40 g/l)	not listed

Sources and explanations: See Table 3.2

IFCN, Deblitz 1999

Corn production in Southern Germany

The examples are on corn production in Bavaria and Baden-Württemberg. To isolate the effect of the Atrazine-ban, the use of Atrazine in the production systems has been simulated by replacing the relevant herbicides by Atrazine. Tables 3.6 and 3.7 show the gross margins and the differences between the status-quo situation and the "*what if they were still allowed to use Atrazine*" situation.

The Bavarian farm can save approx. DM 100 per ha when replacing the presently used herbicides by Atrazin, corresponding to a 5 % reduction in variable cost (Table 3.6). The figures for the farm in Baden-Württemberg are similar but the gross margin calculation has been extended to a total cost calculation (Table 3.7). The total cost reduction is around 3 %.

Table 3.6: Simulation of Atrazine use in corn production in Bavaria

	Unit	**Status quo**	**With Atrazin**
Yield (Sold product)	dt/ha	89,30	89,30
Gross price (incl. VAT)	DM/dt	23,76	23,76
Market return	DM/ha	2.121,77	2.121,77
Compensation payment GAP	DM/ha	774,00	774,00
Total returns	DM/ha	2.895,77	2.895,77
Seed cost	DM/ha	271,26	271,26
Fertiliser	DM/dt	308,09	308,09
Plant protection	DM/ha	142,52	**38,82**
Variable machinery cost	DM/ha	126,80	126,80
Machinery association (harvest)	DM/ha	270,00	270,00
Drying	DM/dt	776,91	776,91
Hail insurance	DM/dt	47,33	47,33
Interest (5 % for 5 months)	DM/ha	40,48	**38,32**
Total variable cost per ha	DM/ha	1.983,38	**1.877,53**
Total variable cost per dt	DM/dt	22,21	**21,02**
Difference variable cost per ha	DM/ha	-	**-105,85**
Difference variable cost per dt	DM/dt	-	**-1,19**
Difference as percentage of status quo	%	-	**-5%**
Gross margin per ha	DM/ha	912,39	**1.018,24**
Gross margin per dt	DM/dt	10,22	**11,40**
Source: IFCN calculations based on information of the "Bayerische Landesanstalt für Betriebswirtschaft und Agrarstruktur" (1999)			IFCN, DEBLITZ (1999)

Table 3.7: Simulation of Atrazine use in corn production in Baden-Württemberg

	Unit	Status quo	With Atrazin
Yield (Sold product)	dt/ha	90,00	90,00
Gross price (incl. VAT)	DM/dt	22,00	22,00
Market return	DM/ha	1.980,00	1.980,00
Compensation payment GAP	DM/ha	771,00	771,00
Compensation payment env. Progr.	DM/ha	260,00	260,00
Less share in set-aside	DM/ha	-33,00	-33,00
Total returns	DM/ha	2.978,00	2.978,00
Seed cost	DM/ha	354,00	354,00
Fertiliser	DM/ha	254,00	254,00
Plant protection	DM/ha	143,37	**53,82**
Variable machinery cost	DM/ha	167,00	167,00
Machinery association (harvest)	DM/ha	280,00	280,00
Drying	DM/ha	414,00	414,00
Hail insurance	DM/ha	24,00	24,00
Interest (5 % for 5 months)	DM/ha	34,09	**32,23**
Total variable cost per ha	DM/ha	1.670,47	**1.579,05**
Total variable cost per dt	DM/dt	18,56	**17,54**
Difference variable cost per ha	DM/ha	-	**-91,42**
Difference variable cost per dt	DM/dt	-	**-1,02**
Difference as percentage of status quo	%	-	**-5%**
Gross margin per ha	DM/ha	1.307,53	**1.398,95**
Gross margin per dt	DM/dt	14,53	**15,54**
Fix machinery cost	DM/ha	800,00	800,00
Fix building cost	DM/ha	100,00	100,00
Opportunity cost for own land	DM/ha	380,00	380,00
Own labour (25 DM * 11,5 Akh/ha)	DM/ha	287,00	287,00
Overhead cost	DM/ha	150,00	150,00
Total fix cost	DM/ha	1.717,00	1.717,00
Fix cost per ha	DM/ha	3.387,47	**3.296,05**
Fix cost per dt	DM/dt	37,64	**36,62**
Difference fix cost per ha	DM/ha	-	**-91,42**
Difference fix cost per dt	DM/dt	-	**-1,02**
Difference as percentage of status quo	%	-	**-3%**

Source: Own calculations based on information of the "Landesanstalt zur Entwicklung der Landwirtschaft und der Ländlichen Räume (LEL) Schwäbisch Gmünd"; Fax-message 26.8.1999 — IFCN, DEBLITZ (1999)

Barley and wheat production

Before it has been banned in 1991, Simazine was used in German barley and wheat production. Table 3.8 shows the simulation result for barley and wheat production comparing the status-quo with a situation *"with Simazine"*.

Table 3.8: Simulation of Simazine use in German barley and wheat production

	Unit	Units/ha	DM/Unit	DM/ha
Without Simazine				
Round up Ultra	l	0,6	15,53	9,32
Hora Flo (IPU)	l	1,5	13,32	19,98
Foxtril Super	l	1,5	31,05	46,58
Starane 180	l	0,4	61,60	24,64
Total				100,51
With Simazine				
Round up Ultra	l	0,6	15,53	9,32
Simazin 500 flüssig	l	0,2	16,16	3,23
Starane 180	l	0,4	61,60	24,64
Hora Flo (IPU)	l	1	13,32	13,32
Total	DM			41,19
Difference	DM			**59,32**
	%			**-59%**
Source: IFCN, WLZ Raiffeisen AG (1998), Bassermann (1999)			IFCN	IFCN, DEBLITZ (1999)

The difference of DM 59 per ha means a difference of approximately DM 0,73 per 100 kg at yields of 8 t per ha. This will be taken into account for the calculations of the total effects of environmental and social standards in chapter 3.5.

Disposal of pesticides and their packages

As described in chapter 2.4.1, residuals of pesticides as well as their packages are not disposed properly in all cases in Brazil. Three times rinsing of pesticides packages before disposing them is recommended but this recommendation is not always followed by the farmers. Moreover, the waste management of empty packages is not organised and as a result farmers either store the empty packages on their farms (waiting for a solution), throw them away or even burn them.

The chemical industry in Germany has established a system in which packages for pesticides are returned to the industry after use, called PAMIRA. PAMIRA has established collection points where farmers can take the empty packages. The packages have to be rinsed three times and stored open and dry before they are taken to the collection points. Locations and collection dates can be checked in the Internet at http://www.iva.de/frame4/thema13teil3_pamira.htm. The collection itself is free of charge. However, recycling cost are certainly included in the sale prices of the pesticides but it was not possible to isolate them.

3.4.2 Operating cost

6.4.2.1 Labour and social standards

Social standards are closely linked to labour in terms of laws on working time, minimum wage levels, social contributions, additional wage cost, labour safety regulations and benefits from social systems. Hence, they are discussed in this chapter.

Germany

Table 3.9 shows the wage levels and the working hours paid in West and East Germany.

Depending on the qualification of the workers, wage levels agreed on by the union and the management are between DM 10,45 and DM 16,37 per hour. Wage levels are lower in East Germany than in West Germany. The level of **paid** wages in West Germany is even above the agreed levels whereas in East Germany wages paid are usually below that. The differences between East and West are also reflected in the monthly salary.

Table 3.10 indicates the cost related to labour in Germany. The top section shows the cost that can be directly attributed to the wage payments. The second section shows additional regulations and benefits which can not be attributed to the cost per unit produced. However, they are covered by the figures shown in the top section. The Table shows that taking the compulsory social contribution (pension, health, unemployment) plus the 13^{th} wage and the vacation payment into account, approximately 51 % of the gross wage paid to the worker can be considered as additional wage cost (before taxes).

Table 3.9: Agricultural gross wage levels in Germany 1997

	Unit	Qualified Workers	Field Workers	Unqualified Workers heavy work	Unqualified Workers light work
Wage rates 1)					
West Germany	DM/h	16,37	15,25	14,37	10,78
East Germany	DM/h	15,13	13,93	12,73	10,45
Paid Wages					
West Germany	DM/h	20,73	18,81	17,86	
East Germany	DM/h	13,46	13,57	11,07	
West Germany	DM/Month	3.443			
East Germany	DM/Month	2.725			
Paid hours					
West Germany	h/Month	198,2	203,8	191,8	
East Germany	h/Month	209,5	247,7	223,3	

1) as agreed between unions and management
Source: Statistisches Bundesamt (1999); BML (1999)

IFCN, DEBLITZ (1999)

Brazil

In Brazil, the minimum wage is R$ 136 per month (approx. DM 190). Usually, workers are paid 3 to 4 times of the minimum wage (DM 571 to 762 per month). Table 3.11 indicates the cost related to labour in Brazil.

Table 3.10: Social contributions, additional wage cost and social standards in German agriculture

Item	Percentage	Used for	Example
Minimum wage level:	**11,41**	DM/h	
Average wage level:	**18,45**	DM/h (West Germany)	
I. Contributions linked to the total gross wage paid per month			**3.443**
I.a Employers	10,15%	Pension scheme	349
	6,50%	Health Insurance	224
	0,85%	Nursery Insurance (Pflegeversicherung)	29
	3,25%	Unemployment scheme	112
	1,21%	Vacation payment *(assumption: DM 500 per year)*	42
	8,33%	13th wage	287
		Accident Insurance (Berufsgenossenschaft)	
Subtotal I.a	30,29%		1.043
I.b Employees	10,15%	Pension scheme	349
	6,50%	Health Insurance	224
	0,85%	Nursery Insurance (Pflegeversicherung)	29
	3,25%	Unemployment scheme	112
Subtotal I.b	20,75%		714
Total I.a and I.b	51,04%		1.757

Other labour regulations

Working time	• Total 40 h/week [Monday to Friday: 8 h/day]; Overtime and weekend is paid extra
Minimum wage	• There is no general minimum wage but agreements between unions and management which are, however, not legally binding. Workers above 18 years placed by the labout offices in Western Germany are paid DM 11,41 gross per hour, less than 18 years DM 10,24 gross per hour.
Sickness payment	• First 6 weeks 100% continued payment by the employer. • After that payment by Health Insurance.
Protection against dismissal	• KSchG clarifies that no dismissal is allowed if socially not reasonable • Dismissal periods are usually 6 weeks prior to the end of the trimestre but subject to negotiation between the unions and the management • The dismissal period defined by law is 4 weeks to the 15th ot the end of the upcoming month (BGB § 622)
Vacation payment	• Not compulsory by law, but usually paid based on individual or company contracts or based on collective agreements, approx. DM 500 per year
Maternity leave	• 6 weeks before and 8 weeks after birth (100% payment by the employer)
Child allowance	• DM 250/month for the first and the second child • DM 300/month for the third child • DM 350/month for all following children
Support for raising children	• Up to DM 600 per month for up to 3 years after birth depending on the total family income

Source: Oral and written communication with IG Bau, Agrar und Umwelt (1999) | IFCN, DEBLITZ (1999)

Table 3.11: Wage levels, social contributions, additional wage cost and social standards in Brazilian agriculture

Item	Percentage	Used for	Example
I. Contributions linked to the total sales value per year			**300.000**
I.a Farm with employees	2,20%	2 % Social security, in particular accident insurance 0,1 % SENAR (National Service of Rural Apprenticeship) 0,1 % SAT	6.600
I.b Farm without employees	2,30%		6.900
Subtotal I.a			**6.600**
II. Contributions linked to the total wage paid per month			**665**
Minimum wage level:	**1,01**	DM/h (0,72 R$ * 1,4 DM/R$)	
Average wage level:	**3,53**	DM/h (3,5 times minimum wage)	
II.a Employers	2,70%	INSS (Instituto Nacional de Seguro Social) 2,2% Education Contribution 0,5% INCRA (Nat. Inst. of Colonisation and Agrarian Reforms)	18
	8,00%	FGTS (Working Time Guarantee Fund)	53
	11,11%	Vacation payment (4/3 of a monthly salary)	74
	8,33%	13th wage	55
Subtotal II.a	30,14%		200
II.b Employees	8,00%	INSS	53
	2,00%	National Union	13
	0,11%	Local Union (equivalent to one day salary per year) 1)	1
Subtotal II.b	10,11%		67
Total II.a and II.b	40,25%		**268**

Other labour regulations	
Working time	• Total 44 h/week [Monday to Friday: 8 h/day; Saturday: 4 h]; Overtime is paid extra
Minimum wage	• 136 R$/month (equivalent to 0,72 R$/h) 1)
Sickness payment	• First 15 days 100% continued payment by the employer • After that 70% payment of social service
Protection against dismissal	• Employer has to pay 30 days • Unemployment payment for 3 months from INSS; if the employee was dismissed by the employer, payments are made by the funds accumulated in the FGTS

1) 1 month = 30 days = 4,28 weeks. 136 R$/month / 4,28 weeks = 31,78 R$/week / 44 h/week = 0,72 R$/h * 8h = 5,76 R$/day

Source: Written communication with CEPEA (1999) — IFCN, DEBLITZ (1999)

Conclusions on labour and social standards

As shown in the previous sections, there are differences in (a) the wage levels for agricultural employees as well as (b) in social contributions and additional wage cost between Germany and Brazil. It could be shown that social contributions directly attributable to the gross wage sum up to around 50 % in Germany and 40 % in Brazil. The major difference in labour cost between the two countries is however caused by the wage level itself which is about five times higher in Germany than in Brazil.

Table 3.12 shows the labour cost on the typical farms. In section A of the Table the labour cost for permanent employees are shown. Casual labour cost could not be split up in this way because the necessary information is lacking and in many cases specific (legal) arrangements between the farmers and the workers are made to avoid full payment of social contributions. Wage levels show an average of all workers employed.

Table 3.12: Labour cost on typical crop farms in Germany and Brazil

	Unit	D100HI	D560MD	D700MV	D1300MD	BR290OR	BR500UB	BR1000RV
A. Direct labour cost for permanent employees								
Gross wage	DM/year	-	38.500	42.300	42.300	7.098	6.377	9.783
Employer's social contrib.	DM/year	-	11.500	12.700	12.700	2.129	1.913	2.935
Labour cost for employer	DM/year	-	*50.000*	*55.000*	*55.000*	*9.227*	*8.290*	*12.718*
Employee's social contrib.	DM/year	-	8.085	8.883	8.883	710	638	978
Total cost of labour	DM/year	-	58.085	63.883	63.883	9.937	8.928	13.696
No. of workers	No.	-	2	2	4	2	2	4
Total labour input	h/year	-	4.200	5.000	9.200	4.818	5.037	10.240
Total cost per farm	*DM/year*	-	*100.000*	*110.000*	*220.000*	*18.455*	*16.580*	*50.873*
	DM/h	-	*23,81*	*22,00*	*23,91*	*3,83*	*3,29*	*4,97*
B. Indirect labour cost for total farm		***** Figures on B must be considered with great care! See remarks in text. *****						
Total sales value	DM/year	**not relevant for German farms**				344.568	436.464	1.280.027
Employer's social contrib.	%					2,2%	2,2%	2,2%
Total B	DM/year					7.580	9.602	28.161
	DM/worker					3.790	4.801	7.040
	DM/h					1,57	1,91	2,75
Total A + B	DM/year	0	100.000	110.000	220.000	26.035	26.182	79.033
	DM/worker		50.000	55.000	55.000	13.018	13.091	19.758
	DM/h		23,81	22,00	23,91	5,40	5,20	7,72

Exchange rate DM/Real: 1,4
Source: IFCN-calculations

IFCN, DEBLITZ (1999)

The Table indicates that on a per hour basis the labour cost in Germany are between 4 to 7 times higher than in Brazil. The labour cost for the large Brazilian farm (BR1000RV) are higher than for the other Brazilian farms because (a) the wage level for ordinary workers is higher and (b) the farm employs a manager with a salary about twice as high as for the other workers.

In the bottom part the second financial source of the Brazilian social system, the total sales values, are indicated as they occurred for the three typical farms (total production multiplied by the product prices). The social payments derived from these figures have to be considered with extreme care because they are most likely only a hypothetical basis for calculating the farms contributions. As the table show they have a significant impact on the level of wage cost. This provides an incentive for Brazilian farmers to reduce the calculated amount of sales revenues.

Apart from cost directly attributable to the wage level there are cost related to labour safety regulations. Standards on labour safety in Germany are higher than in Brazil. However, it was not possible within the scope of the study to isolate them because cost for safety standards are often included in prices for equipment (like requirements on building or machinery design) and information to determine their share in the total price was lacking. It should be clarified in further studies if the cost effect of safety standards is of high or of low importance.

Against the background of these findings, the sense of making additional calculations, e.g. by applying the 10 % lower Brazilian additional wage cost on the German wage level, appears to be doubtful without considering the benefits that result from the higher level of social standards in Germany. In other words, the more costly German system also buys more social benefits. To make figures comparable, an identical level of social benefits for both countries should be identified first. This would exceed the scope of this study. As a consequence, no additional calculations on social standards are made.

3.4.2.2 Machinery and equipment

With regard to environmental and social standards, there is no indication that the technical design of machines is different between Germany and Brazil as a result of environmental standards. Safety standards that can be allocated to social standards are different between the countries but as mentioned in the previous chapter that it is difficult to isolate the part that safety standards have in the total machinery price.

It should however be noted that the most important legal basis for machinery operation in Germany is the Straßenverkehrszulassungsordnung (StVZO). The StVZO provides regulations on the measures and the weight of vehicles permitted on roads as well as the traffic rules. The enforcement of the technical issues related to the StVZO is carried out by the technical supervision authority (TÜV). The enforcement of the traffic rules is due to the police. A regulation similar to the German StVZO has been introduced recently in Brazil. The main purpose is to ensure that trucks and tractors are in good shape and technical condition.

Every vehicle has to undergo a mandatory technical check by the TÜV every other year. In case of defects or shortcomings, no permission is granted and the vehicle has to be fixed. Moreover, there are technical specifications and limitations on sizes (for example width, length and weight) for agricultural machines when driven on public roads as well as security standards for tractors and other equipment.

The regulations imposed by the StVZO can become cost-relevant if for example tillage equipment may not exceed a certain width when moved on public roads and additional technical equipment (e.g. for folding cultivators) has to be installed to meet the requirements. The linkage of sprayers for instance may only have a maximum width of 3 m. Linkages must be foldable in 3 m units which makes them more expensive. Additionally, very big machines with a potential to reduce unit cost might even not be used at all. These regulations are, however, made mainly for safety reasons and can not be directly attributed to environmental or social standards. High traffic density in Germany is the main reason for this kind of regulations.

The TÜV-inspection for sprayers may be interpreted as environmental standard in a broader sense. German farmers have to take their sprayers to the TÜV every second year to check functionality and ensure proper application of pesticides. The cost for that depend on the width of the spraying equipment. For a 18 m sprayer the cost are DM 165 per check. It is obvious that these cost have a very low impact on total cost of production if they are related to the acreage and the related yields. For example, the cost per 100 kg wheat for the 100 ha farm in South Hanover are less than a third of a Pfennig.

As a consequence, no additional calculations on the standards imposed by the StVZO are made.

3.4.2.3 Fuel and lubrication

Present situation

Prices for fuels and lubricants are often influenced by taxes, like in Germany where the mineral oil tax was DM 62 per 100 l in 1998. This accounted for almost 60 % of the average 1998 sale price of approx. DM 1,05 including 16 % value added tax (equivalent to a net price of DM 0,905 per 100 l). On the other hand, up to now German farmers pay less for diesel because they receive a subsidy of DM 41,15 per 100 l (BML, 1999), resulting in farm prices for diesel of approx. DM 65 per 100 l.

In Brazil, there are a National Petroleum Agency (Agência Nacional do Petróleo) that provides regulations on the quality of the fuels and on the distribution. Prices for diesel have increased in 1999 because of the devaluation of the R$.

It can be concluded (a) that in Germany there is a strong influence of regulatory framework conditions on fuel prices but that (b) there is no indication that there are different environmental standards leading to a significant price difference of fuel prices between Germany and Brazil. As a consequence, no additional calculations on the present situation are made.

Foreseeable future

The present German government is going to remove or at least to reduce the diesel subsidy in the year 2000. Moreover, the government has introduced a so-called ‘eco-tax’ on diesel and other fuels which will be DM 30 per 100 l in its final stage in the year 2003. It is imposed via an increase of the mineral oil tax and it is a ‘hot issue’ in the political discussion.

Although not being reality for the year under consideration, the removal of the diesel-subsidy and the introduction of the eco-tax to its full extent have been calculated for the German farms to provide an idea which effect it has on the production cost. Even if the removal of the diesel-subsidy is not supposed to be done for environmental reasons, it is reasonable to assume that the increase in the diesel price will provide incentives to reduce the use of diesel which again leads to less air pollution. In this sense, the removal of the subsidy could be interpreted as being partly environmentally-driven.

Adding the subsidy (DM 41,15) and the eco-tax (DM 30) to the net diesel price of DM 49 per 100 l leads to an increase of net fuel cost of 145 %.[5] It should be noted that **no adoptions** to the changed situation have been simulated which are, however, most likely to take place within the 4 years period. Thus the result is most likely the maximum cost effect. As Table 3.13 shows, the cost increase is between DM 1,63 and DM 1,94 for rape-seed and between DM 0,83 and DM 1,38 for grains. The effect on total cost of production is in the range between 3 to 5 %.

As the eco-tax has not been reality in the period of consideration in this study, it has not been taken into account for the summary of environmental and social standards in chapter 3.5.

Table 3.13: Effect of removal of diesel subsidy and introduction of eco-tax on typical German farms (note: no farm level adoptions assumed)

	Unit	D100HI	D560MD	D700MV	D1300MD
Rape-seed					
Tractor fuel	DM/dt	-	+ 1,81	+ 1,72	+ 1,50
Dryer Fuel	DM/dt	-	+ 0,13	+ 0,18	+ 0,13
Total fuel	*DM/dt*	-	+ 1,94	+ 1,91	+ 1,63
Increase in total cost	*%*	-	*+ 3,44%*	*+ 3,77%*	*+ 3,10%*
Winter Barley					
Tractor fuel	DM/dt	+ 0,92	+ 1,06	+ 1,10	+ 0,89
Dryer Fuel	DM/dt	+ 0,37	+ 0,11	+ 0,27	+ 0,11
Total fuel	*DM/dt*	+ 1,29	+ 1,16	+ 1,38	+ 0,99
Increase in total cost	*%*	*+ 3,52%*	*+ 3,81%*	*+ 4,69%*	*+ 3,56%*
Winter Wheat					
Tractor fuel	DM/dt	+ 0,86	+ 0,86	+ 0,77	+ 0,70
Dryer Fuel	DM/dt	+ 0,36	+ 0,13	+ 0,09	+ 0,13
Total fuel	*DM/dt*	+ 1,22	+ 0,99	+ 0,86	+ 0,83
Increase in total cost	*%*	*+ 3,35%*	*+ 3,47%*	*+ 3,53%*	*+ 3,14%*

Source: IFCN-calculations | IFCN | IFCN, DEBLITZ (1999)

[5] Additionally, cost for custom work will also increase slightly depending on the share that fuel cost have in total custom work cost. As cost for custom work are zero or negligibly low on the farms considered, they have not been reflected in the calculations.

3.4.3 Overhead cost including interest cost

6.4.3.1 Buildings

As mentioned earlier, building cost per 100 kg produced are far higher in Germany than in Brazil. The main reason is that construction prices are much higher and that building design is completely different. The latter is partly resulting from different climatic conditions but also from non-environmental regulations on construction, structural engineering and design. As regards design, the authorities also take into account whether the building fits into the landscape. There is no indication that in Brazil there are comparable regulations. In the following, some German building cost that can be directly attributed to environmental standards are identified.

Cleaning place and oil separator

In Germany, for cleaning machines and equipment a special area has to be build meeting the following requirements:

- Concrete area
- Oil separator
- Sewage treatment plant

There is no such regulation in Brazil.

To avoid investment cost for these items, many German farmers take their machines to a local tractor dealer for cleaning, changing oil and maintenance work. However, if the local dealer is far away from the farm or to keep flexibility and independence, in particular on large farms farmers prefer to have their own cleaning place. This means that building cleaning places for machines is not solely a reason of environmental regulations. In any case, if a farmer decides to build this place, he has to do it according to the regulations. Without the regulations, farmers might build the place less costly.

To simplify the calculations, the assumption was made that farmers on the selected typical farms have made the investment only because they had to do so. The cleaning place has therefore been taken out of the building list of the farms.

Fuel storage and petrol station

For storing fuels (mainly Diesel) and lubricants, for the size of the petrol stations on the typical farms the following requirements have to be met in Germany:

- Concrete area under storage tanks or storage tanks in the ground made of special concrete (Ortbeton B 35 WU)
- Oil and fuel tanks must have two layer walls instead of single layer walls. Tanks with two layer walls are sometimes even cheaper than tanks with single layer walls (ZAHL, 1999)
- A concrete basin with a 'wall' of 3-4 cm height has to be build around the storage tanks that can hold the content of at least one of the tanks.
- An oil separator has to build (in the calculations already included in the cleaning place)
- The storage tanks and the basin are subject to technical supervision by the TÜV.

Also Brazilian farmers store fuels on their farm. In Brazil the storage have regulations and control. For instance, the farmers need to have a place in such conditions that they can receive the fuel from the retail.

The question again is which share of the total investment cost is a result of the environmental regulations. Storing of fuels and oil would also happen without environmental regulations. Therefore, the only cost deducted from the investment cost of the petrol station in Germany are:

- Cost for the technical supervision (DM 260 per year)
- Cost for a building permission (DM 580)
- Cost for the basin (DM 170 per m³ of concrete)

Table 3.14 shows the assumptions on reductions in investment cost made for the calculations and Table 3.15 shows the result of the calculations on a per 100 kg basis.

Depending on the present situation, possible cost reductions are between DM 0,08 to DM 0,11 per 100 kg in rape-seed production and DM 0,01 to DM 0,06 per 100 kg in grain production. Thus, the impact of environmental standards in this field is limited.

Table 3.14: Investment cost for cleaning place, oil separator and petrol st a-tion

	Unit	D100HI	D560MD	D700MV	D1300MD
Status quo situation					
Cleaning place (incl. oil separator)	DM	0	30.000	30.000	50.000
Petrol station	DM	4.500	16.000	16.000	25.000
Without regulations					
Cleaning place (incl. oil separator)	DM	0	0	0	0
Petrol station	DM	2.640	13.120	13.120	20.760
Difference	**DM**	**-1.860**	**-32.880**	**-32.880**	**-54.240**

Source: IFCN-calculations — IFCN, DEBLITZ (1999)

Table 3.15: Total cost comparison with and without regulations on cleaning place, oil separator and petrol station (DM per 100kg)

	Unit	D100HI	D560MD	D700MV	D1300MD
Rape-Seed					
With standards	DM/100kg	-	56,40	50,52	52,57
Without standards	DM/100kg	-	56,29	50,43	52,49
Difference	DM/100kg	-	0,11	0,09	0,08
Winter-Barley					
With standards	DM/100kg	36,52	28,40	24,51	26,30
Without standards	DM/100kg	36,51	28,34	24,46	26,26
Difference	DM/100kg	0,01	0,06	0,05	0,04
Winter-Wheat					
With standards	DM/100kg	36,39	30,53	29,30	27,89
Without standards	DM/100kg	36,38	30,47	29,25	27,85
Difference	DM/100kg	0,01	0,06	0,05	0,04

Source: IFCN-calculations — IFCN, DEBLITZ (1999)

Fertiliser and pesticide storage

Fertiliser may not be stored outside without cover. As a consequence, a fertiliser storage is required. The same is true for pesticides. However, fertiliser are usually stored within or aside the machinery hall anyway for climatic reasons. Pesticides have to be kept in a lockable room that can also consist of cheap wooden walls. Thus, storage place for fertiliser and pesticides can be either considered independent from environmental and social standards or as being negligibly low. As a consequence, no additional calculations on fertiliser and pesticide storage are made.

3.4.3.2 Electricity, Water, Gas

Electricity

Electricity prices in Brazil are about 50 % of the German prices. There is no indication that in the year considered for analysis environmental or social standards had an immediate impact on electricity prices and use. Electricity prices in Germany can rather be considered as having been distorted by regional monopolies. Like fuel prices, future electricity prices in Germany are subject to the 'eco-tax' introduced by the government in 1999. In its final stage in the year 2003, the electricity price will be + DM 0,05 per kwh based on today's prices of DM 0,20 to DM 0,50 per kwh. It is most likely that the price-increasing effect of the eco-tax will be more than offset by the price-reducing effects of the current liberalisation of the German market for electricity. Therefore, no additional calculations on electricity in the period under consideration and in the future have been made.

Fresh water and waste water

Cost for **fresh water** can consist of (a) expenses for public water fees and (b) expenses for investments necessary to get fresh water from groundwater, rivers or other water sources (wells, pumps etc.) on the farm.

The typical farms considered in Brazil get their water from own wells and use it mainly for spraying and to some extent for cleaning machines. Thus, water cost for Brazilian farms are negligible.

The typical farms in Germany get most of their water from public water networks and have to pay between DM 2 to DM 4 per m³. Total fresh water cost are between DM 3 and DM 6 per ha. Amongst other factors., water prices in some cases include water treatment cost if the source of the water does not meet the high standards on drinking water (for details see Trinkwasserverordnung, 1990). Depending on the source of the water, treatment cost vary significantly and it is not possible to isolate the effects of water quality standards on prices for farmers.[6]

As regards **waste water**, there is at present no fee in Brazil. However, probably in the next two years the introduction of a fee for waste water is announced by the government. Similar to the eco-tax in Germany, this is at present a controversially discussed topic in Brazil.

In Germany, farmers have either to pay waste-water fees or invest into a cleaning place, oil separator and waste water treatment plant. The cost for oil separator and cleaning place has been calculated in the previous chapter. The fees for waste water are from DM 3 and DM 4 per m³. There is a big difference between the amount of fresh water and waste water that has to be paid. The reason is that between 75 % and 90 % of the fresh water on the arable farms is used for spraying. Payment for waste water is only required for the amount of water that goes to the public waste water system.

It was not possible to exactly extract the water and the waste water cost from the data available. However, an estimation can be made. The figures above show that prices for fresh water and for waste water are mainly the same. If one further assumes that cost for fresh water are DM 5,00 per ha and that 20 % of the amount fresh water is waste water, waste water cost are at DM 1,00 per ha. The corresponding per unit figures are DM 0,03 per 100 kg rape-seed and DM 0,02 per 100 kg barley or wheat.

It should be noted that these figures have not been taken into account in the summarising chapter 3.5 because they are very small and parts of the alternatives to payment of public waste-water fees (cleaning place, oil separator) have already been calculated.

Gas

There is no indication that in the year considered for analysis environmental or social standards had an immediate impact on electricity prices and use. Like fuel and electricity, the gas price in Germany is subject to the 'eco-tax'. The mineral oil tax

[6] An exception is the so-called 'Wasserpfennig' that has been introduced in Baden-Württemberg (1988) and Hessen (1992). It aims to reduce the use of water. Fees are between DM 0,10 to DM 1,00 per m³. Water used for irrigation in agriculture is free of charge (Hessen) or only 10 % of the fees (Baden-Württemberg).

on gas was raised once in 1999 by + DM 3,20 DM per Mwh based on a price of between DM 40 to DM 110 per Mwh. However, no additional calculations are made because (a) gas has not been used on the farms considered and (b) the eco-tax has been introduced after the period of consideration.

3.4.3.3 Insurance, farm taxes and duties

The most important examples for insurance, farm taxes and duties are:

- *Land tax*
  Compulsory in Germany and in Brazil. Based on the land value. Can not be attributed to environmental or social standards.
- *Fire insurance*
  Compulsory in Germany. Contributions are based on the value of the buildings. If fertiliser and pesticides are stored inside a building, insurance cost and requirements for fire protection are higher. These can, however, not be considered as environmental standards but as safety standards.
- *Liability insurance*
  Compulsory in Germany. Can not be attributed to environmental or social standards.
- *Accident insurance (Berufsgenossenschaft)*
  Has been considered with social standards, mainly safety of workers.
- *Contributions to professional organisations*
  These are for instance farmers unions and chambers of agriculture. Contributions for these institutions can not be attributed to environmental and social standards.

It was mentioned in chapters 3.2 and 3.3 that cost for insurance, farm taxes and duties are much higher in Germany than in Brazil. However, none of the insurance, taxes and duties can be considered as environmental or social standards. Therefore, no additional calculations are made.

3.4.3.4 Interest

As shown in the previous analysis of production cost, interest cost for all farms under consideration are rather low. Moreover, there is no indication that interest is directly influenced by environmental or social standards. Therefore, no additional calculations on interest are made.

'Old liabilities' in Brazil

Although not being an environmental or social standard, this issue shall be explained because it is a particularity of Brazilian farms.

Brazilian farmers are obliged to accept a loan referring to 'old liabilities' from the time prior to the economic reforms in 1994. It has been imposed in 1995 by the Bank of Brazil (Banco do Brasil) to all farmers in the regions considered. For this purpose, the bank made a revaluation of the old liabilities which is considered to be too high. For example, a R$ 58.000 loan from 1994 is considered four times as high today. Additionally, the bank could not make clear how the revaluation was done.

Because the bank refused to provide information on the way of recalculating the loans, it was taken to the Brazilian high court and the revaluation of the loans was declared illegal. Farmers pledged for abandoning the law or at least extend the pay back period towards 20 years. However, at August 16, 1999 the government has confirmed the law in its present version arguing that major changes in favour of the farmers would increase public deficits. However, a discussion has been initiated and it is likely that (a) small farmers will be granted a delay in paying back and (b) a discount might be given to producers that pay back without delays.

For most Brazilian farms it will be difficult or impossible to comply with the present loan conditions without running into serious financial problems. In 1998 none of the typical farms investigated had paid interest or principal for the loan. As the loan could practically not be enforced in 1998, it has not been taken into consideration for the calculations. It should be pointed out, however, that if the payback of the loan will be enforced, it will result in an increase of production cost (interest payments) and a decrease of available incomes of Brazilian farmers (principal payments).

3.4.4 Land cost

Land cost consist of (a) rents paid and (b) opportunity cost for own land imputed with the rental price for new rental contracts. Neither in Germany nor in Brazil there is a quantified evidence that parts of the purchase prices and rent prices for land are determined by environmental and social standards. Recent research in Germany has shown that rent prices are mainly influenced by other factors such as demand from growing farms, use of the land, share of quota crops, livestock density, support payments linked to the acreage (FASTERDING and KLARE, 1998).

As a result, no additional calculations on land cost have been made for German farms.

Law on legal reserve in Brazil

Probably the most important environmental regulation imposed on Brazilian farms is the law Nr. 4.771/65 1965. It has two main parts strongly affecting the land use: one is called the legal reserve, the other one is called Permanent Preservation Areas (PPA) (see chapter 2.4.1).

Within the legal reserve, each farmer is obliged to permanently set aside at least 20 % of his land for the purpose of maintaining or replanting local species, mainly trees. In regions with a high share of rain forest the legal reserve is supposed to be 50 %. It is not clarified yet whether the farmer may use this land for purposes like tourism and other non-agricultural uses that ensure the natural conditions of the site. Within the PPA, farmers have to permanently set aside stripes alongside rivers, lakes and waterways for nature protection: As with the legal reserve, they have to plant native plants. Contrary to the legal reserve, they may not use these stripes for any purposes. At present, there is no compensation and no support for establishment of the areas available.

Despite its age and the changes made during the last decades, enforcement of the law is generally rather low and it is still unclear what kind of activities will be allowed on the legal reserve land. Some cases have been taken to court because applying the law on existing farm land actually means an expropriation of the land owners without compensation. Moreover, to fully comply with the requirements of the law, there are not enough native trees available for planting in some regions.

Enforcement may vary between zero and 100 % and depends mainly on the activities of the regional environmental agencies. If a farmer gets accused by the environmental bodies or anybody else of not complying with the law, he will be forced to do so. However, these cases are not common until now. In those cases were farmers were forced to implement the law, they tried first to declare non-productive land as legal reserve. However, in some cases, productive land had to be declared as legal reserve.

It is expected that the enforcement of the law will be much stricter in the future, in particular in the frontier regions of expansion in the mid and north west. The cost of enforcement of the law in terms of keeping 20 % or 50 % of the land taken into agricultural production for native vegetation will probably be internalised via rising land prices.

To provide an estimation on what maximum effect a very strict enforcement of the law would have on land already in production, the following calculations and assumptions are made:

- 20 % of the presently farmed land have to be dedicated to the legal reserve
- No adjustment in intensity (fertiliser, pesticides) on the remaining land is made
- Labour input is reduced by 20 %
- 1 tractor less is required for cultivating the land
- Equipment and buildings are unchanged
- Planting of native tress is calculated with R$ 2.000 per ha (equivalent to DM 2.800 with exchange rate of 1,40) and calculated to annual figures by applying the present interest rate.
- Land prices are assumed to remain short-term at the same level
- There is no compensation paid to the farmers

The results are shown in Table 3.16:

Table 3.16: Cost effect of strict enforcement of the law on legal reserve

	Unit	BR290OR	BR500UB	BR1000RV
Soybean				
Status quo	DM/100kg	37,16	36,91	25,81
With 20 % add. LR	DM/100kg	42,89	45,54	30,73
Difference	DM/100kg	5,73	8,63	4,92
Difference	%	15%	23%	19%
Corn				
Status quo	DM/100kg	16,50	16,23	13,22
With 20 % add. LR	DM/100kg	19,20	18,98	15,39
Difference	DM/100kg	2,70	2,75	2,17
Difference	%	16%	17%	16%

Exchange rate DM/Real: 1,4; LR = Legal Reserve
Source: IFCN-calculations
IFCN
IFCN, DEBLITZ (1999)

The Table shows that total cost would increase significantly between 15 % and 23 % for soybean production and around 16 % for corn production. It should be noted that the extent of these figures show the maximum possible cost effect. Moreover, in

Germany similar restrictions on land use exist, like the obligation to keep certain landscape elements like hedgerows and trees. As these regulations have been enforced for some time already, they probably had a certain effect on the land prices, which compared to other effects has probably been rather limited (see above). Additionally, it was not possible to isolate these or similar effects from the data sets available for the typical German farms.

3.5 Summary and conclusions for oil and grain production

In this chapter, the various calculations on environmental and social standards made in the previous chapters are summarised and their aggregated effect on total cost of production is shown.

For Germany, the following calculations are taken into consideration:

- No soil testing
- Use of Simazine in grain production
- Technical supervision of sprayers
- No cleaning place, no oil separator
- Reduced petrol station

As Table 3.17 shows, there is only a little cost effect resulting from the environmental standards quantified on the **German** farms. However, this result will be further commented in the following.

For the **Brazilian** farms, no cost related to environmental standards could be identified and consequently no cost reduction can be demonstrated. The hypothetical cost increase induced by a very strict enforcement of the legal reserve would lead to higher cost as already shown in chapter 3.4.4.

The results show that **only few cost differences can be explained by environmental standards considered in this report**. It should be noted that this result is drawn from the information available and quantifiable in the short time available for the study. On the other hand it appears to be reasonable to investigate other reasons for cost differences such as price differences and differences in productivity that have been touched upon in previous sections of this report. As explained earlier, prices and productivity may also be affected by environmental, social and other legislative framework conditions that have not been considered in this study.

Table 3.17: Aggregated cost effects of environmental standards on typical German and Brazilian arable farms

	Rape-seed / Soybean DM/dt	%	Winter-Barley DM/dt	%	Winter-Wheat DM/dt	%	Corn DM/dt	%
Germany								
D100HI								
Status quo			36,52		36,39			
- env. Cost			-0,51	-1,4%	-0,56	-1,5%		
D560MD								
Status quo	56,40		30,53		28,40			
- env. Cost	-0,16	-0,3%	-0,55	-1,8%	-0,70	-2,5%		
D700MV								
Status quo	50,52		29,30		24,51			
- env. Cost	-0,13	-0,3%	-0,63	-2,2%	-1,07	-4,4%		
D1300MD								
Status quo	52,57		27,89		26,30			
- env. Cost	-0,49	-0,9%	-0,53	-1,9%	-0,68	-2,6%		
Brazil								
BR290OR								
Status quo	37,16						16,50	
+ env. cost	5,73	+15,4%					2,70	+16,3%
BR500UB								
Status quo	36,91						16,23	
+ env. cost	8,63	+23,4%					2,75	+16,9%
BR1000RV								
Status quo	25,81						13,22	
+ env. cost	4,93	+19,1%					2,17	+16,4%

Source: IFCN-calculations — IFCN DEBLITZ (1999)

Tables 3.18 and 3.19 provide a summary on **prices** for production factors and means of production in German and Brazilian arable production.

Table 3.18 shows that German prices are particularly high for labour, land, machinery and equipment. It could be shown in the previous chapters that the main cost disadvantages of the German farms occur for the cost groups related to these production factors. Moreover, water and electricity prices are significantly higher in Germany. On the other hand, fertiliser prices are higher in Brazil than in Germany. As a result fertiliser cost are also higher in most cases as shown in chapter 3.4.1.2.

Table 3.18: Prices for inputs / production factors in Brazil and Germany 1998

Description	Unit	Price per unit in DM [1]		
	DM per	Germany	Brazil	
Exchange rate DM/R$			1,40	1,00
Factors of production				
Labour				
Minimum wage	h	11,41 [2]	1,01	0,72
Average wage	h	18,45 [2]	3,53	2,52
Arable Land				
Rent price	ha	250 - 1.200	113	81
Purchase price	ha	8.000 - 80.000	2.310	1.650
Machines				
Tractor 100 HP	piece	100.000	63.000	45.000
Combine 6 m	piece	260.000	182.000	130.000
Combine 9 m	piece	370.000	-	-
Seeding machine 4,5 m	piece	19.000	11.200	8.000
Planting machine 4,5 m	piece	35.000 [3]	23.380 [3]	16.700 [3]
Sprayer 600 l, 10 m	piece	7.750	4.060	2.900
Sprayer 2.000 l, 18 m	piece	33.000	29.400	21.000
Fertiliser-spreader, 600 kg	piece	4.000	4.200	3.000
Fertiliser-spreader, 5 t trailer	piece	25.000	12.600	9.000
Capital interest rates				
Long term (> 8 years)	%	5,25	-	-
Medium term (3-8 years)	%	6,25	13,00	13,00
Short term (1-3 years)	%	9,50	10,00	10,00
Operating (< 1year)	%	12,00	10,00 [4]	10,00 [4]
Savings	%	3,00	6,00	6,00
Means of production (pesticides see next table)				
Seeds				
Corn	kg	10,24 [5]	3,25	2,32
Soybean	kg	-	0,81	0,58
Wheat	kg	7,85	-	-
Barley	kg	7,85	-	-
Rapeseed	kg	16,80	-	-
Fertilisers				
Urea (45 %)	t	330	518	370
Ammonium nitrate (27 %)	t	220	378	270
Ammonium Sulfate	t	290	336	240
Superphosphate	t	230	308	220
04-20-20	t	-	420	300
00-20-20	t	-	364	260
03-15-15	t	340	364	260
Limestone (45 %)	t	95	38	27
Energy, Water and Fuel				
Electricity	kwh	0,20-0,50	0,11	0,08
Water	m³	1,75-2,50	n.a.	n.a.
Waste water	m³	3,50	n.a.	n.a.
Diesel fuel	l	0,49 [6]	0,55	0,39
Gas	kwh	0,04-0,11	0,12	0,09

Remarks: 1) Net prices without value added tax 2) West Germany
3) Mulch seed/ no tillage planting machine with 8 lines for corn
4) Mainly for financing Input, most of it financed by input companies and linked to US-$
5) Based on a unit price of DM 128,-. 1 unit = 50.000 kernels @ 1.000 kernel weight of 250 g
6) Diesel subsidy deducted (DM 0,4415 per l)

Table 3.19 shows that – with the exception of Dimilin - the pesticide prices in Germany are significantly higher than in Brazil. As explained in chapter 3.4.1.3, it is not possible to identify to which extent these differences can be attributed to environmental standards. It is, however, likely that the contribution of environmental standards is rather limited.

Table 3.19: Prices for pesticides in Brazil and Germany 1998 (Sources are also given for table 3.18)

Active Substances (AS)	Brandname in Brazil	AI content g/l or g/kg	Brandname in Germany	AI content g/l or g/kg	Unit	Price per unit in DM [1) 2)] Germany [3)]	Brazil	
Exchange rate DM/R$							1,40	1,00
Herbicides								
Fenoxaprop-P-Ethyl	Podium 5	110	Ralon Super	66	l	69,06	22,72	16,23
Glyphosate	Roundup	360	Roundup Ultra	360	l	15,53	12,04	8,60
Nicosulfuron	Sanson 40 SC	40	Motivell	40	l	83,30	59,82	42,73
Paraquat	Gramoxone	200	Gramoxone Extra	100	l	18,11	6,97	4,98
Trifluralin	Trifluralin	445	Stefes Trifluralin	460	l	14,45	7,13	5,09
Fungicides								
Benomyl	Benlate	500	DU Pont Benomyl	524	kg	70,59	41,30	29,50
Carbendazim	Derosal 500 SC	500	Derosal flüssig	360	l	60,90	21,79	15,57
Insecticides								
Carbofuran	Furadan	350	Carbosip Granulat	50	kg	11,86	4,75	3,39
Deltamethin	Decis 25 CE	25	Decis flüssig	25	l	63,03	30,97	22,12
Diflubenzuron	Dimilin	250	Dimilin 80 WG	800	kg	167,06	315,30	225,22
Lambdacyhalothrine	Karate	50	Karate	50	l	129,24	36,60	26,14
Methamidiphos	Tamaron	600	Tamaron	605	l	59,37	15,61	11,15
Permethrine	Ambush 500 CE	500	Ambush	250	l	133,49	15,48	11,06
Thiodicarb	Semevin	350	Skipper	40	kg	9,22	4,42	3,16
Thiodicarb	Futur 300	300	Skipper	40	l	9,22	6,04	4,31

Remarks:
1) Net prices without value added tax
2) Brazilian prices readjusted to German content of active ingredients
3) Listenpreise WLZ Agrar Pflanzenschutzpreisliste 1998 abzüglich 15 % Rabatt

Sources: Informacoes Economicas, V. 28, No. 10, 1998, Instituto de Economia Agricola
Averages of panel farm data; Fax-message Carol Cooperativa (1999)
Biologische Bundesanstalt (1999); Agrarbericht (1999); KTBL-Taschenbuch (1998/99)
WLZ Agrar (1998)

IFCN, DEBLITZ (1999)

Differences in **productivity** can be another reason for cost differences. It could already been shown that land productivity in terms of yields is much higher in Germany compared to Brazil. Figures comparing the labour productivity between the German and Brazilian farms are shown in Table 3.20.

For the **oilseeds** the table shows that tractor hours per ha are similar between rapeseed and soybean production. As regards total labour hours per ha, figures vary between 12 and 14 hours per ha for the German farms and 7 to 13 hours for the farms in Brazil. Labour productivity in Germany is up to two times as high as in Brazil with the exception of the large Brazilian farm (BR1000RV) which has a higher productivity level than the German farms.

For **grains** the picture is similar but at different levels. Labour input per ha is similar but due to higher yields compared to the oilseeds labour productivity is generally higher. Here, a certain scale effect can be observed. Highest labour productivity can be observed with the large farms in Germany in Brazil.

It can be concluded that the impact of labour price differences is more important than differences in labour productivity observed for the typical farms.

Table 3.20: Labour input and productivity levels in rape-seed and grai n production in Germany and soybean and corn production in Brazil

	Tractor hours h/ha	Total Labour hours h/ha	Yields 100 kg / ha	Labour productivity 100 kg / h
Oilseeds				
Germany: Rape-seed				
D560MD	5,76	13,79	39	2,83
D700MV	5,59	14,72	40	2,72
D1300MD	4,81	11,79	39	3,31
Brazil: Soybean				
BR290OR	5,48	13,44	25	1,42 *
BR500UB	5,56	10,23	24	1,81 *
BR1000RV	5,48	7,06	32	3,49 *
Grains				
Germany: Winter-Barley				
D100HI	8,97	22,91	88	3,84
D560MD	6,62	15,86	72	4,54
D700MV	6,22	15,77	70	4,44
D1300MD	5,39	13,00	72	5,54
Germany: Winter-Wheat				
D100HI	8,64	22,60	90	4,00
D560MD	5,70	13,03	76	5,84
D700MV	5,35	14,31	80	5,58
D1300MD	4,64	11,44	76	6,65
Brazil: Corn				
BR290OR	5,53	11,74	38	3,27
BR500UB	6,11	11,19	60	5,36
BR1000RV	5,62	6,20	55	8,87

* Yield correction to rape-seed equivalent (see chapter 6.2)
Source: IFCN-calculations

IFCN, DEBLITZ (1999)

3.6 Total cost of chicken production in Germany and Brazil

3.6.1 On farm cost of production and reasons for differences

Calculation of the total cost of production was slightly more difficult than for the crops. The reasons are:

- In **Germany**, no figures on buildings and equipment were available in the same data set as the direct cost based on the enterprise data supplied by the CHAMBER OF AGRICULTURE (1999) in Oldenburg. As a consequence, calculation figures were obtained from two regional suppliers of equipment and buildings. Additional information and data were taken from GARTUNG and KNIES (1999).
- Due to the prevalence of the integrated system in **Brazil**, cost for chicks, feed and medicine could not be obtained by the farmers. As a consequence, the industry was asked to provide these figures which were then corrected to farm level values and used for the calculations.

The presentation of the production cost has been adjusted to the relevance of the cost positions in chicken production. The following structure is used:

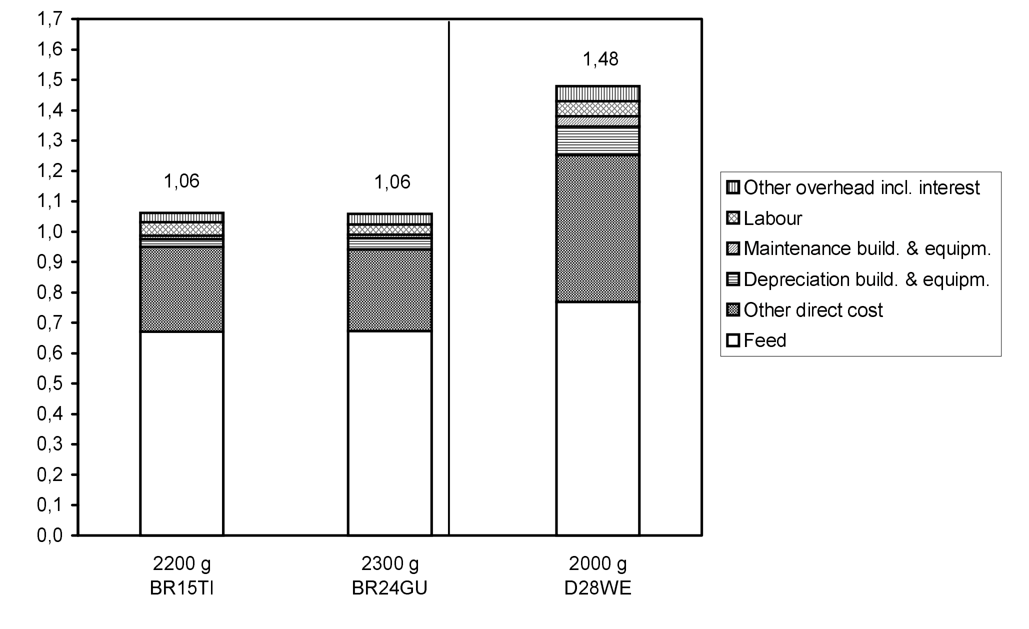
- **Direct cost**, split up in *feed* and *other direct cost* (see explanations below)
- **Depreciation** for buildings and equipment
- **Maintenance** for buildings and equipment
- **Labour** cost
- **Other overhead** cost including **interest**

Figure 3.15 shows the total cost of chicken production for the typical farms in Brazil and in Germany on a per unit basis. Figure 3.16 illustrates the percentage share of the cost components in total cost. Livestock losses are reflected in the figures.

Total cost for the two typical Brazilian farms are rather the same at DM 1,06 per kg LW with very minor differences in the cost composition. Total cost for the German farm is DM 1,48 per kg LW. The equivalent figures per chicken produced are DM 2,35 for the small Brazilian farm (BR15TI with 15.000 chicken), DM 2,43 for the larger Brazilian farm (BR24GU with 24.000 chicken) and DM 2,96 for the German farm (D28WE with 28.000 chicken).

Direct cost were divided into *feed cost* and *other direct cost*, the latter representing cost for chicks, vet and medicine, bedding, cleaning and disinfection as well as electricity, water and gas. Direct cost contribute 90 % to the total cost in Brazil and 85 % to the total cost in Germany.

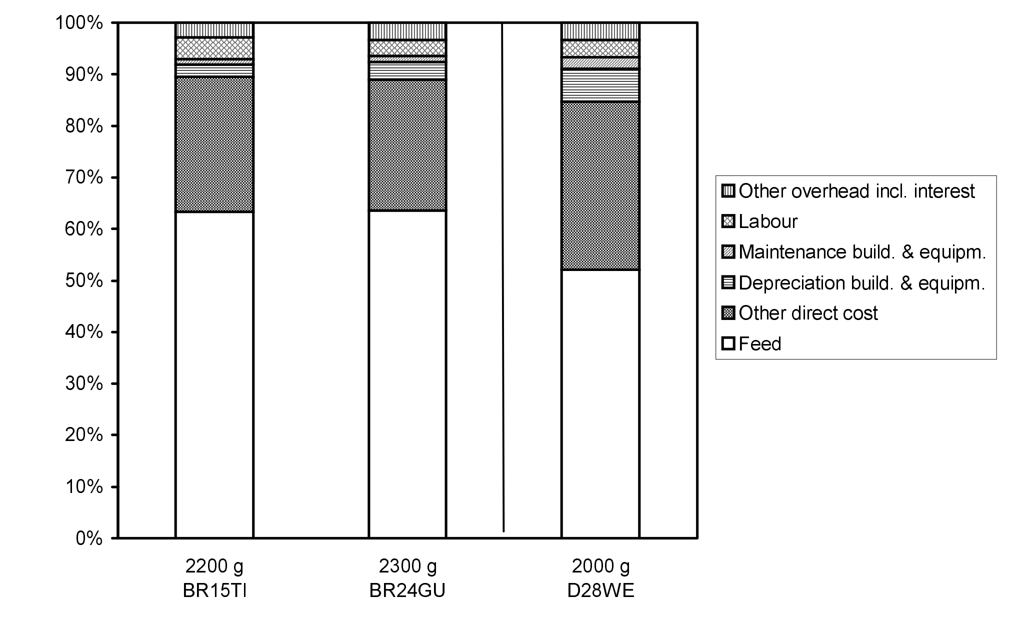
Figure 3.15: Total cost of chicken production for typical farms in Brazil and Germany 1998 (DM per kg LW)



Exchange rate DM/Real: 1,4
Source: IFCN-calculations

IFCN, DEBLITZ (1999)

Figure 3.16: Percentage share of total cost of chicken production for typical farms in Brazil and Germany 1998 (% of DM per kg LW)



Exchange rate DM/Real: 1,4
Source: IFCN-calculations

IFCN, DEBLITZ (1999)

Feed cost are both in Germany (DM 0,77 per kg LW) and Brazil (DM 0,67 per kg LW) by far the most important cost component, making up 52 % of total cost on the German farm and two thirds of total cost on the Brazilian farms. The difference in feed cost between Germany and Brazil is not as high as feed price differences and cost differences between the crops mainly used for feeding the chicken in both countries would suggest (see cost analysis in chapters 3.2 and 3.3). Feed prices are around DM 0,35 per kg feed in Brazil and DM 0,42 per kg feed in Germany. The main reason for the feed cost differences being less than the price differences is that the feed conversion rate on the German farm is lower, i.e. better (approx. 1:1,8) than in Brazil (approx. 1:2,0).

Other direct cost are DM 0,48 per kg LW in Germany (one third of the total cost) and DM 0,28 per kg LW in Brazil (one quarter of the total cost). The most important cost item in both countries is the purchase of chicks, costing DM 0,19 per kg LW in Brazil and DM 0,32 per kg LW in Germany. The second most important cost component in Germany is electricity, water and gas (DM 0,05 per kg LW) followed by vet and medicine (DM 0,04 per kg LW). Medicine cost in Brazil are slightly lower but second most important.

Depreciation and maintenance cover buildings and equipment. These cost are 3 to 4 times higher in Germany than in Brazil and nearly DM 0,10 for depreciation and DM 0,03 per kg LW for maintenance. This is not surprising if one considers the investment for buildings and equipment. Investment cost for buildings in Brazil are between DM 67.000 and DM 118.000 for the two farms whereas in Germany the building cost around DM 412.000. The corresponding figures for the equipment are 13.900 (BR15TI) and DM 65.106 (BR24GU) for the Brazilian farms and DM 152.000 for the German farm. The reason for the big difference between the Brazilian farms is mainly because the small farm uses rather old technology and manual feeding. The share of depreciation and maintenance in total cost is between 3 to 4 % on the Brazilian farms and 6 % on the German farm.

Labour cost cover both paid wages and imputed opportunity cost for the farmers labour. They are DM 0,05 on the small Brazilian farm and DM 0,03 per kg LW on the larger Brazilian farm. In Germany, labour cost are DM 0,05 per kg LW. Labour cost contribute between 3 and 4 % of total cost on all farms considered.

Other overhead cost including interest are between DM 0,03 for the Brazilian farms and DM 0,05 per kg LW for the German farm. Other overhead cost including interest comprise around 3 % of total cost on all farms considered.

It should be noted that the competitive situation of Brazilian chicken production has improved drastically in January 1999 with the decline of the R$. If Brazilian figures were converted with the present exchange rate of DM 1,00 per R$, production cost would come down from DM 1,06 per kg LW to DM 0,76 per kg LW. As a result, Brazilian exports are forecasted to expand 15 % in both 1999 and 2000 and production is forecasted to increase 11 % in 1999 and another 5 % in 2000, the latter also due to the further increase of domestic consumption (USDA, 1999).

3.6.2 Impact of environmental standards on cost of production

3.6.2.1 Direct cost

Feed cost

It could be shown in chapter 3.4 that the total effect of environmental standards on production cost of grains is close to DM 1 per 100 kg produced. Assuming that chicken feed has 75 % of grain, the feed price could be reduced from presently DM 42 per 100 kg to DM 41,25 per 100 kg (-1,8 %). This reduces feed cost from DM 0,77 to DM 0,756 per kg LW. It should be noted that this cost reduction only refers to the environmental standards identified for agricultural production. Standards relevant for processing and transport cost as well as margins of feed companies are not considered in this calculation.

It was not possible to receive information on whether the Brazilian chicken industry uses different (or not permitted) feed additives than German farmers. Based on the information available, it can therefore not be concluded that feed cost for chicken are significantly affected in different ways by environmental standards between Brazil and Germany.

Vet and Medicine

Table 2.8 in chapter 2.3.1 indicates that diseases and hygienic problems are similar in Germany and Brazil. Disinfection of the barns as well as vaccination and treatment of the chicken is done in the same way. Detailed information on the use of medicine and growth promoters was difficult to obtain in Brazil. Due to the integrated system farmers do not know the type of medicine given to the chicken and industry is reluctant to provide information. Therefore, it is not possible to do additional calculations, e.g. for the case that medicine not allowed in Germany is used in Brazil (and vice versa).

It can, however, be supposed that at least chicken meat produced for export to Europe meets the product standards set by the EU. This means that residuals of medicine or banned substances can not be found in the chicken meat which again can be an indicator that (a) certain substances are not used at all or (b) waiting periods between treatment of animals and slaughter are kept.

Electricity, water and gas

The relevance of environmental standards for electricity cost has been discussed in the crop section (chapter 3.4.3.2). For chicken production, the conclusions are the same as for crop production. Thus, for the year considered it can not be concluded that electricity prices are affected by environmental standards.

Water cost for the typical German farm is around DM 2,00 per m³. Water use for watering chicken is around 187 m³ plus approximately 20 m³ for cleaning per cycle, resulting in fresh water expenses of DM 414, equivalent to DM 0,008 per kg LW. On hot summer days, water for cooling has to be added. Water requirements in Brazil are according to the information obtained from the farmers around 300 m³ per cycle for the small farm and 480 m³ for the larger farm including cleaning. Higher temperatures and higher requirements for cooling water result in higher water requirements compared to Germany. However, cost for fresh water are negligible because like in crop production water is usually taken from own wells.

Waste water only becomes relevant for the water used for cleaning and disinfection, e.g. for around 20 m³ per cycle. At a price of DM 3,50 per m³, cost for waste water are DM 70 per cycle.

Gas prices in Germany and Brazil are similar. In the year considered (1998), there is no indication that prices are influenced by an environmental standard. In 1999, the German government introduced the eco-tax, increasing gas prices by DM 0,0032 per kwh. Depending on the gas-price presently paid, this means an increase of 3 to 8 % (see Table 3.18 in chapter 3.5). With gas cost presently less than 2 % of total cost, total cost of production would barely rise as a result of the eco-tax on gas.

Summarising the section on electricity, water and gas, it can be concluded that cost caused by environmental standards are only of minor importance.

Use of chicken litter

Although not being a cost issue, a few words shall be spend on the use of chicken litter in Germany and Brazil.

As mentioned in chapter 2.3.1, the chicken litter is sold at a price of approximately DM 50 per ton by the Brazilian farms to the cattle industry for feeding purposes. For the typical farms considered, annual litter amounts are 90 tons (BR15TI) and 144 tons (BR24GU), resulting in an annual income from litter of DM 4.500 and DM 7.200, respectively. Allocated to a per unit base, the return is around DM 0,025 per kg LW, corresponding to 2,4 % of the total cost.

In Germany, feeding of chicken litter to ruminants and other animals is not permitted. Litter is spread as fertiliser and farms with limited acreage sell the litter to a co-operative or a feed mill at a price between DM 20 to DM 25 per ton. Total annual manure and straw adds up to 177 tons and provides a return of DM 3.894 at a price of DM 22 per ton. On a per unit base, this equivalents to a per unit return of DM 0,01 per kg LW, corresponding to 0,7 % of the total cost. Thus, there is a significant return advantage for Brazilian farms.

3.6.2.2 Depreciation and maintenance for buildings and equipment

It could be shown that cost for building and equipment in Germany are higher than in Brazil. Reasons are different building types, materials and design as well as prices for materials and equipment. In this section, it shall be identified which part of the cost differences is caused by environmental standards.

In Brazil no standards could be identified that have an immediate impact on building and equipment cost. The following laws and regulations affect the building cost of chicken barns and equipment in Germany.

Federal Law on Emission Protection (Bundesimmissionsschutzgesetz (BimSchG))

According to the law, flock sizes of more than 40.000 chicken have to be approved. Additionally, these farms need a ‘declaration of emissions’ caused by the operation of the chicken unit. The administration rule (Verwaltungsvorschrift) of the BimSchG is the TA-Luft from 1985. The TA-Luft details the implementation of the law. Farms below that size mentioned above have to follow the regulation laid down in the VDI guideline 3472 on emission control in chicken production.

Chicken barns must keep a distance of at least 200 m to neighbouring buildings and woods. The required distance increases with the number of chicken kept in one unit and is 280 m for a unit of 80.000 chicken. This may increase the developing cost (water, waste water, electricity, gas) of the construction ground. Developing cost vary significantly depending on the location. For the calculations, a value of DM 12.500 per 100 m has been assumed.

Moreover, farmers have to introduce measures for smell-reduction (TA-Luft, 3.3.7). The law provides regulations on reduction of emissions which have an impact on the position and the technical requirements of ventilators. The height of chimneys is determined with a formula depending on technical parameters of the chimney (e.g. diameter) and the exhaust air passing it (e.g. temperature, volume). In reality, chimneys for chicken barns must be installed at least 1,50 m above roof ridge level. Moreover, ventilators must be more powerful, sometimes need additional metal plates (Bleche) to lead the air away from any buildings in the surrounding. In open barn systems, swivelling ventilators must be installed. However, as this would be done for technical reasons even without being regulated, it can not be considered as being an avoidable cost issue.

Law on water resources (Wasserhaushaltsgesetz)

According to the law on water resources (Wasserhaushaltsgesetz §19g, specified in the Lower Saxony Law on Water), equipment for storage and transfer of slurry, manure and sewage must be constructed, maintained and operated in a way that the best possible protection of water and waterways is achieved.

For chicken barns, a sealed outside area for storing manure must be build. Normally it is made from concrete. However, for hygienic reasons and disease prevention advisory services strongly recommend not to store manure closer than 100 m to the barn. Usually, manure is not stored at all but put on the fields or transported to users right after removal from the barn. Hence, the storage area for manure is not used for the purpose it has to be build for. Nevertheless, farmers usually manage to make use of the area. For loading and transporting the chicken, a concrete or paved surface in front of the barn is necessary anyway which must be big enough to allow a 38 t truck to turn. Therefore, this area is usually declared as the manure storage area (where no manure is stored).

Law on environmental impact evaluation (Umweltverträglichkeitsprüfung)

For flock sizes of more than 84.000 chicken, an environmental impact evaluation (Law on UVP from 12. Feb. 1990) is required. This is an extensive procedure mainly dealing with the emissions caused by keeping animals. It usually takes about 1 year and cost between DM 15.000 and DM 30.000. Converting these cost into unit cost results in rather low figures. For example, cost for an UVP of DM 20.000 spread over the period of 10 years (lifetime of the equipment) by imputing an interest of 6 % and depreciation over 10 years would lead to annual cost of DM 3.200 (DM 2.000 depreciation, DM 1.200 interest) which would mean an increase of production cost of DM 0,009 per kg LW for the typical farm considered.

Lower Saxony chicken agreement ("Niedersächsische Hähnchenvereinbarung")

This agreement has been drawn up in 1997 between the Lower Saxony Ministry of Agriculture and the Lower Saxony Association of Chicken Producers (Niedersächsische Geflügelwirtschaft). It is a voluntary regulatory framework resulting from society pressure on improved animal welfare standards in chicken production. It includes the following main fields:

- The maximum livestock-density may be 35 kg life-weight (LW) per m² 3 days prior to the end of the fattening period, equivalent to approx. 20 chicken per m² in a 42 day fattening system.
- Every day (24 hours) at least 8 hours of light must be ensured. In existing barns with artificial light only, a dark period of 8 hours in total must be ensured.
- For new barns, at least 3 % of the ground surface must be windows.
- Feeding space must be available at maximum 3 m distance from each animal. Round feeding troughs must provide 0,66 cm space per kg LW, long troughs must provide 1,5 cm space per kg LW. The same values are valid for drinking troughs. Drinking systems with nipples have to provide at least one nipple for 15 animals. Additionally, the distance between drinking facilities and feeding troughs may only be 2 m at maximum.
- Farmers have to install an emergency power system.
- The capacity of the ventilation systems must be at least 4,5 m³ per kg life weight and hour. This leads to an increase of investment cost for ventilation due to the higher number of ventilators or more powerful ventilators required.

Although it is not legally binding, the agreement is practically taken as a precondition for approval of chicken barns and for operation of existing systems in Lower Saxony. Therefore it must be considered equivalent to a legally binding standard and the regulations of the agreement have been fully reflected in the additional calculations.

Conclusions for the calculations

Based on the explanations made above, the following changes and assumptions compared to the present situation are made to quantify the impact of environmental standards:

- Concrete floor with less thickness and reinforcement (12 cm instead of 15 cm)
- No painting of the building
- No windows at the outside walls
- No manure storage area
- No development cost
- Reduction of the number of drinking troughs and drinking nipples
- Reduction of the number of feed troughs
- Change of the automatic trough winding system to a manual system
- No roof ridge ventilation, only wall
- No cooling system
- No alarm system for climate and electricity
- No emergency power system

Some of the activities listed above might be realised even without the existence of regulations. In particular, cooling and alarm systems can prevent death of animals in case of emergency. Thus, they are not exclusively justified from an animal welfare perspective but can also become relevant from an economic point of view. The calculated effect on cost of production should therefore be considered as a maximum effect of the standard-caused cost. Table 3.21 shows the investment cost and the resulting unit cost before and after the changes made.

The Table shows that total investment cost can be reduced by approx. DM 132.000 which is 23 % of the original investment. By this, total cost can be reduced by DM 0,04 per kg LW, equivalent to –2,7 % of total cost. Hence, environmental standards computed do not have a big impact on the level of production cost per kg LW. However, with low margins in chicken production the difference of DM 0,04 per kg LW sums up to around DM 15.000 per year which can be the difference between entrepreneur’s profit and loss.

Table 3.21: Investment cost and resulting unit cost for chicken production with and without environmental standards in Germany

	Unit	Status quo 1	Without standards 2	Difference DM 3 (2-1)
Investment cost (Barn size 80 m * 18 m = 1.440 m²)				
Construction	DM	412.300	316.800	-95.500
Building	DM	388.800	316.800	-72.000
	DM/m²	270	220	-50
Manure area	DM	11.000	0	-11.000
Development cost	DM	12.500	0	-12.500
Feeding and drinking	DM	51.903	47.442	-4.461
Feed storage and transport	DM	18.320	18.320	0
Feeding system	DM	17.212	15.440	-1.773
Drinking system	DM	16.371	13.682	-2.689
Climate system	DM	64.934	41.392	-23.542
Aereation	DM	46.011	31.809	-14.202
Heating	DM	9.583	9.583	0
Cooling	DM	9.340	0	-9.340
Electrical installations	DM	35.030	26.080	-8.950
Total	DM	*564.167*	*431.713*	*-132.453*
Unit cost				
Total annual production	kg LW	378.398	378.398	0
Depreciation	DM/kg LW	0,094	0,072	-0,022
Construction	DM/kg LW	0,054	0,042	-0,012
Feeding and drinking	DM/kg LW	0,014	0,013	-0,001
Climate system	DM/kg LW	0,017	0,011	-0,006
Electrical installations	DM/kg LW	0,009	0,007	-0,002
Maintenance	DM/kg LW	0,034	0,026	-0,008
Construction	DM/kg LW	0,022	0,017	-0,005
Feeding and drinking	DM/kg LW	0,004	0,004	0,000
Climate system	DM/kg LW	0,005	0,003	-0,002
Electrical installations	DM/kg LW	0,003	0,002	-0,001
Interest	DM/kg LW	0,045	0,034	-0,011
Total	DM/kg LW	*0,173*	*0,132*	***-0,041***

Source: IFCN-calculations, based on data and information obtained from industry

IFCN, DEBLITZ (1999)

3.6.2.3 Labour cost

In chapter 3.4.2.1, labour cost and social standards were intensively discussed for crop farms. The cost analysis in chapter 3.6.1 has shown that the differences in labour cost between Brazil and Germany are very low in chicken production. As a consequence and following the conclusions drawn for crop production (chapter 3.4.2.1), no additional calculations on labour cost are made.

3.6.2.4 Other overhead cost including interest

Other overhead cost including interest are only around 3 % of total cost for all farms considered. Parts of overhead cost that can not be considered as being affected by environmental or social standards are accounting cost and interest cost, summing up to 90 % of all overhead cost. Cost like insurance are covered in the other cost or in the vet section of direct cost. From the information available, it can not be concluded that any of the cost items in this section are a result of environmental or social standards. Therefore, no additional calculations are made.

3.6.3 Summary and conclusions for chicken production

It could be shown in the previous sections that cost disadvantages for German chicken production mainly result from standards on type, number and design of buildings and equipment. Many of these standards can be attributed to animal welfare rather than to environmental standards.

Some regulations relevant in the approval period do not necessarily lead to high unit cost (see example of UVP). However, approval cost might cause a liquidity problem for the farm if they have to be financed with borrowed money (Fremdkapital). Moreover, in case of delays in approval, farmers may face expenses like wages for employees already hired or interest and principal for loans already taken before production can start. These cost can, however, not be considered as usual and they have therefore not been reflected in the calculations.

It should be noted that in some counties in the north west of Germany with a high concentration of chicken and pig production, new units for chicken production are not approved anymore if they exceed a certain size (approx. 30.000 chicken). This is the case even if all legislative requirements are met. The reason is that many counties try to generate additional rural income from tourism which is considered to be disturbed by intensive animal production. **Hence, the main problem today is not the cost related to buildings and equipment but to get a pproval at all**.

3.7 Conclusions on farm level analysis

It should be mentioned that the case studies in this report can only provide answers for the regions considered. This is particularly true for Brazil with its large variety of natural conditions and agricultural systems. The cost analysis on selected crops and chicken between Germany and Brazil has lead to the following main results:

- There are more and higher environmental standards affecting farming in **Germany** than in Brazil.
- In this report, only environmental and social standards were considered. **Other legislative framework conditions** may have a bigger influence on production cost than environmental and social standards (e.g. tax systems, technical standards).
- The cost-effect of environmental and social standards that could be identified within the scope of this study is **rather limited**. Price and productivity differences have a higher cost-effect than the standards. It should be noted, however, that also prices and productivity may be influenced by legislative framework conditions. Examples for prices are taxes on inputs like fertiliser or pesticide prices as a result of high development cost influenced by standards. An example for influences on productivity is a heritage law that leads to an increase of the number and scattering of fields, preventing the realisation of scale effects in production.
- Even if the impact of standards on production cost identified in this study is limited, it should be noted that with **small margins** (e.g. in chicken production), cost differences caused by legislative framework conditions may make the difference between profit and loss.
- Cost created by environmental and social standards may be **compensated** by cost savings in other areas. Comparably high environmental and social standards must therefore not automatically lead to a total competitive disadvantage. Examples are:
    - Farmers might be able to pass parts of the cost to the land owner by paying **lower rents** (OECD, 1999).
    - Cost created by environmental and social standards might well be offset by differences between countries in **non-environmental and non-social regulations** such as taxes, transport, market infrastructure and distribution as well as public services (OECD, 1999). Considering environmental and

social standards only is therefore not sufficient to identify competitive (dis-) advantages created by legislative framework conditions.

- Another possibility to compensate cost induced by standards is to realise **higher product prices**. If the country is a big player in the world market for a given commodity, additional cost created by standards might be passed partly to the consumer in terms of higher product prices (OECD, 1999).
- The calculations on the law on **legal reserve** in Brazil indicate that differences in production cost between Germany and Brazil would be lower if existing laws in Brazil were enforced **stricter**.
- Concerning the upcoming **eco-tax** and the **reduction** of the diesel-subsidy in Germany, it could be shown that these future issues will have a **bigger impact** on cost of arable production than the environmental standards that could have been quantified for the situation of the harvest year 1998/1999.

Total cost are an important indicator for the competitive situation. To make a final judgement on the survivability of particular farms it is necessary to look beyond the total cost on the **total income**:

- The first look should be on the product prices. Figures A.3 to A.5 in the Annex show that with the exception of the small German grain producing farm (D100HI) all farms can cover total cost. It should be mentioned, however, that without direct CAP-payments none of the German farms would be in the position to cover total cost.
- In addition, the total farm income situation, personal income taxes etc. should be taken into account to get a complete picture of the competitive situation of the whole farm. It was not possible to provide this information within the scope of this study.

To fully clarify the impact of legislative framework conditions, a more comprehensive approach including the whole range of legislative framework conditions and their impact on the competitive situation of different countries appears to be appropriate for further studies. The International Farm Comparison Network provides a platform to deepen research and analysis on legislative framework conditions for typical farms around the world in the sense described above.

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Annex

Figure A.1: Overview on chemicals under the PIC-Procedure

Chemical	*CAS*
Plant protection chemicals	
Aldrin	309-00-2
Captafol	2425-06-1
Chlorbenzilat	510-15-6
Chlordan	57-74-9
Chlordimeform	6164-98-3
DDT	50-29-3
1,2-Dibromethan (EDB)	106-93-4
Dieldrin	60-57-1
Dinoseb and its salts	88-85-7
Fluoracetamid	640-19-7
Heptachlor	76-44-8
Hexachlorbenzol	118-74-1
Hexachlorcyclohexan (HCH, Isomer-mixture)	608-73-1
Lindan	58-89-9
Pentachlorphenol	87-86-5
Mercury	No single numbers
2,4,5-T	93-76-5
Plant protection formulations	
Methamidophos	10265-92-6
Methyl-Parathion	298-00-0
Monocrotophos	6923-22-4
Parathion	56-38-2
Phosphamidon	13171-21-6/23783-98-4/297-99-4
Industrial chemicals	
Krokydolith	12001-28-4
Polybromierte Biphenyle (PBB)	13654-09-06
Polychlorierte Biphenyle (PCB), ecept mono- and dichlor	1336-36-3
Polychloro Terphenyle (PCT)	61788-33-8
Tris(2,3-dibrompropyl)phosphate	126-72-7

Source: BIOLOGISCHE BUNDESANSTALT (1998): http://www.bba.de/ap/ap_psm/pc/pic.htm

Figure A.2: Active plant protection substances banned in Brazil

Aldrin

Arsenicais

BHC

Captafol

Clordane

Canfeno clorado (Toxafeno)

Camphechlor

Clordimeform

DDT

Dieldrin

Dinocap

Dinoseb

DBCP (2, dibromo-3-cloropropano)

Endrin

EPN (etil-4-nitrofenil-fenil-fosfonotioato)

Heptacloro

Hexaclorobenzeno

Lindan

Metoxicloro

Mercuriais: Acetato de fenil-mercúrio, Cloreto de metoxietil, mercúrio, Fosfato etil mercúrio.

Nonacloro

Pentaclorofenol

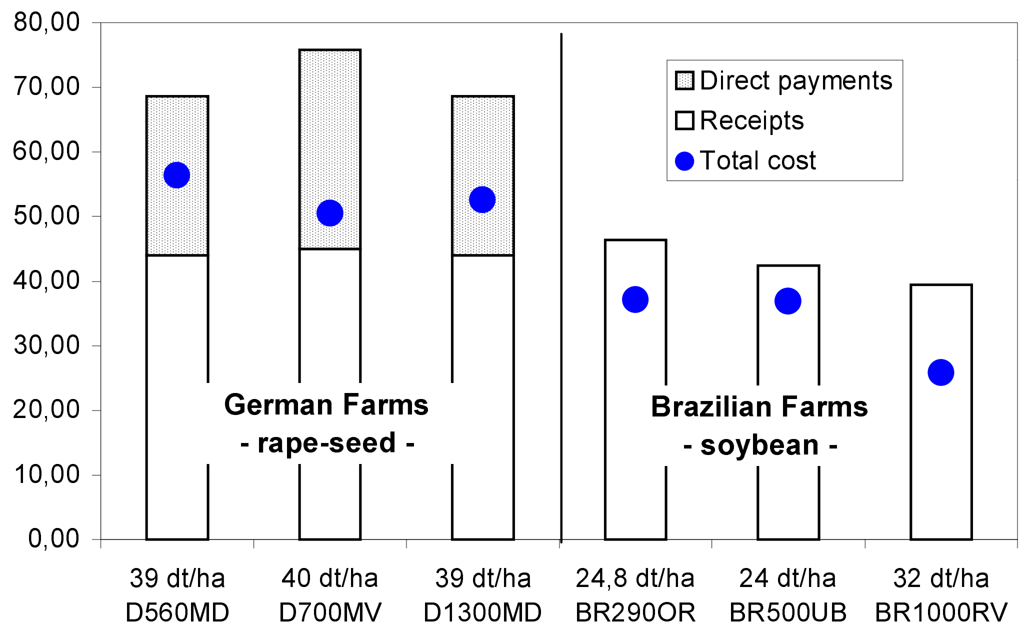
Zineb 2,4,5-T

Clorobenzilato

Parathion Etílico

Dodecacloro

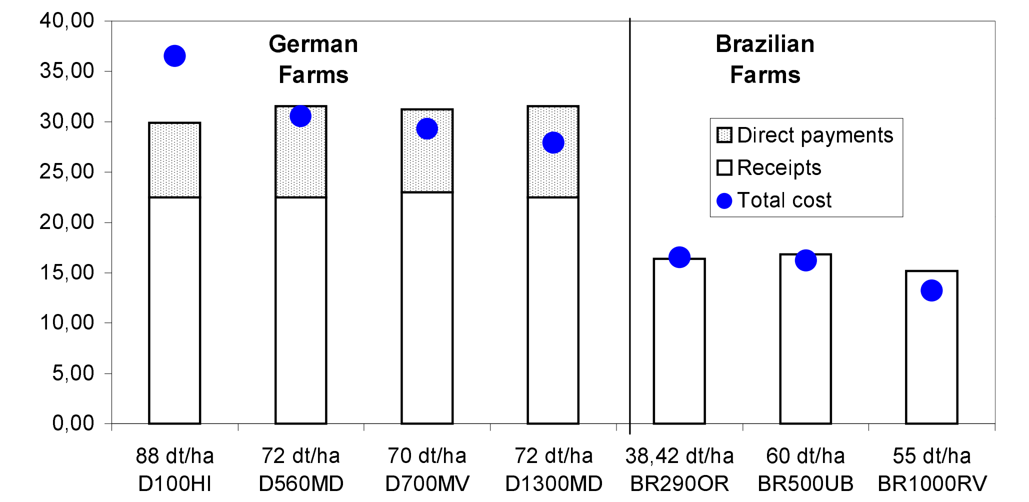
Figure A.3: Total cost of rape-seed production in Germany and soybean production in Brazil 1998/99 (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

IFCN, DEBLITZ (1999)

Figure A.4: Total cost and returns of winter-barley production in Germany and corn production in Brazil 1998/99 (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

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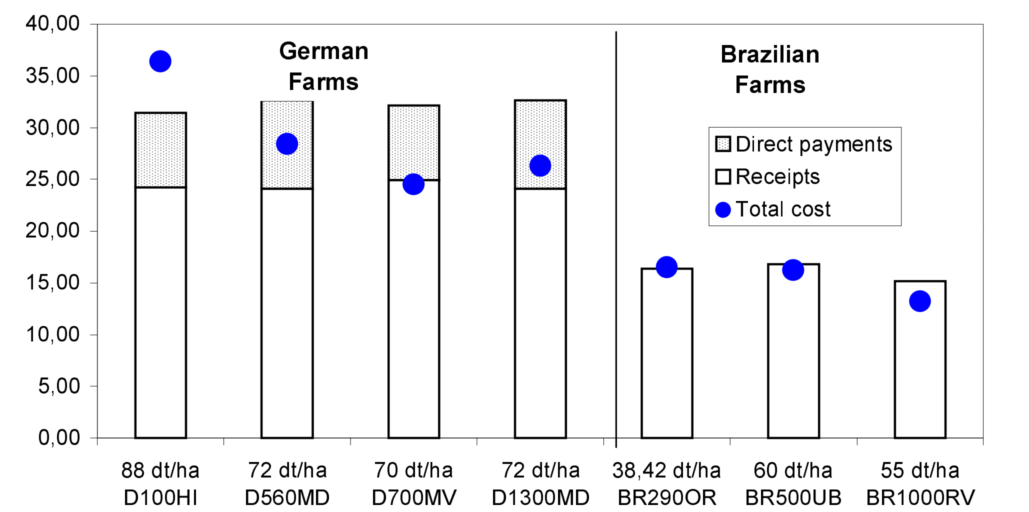
Figure A.5: Total cost and returns of winter-wheat production in Germany and corn production in Brazil 1998/99 (DM/100 kg)



Exchange rate DM/Real: 1,4
Source: Own calculations

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Table 2.3: Comparative description of corn production systems in Brazil and barley and wheat production systems in Germany

		Brazil - Corn			
		After soybean Orlândia	**After soybean** Uberaba	**After soybean** Rio Verde	**After beets** Hanover Sachsen-Anhalt Mecklenburg-Vorpommern
Systems					
Seasonality		Summer Crop	Summer Crop	Summer Crop	Winter Crop
Crop rotations		Corn-Soybean (+ Safrinha in same year)	Corn-Soybean (+ Cover Crop in same year)	Corn-Soybean (+ Safrinha in same year)	1. Beets-Wheat-Wheat-(Barley) 2. Canola-Wheat-Barley
Tillage system		Conventional	No tillage	No tillage	Conventional
Harvest	No./year	1	1	1	1
	Month(s)	Feb/Mar	Feb/Mar	Feb/Mar	Aug
Yields	t/ha	5,8	6,0	6,9	7,6 - 9,2
Seed preparation and seeding					
Post-Harvest Tillage	Month	Oct	Oct	Oct	Nov
	No. of operations	4			1
	Operations	4 x Tillage	**none**	**none**	1x Tillage **or** 1 x Ploughing
Seeding/Planting	Month	Oct	Oct	Oct	Nov
	No. of operations	1	1	1	1
	Operations	Seed bed preparation including seeding	Seed bed preparation including seeding	Seed bed preparation including seeding	Seed bed preparation including seeding
Fertilising					
N-Fertiliser	No. of applications	3	2	2	4
	Type of fertilisers	1. Formulated N - P - K with Zn 2. Formulated N - P - K 3. Urea	1. Formulated N - P - K with Zn 2. Ammoniun Sulfate	1. Formulated N - P - K with Zn 2. Urea	Ureas
	Total nutrient kg/ha	114	94	100	220
P-Fertiliser	No. of applications	1 (together with N and K)	1 (together with N and K)	1 (together with N and K)	1 [2)]
	Type of fertilisers	Formulated N - P - K with Zn	Formulated N - P - K with Zn	Formulated N - P - K with Zn	Mono-Ammonphosphate
	Total nutrient kg/ha	80	100	80	60
K-Fertiliser	No. of applications	2 (together with N and P)	1 (together with N and K)	1 (together with N and K)	1 [2)]

Type of fertilisers	1. Formulated N - P - K with Zn 2. Formulated N - P - K with Zn	Formulated N - P - K with Zn	Formulated N - P - K with Zn	Potassium-Magnesium
Total nutrient kg/ha	113	100	80	75
Machine	Planter (at planting) Spreader (dry)	Planter (at planting)	Planter (at planting)	Spreader (dry)

Plant protection					
Herbicides Grass weeds	No. of applications	1	2	2	1
	Active substances	Atrazine + Simazine	Glyphosate / Atrazine + Simazine / Acetochlor	Glyphosate + 2,4 D / Paraquat	Isoproturon (IPU 500 g/l)
Herbicides Broadleaves	No. of applications	0	0	2	2
	Brand names	**Grass weeds and broadleaves are controlled in one operation**	**Grass weeds and broadleaves are controlled in one operation**	Primestra (pre-emergence) Sanson + Atrazine (post-emergence)	Foxtril Super + Duplosan KV / Starane 180 + Aaherba-M [5])
Fungicides	No. of applications	**none**	**none**	**none**	2
	Brand names				Pronto plus / Juwel Top
Growth Regulators	No. of applications	**none**	**none**	**none**	2
	Brand names				CCC-720
Insecticides	No. of applications	3 (incl. seed treatment)	3 (incl. seed treatment)	4 (incl. seed treatment)	1
	Brand names	Furadan (seed treatment)/ Decis 25 CE or Karate 50 CE or Alsyistin / Sulfluramide	Furadan (seed treatment)/ Decis 25 CE or Karate 50 CE or Alsyistin / Sulfluramide	Semevin or Futur (seed treatment) / Decis 25 CE / Dimilin / Sulflunamide	Fastac SC
Harvest and post-harvest					
Harvest	Activities	1	1	1	Aug (Straight Cut Harvesting)
	Machine	Combine	Combine	Combine	Own combine + grain headder
Transport	Activities	1	1	1	Aug
	Machine	15 ton truck or a trailer	15 ton truck or a trailer	15 ton truck or a trailer	Own Tractor + Trailers
Drying	Share of Harvest to be dried (%)	100	100	100 / 0 [12)]	33
	Water content before drying (%)	18	18	18	18
	Tolerated water content (%)	13	13	14	15
	Period	Feb/Mar	Feb/Mar	Feb/Mar	Aug/Sep
	Technology used	Coops drier	Coops drier	Coops drier	Own Floor Drier / Aireation
	Energy source	heating fuel/propane	heating fuel/propane	heating fuel/propane	heating fuel / propane
Storage / Marketing	Type of storage	Coops storage	Coops storage	Coops storage	Mostly on farm bin or flat storage
	Percentage stored %	100	100	100	100
	Period of Storage	depends	depends	depends	Aug-May
	Marketing	depends	depends	depends	50% contracted

1) Together with Nitrogen
2) Once in a three year rotation **or** twice in a four year rotation
7) Combined with fungicide application in the same month
8) Borrowed spreader

3) One of the three products
4) Every second year 3l/ha Round up Ultra
5) Thistle - shot; mostly just selected spots
6) Combined with first or second fungicide application

9) i.e. flower used for coockies
10) based on 9 % water content
11) based on 15 % water content
12) Second value for Safrinha com

Source: IFCN surveys and calculations

Germany - Wheat		Germany - Barley
After canola Sachsen-Anhalt Mecklenburg-Vorpommern	**After wheat** Sachsen-Anhalt Hanover Mecklenburg-Vorpommern	**After cereals (wheat, rye)** Sachsen-Anhalt Hanover Mecklenburg-Vorpommern
Winter-Crop	Winter Crop	Winter-Crop
1. Beets-Wheat-Wheat-(Barley) 2. Canola-Wheat-Barley	1. Beets-Wheat-Wheat-(Barley) 2. Canola-Wheat-Barley	1. Beets-Wheat-Wheat-(Barley) 2. Canola-Wheat (Rye) -Barley
Conventional	Conventional	Conventional
1 Aug	1 Aug	1 July
7,6 - 9,2	7,6 - 9,2	7 - 8,8
Aug/Sep 2 2 x Tillage	Aug/Sep 3 2 x Tillage 1 x Ploughing	Aug/Sep 3 2 x Tillage 1 x Ploughing
Sep/Oct 1 Seed bed preparation including seeding	Sep/Oct 1 Seed bed preparation including seeding	September 1 Seed bed preparation including seeding
4	4	3
Ureas	Ureas	Ureas
230	240	170-210
1 [2)] Mono-Ammonphosphate 60	1 [2)] Mono-Ammonphosphate 60	1 [2)] Mono-Ammonphosphate 60
1 [2)]	1 [2)]	1 [2)]

Potassium-Magnesium	Potassium-Magnesium	Potassium-Magnesium
75	75	75
Spreader (dry)	Spreader (dry)	Spreader (dry)

2 Isoproturon (IPU 500 g/l)) / Glyphosate (360 g/l)	2 Isoproturon (IPU 500 g/l) / Glyphosate (360 g/l)	2 Isoproturon (IPU 500 g/l))
2	2	2
Foxtril Super + Duplosan KV / Starane 180 + Aaherba-M [5])	Foxtril Super + Duplosan KV / Starane 180 + Aaherba-M [5])	Foxtril Super + Duplosan KV / Starane 180)
2 Pronto plus+Amistar / Juwel Top	3 Pronto plus / Sportak Alpha+Amistar / Amistar+Caramba	2 Harvesan / Amistar
2 CCC-720	2 [6)] CCC-720	2 [6)] Terpal C / Camposan Extra
1	1	1
Fastac SC	Fastac SC	Fastac SC
Aug (Straight Cut Harvesting) Own combine + grain headder	Aug (Straight Cut Harvesting) Own combine + grain headder	July (Straight Cut Harvesting) Own combine + grain headder
Aug Own Tractor + Trailers	Aug Own Tractor + Trailers	July Own Tractor + Trailers
33 17 15 Aug Own Floor Drier / Aireation heating fuel / propane	33 17 15 Aug Own Floor Drier / Aireation heating fuel / propane	15 17 15 July Own Stationary Drier / Aireation heating fuel / propane
Mostly on farm bin or flat storage 100 Aug-May not contracted	Mostly on farm bin or flat storage 100 Aug-May not contracted	Mostly on farm bin or flat storage 100 July-Nov not contracted

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