



Production and evaluation of the quality of meat and milk in the Republic of Croatia

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ABSTRACT

The Republic of Croatia has favourable conditions for the development of animal production. The analysis of the current position takes into account the period from 1990 to 1998, especially from the aspect of meat and milk production. The data show that because of the war in 1991/1992 the number of cattle declined by 46.6%, that of pigs by 25.9% and that of poultry by 41.8% in the period analysed. In the process of the restoration of animal production not only should the number of animals should be increased, but production technology and the choice of appropriate genotypes of animals and the efficiency of production systems should also be improved. In this review activities which influence the enhancement and more rapid development of animal production, such as orientation towards family farming, breeding techniques and government support for the production programmes, are emphasised. With the transition to a market economy the grading of animal products has become a very important task. The Croatian government is drafting new legislation which includes indicators of quality in the payment system. This should influence more rapid progress in the production of some kinds of meat and milk as well as in achieving an increase in product quality.

(Keywords: production, evaluation, meat, milk, quality)

ZUSAMMENFASSUNG

Entwicklung einer qualitätsgerechten Fleisch- und Milchproduktion in der Republik Kroatien

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Kroatien hat gute Voraussetzungen zur Entwicklung seiner Tierproduktion. Die Analyse der Tierproduktion – besonders die Fleisch- und Milchproduktion – erstreckt sich auf den Zeitraum von 1990 bis 1998. Die Daten zeigen, dass infolge des Kriegszustandes gegenüber den Jahren 1991/1992 der Rinderbestand um 46,6 %, der Schweinebestand um 25,9 % und der Geflügelbestand um 41,8 % zurückfiel. Bei der Gelegenheit zur Erneuerung der Tierbestände muss darauf geachtet werden, nicht nur die Bestandszahlen, sondern auch die Produktionstechnologie zu entwickeln, d.h. den

entsprechenden Genotyp auszuwählen und die Rentabilität der Produktion zu verbessern. Schwerpunkte sind also Verbesserung und schnelle Entwicklung der Tierproduktion, die Belegung der Familienbetriebe, Anwendung moderner Zuchtmethoden und Unterstützung einiger Zuchtprogramme. Seit Einführung der Marktwirtschaft spielt eine gute Qualität bei tierischen Produkte eine besonders große Rolle. Die kroatische Regierung berücksichtigte in ihrer neuen Gesetzgebung bereits Qualitätsmerkmale für das Preissystem. Aufgrund der hier aufgeführten Einflüsse ist bei einigen Fleischarten und Milchprodukten eine schnellere und qualitätsgerechtere Entwicklung zu erwarten.

(Schlüsselwörter: Produktion, Entwicklung, Fleisch, Milch, Qualität)

INTRODUCTION

Animal production is an important branch of the economy of Croatia. The majority of production is located on small and medium-sized family farms. The previous socialist system did not pay much attention to private farms, so animal breeding was not developed in an adequate manner at all levels. When presenting the level of development of specific animal breeding, data relating to the number of stock, specificity of production and actual interventions with the aim of its improvement are shown. With regard to their importance this analysis will take into consideration cattle, pig and poultry production.

Production and evaluation of beef production

Despite very favourable natural resources this branch of production in Croatia has not caught up with that in the more developed European countries. However, marked movements have been made in enhancing domestic low productive cattle using predominantly Simmental bulls. This fact contributed to cattle meat being in great demand on the European market during the 60s and 70s (especially in London meat wholesale). The genetic potential of the new domestic, so-termed red-white breed of the Simmental type, which had very favourable traits of meat quality (tenderness, muscle structure, moderate subcutaneous fat and good marbling, a pleasant colour and a very acceptable aroma) contributed to this. The above situation worked in favour of progress in cattle production and the improvement of beef quality (very good conformation, etc.).

The decline in domestic beef production was due to neglect by the socialist regime of production in the individual sector which owned over 80% of all categories of cattle and 97% of cows and pregnant heifers. This resulted in a marked and continuous linear decrease in the total number of cattle up to 1991, when, due to aggression in Croatia, cattle stocks were halved until 1995 (*Table 1*). Taking in account that in 1975 Croatia had over 1 million cattle and 1998 there were less than 450 thousand, it is clear that the situation is alarming despite recent significant moves in the direction of recovery. Due to biological 'slowness' in these animals the state should make even more effort to stimulate the production of cattle meat and milk.

Table 1

Total number of cattle in the period 1990 to 1998 (1000 head)

Year (1)	Beef (2)			Cows and fertilised heifers (3)			Veal and steers/heifers younger than 1 year (4)			Steers/heifers 1-2.5 years old (5)		
	Total number (6)	On family farms (7)	%	Total number	On family farms	%	Total number	On family farms	%	Total number	On family farms	%
1990	830	623	75.06	492	477	96.95	262	105	40.07	68	33	48.52
1991	757	590	77.93	473	458	96.82	222	95	42.79	54	29	53.70
1992	590	473	80.16	383	378	98.69	159	70	44.02	43	20	46.51
1993	589	465	78.94	370	362	97.83	152	81	53.28	63	18	28.57
1994	519	427	82.27	347	339	97.69	136	66	48.52	32	18	56.25
1995	494	423	85.62	335	327	97.61	103	69	66.99	51	22	43.13
1996	461	399	86.55	311	303	97.42	98	70	71.42	48	32	66.67
1997	451	400	88.69	304	298	98.02	93	73	78.49	51	26	50.98
1998	443	393	88.71	300	294	98.00	112	73	65.18	28	rsen	82.14

Source: statistical yearbooks (*Quelle: Statistisches Jahrbuch*)

1. Tabelle: Rinderbestand in den Jahren 1990-1998 (in 1000 Stück)

Jahr(1), Rinder(2), Kühe und trächtige Färsen(3), Kälber, Jungochsen, Färsen – jünger als 1 Jahr(4) Jungochsen, Färsen, 1-2,5 Jahre alt(5), Gesamtzahl(6), in Familienfarmen(7)

Nevertheless, in the renewal of cattle stocks it should be taken into account that reconstruction should not focus only on increasing the number of animals but also on improving the technology involved in production and the quality of meat and milk. According to experience so far this could be achieved, with governmental support, by the work of the agricultural advisory department. This will be no easy task, neither financially nor organisationally, as the productive structure is changing toward bigger operations in the form of family type economies. This trend should be encouraged and stimulated by means of appropriate measures. For this purpose attention should be given to several important activities:

- undertaking steps in breeding which may have a rapid impact on the profitability of certain production characteristics,
- selection of the main economic traits,
- application of modern technologies, generally by better organisation of production, by rational usage of the means for its improvement and by improvement of product quality.

In Croatia intensive genetic build-up of the Simmental, brown and Holstein population is currently in progress. *Table 2* shows mean live and slaughter weights of cattle in the period 1990-1997.

Table 2

**Mean live and slaughter weights of cattle in the Republic of Croatia
in the period 1990 to 1997**

Year(1)	Slaughtered (1000 head)(2)	Live weight (kg/head)(3)	Slaughter weight (kg/head)(4)	Total carcass weight (tonnes)(5)
1990	288	390	214	61,632
1991	212	403	221	46,852
1992	157	434	235	36,895
1993	146	425	232	33,872
1994	123	420	230	28,290
1995	118	396	218	25,724
1996	115	415	230	26,450
1997	130	363	203	26,390

Source: statistical yearbooks (*Quelle: Statistisches Jahrbuch*)

2. Tabelle: Durchschnittliches Lebend- und Schlachtgewicht der Rinder in Kroatien von 1990-1997

Jahr(1), Geschlachtete Tiere(2), Lebendgewicht(3), Schlachtgewicht(4), Menge aller Schlachtkörper(5)

Other important measures which could contribute to improvement in production are changes in legislation. In 1992 Croatia adopted as a package all existing laws and bills from the former Yugoslavia for the period before new legislation was to be enforced. It should be stated here that, unfortunately, some regulations were completely absent (e.g. market law for animals and animal products) and that some old regulations such as those on meat and milk quality are still in force.

Regulation *JUS E.C1-022/74* on cattle carcass classification is still on force, but there is no use in its application because it is not compatible with the current EU regulations which are used as a base for national regulations in all member countries. This regulation did yield some progress in its time because its use and payment according to classes were obligatory. It is not applicable to the circumstances of today, as it classifies carcasses into only 3 categories (veal, steers/heifers and beef) and in classification, besides conformation and fat coverage, it takes into account colour, structure and consistency of meat and fatty tissue, which give rise to additional complications in this subjective grading system.

A group of experts is presently working with the state office for standardisation and measurements on the matrix for the regulations for the cattle carcass grading system. These regulations should be compatible with the main amendments proscribed by the EU commission for its members. Similar to the case of regulations for the pig carcass grading system, this working group has taken into account certain domestic characteristics which do not put in question its application at EU level. Differences exist only in classification in age categories. Due to the specificity of the Croatian market and the habits of our foreign customers, classification based on categories is basically focussed on the age of the animal at the time of slaughter (veal up to 6 months of age, young steers/heifers from 6 to 12 months, steers/heifers from 12 to 24 or 30 months, and beef above 24 or 30 months). Besides this there are few other sub-categories in the category of steers/heifers: meat of young bulls (12-24 months), heifers and young oxen (up to 30 months) and the sub-category of beef category: meat of bulls (above 24 months) and meat of cows and oxen (above 30 months).

The procedure of classification will continue on the basis of the same traits as in the EU, i.e. on the basis of the evaluation of muscle development (conformation). According to this evaluation carcasses will be classified into 6 classes (S-super; E-excellent; U-very good; R-good; O-medium and P-poor). Besides this, on the basis of fatty tissue content carcasses are evaluated and classified into 5 grades according to subcutaneous fat content and marbling (1-very poor; 2- poor; 3-medium; 4-good and 5-very good).

It is hoped that the drafting enforcing of these regulations will significantly contribute to improvement in cattle production in the sense of improved carcass quality in all categories. European experience shows that the consistent application of objective evaluation (classification) can lead relatively quickly to increased proportions of high quality classes from the population, since this is the only objective and real stimulation for production improvement.

Production and evaluation of raw milk in Croatia

Milk production has a long tradition in Croatia. The mainland part of the country is very suitable for milk production with respect to climate and environmental characteristics. In this area it is basically cow's milk which is produced. In coast areas goat's and sheep's milk are the types of milk generally produced. Before the war in Croatia milk production was established on small non-specialised family dairy farms. At the same time the large state dairy farms were not profitable, and the number of these farms was not sufficient. When the socialist regime decayed Croatia inherited this poor situation.

Table 3

Figures for national production (processed by industry) + imported volumes of some dairy products for 1997, expressed in tonnes (t) or hectolitres (hl)

Product (1)	Industrial milk production in Croatia (2)	Imported (3)
Pasteurised and long life milk (UHT or sterilised) (4)	2,543,707 hl	
Concentrated milk (5)	5,443 t	58,199 t*
Fresh cream (6)	9,247 hl	-
Fermented acidified milk and yoghurt (7)	61,260 t	2,176 t
Butter (8)	2,569 t	315 t
Fresh cheese (9)	8,641 t	
Hard cheese (10)	9,675 t	
Processed cheese (11)	2,636 t	3,203 t**
Powder, 0% and 26% (12)	2,790 t	16,783 t

* Including pasteurised milk, long life milk (UHT or sterilised) and concentrated milk. (*Einschließlichpasteurisierte Milch, H-Milch (UHT oder sterilisiert) und Kondensmilch.*)

** Including fresh, hard and processed cheese. (*Einschließlich Frisch-, Hart- und verarbeiteter Käse.*)

3. Tabelle: In Großbetrieben Kroatiens erzeugte Milchprodukte sowie importierte Milchprodukte in Tonnen (t) bzw. Hektoliter (hl)

Milchprodukt(1), großbetriebliche Produktion(2), Import(3), Pasteurisierte Milch und H-Milch (UHT oder sterilisiert)(4), Kondensierte Milch(5), Sahne(6), Sauermilchprodukte und Joghurt(7), Butter(8), Frischkäse(9), Hartkäse(10), verarbeiteter Käse(11), Milchpulver(12)

The new government began to improve dairy production on the family farm level, but this process is proceeding too slowly. Croatia imports a significant number of dairy heifers from Germany, Austria and the Netherlands, and credits farmers for them. At the same time, the government subsidy is about 25% of the milk price. By virtue of this encouraging process many new specialised dairy farms are now appearing. However, there are still many farms with only two or three cows involved in milk production. As the general economic situation in the country becomes worse this process of improving dairy production is in stagnation. In consequence of all these facts the production of milk in Croatia is not sufficient, and Croatia now imports more milk and dairy products than it exports (*Table 3*).

Croatia has several quite large and well organised dairy plants. The main dairy products produced in Croatia are outlined in *Table 4*.

Table 4

The production of milk by farmers in the past six years

Year(1)	Production (1000 l)(2)
1990	888,927
1995	587,922
1996	592,986
1997	621,034
1998	614,400

4. Tabelle: Milchproduktion auf Familienfarmen in den letzten 6 Jahren

Jahr(1), Milchmenge(2)

Average milk production in Croatia is 3,500 litres of milk per year. The number of cows and heifers was 392,706 in 1998, when total milk production was 900 million litres and the supply of milk to the dairy was 500 million liters (about 55%).

Annual consumption of dairy products is 187.3 litres of milk on a per capita basis. Consumption of milk and dairy products in Croatia in total is presented in *Table 5*.

Table 5

**Consumption of dairy products in Croatia in the past three years
(in thousands of tonnes)**

Year(1)	1996	1997	1998
Liquid milk (2) 19	528.0	554.4	426.7
Cream (3)	33.6	35.3	37.0*
Milk drinks, fermented products(4)	24.0	25.2	
Butter (5)	3.4	3.6	2.0
Cheese (6)	57.6	60.0	33.1
Population (thousands) (7)	4,800	4,800	4,800

*Including cream for consumption

5. Tabelle: Verbrauch von Milchprodukten in Kroatien in den letzten 3 Jahren

Jahr(1), Trinkmilch(2), Sahne(3), Milchgetränke und Sauermilchprodukte(4), Butter(5), Käse(6), Verbrauch pro 1000 Einwohner(7)

As Croatia has transformed from a state economy to a market economy the quality criteria for raw milk have become very important. The Croatian government is drafting new legislation which includes many parameters of quality in the payment system. Milk will be priced according to chemical composition (fat and protein), somatic cell count, total germ, cryoscopy and inhibitors. This new system will be introduced in practice by the end of this year. So far, some dairy plants have already introduced into the milk payment scheme some quality parameters (such as factory premium), as follows: percentage of fat, percentage of solid non-fat and somatic cell count.

Production and evaluation of pig meat

As a consequence of war the total number of pigs and also the total number of sows and fertilised gilts in the period 1990-1998 decreased by 25.9% and 20.3% respectively. According to statistics for 1998 74.9% of all swine categories and 84.5% of sows and fertilised gilts are reared on family farms (*Table 6*). Although a significant proportion of the pig population is located on family farms, these farms are characterised by low capacity.

Table 6

Total number of pigs, sows and fertilised gilts in the period 1990 to 1998 (in thousands)

Year (3)	Pigs (1)			Sows and fertilised gilts (2)		
	Total (4)	On family farms (5)	%	Total	On family farms	%
1990	1,573	1,025	65.2	227	177	78.0
1991	1,621	1,025	63.2	229	177	77.3
1992	1,182	852	72.1	176	149	84.6
1993	1,262	890	70.5	189	158	83.6
1994	1,345	970	72.1	194	161	83.0
1995	1,175	826	70.3	178	146	82.0
1996	1,197	871	72.8	176	145	82.4
1997	1,176	878	74.6	180	149	82.8
1998	1,166	874	74.9	181	150	82.9

Source: statistical yearbooks (Quelle: Statistisches Jahrbuch)

6. Tabelle: Gesamtbestand von Schweinen, Sauen und trächtigen Jungsauen von 1990 bis 1998

Schweine(1), Sauen und trächtige Jungsauen(2), Jahr(3), Gesamtbestand(4), auf Familienfarmen(5)

Analysis of the data on slaughtered pigs in the Republic of Croatia shows a dramatic fall in production. The number of slaughter pigs in the period 1990 to 1998 was reduced by 47.5% (*Table 7*).

Table 7

**Mean live and slaughter weights of pigs in the Republic of Croatia
in the period 1990 to 1997**

Year(1)	Slaughtered (1000 head) (2)	Live weight (kg/head) (3)	Slaughter weight (kg/head) (4)	Total carcasses weight (tonnes) (5)
1990	1,278	97	73	93,294
1991	502	100	77	38,654
1992	556	97	74	41,144
1993	706	97	74	52,244
1994	746	94	73	54,458
1995	626	93	74	46,324
1996	580	92	74	42,920
1997	671	90	69	46,299

Source: statistical yearbooks (*Quelle: Statistisches Jahrbuch*)

7. Tabelle: Lebend- und Schlachtgewicht von Schweinen in Kroatien von 1990 bis 1997

Jahr(1), Schlachtschweine in 1000 Stück(2), Lebendgewicht kg/Schwein(3), Schlachtgewicht kg/Schwein(4), Schlachtkörpergewicht (t)(5)

The lean meat content of Croatian swine carcasses is estimated to be between 44% and 46% (classes 'O' and 'R'). This estimate is based on the regulation on the classification and categorisation of swine carcasses, which is compatible with current European regulations. The bases and measurements for the classification of pig carcasses into categories and classes are proscribed by this regulations. Pigs for slaughter and young boars are classified, according to carcass lean meat content, into the (S)EUROP classes.

Research results show that swine carcasses produced on the farms in east Croatia have higher mean muscle percentage than those produced in the rest of the country. On the basis of the current regulations, lean meat percentages were calculated for 1,047 slaughtered pigs and their carcasses were classified into appropriate classes (*Tables 8 and 9*).

Table 8

Slaughter quality of pig carcasses in eastern Croatia (n=1047)

Indicator (1)	\bar{x}	$S_{\bar{x}}$	s	x_{\min}	x_{\max}
Carcass weight, kg (2)	81.11	0.35	11.76	60	120
Fat thickness, mm (3)	24.16	0.21	6.70	5	48
Muscle thickness, mm (4)	62.53	0.21	7.11	40	85
Lean meat, % (5)	49.43	0.11	3.44	41	68

8. Tabelle: Qualität der Schlachtkörper in Ostkroatien (n=1047)

Merkmal(1), Schlachtkörpergewicht(2), Speckdicke(3), Muskeldicke(4), Fleischanteil(5)

Table 9**Commercial classes (%)**

S	E	U	R	O	P
1.4	5.0	33.5	51.3	8.8	-

Source: Kralik *et al.* (1997)

9. Tabelle: Handelsklassen (%)

Results of dissection of 505 swine carcasses of various genotypes from 5 large pig breeding farms showing a mean lean meat percentage of 55.47% (Table 10).

Table 10**Indicators of pig carcass quality (n=505)**

Indicator(1)	\bar{x}	S	V	x_{\min}	x_{\max}
Carcass weight, kg (2)	85.47	9.11	10.66	67	119
Fat thickness (3)					
- loin, mm (4)	21.10	6.75	32.01	6	40
- crosses, mm (5)	21.71	5.88	27.06	8	40
Muscle tissue, % (6)	55.47	3.91	7.04	44.3	64.3

Source: Kralik and Petričević (1997)

10. Tabelle: Merkmale der Schlachtkörperqualität bei Schweinen (n=505)

Merkmale(1), Schlachtkörpergewicht(2), Speckdicke(3), - in Lendenhöhe(4), - am Kreuzbein(5), Muskelanteil(6)

This record shows that farms with organised selection activities can produce pigs which are significantly leaner than the national average.

Production of poultry meat

This production was developed on industrial principles from 1961 right up until 1990. Development was very intensive. The number of poultry in 1990 was 17,102 million, with approximately equal shares in the state sector and on family farms. There are no data available on numbers of specific species or breeds of poultry. It is estimated that 92-94% of the total number are chickens and only 6-8% are other types of poultry (turkeys, ducks and geese). In the period analysed the number of poultry decreased constantly, and in 1998 it was at a level of only 58% of the total recorded in 1990.

The production of fattened broilers and the number of slaughtered poultry are important indicators of poultry meat production (Table 11). The number of slaughtered poultry has decreased together with the decrease in the total number of poultry reared. In comparison with 1990 the number of slaughtered poultry in 1997 had decreased by 45% (Table 12). In the same period egg production decreased by 21%. New regulations on the quality of poultry meat are also in the process of being drafted, since current regulations are not compatible with those of the EU countries.

Table 11

Indicators of number of poultry

Year (2)	Poultry (1000 birds)(1)		
	Total (3)	On family farms (4)	%
1990	17,102	8,639	50.51
1991	16,512	8,411	50.94
1992	13,142	6,668	50.74
1993	12,697	6,579	51.81
1994	12,503	6,606	52.83
1995	12,024	6,900	57.38
1996	10,993	6,852	62.33
1997	10,945	6,656	60.81
1998	9,959	6,455	64.81

Source: statistical yearbooks (*Quelle: Statistisches Jahrbuch*)

11. Tabelle: Merkmale des Geflügelbestandes

Geflügelbestand in 1000 Stück(1), (Jahr(2), Gesamtbestand(3), Bestand auf Familienfarmen(4)

Table 12

Mean live and slaughter weights of poultry in the Republic of Croatia and quantity of meat by year in the period 1990 to 1997

Year (1)	Slaughtered (1000 birds) (2)	Live weight (kg/bird) (3)	Slaughter weight (kg/bird) (4)	Total carcass weight (tonnes) (5)
1990	35,308	2.0	1.4	49,431
1991	30,508	2.1	1.5	45,762
1992	26,668	2.1	1.5	40,002
1993	23,016	2.1	1.5	34,524
1994	21,784	2.2	1.6	34,854
1995	18,504	2.3	1.7	31,457
1996	20,521	2.3	1.7	34,885
1997	19,361	2.3	1.7	32,914

Source: statistical yearbooks (*Quelle: Statistisches Jahrbuch*)

7. Tabelle: Lebend- und Schlachtgewicht von Geflügel und die produzierte Fleischmenge pro Jahr von 1990 bis 1997 in Kroatien

Jahr(1), Geschlachtetes Geflügel in 1000 Stück(2), Lebendgewicht kg/Tier(3), Schlachtgewicht kg/Tier(4), Schlachtmenge gesamt (t)(5)

Large poultry production companies – reproduction centres for heavy and light lines of chicken and turkey - are also good bases for faster development of poultry production on

family farms. Croatian poultry production will in future still be developed on the basis of the utilisation of genetic potentials of poultry (hybrids) from foreign selection companies. While the productivity of poultry accompanied by modern technology on the farms of the former state sector is high, less favourable results are achieved on individual farms. Regional distribution of capacities enables the directing of meat and egg production towards family farms. Besides intensive poultry rearing outdoor rearing should also be planned. Diverse production would influence the supply of products according to manner of production and quality. Poultry production offers a great possibility for the alternative production of biologically functional food (eggs with lower cholesterol level, meat enhanced by omega-3 fatty acids etc.). It can be anticipated that farmers will become interested in producing geese, ducks, pheasants etc.

CONCLUSIONS

The Republic of Croatia has good natural circumstances for the development of all animal production systems, which in the period to come will be based on family types of economy and the enlargement of animal production farms, similar to those in existence in countries with more developed animal production.

Advisory and selection services, which are organised at the state level, should exert influence in the manner of application of new technologies in production, the improvement of animal production capacities and the organisation of highly efficient animal production. The authors presume that this will be followed by other means of state support. The rapid adjustment of Croatian regulations to make them compatible with those in force in EU countries is now emerging as one of the primary needs.

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