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USING A BIOECONOMIC MODEL TO INVESTIGATE THE INFLUENCE OF REPRODUCTIVE TRAITS ON PROFIT CHANGE IN A PIG HERD

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Introduction

This paper is dealt with observation of the influence of sow reproductive traits level on the profit amount in a pig herd. A bioecoonmic model of pig herd (program EPOS, Houška, Fiedler, Pulkrábek, 1992) was used for a survey. This model and computer program have been created in Research Institute of Animal Production in Uhříněves in 1991 on the basis of detailed analysis of herd turnover in nucleus herd of dam breeds in Czech Republic. Program can calculate economic characteristics of the pig herd in dependance on the structure and turnover of the herd, size of input items and structure of production. A simulation of different situations in the herd, different levels of input items and evaluation of their influence on the economy of the herd production can be done by means of the program, too. The use of bioeconomic model was referred by Stewart et al. (1990), de Vries (1989) etc.

Material and Method

By means of program EPOS a production of a sow herd was modelled, in which all produced pigs were sold at 30 kilograms of live weight. All costs and incomes in the herd with initial size of 100 purchased gilts for all sow's lifetimes were calculated. Total profit in the herd (in Czech crowns, Cc) was recalculated per pigs produced on average per sow per year.

Different levels of litter size at weaning, age of gilt at first conception, farrowing interval length, number of heats per conception and the number of insemination doses (ID) within a heat were simulated. In each simulation usual output items were calculated while changing the level of only one tested trait. All other input values and herd turnover (30%) were the same in each simulation. With exception of simulation for influence of litter size on the profit the average litter size was on the level of 9 piglets weaned.

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After evaluation of simulated changes of tested traits the linear regression equations describing influence of the change of the trait level on the amount of profit for pigs produced on average per sow per year were constructed.

Results

Litter size at weaning (correlated with litter weight) was observed at four levels, differences between them being one piglet converted on the herd average with respect on parity. Influence of litter size at weaning on costs and profit for pigs produced on average per sow per year shows tab. 1. Average costs per sow/year are constant (8515.00 Cc) because of the same length of sow stay in the herd. Relation between average litter size at weaning (x) and profit for pigs produced on average per sow/year (y) is expresse by following regression equation:

$$y = -8944 + 1313x \qquad (1)$$

Tab. 1. - COSTS AND PROFIT FOR PIGS PRODUCED ON AVERAGE PER SOW PER YEAR ACCORDING TO THE LITTER SIZE

Character	Average litter size at weaning			
	7	8	9	10
Total No. of piglets in the herd	1953	2236	1519	2802
Weaned piglets/sow/yr	13.7	15.7	17.7	19.7
Costs/piglet till weaning (Cc)	620	541	480	432
Costs/pig till 30 kg (Cc)	951	872	809	757
Profit for pig sold (Cc)	19	98	161	213
Profit for pigs produced per sow/yr (Cc)	265	1538	2863	4200

Four levels of age of gilts at first conception (matching the variability of dam breeds in Czech Republic) were used. The relation between the age at first conception and longevity and culling rate at 1st to 5th parity, resp. were contemporary considered. The influence of age of gilts at first conception on costs and profit displays tab. 2. Dependance of profit for pigs produced on average per sow/year (y) on average age of sow at first conception (x) shows regression equation:

$$y = 5929.3 - 12.815 \, x \qquad (2)$$

Tab. 2. - COSTS AND PROFIT FOR PIGS PRODUCED ON AVERAGE PER SOW PER YEAR ACCORDING TO THE AGE OF SOWS AT FIRST CONCEPTION

Character	Average age at 1st conception (days)			
	240	260	280	300
Average length of sow stay in the				
herd (days)	519	539	559	579
Weaned piglets/sow/yr	17.7	17.1	16.5	15.9
Cost per sow/yr (Cc)	8515	8368	8232	8104
Costs/piglet till weaning (Cc)	480	490	500	510
Costs/pig till 30 kg (Cc)	809	818	828	838
Profit for pig sold (Cc)	161	152	142	132
Profit for pigs produced per sow/yr (Cc)	2863	2588	2332	2094

Four levels of farrowing interval, differing on the level of the first litter by 10 days (160 - 190 days), were used. In this case the relation between average length of farrowing interval and parity was considered. Table 3. describes the influence of farrowing interval length on costs and profit. Regression equation

$$y = 6916 - 25.30 \, x \qquad (3)$$

shows influence of average length of farrowing interval (x) on profit for pigs produced on average per sow/year (y).

Tab. 3. - COSTS AND PROFIT FOR PIGS PRODUCED ON AVERAGE PER SOW PER YEAR ACCORDING TO FARROWING INTERVAL LENGTH

Character	Average length of farrowing interval (days)			
	160	170	180	190
Average length of sow stay in the				
herd (days)	519	538	558	578
Weaned piglets/sow/yr	17.7	17.1	16.5	15.9
Cost per sow/yr (Cc)	8515	8370	8234	8108
Costs/piglet till weaning (Cc)	480	490	500	510
Costs/pig till 30 kg (Cc)	809	818	828	838
Profit for pig sold (Cc)	161	152	142	132
Profit for pigs produced per sow/yr (Cc)	2863	2590	2337	2101

Table 4 demonstrates the influecne of the number of heats per conception of the sow on costs and profit. Higher number of ID used for conception of the sow is consequence of repeated heats. So costs per sow/year, costs per piglet till weaning and costs per pig till 30 kg of live weight increase. Regression equation for determination of profit for pigs produced on average per sow/year (y) in dependance on the percentage of sows conceived at first heat (x) is as follows:

$$y = 2227 + 6.970 \, x \qquad (4)$$

Tab. 4. - COSTS AND PROFIT FOR PIGS PRODUCED ON AVERAGE PER SOW PER YEAR ACCORDING TO THE SHARE OF SOWS CONCEIVED AT 1ST HEAT

Character	Average percentage of sows conceived at 1st heat			
	90	80	70	60
Total number of ID in a herd	713	848	905	1024
Costs per sow/yr (Cc)	8515	8611	8651	8735
Costs/piglet till weaning (Cc)	480	486	488	493
Costs/pig till 30 kg (Cc)	809	814	816	821
Profit for pig sold (CC)	161	156	154	149
Profit for pigs produced per sow/yr (Cc)	2863	2767	2727	2644

The influence of ID number within a heat on costs and profit is shown in tab. 5. The dependance of profit for pigs produced on average per sow/year (y) on the number of insemination doses within a heat (x) describes following regression equation:

$$y = 3365.167 - 251 \, x \qquad (5)$$

Tab. 5. - COSTS AND PROFIT FOR PIGS PRODUCED ON AVERAGE PER SOW PER YEAR ACCORDING TO THE NUMBER OF INSEMINATION DOSES

Character	Average number of ID within a heat		
	2	2.5	3
Total number of ID in a herd	713	891	1069
Costs per sow/yr (Cc)	8515	8641	8766
Costs/piglet till weaning (Cc)	480	487	495
Costs/pig till 30 kg (Cc)	809	816	823
Profit for pig sold (CC)	161	154	147
Profit for pigs produced per sow/yr (Cc)	2863	2738	2612

Conclusions

Following changes of profit for pigs produced on average per sow/year (and sold at 30 kg of live weight) as concequence of changes of tested traits levels were found:

Increase of profit:
- by 1313.00 Czech crowns as a consequence of increase of aferage litter size at weaning by a piglet
- by 6.97 Czech crowns as a consequence of increase of percentage of sows conceived at first heat by a percent

Decrease of profit:
- by 12.815 Czech crowns as a consequence of increase of average age at first conception by a day
- by 25.39 Czech crowns as a consequence of increase of average length of farrowing interval by a day
- by 251.00 Czech crowns as a consequence of increase of ID number within a heat by a dose.

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PRIMJENA BIOEKONOMSKOG MODELA ZA ISPITIVANJE UTJECAJA REPRODUKTIVNIH OSOBINA NA PROMJENU DOBITI KRDA SVINJA

Sažetak

U ovom radu se promatra utjecaj razine reproduktivnih osobina krmača na visinu dobiti krda svinja. Za procjenu je primijenjen bioekonomski model krda svinja (EPOS program, Houška, Fiedler, Pulkrabek, 1992.) Ovaj model i kompjutorski program načinjeni su u Istraživačkom zavodu za proizvodnju životinja u Uhrinevesu god. 1992. na temelju podrobne analize prometa krda u nukleus krdima pasmina ženka-roditeljica u republici Češkoj. Programom se mogu proračunati ekonomske karakteristike krda svinja ovisno o strukturi i prometu krda, veličini stavka inputa i strukturi proizvodnje. Pomoću ovog programa mogu se isto tako načiniti simulacije raznih situacija u krdu, različite razine stavaka inputa te procjena njihovog utjecaja na ekonomičnost proizvodnje krda. Nakon promjena dobiti za svinje prosječno proizvedene po krmači (na godinu) i prodanih pri 30 kg žive vage nađeni su kao posljedica promjena ispitivanih razina osobina:

Povećanje dobiti:

- za 1313.00 čeških kruna kao posljedica porasta veličine prosječnog legla pri odbiću prasadi

- za 6.97 čeških kruna kao posljedica porasta postotka krmača oplođenih pri prvom tjeranju i to jednim postotkom.

Smanjenje dobiti:

- za 12.815 češkili kruna kao posljedica povećanja prosječne dobi pri prvoj oplodnji i to jednim danom

- za 25.39 češkili kruna kao posljedica povećanja prosječne dužine razmaka prašenja i to jednim danom

- za 251.00 češkili kruna kao posljedica povećanja broja ID (doza inseminacije) za vrijeme tjeranja i to jednom dozom.

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