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Kovac M., Salehar A.

in

Aumaître A. (ed.).
The production of pig meat in Mediterranean Countries

Paris : CIHEAM
Options Méditerranéennes : Série Etudes; n. 1989-I

1989
pages 129-136

Some economic aspects of the reproductive performance of sows in Yugoslavia

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High fertility levels are one of the most representative characteristics of domestic pigs. Their high rate of reproduction, accompanied by quick development of their physiological stages, makes piglet production particularly dynamic. Considerable research illustrates and explains several different viewpoints regarding pig reproduction and thus piglet production. To regulate sow fertility and piglet production it is necessary to follow a series of biological, ethological, physiological, economical and other laws. Immediate and accurate knowledge of the fertility measures is thus also absolutely necessary.

I - Measures of efficiency in piglet production

Fertility is very complex and so a number of measures are used for its presentation. They cannot be defined uniformly, however, as there are often quite different traits hidden behind the same expression. This makes direct comparison of the attained results difficult in practice as well as in experiments.Uniform measures of fertility have thus been agreed upon in Slovenia and they have been used in all analyses since 1979.

As a measure of efficiency in piglet production, the **number of feeding days per liveborn piglet** is used. Because of fostering of piglets among sows, the number of feeding days per weaned piglet can only be calculated for all sows together.

$$FDp = \frac{FDs}{p.\ nl}$$

FDp – number of feeding days per liveborn piglet

FDs – number of feeding days with sows

p – number of liveborn piglets per litter

nl – number of litters

The efficiency of piglet production depends upon the litter size and the number of feeding days per litter. The significance of separate traits for the efficiency of piglet production is expressed as the difference in the number of feeding days per piglet which is caused by this trait.

Table 1 gives the calculation of the effects of the number of liveborn piglets and the number of feeding days per litter on the efficiency of liveborn piglet production. For this calculation, the best (B) and the worst (A) results reached on Slovene farms in 1984 were used, while the possible result (x) is presented in estimated values.

Table 1 clearly shows that the efficiency of piglet production can be increased more rapidly by

reducing the number of feeding days per litter as well as by increasing the litter size. An exception is the gilts on farm A where the number of feeding days per litter has been reduced to a minimum. The possibilities are greater with gilts than with sows.

Further examples evaluate the importance of reproductive performance on the efficiency of piglet production.

II - Number of feeding days per litter

In calculating the number of feeding days per litter (FDl) the feeding days of sows between 200 days of age and culling are taken into account.

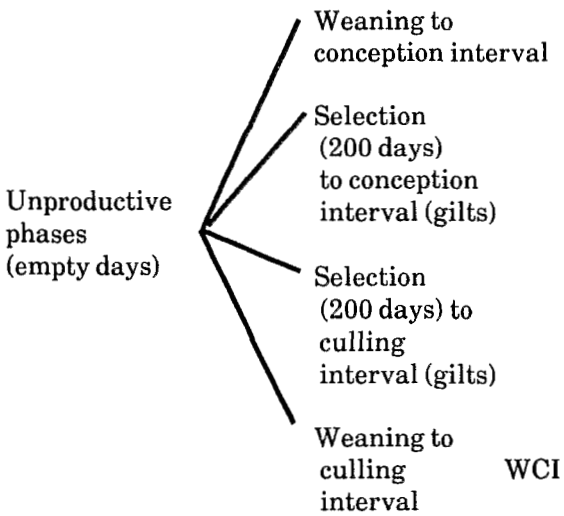
$$FDl = \frac{\text{Sum of feeding days of sows and gilts}}{\text{Number of litters}}$$

The feeding days of sows are divided into productive and unproductive phases.

a) **Productive phases** (lactation and pregnancy) are practically constant and can hardly influence the efficiency of piglet production. Greater effects are possible only with certain lengths of lactation when connections between lactation length and some reproductive factors (like litter size in the next farrowing, culling rate, interval between weaning and conception, etc.) become important. On our farms lactation varies between 20 and 28 days. Within this period the contrary effects of lactation length on different reproductive performance level out with one another.

b) **Unproductive phases** are presented in the **diagram** below.

The unproductive feeding days in the normal reproductive cycle of sows are represented by the weaning to conception interval. With replacement gilts, the unproductive phases are represented by the selection (at 200 days) to conception interval, which is usually longer that the weaning to conception interval. With each culled sow, the feeding days after the last weaning to culling interval must be taken into account. There are also some gilts culled before their first litter, with feeding days from the age of 200 days to culling.



1. The effect of the weaning to conception interval on the efficiency of piglet production

The weaning to conception interval affects the number of feeding days per litter: the longer the interval between weaning and conception, the higher the number of feeding days per litter. The change in the length of the weaning to conception interval (WCI) is determined by the length of the weaning to first oestrus interval (WOI), the service to return interval (SRI), and the percentage rate of returns (RR):

$$WCI = WOI + \frac{SRI.RR}{100 - RR}$$

The literature contains a number of effects on the weaning to conception interval itself or on its separate parts. Our interest here is on their effect on the efficiency of piglet production.

A - The weaning to first oestrus interval

The duration of this period with primiparous and multiparous sows is shown in **Figure 1**.

The difference in the length of the weaning to first oestrus interval between the named categories of sows is 6.33 days (half being the difference in length in the weaning to conception interval and half reflecting the success of service and of the detection of returns itself).

B - Percentage rate of returns and service to return interval

According to data from **Table 2,** the weaning to conception interval has been prolonged because of returns by 2.24 to 6.45 feeding days, which with 9.5 piglets per litter amounts to 0.24 to 0.68 more feeding days per piglets. More important is that the farrowing rate is not enough for evaluating the success of service. The evaluation must also include the feeding days after service as well as the number of liveborn piglets per litter.

Effect of the percentage rate of returns and of the service to return interval on the number of feeding days per litter (**Table 2**)

2. Effect of the selection to service interval on the efficiency of piglet production

The selection to service interval directly affects the efficiency of piglet production by affecting the number of feeding days per litter, and indirectly by affecting the litter size at first farrowing and thus the lifetime performance of sows (**Table 3**).

Older gilts at service used more feeding days for their litters (see the corrected interval from selection to first farrowing in **Table 3**). The data on the number of liveborn piglets on farm B is surprising as with greater age at service, a larger litter was expected (**Figure 3**). Part of the explanation can be seen in **Figure 2**.

There are differences between farms (**Figure 2**) not only with regard to the mean values but also the distribution of age at service. Thus on farm A, 90% of the gilts were serviced before they were 230 days old. On farm B, only 20% of the gilts were serviced before this age. The majority of the differences between farms are in the gilt management before their first service.

The explanation can be seen in **Figure 3** which clearly shows that the number of liveborn piglets grows with the age at farrowing up to approximately one year. The calculation on the costs for an extra piglet due to the greater age at the first farrowing is interesting.

Table 4 clearly shows that an increase of the litter size does not compensate for the greater number of feeding days per litter. Therefore, the costs for an extra piglet are very high.

III - The replacement and the economic aspects of piglet production

Replacement affects the economic aspect of piglet production in two ways. The first one has already been shown: for each replaced sow, extra unproductive feeding days are used with culled sows. The more sows are replaced, the greater the sum of feeding days of culled sows becomes, and thus also the number of unproductive days per litter. The second way, mentioned briefly, is that the gilts and primiparous sows piglets are usually more expensive than those of multiparous sows. The greater the proportion of gilts and primiparous sows in the herd, the worse the results can be expected.

The economic aspect of piglet production according to the litter number can be presented in several ways (see **Figure 4**).

The first curve presents the economic aspects of piglet production with sows of two farrowings on Slovene farms. Piglets of gilts and primiparous sows are more expensive than those of multiparous sow by roughly four feeding days. After the fifth litter the piglets become more expensive again, mostly because of the increased culling rate of sows.

The second curve shows the number of feeding days per piglet with a sow which has given exactly one, two, three etc. litters in her lifetime. The piglets are cheaper the more litters the sow has given. The most expensive are those of sows with only one litter (37.7 feeding days). With sows with more than seven litters, less than 18 feeding days are used per piglet (see **Table 5**). The proportion of unproductive phases become smaller and smaller.

The third curve shows the economic aspects of piglet production with sows giving one, two, three, etc. litters or less. This curve includes the age structure as well as costs per piglet at the successive parity. The proportion of sows with higher litter numbers, when the number of feeding days becomes higher than the average, is so small that it does not significantly affect the economic aspects of piglet production.

In a simplified way, it can be said that in the sow's productive period – from the age of 200 days to culling – the only variable is the number of litters

per sow. The greater their number, the better the ratio between the productive and the unproductive phases. At the same time, the number of piglets per sow grows and the number of feeding days per piglet decreases (see **Table 5**). It must be taken into consideration that litter size decreases after the eighth parity, while piglet losses are higher and the rate of absolute culling increases. As a result, piglet production with old sows is not that economic.

In the evaluation of the effect of replacement on the economic aspects of piglet production, it has been assumed that other reproductive performances do not change. The values were taken from the fertility results on Slovene farms in 1985:

- selection to farrowing interval:159.4 days
- farrowing interval with primiparous sows: 162.8 days
- farrowing interval with multiparous sows: 151.5 days
- farrowing to culling interval: 93.6 days
- number of liveborn piglets with gilts: 8.7
- number of liveborn piglets with primiparous sows: 9.40
- number of liveborn piglets with multiparous sows: 9.77

From the figures in **Table 6** it can be established that the replacement rate affects the economic aspects of piglet production. The size depends on the differences in piglet production with gilts, primiparous and multiparous sows. By regulating the replacement of the herd, the economic aspects can be influenced: the proportion of sows of the most convenient age structures must be increased.

A calculation according to farms would not be exactly the same as in **Table 6**, since it depends on the attained results of the mentioned categeories of sows. **Table 1** presents a case where better results were reached with gilts than with old sows.

IV - Conclusions

The number of feeding days per liveborn piglet is used as measure for the economic aspects of piglet production. Fertility is also presented by a number of parameters, the effect of which is expressed in the difference between the number of feeding days per liveborn piglet, caused by a change in the traits. The importance of separate traits varies between breeders. The economic aspects of piglet production can be improved more often and more successfully by reducing the number of feeding days per litter as well as by increasing the litter size.

Changes were observed in the weaning to first oestrus interval, returns, age of gilts at service and replacement rate. These traits influence the number of unproductive days per litter. The productive phases - lactation and pregnancy - are practically constant and they can hardly influence the efficiency of piglet production.

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Table 1: Effect of litter size and number of feeding days per litter on the efficiency of piglet production

Farm	FD per liveborn piglet	Number of liveborn piglets	Number of FD per litter	Effect of litter size		Effect of feeding days per litter	
				Days	%	Days	%
Gilts							
A	25.02	8.36	209.08	2.24	22.58	6.69	67.44
B	16.60	8.73	144.92	1.51	100.00	0.00	0.00
x	15.10	9.60	145.00				
Sows							
A	20.33	10.25	208.42	0.36	6.37	5.17	91.51
B	17.66	10.02	175.92	0.70	23.49	2.17	72.84
x	14.68	10.50	154.10				

A: Worst results; B: Best results; x: Possible results

Table 2: Effect of the percentage rate of returns and of the service to return interval on the number of feeding days per litter

Farm	A	B	C
Percentage rate of returns	11.3	10.0	11.9
Service to return interval (days)	40.8	31.3	27.0
Up to the 25th day	43.0	55.2	48.4
Distribution of returns			
25th to 40th day	17.6	20.3	44.7
41st to 60th day	17.0	18.4	6.8
after the 60th day	22.3	6.1	0.0
Effect of returns on feeding days per litter	6.45	2.24	4.12

Table 3: Age of gilts at service and efficiency of piglet production

Farm	A	B
Age at service (days)	218.9	263.4
Selection to service interval (days)	18.9	63.4
Corrected interval from selection to first farrowing (days)	145.6	214.1
Number of liveborn piglets per litter	8.8	8.6
Feeding days per liveborn piglet (days)	16.6	25.0

Table 4: Calculation of the costs for an extra piglet

	A	B	Difference A-B	FD per extra piglet
Age at first farrowing	365	330	35	
Number of liveborn piglets per litter	8.90	8.20	0.70	
FD per liveborn piglet	18.54	15.85	2.69	50.00

Table 5: The sow's productive period and economic aspects of piglet production

No. of litters per sow	Productive period of the sow (days)	Productive phases (%)	Unproductive phases (%)	No. of liveborn piglets	No. of FD per liveborn piglet (days)
1	328.0	41.2	58.8	8.7	37.7
2	452.4	59.7	40.3	18.1	25.0
3	605.9	66.8	33.1	28.0	21.6
4	757.6	71.3	28.7	38.2	19.8
5	906.4	74.5	25.5	48.5	18.7
6	1,056.9	76.6	23.4	58.3	18.1
7	1,203.7	78.5	21.5	67.0	17.7
8	1,357.8	79.5	20.5	77.5	17.5
9	1,493.4	81.4	18.6	86.6	17.2

Table 6: Replacement rate and the economic aspects of piglet production

Replacement rate	35%	40%	50%	60%
Age at culling (years)	3.4	3.1	2.6	2.2
Productive period of sow (years)	2.9	2.5	2.0	1.7
Productive phases (%)	82.0	80.6	77.9	75.0
Unproductive phases (%)	18.0	19.4	22.1	25.0
Number of litters per sow	6.1	5.3	4.1	3.3
Number of liveborn piglets of sow	58.5	50.1	38.4	30.6
Feeding days per liveborn piglet	17.8	18.2	19.0	19.9

Figure 1: Distribution of the weaning to first oestrus interval with primiparous and multiparous sows

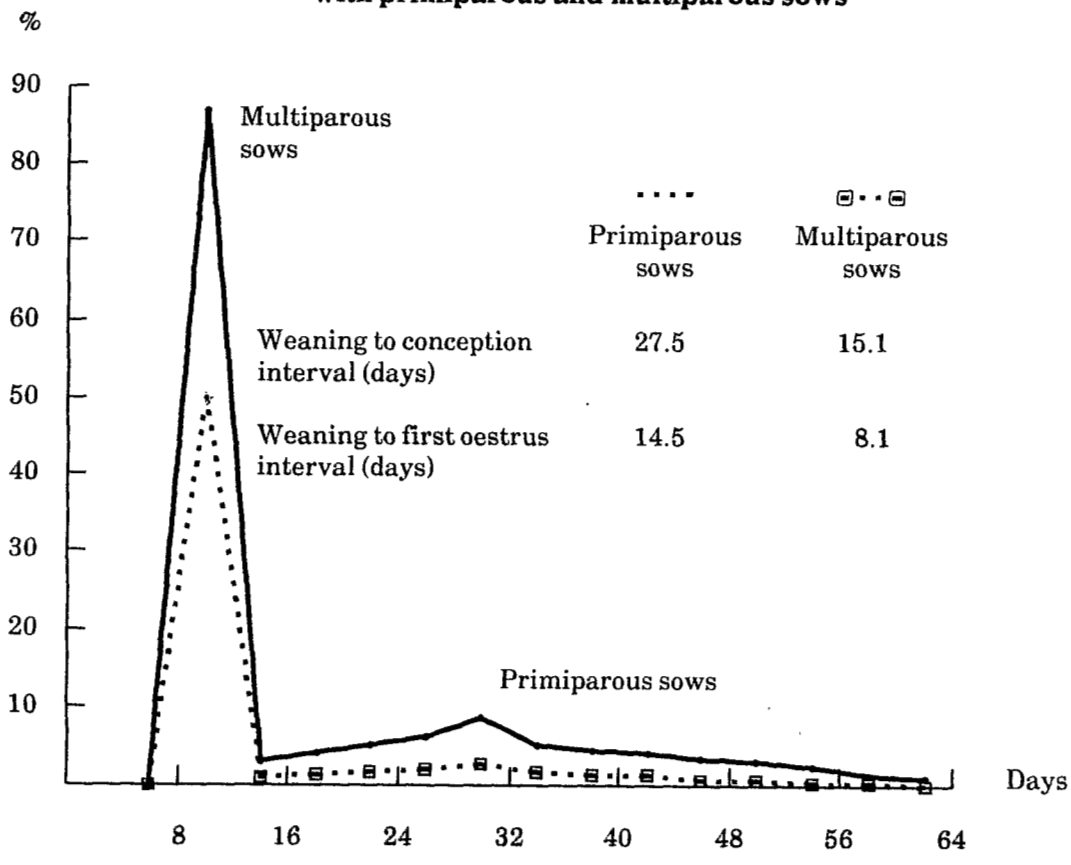

Figure 2: Distribution of age at service for gilts

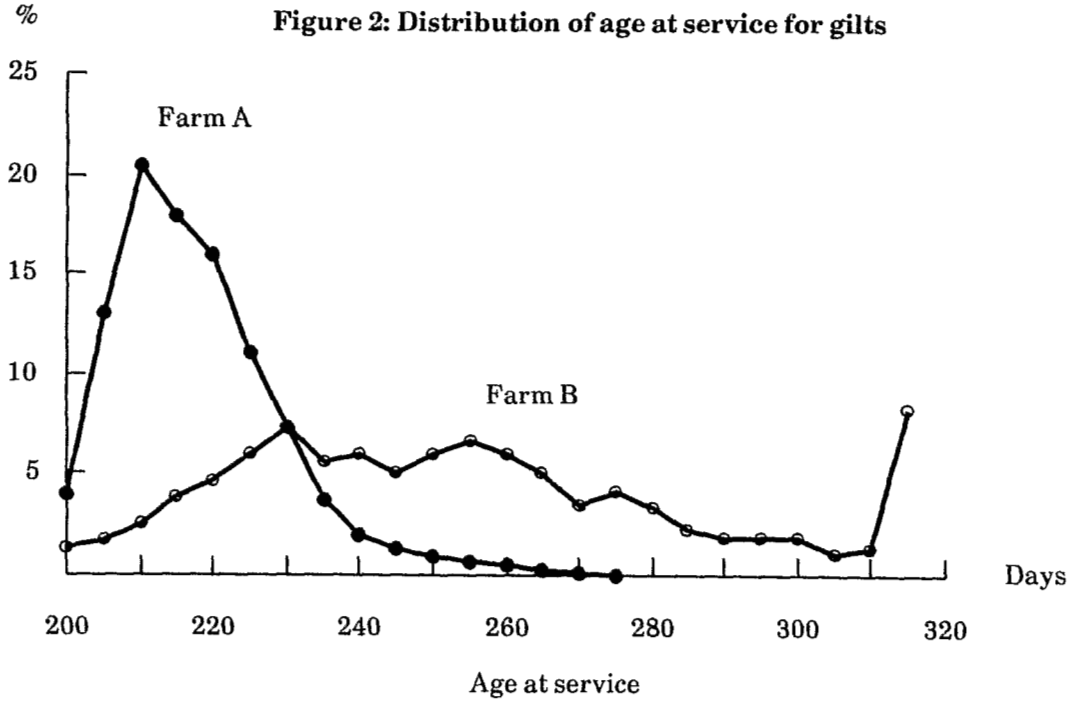

Figure 3: Effect of age at first farrowing on the litter size of gilts

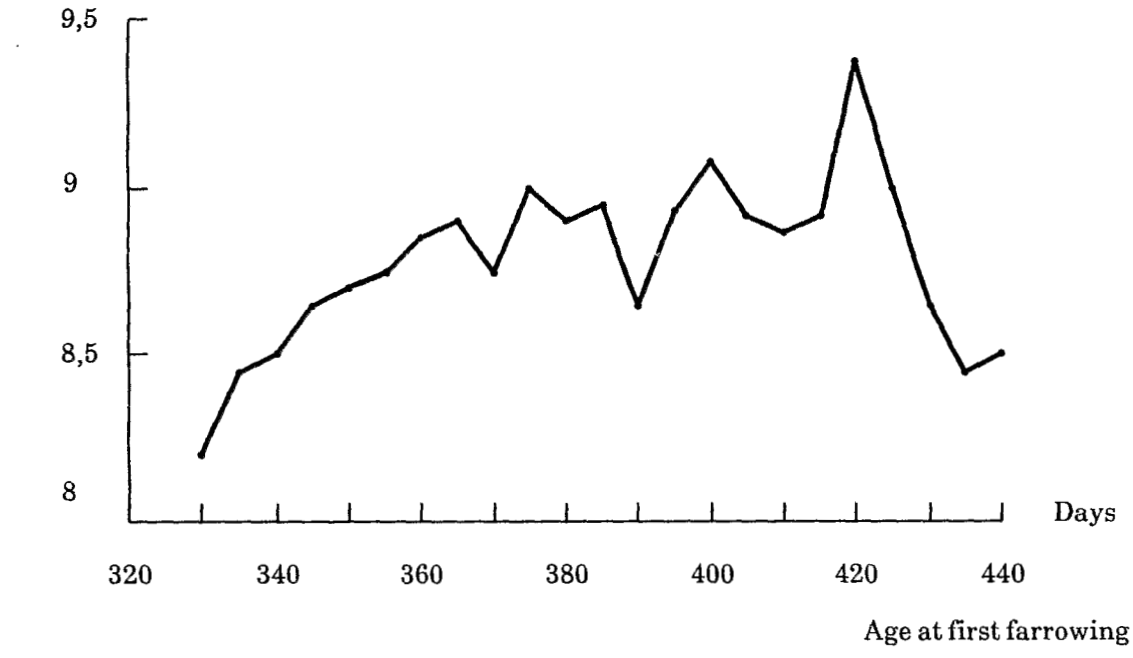

Figure 4: Effect of litter number (parity) on efficiency in piglet production