RESEARCH ARTICLE

An Investigation on Fertility Characteristics of Sows and Growth Performances of Piglets Bred in A Commercial Farm [1]

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Summary

In this study, some fertility characteristics such as fertility, survavilty and growth performance of limited number of sows bred in commercial farm were compared between the two birth season in a production year (autumn and spring). The effect of farrowing season on conception rate, litter size and the number of live born piglets in a litter was found insignificant (P>0.05), the effect of farrowing season on stilborn was found to be significant (P<0.05). It was found out that the effect of birth season, parity, litter size on pre-weaning survival rate of piglets borned in different birth seasons was significant (P<0.05) while the effect of sex was found to be insignificant (P>0.05). The factors, effecting the growth rate of piglets, like birth season, sex, parity, litter size were evaluated and it was found out that the effects of birth season and litter size was significant (P<0.05), but effecting of parity and sex on the growth rate were found insignificant (P>0.05).

Keywords: *Sows, Farrowing rate, Litter size, Live weight, Survival rate*

Özel İşletme Koşullarında Yetiştirilen Domuzların Döl Verimi Özellikleri ve Yavruların Büyüme Performansları Üzerinde Bir Araştırma

Özet

Bu araştırmada, Türkiye'de özel işletme koşullarında sınırlı sayıda üretim hayvanı olarak yetiştirilmekte olan domuzların bir yıllık üretim periyodunda döl verim özellikleri, yaşama gücü ve büyüme performansları gibi bazı verim özellikleri sonbahar ve ilkbahar olmak üzere iki doğum mevsimi açısından karşılaştırılmıştır. Doğum mevsiminin gebelik oranı, doğum oranı, bir doğuma düşen yavru sayısı ve doğum başına canlı doğan yavru sayısı gibi özellikler üzerine olan etkisi önemsiz (P>0.05), doğum başına ölü doğan yavru sayısı bakımından ise doğum mevsimleri arasındaki farklar önemli (P<0.05) bulunmuştur. İki farklı mevsimde doğan yavruların sütten kesime kadar olan yaşama gücü değerleri üzerinde doğum mevsimi, annenin doğum sayısı ve yavru sayısı önemli (P<0.05), cinsiyetin etkisi ise önemsiz (P>0.05) bulunmuştur. Domuz yavrularının büyüme performansını etkileyen faktörler olarak doğum mevsimi, cinsiyet, doğum sayısı ve bir doğuma düşen yavru sayısının etkileri incelenmiş ve doğum mevsimi ile bir doğuma düşen yavru sayısı önemli (P<0.05), doğum sayısı ve cinsiyetin büyüme hızı üzerindeki etkileri ise önemsiz (P>0.05) bulunmuştur.

Anahtar sözcükler: *Anaç domuz, Doğum oranı, Bir doğuma düşen yavru sayısı, Canlı ağırlık, Yaşama gücü*

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INTRODUCTION

In animal production, the fertility is determined according to the following qualities; conception rate, farrowing rate, litter size and farrowing-to-conception interval [1]. Ovulation rate, embriyonic survival rate and capacity of uterus effect the litter size [2]. Farrowing season is one of the factors effect the farrowing rate, conception rate [2,3], litter size and live born [4,5]. Generally, care and nutrition conditions found to be effective on litter size, live born [6,7] and it's known that improvement of nutrition conditions in pre-weaning and in post-weaning increases the rate of farrowing [8]. In sows, anti-badies dont pass to embryo through placenta, piglets take antibadies partially by colostrum postpartum period. That's why the week after born is important for survival rate in sows [9]. Some factors affecting the survival rate are temparature stres, sow's nutrition during pregnancy, piglet nutrition, diseases, sow's agressive behaviours to wards piglets [10]. In addition to this birth weight of piglets, litter size, parity of mother and birth season also affect the survival rate. It was demonstrated that piglets born in spring havehigher survival rate compared to ones born in autumn [11] and increasement of litter size decreases the survival rate [6,12-14]. There is a possitive correlation between birth weight and survival rate. The rate of survival rate increases according to the increase in birth weight [6,13,15]. According to Milligan, parity of mother is a significant effect on survival rate, he demonstrated that the rate of survival of first birth is 75%-89%, second birth is 84%-97%, 3-5th birth is 78%-94%. Nutrition during pregnancy has a determinative effect on litter size and birth weight. Especially fetus devolopement is faster in the second semestre of pregnancy; ideal nutrition condotions in the second semestre increases birth weight [6]. What's more birth season and litter size also effect birth weight and developement [4]. There is a negative correlation betwen litter size and birth weight; as litter size increases, birth weight decreases [5,13]. Male piglet's birth weights are heavier than females but sex do esnit have on effect on developement [16,17].

As pork meat is hardly consuming and also has very low level of pig producing due to the religion limitation in Turkey, there are scarcely available studies on pig farming and especially, are almost no studies relating production performance in pig. This study was aimed to investigate of production performances of the mixed type sow breed, raising in limited number at the commercial farm in Turkey.

MATERIAL and METHODS

Data were collected from 2 birth seasons of a production year. A total of84 sows gave birth for the first, second and third times in autumn, number of piglets was 629. In spring, 30 sows gave birth for the second, third and forth time (parity), number of piglets was 224 for spring.

Animals, Treatments

This study was performed in sow production farm that belongs to a private commercial sow company. 86 sows breed in may-june 2001, 84 of therm farrowed for 1th, 2th, 3th parity 2 sows out of 86 werit pregnant although they were bred betwen september- october 2001. 30 sows breed in november-december 2001 farrowed betwen march-april 2002 for 2th, 3th, 4th parity. The fertility characteristics of sows were determined. All of the newborn piglets were given a number by the help of plastic earings and their birth weight was found.

In order to calculate their growth performances they were weighed weekly until 45th day postpartum. To find out the survival rate of live born a report was prepared daily including the earing number of dead piglet, its mother's earing number and date of death.

During this study, nutrition and management conditions were kept constant. Each the new birth sow and their piglets were housed in 2.0 x 2.20 m. individual box during weaning periods. For sow nutrition; excess of kitchen materials, vegatables which were not suitable to be sold in bazaar, patatoes etc were used. New born piglets were purely feed with milk of their mother. To protect the newborn from Fe related deficiency anemia, they were injected 100 ml Fe-dextran solution wher they were 2 days old [9,18].

Measurements

In the study, fertility characteristics of sow, which farrowed twice (in autumn and in spring), like conception rate, farrowing rate, litter size, stil birth and live born were calculated. In addition to this, survival rate and growth performances of piglets borned in different seasons was measured until 45th day (until pre-wening).

Statistical Analysis

In this study, significance control of reproduction performances of sows farrowed in two different farrowing seasons is performed with Student's t test and significance control of piglets survival rate until weaning is performed with chi-square test [19,20].

In the research, Least Squares Methods was used to calculate the effect rations of factors effecting growth (farrowing season, sex, parity and litter size) and growth in different periods [21,22]. The below model is used to determine effect ratios of effecting factors of the birth weight and 15th, 30th and 45th day alive weights:

$$Y_{ijklm} = \mu + d_i + m_j + s_k + y_l + e_{ijklm}$$

where,

Y_{ijklm} = Any animals alive weight in the observed period,

μ = is the overall population mean for investigated character,

d_i = is the effect of ith parity (i = 1 to 4),

m_j = is the effect of jth season of farrowing (j = 1 to 2),

s_k = is the effect of kth sex (k = 1 to 2),

y_l = is the effect of lth litter size (l = 5 to 12) and

e_{ijklm} = is the random error associated with each observation.

No important interaction was assumed between the observed factors in the used model and the sum of effect rations of the subgroups of a factor was accepted zero. Statistical analysis was performed by using GLM (General Linear Model) procedure from SPSS program packet [20].

RESULTS

The fertility characteristics of 84 sows which farrowed in september-october 2001 (1., 2., 3. parity) and 30 sows farrowed in march- april 2002 (2., 3., 4. parity) were given in *Table 1*. It was found out that the effect of birth season on the conception rate, farrowing rate, litter size and live born was not significant statistically

Table 1. *Fertility characteristics of sows during a production year*
Tablo 1. *Bir yıllık üretim periyodundaki (sonbahar ve ilkbahar) dişi domuzlara ait döl verim özellikleri*

Parameter	Autumn		Spring		Total	
	N	Mean	N	Mean	N	Mean
Mating	86	-	30	-	116	-
Conception rate (%)	84	97.67	30	100	114	98.28
Farrowing rate (%)	84	97.67	30	100	114	98.28
Total born/litter	661	7.87	244	8.13	905	7.94
Stilbirth/litter	32	0.38 [a]	20	0.67 [b]	52	0.46

[a,b], *Means with different superscript in the same row differ (P<0.05)*

Table 2. *Survival rate (%) of piglets in different growth periods*
Tablo 2. *Domuz yavrularının çeşitli büyüme dönemlerine ait yaşama gücü değerleri (%)*

Parameter	NTB	15th Days			30th Days			45th Days		
		N	%	X²	N	%	X²	N	%	X²
Seasons										
Autumn	629	477	75.51 [b]	26.92 *	445	70.74 [b]	18.36 *	385	61.21 [b]	22.12 *
Spring	224	206	91.96 [a]		191	85.26 [a]		176	78.57 [a]	
Sex										
Male	449	371	82.40	3.55	346	77.06	3.12	303	67.48	1.24
Females	404	312	76.98		290	71.78		258	63.86	
Parity										
1	540	409	75.37 [b]	20.22 *	380	70.37 [b]	14.84 *	327	60.55 [b]	19.31 *
2	214	192	89.71 [a]		179	83.64 [a]		161	75.23 [a]	
3	82	68	82.93 [a]		65	79.26 [a]		63	76.82 [a]	
4	17	14	82.35 [ab]		12	70.58 [b]		10	58.82 [b]	
Litter										
5	23	12	52.17 [d]	36.92 *	10	43.47 [e]	28.25 *	9	39.13 [c]	15.91 *
6	62	54	87.09 [b]		51	82.25 [b]		46	74.19 [b]	
7	191	159	83.24 [b]		151	79.05 [b]		127	66.49 [b]	
8	230	191	83.04 [b]		175	76.08 [b]		152	66.08 [b]	
9	197	147	74.61 [c]		137	69.54 [cd]		126	63.95 [b]	
10	87	74	85.05 [b]		67	77.01 [bc]		60	68.96 [b]	
11	42	25	59.52 [d]		25	59.52 [de]		23	54.76 [c]	
12	21	21	100 [a]		20	95.23 [a]		18	85.71 [a]	
Birth Weight (kg)										
0.55-0.90	48	32	66.67 [b]	11.83 *	27	56.25 [c]	24.28 *	25	52.08 [b]	35.34 *
0.90-1.20	289	229	79.24 [ab]		211	73.01 [b]		182	62.98 [b]	
1.20-1.55	311	258	82.96 [a]		256	82.32 [a]		254	81.67 [a]	
1.55-1.90	149	124	83.22 [a]		123	82.55 [a]		106	71.17 [a]	
1.90 +	56	40	71.43 [ab]		38	67.86 [bc]		36	64.29 [ab]	

*** P<0.05; NTB: Number of Total Birth** [a,b,c,d,e] *; Means with different superscript in the same column differ (P<0.05)*

(P>0.05). White, it was found out that birth season effects stillborn statistically (P<0.05).

The survival rate of piglets until 45th day (end of weaning period) according to birth season, sex, parity, litter size and controls among groups are given in *Table 2.*

The survival rate of piglets borned in autumn until pre-wening was 61.21%, the ones borned in spring was 78.57%. All of the piglets born in spring have higher survival rate in all growth periods compared to ones borned in autumn. The efects of birth season, parity, litter size and birth weight on survival rate was found to be significant statistically until pre-weaning was found to be significant (P<0.05).

The effects of birth season, sex, parity and litter size on the birth weight of piglets on the 15th, 30th and 45th days and the mean value of minimum square roots of body weights are given in *Table 3.*

When the mean value of piglet's birth weights is examined, it's seen that ones borned in autumn are 1.40, spring-borned ones, are 1.29 kg and the piglets borned in autumn have a higher weight that the piglets borned in spring. The effect of birth season was found effective

significantly on birth weight (P<0.05). When the weaning weights were evaluated; piglets borned in autumn reached 3.83 kg white the ones borned in spring reached 4.67 kg. It was found out the piglets in all growth intervals. The effect of birth season on growth intervals until weaning was found statistically significant (P<0.05).

When the effect of sex on birth weight was examined; males borned 1.37 kg, females borned 1.32 kg male piglets had higher birth weight than females and the difference betwen piglet groups was found statistically significant (P<0.05). Until weaning, weight gain of females and females during growth intervals found statistically insignificant.

When effect of parity on birth weight whit regard to differences among groups was evaluated, only second group was found significant from first and third parity groups (P<0.05). In other growth intervals and during weaning (45th day) the difference betwen the piglet's body weights was found insignificant according to parity (P>0.05).

When the litter size and birth weight is examined among the groups 5, 6, 7, 8, 9, 10, 11, 12 (according to litter size), the heaviest birth weight was 1.57 kg belonging

Table 3. Least square means and their standard error of means (kg) for live weight of piglets in different growth periods

Tablo 3. Domuz yavrularının çeşitli büyüme dönemlerindeki ağırlıklarına ait en küçük kareler ortalamaları ve standart hataları (kg)

Parameter	N	Birth weight $\overline{X}\pm S\overline{x}$	15. Days $\overline{X}\pm S\overline{x}$	30. Days $\overline{X}\pm S\overline{x}$	45. Days $\overline{X}\pm S\overline{x}$
Seasons					
Autumn	629	1.40±0.04 [a]	2.17±0.08 [b]	2.89±0.12 [b]	3.83±0.19 [b]
Spring	224	1.29±0.03 [b]	2.38±0.07 [a]	3.24±0.12 [a]	4.67±0.16 [a]
Sex					
Male	449	1.37±0.0 3 [a]	2.28±0.06	3.03±0.10	4.21±0.15
Females	404	1.32±0.03 [b]	2.26±0.06	3.09±0.10	4.28±0.15
Parity					
1	540	1.30±0.03 [b]	2.40±0.06	3.21±0.10	4.43±0.15
2	214	1.41±0.03 [a]	2.39±0.06	3.11±0.09	4.28±0.14
3	82	1.31±0.04 [b]	2.28±0.09	3.11±0.14	4.33±0.20
4	17	1.36±0.09 [ab]	2.02±0.20	2.82±0.33	3.94±0.49
Litter					
5	23	1.55±0.08 [a]	1.97±0.19 [cd]	2.45±0.32 [b]	3.53±0.48 [b]
6	62	1.57±0.05 [a]	2.67±0.10 [a]	3.20±0.16 [a]	4.37±0.24 [ab]
7	191	1.33±0.04 [bc]	2.33±0.08 [bc]	3.17±0.12 [a]	4.58±0.18 [a]
8	230	1.35±0.03 [b]	2.38±0.08 [b]	3.21±0.12 [a]	4.43±0.17 [ab]
9	197	1.30±0.03 [bc]	2.45±0.08 [b]	3.17±0.12 [a]	4.33±0.17 [ab]
10	87	1.26±0.04 [c]	2.18±0.09 [cd]	3.30±0.15 [a]	4.29±0.22 [ab]
11	42	1.21±0.06 [d]	2.24±0.14 [bcd]	3.39±0.21 [a]	4.46±0.31 [ab]
12	21	1.19±0.08 [bcd]	1.95±0.15 [d]	2.60±0.23 [b]	4.00±0.34 [ab]

[a, b, c, d] ; *Means with different superscript in the same column differ (P<0.05)*

to group 6 while the lightest birth weight was 1.19 kg belonging to group 12. As litter size increased, birth weight decreased generally. When the body weights of 15th day evaluted, the group which had 6 piglets had the highest body weights compared to other groups (P<0.05). For 30th day, the difference between group 5 and group 12 was insignificant while, both group 5 and group 12 were significant compored to other groups (P<0.05). For 45th day, when we exclude groups 5 and group 7, other groups didn't have statistically insignificant (P>0.05). The difference between group 5 and group 7 was significant (P<0.05).

DISCUSSION

In the study, it was found out that sows farrowed in spring had higher values of conception rate, farrowing rate [2-5] litter size [4,5,23] compared to sows farrowed in autumn. Although the above characteristics were higher in spring births, the effect of birth season on conception rate, farrowing rate and litter size was found statistically insignificant. Koketsu and Dial [23] had demonstrted that the effect of birth season on farrowing rate was significant while the effect of birth season on litter size was insignificant [23,24].

When spring and autumn was compared in terms of stillbirth, sows farrowing in spring had higher levels of stillbirth [5]. Increasement of litter size per birth may increase the risk of stillbirth [10,25,26]. Sows parturated in spring depending on higher litter size, stillbirth by compared with autumn was determined higher rates. Another reason why the stillbirth rate was high in spring was nutrition deficiency during pregnancy [6].

When the survival rate of litters was evaluated at 45th day it was seen that spring-borned litters had a higher survival rate than the ones borned in autumn and the effect of birth season in terms of survival rate was statistically significant [11]. What's more, parity [13] and litter size [6,12-14,26] also affected the survival rate. However, the survival rate could be very low wher the litter size was 5 or less than 5 [17]. When the effect of birth weight on survival rate was evaluated, it was determined that survival rate was also increased, when birth weight was increased. Present study, litters having the heaviest birth weight belanged to mothers which had 5-6 litters. The heaviest birth weight in litters had a low survival rate due to maternal propertier.

In the herd it was thought that, the survival rate of litters which borned in different seasons was low because litters had only milk until weaning (45th day) however the was nutrition deficiency in mothers, the temparature of litter size boxed was not enough [1,10].

As a result of the study, it was found out that the mean value of birth weights of litter born in autumn was higher than the litter born in spring while Xue et al.[4] found out that litters born in spring had higher birth weight. The reason of different results was thought to originate from manegement-nutrition deficiency of sows during pregnancy [6].

In the study, the effect of birth season was found significant on the 15th, 30th and 45th day body weights. This result was similiar to Koketsu and Dial's results [24]. Male litters had higher birth weights than females but the effect of sex on growth was not significant [17]. The effect of parity [5,8,13] on birth weight was significant while parity didn't effect birth weight of other growth interval [13]. The effect of litter size [2,5,13,15] on birth weight was significant while it had various effects on other growth intervals [16].

In this study, fertilitiy characteristics of mix sows survival rate, growth performances bred in commercial farm in Turkey during a production year is examined. In present study, it was concluded that production, mixed-bred sow, can be improvement with changed to betters feeding-management conditions, and, currently mixes types sows was systatically bred to improve with prolific bred.

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