AN ABSTRACT OF THE THESIS OF

Sommai Tachasirinugune for the degree of Master of Science in Animal Science presented on April 20, 1983.

Title: Litter Productivity at First and Second Parity by Gilts Mated at Different Weights at First or Second Estrus

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Abstract appoved:

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Purebred Yorkshire gilts with weights ranging from 70 to 105 kilograms were moved from a total-confinement rearing unit to a total-confinement brood stock unit where approximately ten gilts per pen were mixed to provide new penmates. Each gilt was thus exposed to an unfamiliar environment and to foreign penmates along with continuous area presence of boars and adults sows. Each day, gilts were moved from their pens and checked for estrus by direct boar contact for at least 20 minutes per day. By random allotment within weight groups, gilts were designated to be mated at first or second heat. Gilts which did not reach puberty within 42 days after allotment were removed from the study. After mating, all gilts were managed alike during gestation and lactation. Once gilts were mated, production data were obtained for two parities.

Thirty-four gilts in each mating group farrowed first-parity litters; 79 percent of gilts mated at first estrus and 76 percent

of those mated at second estrus mated within 30 days postweaning of first litter for production of a second litter. Conception rates were 81.5 and 80.7 percent, respectively.

There were no significant differences ($P > .05$) between gilts from the two groups for age or weight on experiment, age or weight at breeding, weight at 110 days of gestation at first or at second parity, or in weight at weaning of first-parity litters, weight loss during first lactation, weaning-to-estrus interval, or in conception percentage following first lactation.

At both first and second parity, number of pigs per litter, total litter weight, and average pig weight at birth, 21 and 42 days of age were not significantly different ($P > .05$) between gilts initially mated at first versus second estrus. Gilts from the two groups produced significantly more pigs ($P < .05$) at second parity than at first parity. Correlation coefficients for litter productivity traits between first and second parity were low and not significant within either mating group. No significant correlation ($P > .05$) existed for first-parity lactation weight loss or litter productivity traits between dams which did or did not come in heat within 30 days postweaning.

On test, weight had no significant association with days to mating within either group. Breeding weight of gilts for first-parity litters was not significantly associated with any first-parity litter trait. The only significant correlations between breeding weight of gilts initially bred at first estrus were with number of pigs at 42 days ($r = 0.36$, $P < .06$) at second

parity, and total second-parity litter weight at birth ($r = 0.38$, $P < .05$). There was no association between breeding weight of those bred at second estrus and second-parity litter traits. Weight loss during first lactation as not significantly associated with days to postweaning estrus for either group, or with litter size at birth at second parity. Weight at 110 days of first-parity gestation of gilts from either of the two groups had no effect on second-parity litter traits except for a significant correlation with number of pigs at 42 days for those initially bred on first estrus ($r = 0.32$, $P < .10$).

For gilts bred at first estrus, dam's weight at weaning of first-parity litters had significant correlation at second parity with number of pigs at 21 days ($r = 0.30$, $P < .10$) and at weaning ($r = 0.42$, $P < .05$), and with total litter weight at weaning ($r = 0.42$, $P < .05$) at second parity. For first-parity gilts bred at second estrus, weight at weaning of first-parity litters had significant correlation at second parity with number of pigs weaned ($r = -0.39$, $P < .06$); total litter weight at 21 days of age ($r = -0.32$, $P < .10$) and with total litter weight at weaning ($r = -0.34$, $P < .10$).

Association of weight with litter productivity tended to be small; when significant, they tended to be positive for dams initially mated at first estrus and negative for those initially mated at second estrus. Correlations between litter productivity traits at first and second parity were not significant for either mating group.

Although litter productivity differences between the two mating groups were not statistically significant, they are in general agreement with findings reported in the literature of increased productivity due to delayed mating versus mating at pubertal estrus.

Litter Productivity at First and Second Parity by Gilts Mated at Different Weights at First or Second Estrus

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I. STATEMENT OF THE PROBLEM

Sows are generally maintained in producer herds for an average of three to five farrowings. Their average gestation period is 114 days and their lactation period varies from 21 to 42 days. About one to two weeks after weaning, sows generally are mated again.

Commercial producers using confinement system of production cull 30 percent of their sows per year and replace them with gilts. This means that about 15 to 20 percent of all litters are born to gilts. Circumstances such as injury to nipples, mastitis, crippling, lack of milk, a low number of piglets born or reared per litter can lead to culling the sow.

In general, it has been recommended that gilts be mated on third estrus. This practice has resulted basically from research conducted by Warnick (1951) and many others subsequently which showed that gilts ovulated more ova at second estrus than at first estrus. Each succeeding estrus resulted in a gradual but statistically nonsignificant increase in ovulation compared to the preceding one but with cumulative difference from first estrus.

Brooks and Cole (1973) reported that gilts mated on third estrus farrowed a nonsignificant average increase of only 0.5 more pigs per litter than did gilts bred on first estrus. Libal and Wahlstrom (1976) reported that 64 percent of gilts mated at 202 days farrowed; whereas, 86 percent of gilts mated at 246 days of age farrowed. No

significant differences were found in litter productivity for the two groups, but the older groups had slightly more pigs born alive and weaned than did the younger group. Young and King (1981) reported that gilts bred on first estrus had lower conception rate than gilts bred on third estrus (69.6 versus 77.4 percent); litter productivity differences between groups were relatively small and not significantly different for number of pigs born and weaned on their first, second, and third parity. Knott (1980) reported no significant difference in occurrence of puberty, regularity of cycling, ovulation rate, conception rate, or embryo survival at 28 days of gestation for gilts of different weights at exposure for cycling and breeding.

There are approximately 42 days between occurrence of first and third estrus. Cost of feeding gilts from market weight to third estrus is approximately equal to one-third the cost of feeding the gilts during gestation. With today's highly sophisticated confinement management, any time saved prior to breeding of gilts can have beneficial economic effect due to reduced feed required prior to birth of the first litter if litter productivity is not adversely affected by the procedures used. Two of the possible approaches are to allot gilts to the breeding herd at lighter-than-customary weight and to breed them sooner than at the customary time of third estrus. Recent research at this station has shown no adverse first- or second-parity litter productivity effects of mating gilts at lighter-than-customary weights at third estrus (Walker and England, 1981).

II. PURPOSE OF THE STUDY

Because of the potential economic value of earlier reproduction due to reduced pre-mating feed and other costs, along with finding in some recent studies of relatively little increased litter productivity from mating at third versus first estrus and no effect of mating at lower-than-customary weights at third estrus, an experiment was conducted to determine litter productivity of gilts mated at various weights at first versus second estrus. The main purposes of this experiment were to determine influence of weight at mating for first-parity litters on litter production at first and second parity and postweaning cycling of gilts mated at first or second estrus. Objectives were to determine:

1. Length of time from allotment to the breeding herd to mating.

2. Size and weight of litters from gilts mated at first versus second estrus.

3. Days postweaning to estrus by first-parity dams bred at first versus second estrus as gilts.

4. Size and weight of litters from each group of dams at second parity.

5. Association between litter traits at first and second parity for both groups of dams.

6. Association of weight at mating, at 110 days of gestation, and at weaning of first litter with first- and second-parity litter productivity characteristics.

III. LITERATURE REVIEW

Profitability of swine production enterprises depends on many biological and management factors. A factor of great biological and economic importance is reproduction. Both promptness and regularity of breeding influence the number of pigs per dam per unit of time. There are many factors involved in the logistics and feasibility of early reproduction in gilts. The main factors affecting litter size are ovulation rate and embryo survival; but, in turn, nutrition, breed, heredity, sexual maturity, age and weight at puberty, uterine capacity, season of birth, and environmental conditions all intertwine to affect various aspects of litter size. This literature review is intended to give an unbiased overview of the work already completed by various researchers.

In 1842, Bischaff stated "in polytocous mammal, the number of corpora lutea usually corresponds to the number of embryos" (Park, 1952). Perry and Rowland (1962) found that the number of corpora lutea usually correspond to the number of ova shed. Longnecker et al. (1968) found that counting of corpora lutea provides a reliable estimate of ovulation rate. Reitmeyer and Sorenson (1965) reported that approximately 22 percent of the corpora lutea on day 40 of gestation were actually accessory corpora lutea which generated post-conception.

Nutrition has several effects on reproductive performance. Clark et al. (1972) reported that gilts fed ad libitum ovulated an average of two more ova than gilts fed a maintenance diet of 1.82 kg

per day. MacPherson et al. (1977) found that gilts fed ad libitum were significantly ($P < .01$) older and heavier at puberty (203 ± 15 days and 120 ± 27 kg) than gilts restricted to 2.7 kg per day (186 ± 17 days and 89 ± 9 kg). Clawson et al. (1963), Rippel et al. (1965), Frobish et al. (1966), Baker et al. (1970), Hawton and Meade (1971), and DeGeeter et al. (1972) reported extensive trials involving wide ranges of protein quantity and quality fed to gilts during various segments of gestation and found no relationship between protein intake of the dam and subsequent litter size or birth weight. Rick and Maxwell (1974) reported reproductive performance for gilts that conceived was not greatly influenced by dietary protein level beyond a daily intake of 254 grams of crude protein.

Friend et al. (1979) studied three levels of soybean oil (0, 10, and 20 percent) and of soybean protein (0, 3, and 6 percent) added to a basal diet (2.5 percent of fat and 10.8 percent of crude protein) in a factorial experiment to determine their effects on puberty. Puberty occurred at an average of 172 days of age; differences between dietary treatments were not significant. The number of piglets born was smaller ($P < .05$) for gilts fed a low level of soybean protein. Anderson and Melampy (1972) reported that restricting the level of energy intake to approximately 70 percent of ad libitum delayed puberty by an average of 16 days in nine experiments, although in five other experiments the restricted diet hastened the onset of puberty by 11 days.

Brooks and Cole (1972) studied the effect of nutrition between weaning and remating on the reproduction performance of primiparous sows. They found that sows fed 1.8 kg of ration per day from weaning to mating had higher incidence of fertility and took longer to return to estrus than did sows fed 3.6 kg per day. There was, however, no significant difference in litter size due to difference in level of feed intake. Brooks et al. (1975) reported similar results.

There are breed differences in reproductive performance of gilts. Baker et al. (1958) reported that Poland China gilts had 1.4 fewer corpora lutea than did Chester White gilts. Kirkpatrick et al. (1967) reported results which agree with Baker in that Chester White gilts had a higher ovultion rate than did Poland China gilts. Clark et al. (1972) found Yorkshire gilts had 1.8 more ova per ovulation period than did Poland China gilts.

The relationship between litter size and inbreeding of the dam was studied by Stewart (1954) and Bereskin et al. (1968). They found litter size, total litter weight, and average of pigs born alive decreased as percent inbreeding of the dam increased. Reddy et al. (1958) reported that sire effect contributed a significant part of the apparent variation in the ovulation rate of his progeny. Wilson et al. (1962) found that gilt productivity was influenced by both sire and the sow line.

Hampshire, Duroc, and Yorkshire gilts had an average of 0.5 more corpora lutea than did crosses of these breeds, but the crosses produced more live embryos (10.6 versus 10.0) at 30 days of pregnancy (Johnson and Omtvedt, 1973). They also found that single-cross gilts

bred to boars of a third breed had a significantly greater embryo survival rate than did purebred gilts mated to produce two-breed crossbred litters. Clark et al. (1970) reported that crossbred gilts (Poland China x Yorkshire) reached puberty at an earlier age than the average of the purebred gilts.

Lassiter (1975) ranked seven breeds according to average pigs born per litter. They were as follows:

Rank	Breed	Pigs born per litter
1	Yorkshire	11.13
2	Landrace	10.52
3	Duroc	9.66
4	Chester White	9.53
5	Hampshire	8.78
6	Poland China	8.07
7	Berkshire	8.07

Johnson (1976) reported no significant breed difference in the percent fertilization or embryonic survival for 237 gilts mated to 45 boars of Yorkshire, Duroc, and Hampshire breeds. Purebred gilts were mated to produce crossbred litters; heterosis resulted in 0.76 more pigs per litter at weaning. Crossbred gilts mated to a third breed weaned one more pig per litter than did the purebreds producing crossbred progeny.

The attainment of puberty can be affected by season of birth. Gossett and Sorenson (1959) reported that fall-farrowed gilts reached sexual maturity approximately 10 percent earlier than did spring-farrowed gilts. Spring-farrowed gilts, however, had higher ovalution rate than did fall-farrowed gilts (13 versus 10.9 corpora lutea; $P < .05$). At 40 days of pregnancy, spring-farrowed gilts had approximately 28 percent more live embryos. Wiggins et al.

(1950b) found that season of farrowing had an influence on age at puberty, with spring-born gilts reaching sexual maturity slower than did those born in other seasons. Sorenson et al. (1961) reported similar results. Wise and Robertson (1953) stated that season of farrowing was unassociated with the age at which gilts reached sexual maturity.

Environmental temperature has influence on reproductive performance. Research by Warnick et al. (1965) found that gilts kept at 60 degrees averaged 1.9 more embryos at 25 days of gestation than did gilts kept at 90 degrees. The number of corpora lutea, however, was not significantly different. Edwards et al. (1968) studied heat stress prior to breeding and in early gestation. No significant differences in number of corpora lutea or in conception rates were found in this study, but the number of live embryos at 30 days postmating was significantly lower ($P < .05$) for gilts exposed to high temperature during a zero to 15 days period directly following mating; after 15 days of gestation, embryo survival was not significantly affected.

Reproductive abnormalities can alter the gilt's ability to farrow. Studies done by Warnick et al. (1949) showed that the main reasons for failure to conceive included bilateral tubal aberrations, bilateral missing reproductive tract segments, and cystic ovaries. They used 63 female swine that had had previous fertility problems; 53.4 percent of these gilts failed to conceive. The remaining females failed to settle for no apparent reasons. Warnick (1951) stated that "the major cause of rebreeding in gilts

appeared to be a failure of fertilization due to genital abnormalities." Wilson et al. (1949) reported that factors impairing fertility in swine included tubal aberration, cystic ovaries, and blind or missing parts of the reproductive tract. Squiers et al. (1952) and Wiggins et al. (1950a) also found similar results.

Embryonic mortality can affect reproductive performance in gilts. Squiers et al. (1952) reported that by day 52 of gestation for gilts bred once in early estrus, embryonic mortality was 35 percent. Gilts had an 11 percent greater embryo death loss prior to farrowing than did sows; total embryonic death loss from gilts was 46 percent. Baker et al. (1958) found that embryo mortality is a greater factor in determining litter size than is ovulation rate. Perry and Rowland (1962) found that 95 percent of all the ova recovered by day 10 of gestation were fertilized; embryonic death was 28.4 percent by day 18 of gestation.

Conception rate can be affected by different mating schemes. Squiers et al. (1952) found that conception rate among gilts increased from 66 to 86 percent with a small increase in litter size when gilts had a second service approximately 24 hours after the first service. Reddy et al. (1958) found similar results. Rich et al. (1968) studied hand-mated and lot-mated gilts; hand-mated gilts had more embryos ($P < .05$), a lower percent of dead embryos ($P < .05$), and a higher percent embryo survival ($P < .05$) at 35 days of gestation than did lot-mated gilts.

Environment change and boar presence have been found to provide stimuli for onset of puberty in gilts. Brooks and Cole (1969, 1970)

reported that the introduction of males to a group of prepubertal females stimulated estrus activity. Brooks and Cole (1970) exposed gilts to boars at gilt age of either 165 or 190 days and initiated estrus. They found that gilts at younger age had a better degree of synchrony of estrus than did older gilts. Of the gilts initiated at a younger age, 11 of the 12 gilts showed estrus within eight days, while 9 of the 11 gilts in the older initiation age group reached estrus by day 14. Introduction of a male to a group of older gilts did not induce a similar degree of synchrony (Brooks and Cole, 1973).

Zimmerman et al. (1974) reported that gilts of 125 or 165 days of age, when moved to a new location and exposed to intact boars for periods of 10 to 15 minutes per day, reached puberty significantly sooner than did gilts just moved but not exposed to the boars. They also found that older gilts tended to attain puberty faster than did younger gilts. Zimmerman et al. (1976) found similar results. Mixing, transferring, and relocating of gilts significantly increased number of ovulations ($P < .05$) compared to gilts which were just mixed or mixed and transferred. Addition of male exposure resulted in even greater increase in ovulation which was significant at $P < .01$. Exposure of gilts to boars at too young an age hindered onset of puberty in studies by Zimmerman et al. (1969). Hughes and Cole (1976) reported that delaying the introduction of a boar to gilts after 160 days in unnecessary since at this age the reproductive mechanisms seem to be sufficiently developed to respond fully to male stimuli.

Bourn et al. (1974) reported that gilts exhibited improved syncronization of estrus when they were mixed, hauled, and exposed to a boar for 10 to 15 minutes per day. Kinsey et al. (1976) studied male presence as a stimulatory effect on age at puberty in gilts. Treatments of audio contact, visual contact, olfactory contact, physical contact, and combinations of these were initiated at 165 days of age. Results showed that audio stimuli without visual contact hastened puberty similar to contiguous contact of the male. Olfactory contact alone or in combination with audio contact retarded puberty. Contrarily, Vandenbergh (1969) stated that male odor can stimulate occurrence of puberty.

George and England (1974) studied pubertal estrus occurrence in gilts of three different weight and age groups subjected to environmental change and boar exposure. They reported that average number of days to first estrus was significantly fewer for the heaviest and oldest group, while age at puberty was lower in the lighter group. Younger gilts had significantly fewer embryos at 30 days of gestation than did the older gilts.

Age and weight of gilts can influence reproductive performance. Robertson et al. (1951) reported that average age at puberty of Chester White and Poland China gilts were 210 days with a range of 167 to 250 days. Their average weight was 89 kg. Reddy et al. (1958) stated that the attainment of puberty was affected more by chronological age than by weight. They reported that average age at puberty was approximately 200 days with a range from 169 to 256 days. Similar results by Duncan and Lodge (1960) indicated that the

attainment of puberty in the gilt was more a function of age than weight and normally occurred at about 200 days of age. However, individual pigs have reached puberty as young as 136 days of age (Sumption et al., 1961).

Robertson et al. (1951) reported gilts with a rapid growth rate tend to reach puberty faster than do slower growing gilts. Their calculated correlation coefficient between age at puberty and weight at 154 days was -0.29. Once puberty was acquired, lower growth rate did not affect the frequency of estrus (Pay and Davies, 1973).

Movement of gilts, ad libitum feeding, boar contact, and genetic differences among groups affected occurrence of early puberty in gilts (Hughes and Cole, 1975). George and England (1974) and Zimmerman et al. (1974) found that attainment of puberty was hastened by mixing of gilts and moving to unfamiliar pens within confinement units. Boar exposure led to more synchronization of pubertal estrus in older gilts than in younger gilts and to overall reduction in average age of first estrus for younger gilts.

Cunningham and Zimmerman (1973) stated that ovulation rate measured at uniform sexual age is highly heritable ($r = 0.52 \pm 0.5$). In a selected line, ovulation rate increased from 8.0 to 10.1 corpora lutea. Boylan et al. (1977) reported similar heritability of ovulation rate to be much lower ($r = 0.03 \pm 0.7$). Zimmerman and Cunningham (1975) found that selection during five generations increased ovulation rate of gilts. Newton et al. (1977) reported similar results. Reddy et al. (1958) found significant correlation of ovulation rate with age at breeding ($r = 0.56$) and with weight at

breeding (r = 0.35); litter size had a high correlation with the number of ova (r = 0.38).

Future production of gilts mated at earlier age and weight have varied. Warnick et al. (1951) found that conception rates during the first three heat periods were not significantly different (58.9, 80, and 55.0, respectively). Brooks and Cole (1973) reported conception rate for early mated gilts to be 81.8 percent while conventional mating reached a 90.4 percent conception rate; gilts mated on their third estrus farrowed an average of only 0.5 more pigs per litter than did gilts bred on their first estrus, which was not a significant difference. Libal and Wahlstrom (1974) found similar results that gilts bred at third estrus had no significant advantage in number of pigs born compared to gilts bred on first estrus.

George and England (1974) found that younger and lighter gilts had significantly fewer embryos at 25 days postmating on first estrus, but no significant differences were found in number of corpora lutea.

Libal and Wahlstrom (1976) found early-mated gilts to be inferior to normally mated gilts in that only 64 percent of gilts mated at 202 days farrowed; 86 percent of gilts mated at 246 days of age farrowed. Number of pigs born alive and weaned and litter weights at birth and 28 days slightly favored the older group. However, no significant differences were found. After weaning of their first litters, the younger group was observed in estrus in a 10-day period while only 79 percent of the older gilts exhibited estrus during a 21-day period. Of all of the gilts initially bred,

39 percent of younger gilts and 68 percent of older gilts farrowed two litters.

MacPherson et al. (1977) studied performance of gilts mated at first, second, and third estrus and observed them for three parities. The gilts mated at first, second, and third estrus had 83, 86, and 94 percent conception rate, respectively, and produced, respectively, 7.8, 9.8, and 10.4 2 piglets at first parity. There was no significant difference in conception rate or number of piglets among gilts mated at the different heat periods. Gilts fed ad libitum and bred at first estrus farrowed nonsignificantly more piglets than restricted-fed gilts mated at third estrus (11.0 versus 10.4). At the end of the third parity, there were no significant differences in total number of piglets born and reared among gilts mated at first, second, and third estrus.

Knott (1980) reported there were no significant differences in days to puberty and successive estrus, ovulation rate, conception rate, or embryo survival at 28 days postmating for two groups of gilts of different weights at exposure for cycling and mating. Research by England and Walker (1981) showed that the number of days to estrus of gilts in three weight groups ranging from 73 to 91 kg was similar; when mated at third estrus, gilts of the lowest weight group at mating farrowed and weaned significantly more piglets than gilts of the heavier weight group.

One hundred and twelve Yorkshire gilts were used to study reproductive performance of gilts bred at first versus third estrus (Young and King, 1981). Conception rate at initial breeding was

lower among gilts bred on first versus third estrus (69.6 versus 77.4 percent). Average age at puberty for all gilts mated was 178 days; some gilts showed estrus between 140 and 149 days of age. There was a tendency toward increased litter size at birth and weaning when breeding was delayed to third estrus, but the difference was not significant. Initial breeding on first or third estrus did not influence the weaning-to-estrus or the weaning-to-conception interval.

IV. METHODS

At weights ranging from 70 to 105 kg, purebred Yorkshire gilts were moved from a total-confinement rearing unit to a total-confinement brood stock unit where they were housed in groups of 10 per pen. Weight was the primary criterion of allotment; no secondary consideration was given to differences in age. Within weight categories, gilts were randomly allotted for mating at first or second estrus. Each group in the brood stock unit was composed of gilts reared in two or more separate growing unit pens. The brood stock unit contained adult boars and non-bred and gestating sows. In essence, each gilt was thus exposed to an unfamiliar environment and to foreign pen mates along with continuous boar and adult sow area-presence in the brood stock unit.

While on experiment, each gilt was weighed at two-week intervals until 110 days of gestation. In open individual crates, gilts were group-fed 2.73 kg/head/day of a balanced ration meeting NRC recommended nutrients content (Table 1). Crude protein content was calculated to be 14 percent.

Boars were housed in the same building but were not contiguous nor visible to the gilts. Beginning two days after movement of gilts to the brood stock unit, visual appraisals were made daily for physical and behavioral indications of estrus. All animals showing indications of estrus were exposed daily in small groups or singly to one or more of several boars for at least 20 minutes per day.

Table 1. Composition of diets fed to gilts during gestation.[a]

Item	International Reference No.	Percent
Wheat or Barley	4-05-247 or 4-07739	68.50
Soybean Oil Meal	5-04-612	13.50
Suncured Alfalfa Meal	1-00-078	15.00
Dicalcium Phosphate	6-01-080	1.50
Limestone	6-02-632	.70
Trace Mineralized Salt		.50
Zinc Sulphate		340 grams

[a]Each diet was supplemented with 2.5 g of vitamin-mineral premix/kg. Composition of the premix per kilogram was: 1,320,000 IU vitamin A, 440,000 IU vitamin D_3, 440 IU vitamin E, 880 mg vitamin K, 4.4 mg vitamin B_{12}, 1,760 mg riboflavin, 3,238 mg pantothenic acid, 8.8 g niacin, 110 g choline chloride, 25 g Mn, 40 g Zn, 8 g Fe, .8 g Cu, 118 mg I, 80 mg Co, 39.6 mg Se.

Gilts were randomly allotted within weight groups to be mated at first or second heat. Designated boars mated approximately the same numbers of gilts in the first estrus and second estrus groups. Date and weight at mating were recorded for each gilt. Gilts which did not reach puberty within 42 days after allotment were removed from the experiment.

After mating, all gilts were managed alike during gestation. All were pregnancy-checked at 42 days after mating. If gilts failed to conceive and came in heat again, they were bred again, weighed and designated at a particular heat period. If gilts mated and did not come in heat again but showed negative to pregnancy-check at 42 days postmating, they were removed from the experiment.

Each gilt was transferred from the brood stock unit to a crate in the farrowing unit at 110 days of gestation; 110-day weight of each gilt was recorded. After farrowing, each gilt was fed a 15 percent crude protein lactation ration in the daily amount of 2.73 kg plus 0.23 kg additional for each piglet in the litter. The ration formula is shown in Table 2. Feeding and management during lactation was the same for all dams and their litters.

Each piglet was weighed within 24 hours after birth. Gilts and their litters were housed in farrowing crates until litters were approximately 21 days of age; afterward, each gilt and litter were housed in a 2.44 x 3.05 meter pen until weaning of litter at 42 days of age. Each piglet was weighed at 21 and 42 days of age.

Table 2. Composition of diets fed to dams during lactation.[a]

Item	International Reference No.	Percent
Corn	4-02-935	72.00
Soybean Meal (44% CP)	5-04-612	18.50
Suncured Alfalfa Meal	1-00-078	5.00
Dicalcium Phosphate	6-01-080	1.50
Limestone	6-02-632	1.50
Potassium Chloride		0.75
Trace Mineralized Salt		0.50
Zinc Sulphate		340 grams

[a]As in Table 1.

At weaning of litters, dams were weighed and moved to the brood stock unit and observed daily for estrus. They were bred for second litter production when they came in heat. Those dams that did not come in heat within 30 days after weaning of their litter were removed from the experiment.

Statistical Methods

Differences among groups were analyzed by analysis of variance with use of the F-test for significance of differences for each variable. Appropriate variables among groups were combined for calculation of coefficients of correlation (Steel and Torrie, 1980).

V. RESULTS AND DISCUSSION

Thirty-four gilts in each mating group farrowed first-parity litters. Average age at allotment of gilts bred at first estrus was 185 ± 22 days; age of those mated on second estrus was 183 ± 19 days (Table 3). Average weights at allotment of gilts mated at first estrus and those mated at second estrus were 88.7 ± 9 kg and 86.6 ± 7 kg, respectively. There were no significant differences in age or weight at allotment for gilts in the two groups. The mean days from allotment to mating of gilts of the two groups were 30 ± 13 and 52 ± 12, respectively. The difference of the two groups was 22 days, which is a usual interval from first to second estrus. Weight at allotment of gilts in each group had low and nonsignificant correlation with number of days from allotment ($r = 0.12$; $P > .05$) and thus had no influence on length of time from allotment to mating. This finding is in agreement with prior results from this station (Schiemann et al., 1975; Knott, 1980; Walker and England, 1981).

The mean weight at mating of gilts at puberty and those at second estrus were 101.5 kg and 110.3 kg, respectively. The mean weight at puberty of gilts in experiments by Young and King (1981) were 91.7 kg, with the range from 60 to 140 kg. Similar weights were reported by Hughes and Cole (1975), with a range from 70 to 125 kg.

The mean ages at mating of gilts bred on first and those on second estrus were 215 ± 39 and 235 ± 23 days, respectively (Table 3). Age at puberty of all gilts was 212 days, which is very

Table 3. Descriptive statistics at first and second parity for gilts which mated on first versus second estrus.

Traits	First Estrus Mean	First Estrus SD	Second Estrus Mean	Second Estrus SD	Statistical Significance[a]
Number of gilts	34		34		
Age of experiment (days)	185	22	183	19	NS
Weight on experiment (kg)	88.7	9.5	86.6	7.6	NS
Number of days to mating	30.0	13	52	12	NS
Age at breeding (days)	215	24	235	12	NS
Weight (kg):					
At breeding	101.5	8.9	110.3	8.5	NS
At 110 days of gestation	172.2	15.4	176.7	14.5	NS
At weaning	148.6	15.0	144.5	12.2	NS
Lactation weight loss (kg)	23.6	8.5	32.1	14.0	NS
Parity 2					
Number and (%) of sows mated	27 (79.4)		26 (76)		
Weaning-to-estrus interval (days)	11	6.5	7.9	5.7	NS
Number of sows conceived	22		21		
Conception rate (%)	81.5		80.7		NS
Weight (kg):					
At 110 days of gestation	206.8	53.6	209.0	18.1	NS
At weaning	186.0	23.2	173.6	22.4	NS

[a]NS:P > .05

similar to the 216 days reported by Brooks and Smith (1980). Brooks and Cole (1973) observed puberty at an average age of 202 days. Knott (1980) reported age at puberty to be 217 days in his experiment. Young and King (1981) reported puberty at an average age of 178 days.

Weight of Gilts at 110 Days of Gestation, At Weaning of Litter, and Litter Productivity at First Parity

Average weights at 110 days of gestation of gilts bred on first estrus and those mated on second estrus were 172 kg and 177 kg, respectively ($P > .05$). Gilts in the two groups thus gained similarly during gestation. Gilts mated on first estrus were of slightly but not significantly heavier weight at weaning of their litters than were those which mated on second estrus (149 ± 15.0 kg *versus* 145 ± 12.2 kg). Gilts mated on first estrus lost a mean of 23.6 kg during the lactation period; whereas, those mated on second estrus lost a mean of 32.1 kg. This difference was not significant ($P > .05$).

Table 4 contains data on litter productivity by gilts of both mating groups at their first parity. Differences due to mating at first *versus* second estrus on number of pigs born alive, number of pigs at 21 days, and number of pigs at 42 days of age were not significantly different ($P > .05$), although there was a tendency toward an increased number at each age when breeding was delayed to second estrus. Other have observed increases in the number of piglets born per litter when breeding of gilts had been similarly delayed (Young and King, 1981; Pay and Davies, 1973; MacPherson *et al.*, 1977; Libal and Wahlstrom, 1976). The number of pigs born

Table 4. Comparison of litter productivity of gilts mated for first parity at first versus second estrus.

	First Estrus		Second Estrus		Statistical Significance[a]
	Mean	SD	Mean	SD	
Number born:					
Alive	8.6	1.9	8.7	2.7	NS
Dead per litter	0.7	1.0	0.9	1.5	NS
Number of pigs:					
At 21 days	6.9	2.0	7.0	2.7	NS
At 42 days	6.7	2.1	6.8	2.8	NS
Total litter weight:					
At birth (kg)	10.5	2.5	11.1	3.9	NS
At 21 days (kg)	29.6	11.5	30.8	15.2	NS
At 42 days (kg)	48.8	16.0	52.2	23.8	NS
Average pig weight:					
At birth (kg)	1.2	0.14	1.3	0.24	NS
At 21 days (kg)	4.3	0.86	4.4	0.57	NS
At 42 days (kg)	7.3	1.3	7.6	1.2	NS

[a]NS:P > .05

dead was small for both groups and not statistically different (Table 4). Total litter weight at birth, 21 days and 42 days of age was slightly but not significantly greater for gilts bred on second estrus than for those mated at first estrus (Table 4). Average weights per piglet at birth, 21 and 42 days of age were 1.2, 4.3, and 7.3 kg, respectively, from gilts mated at first estrus and 1.3, 4.4, and 7.6 kg, respectively, from gilts mated at second estrus (Table 4). Young and King (1981) reported that weight at birth and 21 days of age was greater ($P < .10$) for piglets from gilts bred initially at third estrus than for those from gilts bred at first estrus (1.07 versus 1.15 kg and 4.34 versus 4.68 kg, respectively). MacPherson et al. (1977) reported a slightly heavier birth weight for piglets from gilts mated on first estrus than for those from gilts bred on second estrus (1.3 versus 1.24 kg), but by the third week of age, average weight of piglets from those bred on second estrus was heavier for those from gilts bred at first estrus.

Weaning-to-Estrus Interval

Thirty days were allotted as duration of time for occurrence of postweaning estrus following first parity. Twenty-seven of the 34 gilts bred on first estrus came in heat during this period; 26 gilts bred at second estrus expressed postweaning estrus (Table 3). The average weaning-to-estrus intervals were 11.0 and 7.9 days, respectively, for the two groups. These differences were not significant ($P > .05$).

Table 5 shows the distribution of weaning-to-estrus interval; only 11 percent of sows initially bred on first estrus exhibited

Table 5. Relative cumulative percentage occurrence of first-parity postweaning estrus by time periods for dams mated at first versus second estrus as gilts.

No. of days from weaning to estrus	Cumulative percentage of occurrence of estrus	
	Mated at first estrus	Mated at second estrus
1 to 6	11.0	38.0
6 to 10	55.5	84.6
11 to 20	81.5	92.3

estrus within 5 days postweaning; whereas, 38 percent of sows initially bred on second estrus did. King (1974) reported that 65 percent of the sows in his study exhibited estrus within 5 days after weaning. Within 20 days postweaning in our experiment, 82 percent of dams initially bred on first estrus came in heat and 92 percent of those initially bred on second estrus had done so. The weaning-to-estrus interval of either group was not significantly affected by lactation weight loss ($r = 0.12$ and 0.14, respectively, $P > .05$, Table 6).

Conception Rate and Sow Weight for Second-Parity Litters

Twenty-two of the 27 sows initially bred on first estrus and 21 of the 26 sows initially bred on second estrus conceived for their second parity; conception rates were 81.5 percent and 80.7 percent, respectively. At 110 days of gestation, weights of sows initially bred at first estrus and of sows initially bred at second estrus were 206.8 and 209.0 kg, respectively. There were no significant differences in weight between sows in the two groups at 110 days of second gestation or at weaning of second parity litters.

Sows Productivity at Second Parity

At second parity the number of pigs alive at birth, at 21 days, and 42 days of age were not significantly different for sows in the two initial mating groups. As was true in their first litters, sows initially bred at second estrus had slightly more pigs born and weaned than did those bred at first estrus (10.7 *versus* 10.2 at birth and 8.6 *versus* 8.1 at weaning, $P > .05$). These results are similar to those reported by MacPherson *et al*. (1977) and Young and King

Table 6: Association of lactation weight loss at first parity with days postweaning to mating and number of pigs born alive at second parity.

Traits	Mated at first estrus	Mated at second estrus
Lactation weight loss with days to mating	r = 0.12 (NS)[a]	r = 0.14 (NS)
Lactation weight loss with number of pigs born alive	r = 0.007 (NS)	r = 0.18 (NS)

[a](NS) = nonsignificant difference at P > .05.

(1981). The total litter weight at birth, 21 days and 42 days of age from sows bred on first estrus were 12.7, 37.2, and 63.6 kg, respectively; sows bred initially on second estrus had nonsignificantly higher productivity with litter weight of 14.1, 40.4, and 74.8 kg at birth, 21 and 42 days of age, respectively (Table 7). The average piglet weight at birth and 21 days of age was almost the same from both groups (1.3 versus 1.3 kg and 4.5 versus 4.4 kg). At 42 days of age, the mean piglet weight was higher from sows bred on second estrus than from sows initially bred at first estrus, but not significantly so (8.7 versus 7.9; $P > .05$). The number of piglets born dead per litter was very low and not significantly different for the two groups.

Comparison of Litter Traits at First and Second Parity

Litter productivity increased at second parity compared to first parity for dams of both groups (tables 4 and 7). Sows initially bred on first estrus farrowed an average 1.6 more pigs on second parity than on first parity (10.2 versus 8.6 pigs; $P < .05$). The number of piglets at 21 and 42 days of age, respectively, increased from averages of 6.9 and 6.7 to 8.4 and 8.1 from first to second parity ($P < .05$). MacPherson et al. (1977) reported that the number of piglets at birth increased by an average of 2.4 for an average of 10.7 and at weaning by 1.1 to an average of 8.9 from the first to second parity of sows initially bred on first estrus. Young and King (1981) reported the number of piglets born alive increased an average of 0.4 more pigs per litter at birth and 1.7 more piglets at 21 days from first to second parity for sows initially bred on first estrus.

Table 7. Litter productivity of dams at second parity.

Traits	Mated at first estrus as gilts		Mated at second estrus as gilts		Statistical significance[a]
	Mean	SD	Mean	SD	
Number born:					
Alive	10.2	2.4	10.7	2.3	NS
Dead per litter	0.7	1.0	0.2	0.5	NS
Number of pigs:					
At 21 days	8.4	2.5	9.2	2.6	NS
At 42 days	8.1	2.6	8.6	2.5	NS
Total litter weight:					
At birth (kg)	12.1	2.6	14.1	3.1	NS
At 21 days (kg)	37.2	11.5	40.4	12.3	NS
At 42 days (kg)	63.6	25.4	74.8	22.7	NS
Average pig weight:					
At birth (kg)	1.3	0.14	1.3	0.15	NS
At 21 days (kg)	4.5	0.72	4.4	0.77	NS
At 42 days (kg)	7.9	1.9	8.7	2.10	NS

[a]NS:P > .05

Total litter weight at birth, 21 days and 42 days of age at second parity from sows initially bred at first estrus were higher than those on first parity (12.7 versus 105. kg, 37.2 versus 29.6, and 63.3 versus 48.8 kg, respectively; $P < .05$). Averages of piglets' weights at birth, 21 days and 42 days of age on second parity were 1.3, 4.5, and 7.9 kg, respectively, as compared to 1.2, 4.3, and 7.3 kg, respectively, on first parity.

Dams initially bred on second estrus as gilts farrowed an average of 2.0 more pigs at second parity than at first parity (10.7 versus 8.7, $P < .05$, tables 4 and 7). The number of piglets increased significantly ($P < .05$) at 21 and 42 days, from 7.0 and 6.8 to 9.2 and 8.6, respectively, from first to second parity. Macpherson et al. (1977) reported that litter size at birth and weaning, respectively, increased from 9.6 and 8.3 to 11.0 and 8.9 from first to second parity on sows initially bred on second estrus as gilts. However, Young and King (1981) found the number of piglets at birth and 21 days of age on second parity of sows bred at third estrus were fewer than at their first litter (10.0 versus 8.7 at birth and 7.9 versus 7.7 at 21 days of age).

In the present experiment, litter weight at birth, 21 and 42 days of age also increased on second parity as compared to first parity. Average litter weight increased from 11.1 to 14.1 kg; litter weight at 21 days increased from 30.8 to 40.4 kg and from 52.2 to 74.8 kg at 42 days of age. The mean of pig weight at birth and 21 days from first and second parity were the same, 1.2 and 4.4 kg, respectively, while average piglet weight at 42 days of age

at second parity was heavier than at first parity (8.7 versus 7.6 kg, $P < .05$). MacPherson et al. (1977) and Young and King (1981) reported similar results.

Tables 8 and 9 contain correlation values between litter size at first parity and second parity dams initially bred on first estrus or at second estrus; all are nonsignificant ($P > .05$). Correlation values are negative for dams mated at first estrus as gilts and positive for those initially mated at second estrus as gilts. Correlation values between successive litters, especially those involving first litters, tend to be small and nonsignificant. Page and England (1976) reported values of $r = .04$ ($P < .05$) and $r = .19$ ($P < .01$) for successive litters of gilts which farrowed small or non-small litters, respectively, at first parity.

Association of Weight of Gilts at Mating and Their First-Parity Litter Traits

Correlation values between breeding weight of gilts bred at first or second estrus and litter size were not significantly different from zero; r values were -0.12 and -0.21, respectively (Table 10). Values for number of pigs per litter at 21 and 42 days of age and for total litter weight at birth, 21 and 42 days of age were also low and nonsignificant ($r = -0.05$, -0.07 and 0.09, 0.09, respectively for gilts mated at first estrus; $r = -0.21$, -0.19 and -0.22, -0.18, respectively for those mated at second estrus). These correlations indicate that variations in weight at mating within the range of 70 to 105 kg did not affect first-parity litter traits for gilts of either mating group.

Table 8. Association between litter size at first parity and at second parity for gilts mated at first estrus.

Trait	At birth		At 21 days		At 42 days	
	Number	Weight	Number	Weight	Number	Weight
Number born	-0.31(NS)[a]					
Birth weight		-0.09(NS)				
Number 21 days			-0.16(NS)			
Weight 21 days				0.0003(NS)		
Number 42 days					-0.10(NS)	
Weight 42 days						-0.14(NS)

[a]NS = nonsignificant difference at $P < .05$.

Table 9. Association between litter size at first parity and second parity for gilts mated at second estrus.

Trait	At birth		At 21 days		At 42 days	
	Number	Weight	Number	Weight	Number	Weight
Number born	-0.03(NS)[a]					
Birth weight		0.12(NS)				
Number 21 days			0.09(NS)			
Weight 21 days				0.02(NS)		
Number 42 days					0.18(NS)	
Weight 42 days						0.21(NS)

[a]NS = nonsignificant difference at $P < .05$.

Table 10. Association between breeding weight and litter productivity at first parity for gilts mated at first or second estrus.

Trait	Mated at first estrus	Mated at second estrus
Weight at breeding and number of pigs born	-0.12 (NS)[a]	-0.21 (NS)
Weight at breeding and number of pigs at 21 days	-0.05 (NS)	-0.21 (NS)
Weight at breeding and number of pigs at 42 days	-0.07 (NS)	-0.19 (NS)
Weight at breeding and litter weight at 21 days	0.09 (NS)	-0.22 (NS)
Weight at breeding and litter weight at 42 days	0.09 (NS)	-0.18 (NS)

[a]NS = nonsignificant difference at $P < .05$.

Weight of Gilts at First Mating and Their Second-Parity Litter Traits

Correlation values between weight and litter size for gilts of both groups are shown in Table 11. Correlation values for weight at first-parity mating and second-parity number of pigs at birth and 21 days are 0.28 and 0.22, respectively, for gilts initially mated at first estrus; for gilts initially mated at second estrus, values are 0.21 and 0.14, respectively; none of these correlations are significant ($P > .05$). Breeding weight of gilts first mated at puberty was significantly associated with second-parity number of pigs at 42 days of age ($r = 0.36$, $P < .06$) and total litter weight at birth ($r = 0.38$, $P < 0.5$) but was not significantly correlated with total weight at 21 or 42 days of age. Breeding weight of gilts mated at second heat had low and nonsignificant correlation with second-parity number of pigs at 42 days, total litter weight at birth, 21 days, and 42 days of age. Weight of gilts at first mating thus had little influence on litter traits at second parity.

Association of Weight at 110 Days of Gestation of Gilts at First-Parity Mating and Second-Parity Litter Traits

Weight at 110 days of gestation of gilts mated at first estrus had low association with number of pigs at birth and 21 days or total litter weight at birth, 21 days and 42 days of age but had a significant correlation with number of pigs at 42 days ($r = 0.32$, $P < .10$, Table 7). In sows bred at second estrus, their weight at 110 days of first parity gestation had no significant correlation

Table 11. Association between second-parity litters traits and weight at initial mating, weight at 110 days of gestation and at weaning of first-parity litters for dams mated at first versus second estrus.

Weight	Number			Weight (kg)		
	At birth	At 21 days	At 42 days	At birth	At 21 days	At 42 days
Breeding[1]	0.28(NS)	0.22(NS)	0.36(P<.06)	0.38(P<.05)	0.09(NS)	0.10(NS)
Breeding[2]	0.21(NS)	0.14(NS)	0.25(NS)	0.22(NS)	0.21(NS)	0.23(NS)
110-day[1]	0.15(NS)	0.16(NS)	0.32(P<.10)	0.14(NS)	0.08(NS)	0.21(NS)
110-day[2]	0.03(NS)	0.01(NS)	0.05(NS)	0.01(NS)	-0.14(NS)	0.03(NS)
Dam at weaning[1](kg)	0.17(NS)	0.30(P<.10)	0.42(P<.05)	0.24(NS)	0.24(NS)	0.42(P<.05)
Dam at weaning[2](kg)	-0.18(NS)	-0.23(NS)	-0.39(P<.06)	-0.18(NS)	-0.32(P<.10)	-0.34(P<.10)

[1]Denotes first estrus at which dams were mated for first-parity litters.

[2]Denotes second estrus at which dams were mated for first-parity litters.

with their litter traits at second parity (Table 11). These associations are similar to those for weight at breeding and indicate that adequacy of the different weights at breeding remained relatively unchanged during gestation.

Association of Weight of Dams at Weaning of First-Parity Litters and Litter Traits at Second Parity

Dams at weaning of first-parity litters for gilts mated at puberty had low correlation with second-parity litter size at birth ($r = 0.17$) and total weight at birth ($r = 0.24$) but had significant correlation with number of piglets at 21 days of age ($r = 0.30$, $P < .10$), number of piglets at 42 days of age ($r = 0.42$, $P < .05$), and total litter weight at 42 days of age ($r = 0.42$, $P < .05$). For gilts initially bred on second estrus, weight at weaning of first-parity litters was significantly negatively correlated with second-parity number of pigs at 42 days of age ($r = -0.39$, $P < .06$) and total litter weight at 21 days of age ($r = -0.32$, $P < .10$) but had low and nonsignificant correlations ($P > .05$) with number of piglets born ($r = -0.18$), number of pigs at 21 days ($r = -0.23$), and total litter weight at birth ($r = -0.18$).

Comparison of litter productivity between dams which did not come in heat after weaning their first litters (group A) and those which did (group B) are shown in Table 12. Fifteen of the 68 gilts did not come in heat postweaning; seven of these were from gilts bred on first estrus and eight were from gilts bred on second estrus. Lactation weight loss was 24.8 kg for dams in group A and 28.9 kg for dams in group B; these values are not significantly different

Table 12. Comparison of first-parity litter productivity of gilts which did not come in heat at postweaning (group A) with those which did (group B).

Traits	Group A mean	Group B mean	Statistical Significance[a]
Number of gilts	15	53	
Lactation weight loss (kg)	24.8	28.9	NS
Number of pigs:			
Born alive	7.9	8.9	NS
At 21 days	6.7	7.0	NS
At 42 days	6.6	6.8	NS
Total litter weight (kg):			
At birth	10.4	10.9	NS
At 21 days	28.6	30.7	NS
At 42 days	49.5	50.8	NS
Average pig weight (kg):			
At birth	1.3	1.2	NS
At 21 days	4.3	4.3	NS
At 42 days	7.5	7.5	NS

[a]NS:P > .05

($P > .05$). Dams in group B had slightly larger number of pigs at birth, 21 days and 42 days of age and heavier total litter weight at birth, 21 days and 42 days of age than did group A. None of these differences were significant ($P > .05$). Ability to achieve post-weaning estrus within 30 days is thus not attributable to any characteristic of first-parity litters or to excessive lactation weight loss. Further, mating at first estrus versus second estrus did not influence the proportion of dams which failed to exhibit postweaning estrus within 30 days.

SUMMARY AND CONCLUSION

Thirty-four gilts in the first-estrus mating group and 34 in the second-estrus mating group farrowed first-parity litters. Age and weight on experiment of gilts initially bred at first or second estrus were not statistically different ($P > .05$). The average days from on test to mating of gilts for the two groups were 30 and 52, respectively; within mating group, days to mating were not significantly correlated with weight ($P > .05$). The mean age and weight at mating of gilts at first estrus were 215 days and 101.5 kg, respectively, and were 235 days and 110.3 kg for those bred at second estrus. There was no significant difference ($P > .05$) in age or weight at mating, weight of gilts at 110 days of gestation, and at weaning of litters between the two groups of gilts.

Gilts mated at first estrus farrowed and weaned slightly fewer pigs than those bred at second estrus, but the difference was not significant ($P > .05$). Although total litter weights at birth, 21 days and 42 days of age were slightly greater from gilts bred on second estrus than from those mated at first estrus, none of the differences were significant ($P > .05$). Average pig weights at birth, 21 days and 42 days of age were almost the same for litters from the two groups of dams. There was a tendency toward increased litter size and litter weight at birth and at weaning when breeding was delayed from first to second estrus, but differences were not statistically significant ($P > .05$).

Twenty-seven of the 34 sows initially bred at first estrus post-weaning estrus within the allowed 30 days and 26 of those bred at second estrus did so. The average weaning-to-estrus intervals were 11 and 7.9 days, respectively ($P > .05$). At second parity the number of pigs at birth, 21 days and 42 days of age were not significantly different from dams in the two groups. Similar to results for their first litters, dams initially bred at second estrus produced slightly more pigs which were heavier in total litter weight than did those bred at first estrus, but differences were not significant ($P > .05$). Average pig weight was the same from sows in the two groups except that weight at 42 days was nonsignificantly higher ($P > .05$) from sows bred at second estrus than from those bred at first estrus.

Litter productivity from dams of both groups increased at second parity as compared to first parity; sows initially bred at first estrus farrowed and weaned, respectively, an average of 1.6 and 1.4 more pigs on second parity than on first parity; this increase was significant at $P < .05$. Dams mated at second estrus for first parity had an average of 2.0 and 1.8 more pigs at farrowing and weaning at second parity than at first parity ($P < .05$). Total litter weight at birth, 21 days and 42 days of age increased significantly ($P < .05$) at second parity compared to first parity from dams in each group. Average pig weight at 42 days of age increased significantly ($P < .05$) at second parity compared to first parity from dams bred at second estrus. Correlation values between litter size at first parity and second parity for dams within each group were not significant ($P > .05$); values were negative for sows

initially mated at first estrus and positive for those mated at second estrus.

Breeding weight of gilts at first mating of both groups had no effect on their first litter productivity traits or on number of pigs at birth and 21 days of age of their second litters. Breeding weight of gilts first mated at puberty was significantly correlated ($r = .36$, $P < .06$) with number of pigs at 42 days of age at second parity.

Weight at 110 days of gestation of gilts mated at first estrus was significantly correlated ($r = .32$, $P < .10$) with number of pigs at 42 days of age at second parity; whereas, for gilts bred at second estrus, their weight at 110 days of first-parity gestation had no significant correlation ($P > .05$) with their litter traits at second parity. Weaning weight of first litters of gilts mated at puberty had no effect on second-parity litter size at birth, total weight at birth or 21 days of age; there was, however, a significant correlation with second-parity number of pigs at 21 days ($P < .10$), number of pigs at 42 days ($P < .05$), and total litter weight at 42 days ($P < .05$). Weaning weight of first litters of gilts initially bred at second estrus had significant negative correlation with number of pigs weaned ($P < .05$) at second parity, total litter weight at 21 days and 42 days of age ($P < .10$) at second parity.

There were no significant difference ($P > .05$) of first-parity lactation weight loss or litter productivity traits between gilts which did not come in heat within 30 days postweaning and those which did.

There was a consistently small but nonsignificant ($P > .05$) difference in numbers of pigs born and weaned per litter during the two parities for dams initially mated at second versus first estrus. These results are in agreement with most reports in the literature. Within mating group, weight at mating for first parity was not significantly associated with first-parity litter productivity traits, percentage of dams expressing estrus within 30 days postmating, or for number born per litter at second parity. There tended to be a positive association of weight at first-parity mating on number of second-parity litter at 21 and 42 days for dams originally mated at first estrus; whereas, these values tended to be negative for dams originally mated at second estrus. In general, the results are consistent with reports that estrus cycle at which first mating occurs has more influence on litter productivity than does weight at mating, although differences due to either tended to be nonsignificant for most traits in this experiment.

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