INFLUENCE OF SOCIAL CONDITIONS DURING REARING ON THE SEXUAL BEHAVIOR, MATING ABILITY AND LIBIDO OF YORKSHIRE BOARS

by

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INTRODUCTION

The modernization and intensification of farm livestock production systems has had a dramatic influence on the behavioral development of domesticated farm animals. Among domestic mammals, the pig's environment has been most drastically altered by modern intensive husbandry. Permanent housing in controlled environments has resulted in changes in the opportunity for social interactions. Early weaning and sexual segregation are management practices which modify social interactions. Changes in pig behavior, especially reproductive behavior, have stimulated interest in the relationship between the social environment and the development of sexual behavior. Altering social interaction experiences possibly has contributed to mating problems, including boars which are unwilling or unable to successfully mate. The use of predominately young boars in the swine industry has prompted research of factors which may affect the ultimate reproductive performance of young males. Esbenshade *et al*. (1979) reported that pasture lot *vs* total confinement housing had little, if any, effect upon growth, soundness or sexual development of young males. Thomas *et al*. (1979) showed that boars kept outside on earth lots and reared in groups reached puberty earlier and demonstrated greater sexual aggressiveness as compared with contemporary boars, maintained under all other combinations of confinement on concrete, outdoor lots, and single or group rearing. Wells (1966) demonstrated that individually penned boars in pasture-lots exhibited greater libido, reached puberty at an earlier age and were generally more aggressive than boars penned in groups and/or reared on concrete. Hemsworth *et al*. (1977a) in comparing group *vs* individual rearing for boars reported that rearing the boars in the absence of visual or physical contact with other pigs resulted in boars with low sexual motivation and reduced reproductive performance. Since little is known of the behavioral changes resulting from social conditions imposed during rearing, the present study was conducted to determine the

influence of rearing conditions on the sexual behavior, libido and mating ability of young boars.

LITERATURE REVIEW

Effects of Social Restriction on Male Sexual Behavior

Social experience has a profound effect on male sexual behavior for several species. Work by Mason (1960) with rhesus monkeys demonstrated a striking difference between feral and restricted males in the frequency and integration of sexual behavior. One group of six adolescent monkeys (three males and three females), the restricted group, were separated from their mothers before they were 1 month old and reared in individual cages which prevented physical contact with other monkeys until they were 28 or 29 months old. The feral group (three males and three females) lived in a group with twenty other monkeys of similar age and background until they were 20 months of age. During the next 8 months, they were housed in pairs. Males in the restricted environment never clasped the partner's legs with their feet during mounting and would frequently assume inappropriate postures and body orientation. Grasping the partner with the hands also appeared early in testing, but throughout the experiment this response was less stereotyped and precise among restricted males and was often accompanied by nipping, tugging, or other playful behaviors.

Social restriction has a marked effect on the sexual behavior of male dogs. Males raised individually are inferior in their orientation during mounting (Beach 1967) and persistently displayed incorrect side and head mounts. Males showing this abnormal type of mounting became inflexible in their approach and could not be induced to change. Because of improper mounting orientation the individually reared males achieved a low percentage of mount-positive tests in which intromission occurred. Socially restricted individuals also exhibited a longer delay between the initiation of mounting and the achievement of intromission. Furthermore, reproductive performance by restricted males did not improve with time.

Gerall et al. (1967) reported the disruption of the male rat's sexual behavior as induced by social isolation. Rats raised in social isolation achieved a lower number of copulations as compared to group reared males. Failure to achieve successful copulation by isolated males was primarily due to incorrect mounting orientation and failure to clasp the flanks of the female.

Socially restricted male guinea pigs also demonstrate impaired orienting, clasping, and mounting response in mating tests (Gerall 1963). Numerous males raised individually actively circled and nuzzled the female, but neither mounted her properly nor achieved intromission. Guinea pigs exhibiting inadequate sexual behavior rarely improved to the extent of achieving an intromission and ejaculation during the course of seven weekly tests.

These studies demonstrate that reduced opportunity for social interaction by laboratory animals during rearing results in low copulatory performance attributable primarily to poor mating dexterity. In general this has taken the form of failure to properly mount and clasp the female. The relationship between social restriction during rearing and male sexual behavior is not as well defined in domestic farm animals. Working with rams, Zenchak et al. (1980) found that individually reared rams, physically separated from other rams but allowed visual, auditory and olfactory contact, often failed to execute correctly oriented mounts, however, all males raised individually mounted ewes whereas not all-male group reared rams achieved mounts during the mating tests. All individually reared males, but not all group reared rams, achieved normal levels of sexual performance.

Wells (1966) found that individually rearing boars did not have a harmful effect on sexual behavior. Individually raised boars in pasture-lots displayed a higher degree of libido and were considerably more aggressive toward an estrous gilt when compared to grouped boars raised in pasture-lots, individual

boars raised on concrete, or grouped boars raised on concrete. Hemsworth et al. (1977a) reported that the total number of copulations and sum of all courting behavior activities were less for boars reared individually (from 20 days to 7 months of age) as compared to boars reared in all-male and mixed sex groups. The socially restricted males assumed normal orientation in the mating responses but they achieved fewer copulations, ejaculated for shorter periods, exhibited fewer courting behaviors and were slower to mount the receptive gilts. These observations indicate that individually reared boars lacked sexual motivation. Hemsworth et al. (1978) demonstrated the importance of social interaction during rearing. Individually reared males (from 3 to 32 weeks of age) achieved significantly fewer copulations and exhibited fewer courting behaviors. Lack of physical contact with other pigs accounted for approximately 70 percent of the impairment in the copulatory performance of boars reared in the absence of visual and physical contact with other pigs.

Social conditions also have an effect on post-puberal males. During the breeding season, mature rams continually exposed to sexually receptive ewes achieved a greater number of copulations in a single mating test than rams isolated from ewes (Illius, Haynes and Lamming, 1976). Isolation of mature boars from female pigs may severely reduce their level of sexual behavior (Hemsworth et al. 1977b). Three groups of four mature (12 month old) boars were housed in individual pens for 3 months under one of the following social conditions: (1) near ovariectomized female pigs induced into sexual receptivity at 2 week intervals; (2) isolated from female pigs but either with or without visual and physical contact with neighboring boars. The boars housed near sexually receptive females were superior in their copulatory performance to the boars housed in social and semi-social restriction. The boars housed near females had more copulations and spent more time ejaculating.

Endocrine Changes During Sexual Maturation

The endocrine system plays a major role in sexual development and sexual behavior in animals. Colenbrander et al. (1978) studied changes in serum testosterone concentrations in the male pig during development. Blood samples were collected from 111 fetal male pigs ranging in age from 40 to 117 days post coitum; from 38 boars aged from 0 and 5 weeks after birth; and from eight boars at approximately 2 week intervals from 6 to 25 weeks after birth. Elevated serum testosterone concentrations were reported from 40 until 60 days post coitum. Elevated concentrations of serum testosterone in the second month after conception is most likely involved in differentiation of the male genital tract and the sexual differentiation of centers in the central nervous system (Colenbrander et al.). Testosterone levels were also elevated beginning 18 weeks after birth. The increase in serum testosterone after 18 weeks of age is correlated with increased morphological differentiation and steroid activity in the testis. Gray et al. (1971) reported that testosterone levels in the boar may reach a peak between 5 and 7 months of age. Testosterone was found in the spermatic vein in boars sampled from 3 to 9 months of age.

In most species of animals, testosterone is quantitively, the principal androgen secreted by the testes and this steroid has strong androgenic effects at both the peripheral and central levels. Peripherally it acts by maintaining normalcy of the external genitalia and the accessory sex glands; centrally, it acts by facilitating or activating the neural mechanisms concerned with the expression of male sexual behavior (Mattner 1980). Evidence has been presented indicating that boar testes produce estrogens (Joshi and Raeside 1973). They also demonstrated a synergistic effect of testosterone and estrogen on accessory sex glands and sexual behavior of the boar. Five castrated mature boars (10 to 13 months old) which received weekly injections of testosterone along with supplementary

treatments of diethylstilbestrol (DES), 17-B estradiol (E_2) and estrone (E_1) for a period of 15 months were subjected to weekly semen collections while they mounted a dummy sow. Supplementary treatment with DES, E_2 and E_1 significantly increased the secretory activity of the accessory sex glands above levels stimulated by testosterone alone. Estrogens also had a synergistic effect with testosterone on improving the libido of castrated boars. The reaction time to mounting the dummy sow was decreased by 45 percent during supplementary treatment with estrone for 12 weeks. Booth (1980) investigated the effect of some of the major testicular steroids on the development of male characteristics in the prepubertally castrated boar. Twelve prepubertally castrated boars received subcutaneous injections twice weekly, from 12 to 38 weeks of age, of testosterone or 5-androstenediol (5-androstene-3B, 17B-diol) (2 mg/5kg), or each of these steroids in combination with estrone (1mg/5kg). Three other castrates served as controls. All pigs were slaughtered at 38 weeks of age. Ten additional castrated boars (38 weeks old), and 12 intact boars (47-49 weeks old) were slaughtered to provide control data. During the last month of steroid treatment, three blood samples were collected at weekly intervals, 2 days after a steroid injection. Blood samples were also collected from the 10 additional castrated boars and the 12 intact boars at the slaughterhouse. All steroid treatments induced growth and secretory activity of the accessory organs. The prostate was maintained best by testosterone, and the seminal vesicles by 5-androstenediol. No specific effects of estrone on these organs were found. Only boars receiving testosterone displayed intense mating behavior and, in three animals ejaculation, when exposed to an estrous gilt. No specific effects of estrone on behavior were seen.

Behavioral and Spermatogenic Maturation of Boars

Wiggins *et al.* (1951) conducted a 2 year experiment to determine the age of puberty in 136 inbred boars. Boars were

considered to have reached puberty when they began mating within 15 minutes after exposure to an estrous female. In the first year of the experiment, checking for attainment of puberty with bi-weekly mating tests began when the boars were 127 days old. During the second year, weekly mating tests were started when the boars were 130 days old. Average age at puberty was 196 days for 41 boars in the first year and 205 days for 95 boars in the second year of the experiment.

Swiestra (1976) determined the postnatal development of spermatogenesis in the pig by slaughtering 69 Yorkshire boars at various weights between birth and approximately 154 days of age. From birth to about 70 days of age, the testes grew slowly. This initial phase was followed by a period of rapid testicular growth when the seminiferous tubules increased in size and spermatogenesis became established. In 112 to 116 day old pigs, about half of the boars had sperm throughout both epididymides. Based on these observations, Swiestra (1976) concluded that spermatogenesis was initiated in some boars as early as 60 days of age and in others as late as 90 days of age. All boars older than 127 days, except one, had sperm in both epididymides. However, considerable variation in epididymal sperm reserves was found among boars of the same age and weight.

Libido

Defects in libido (sexual desire) may be hereditary or may originate from psychogenic disturbances, endocrine imbalance or environmental factors (Hafez 1980). Knowledge of the factors influencing sex drive and mating ability is necessary to properly use young boars in breeding programs. Lack of libido is a major cause of boar wastage. Dziuk (1971) states that a common complaint of hog breeders centers on the unwillingness and inability of boars to successfully mate with a sow or gilt in estrus. Nelson (1976) estimated that as high as 18 percent of all young boars culled annually for reproductive deficiencies are unwilling

to mate. Accurate evaluation of boar libido is necessary to determine the factors affecting male sex drive and mating ability.

Libido and Mating Tests

Libido and the ability to mate can only be measured by testing the male in the presence of an estrous female (Sorenson 1979). Osborne *et al*. (1971) used estrus induced ovariectomized heifers restrained in a service bail to examine the libido and mating ability of bulls. Individual bulls were allowed in a small yard with the restrained female for 5 minutes, or for a shorter period if a service was completed. A system of descriptive recording was used and from this record a numerical libido score based on sexual interest, mounts, and completed service was assigned to each bull. Five minutes of exposure to a cow in estrus was considered adequate to determine the sexual behavior of a young bull and this forms the basis of a simple test for libido and serving capacity which has been used experimentally and may find application in beef herds.

Zenchak *et al*. (1980) evaluated sexual behavior, libido and mating ability in rams by exposing them to estrus induced ovariectomized ewes. One week prior to the start of mating tests rams were allowed three, 3-minute familiarization periods in the mating pen. Mating tests were then conducted by exposing each ram individually to an estrous ewe in the mating pen for 15 minutes. Parameters of ram sexual behavior, measured on an event recorder, were mounting, thrusting, and ejaculation. Mounting was the criterion used for categorizing the ram as having a high or low response to the estrous female.

Hemsworth *et al*. (1977a) conducted mating tests on boars. The mating test consisted of allowing each boar a 5 minute familiarization period alone in the mating pen and then introducing a randomly selected, sexually receptive gilt. Gilts were ovariectomized and estrus induced with estrogen injections. Receptive gilts were identified by their response to hand pressure on the

back in the presence of boars (Signoret 1970). The following sexual activities of the boar, and their times of occurrence were recorded: naso-nasal contact; nosing the sides of the gilt; ano-genital sniffing; "chanting" (short series of characteristic grunts); mounting; intromission and ejaculation. After each copulation the gilt was removed, a fresh receptive gilt introduced, and the test continued until twenty minutes had elapsed. A boar was considered to have achieved a copulation with a gilt when the duration of ejaculation was at least 1.5 minutes.

Mating tests are a necessary tool in the assessment of libido and mating ability. Developing techniques for evaluating libido and mating ability of boars provides a basis for substantial improvement in male reproductive efficiency.

Swine Mating Behavior

Three major phases can be identified in the sequence of mating behavior in the pig: (1) searching for the sexual partner; (2) identifying that the partner is in the appropriate physiological state; and (3) copulatory behavior (Signoret 1979). When placed in a group of females, the boar begins sexual interactions with any female with whom he is in contact, irrespective of her physiological state. Most of these interactions consist of naso-nasal contact, naso-genital contact, chomping, chanting and nosing the sides or flanks of the female. When in estrus, the female goes to the boar and remains permanently in close proximity to him. Signoret (1971) tested the orientation of the pig towards a potential sexual partner. In T-Maze tests, the boar is hardly able to discriminate between an estrous female and an anestrous one; however, the estrous female discriminates very accurately between an intact and an adult castrated male. The estrous female is attracted to the intact male primarily because of olfactory stimuli which helps her readily identify the location of the male even though he cannot be seen. In searching for the sexual partner, the major role appears to be that of the

female; the boar appears to identify the sexual stage of the female by trial and error, his reaction being orientated by the female's response. In response to these courting acts by the male, the female becomes immobilized. This standing reaction by the female ends the preliminary phase of sexual behavior by allowing the boar to mount and copulate (Signoret 1970). This immobilization reaction is characterized by the female becoming immobile, arching her back, cocking her ears and standing completely rigid.

The mounting reaction of the male seems to be a result of the immobilization reaction by the female. The overall shape of the body of the female and its immobility appear to be the major stimuli by which the boar identifies a receptive female. These visual and tactile factors (overall body shape and immobility) could account for the rapid response observed in both sexually experienced and inexperienced boars to simplified dummies used for semen collection (Signoret 1979). Signoret (1970) concluded that the stimuli releasing mounting are not specific of the estrous female since homosexual mounting is frequently observed in groups of males.

Erection occurs only after mounting. Following a mount, the boar thrusts until the tip of the penis is partially unsheathed and then penetrates the vaginal orifice. After some more thrusts, ejaculation begins. During ejaculation, the boar is generally immobile. Generally the end of copulation is caused by the boar dismounting.

Effect of Housing on Soundness in Boars

In addition to having sufficient libido to mount an estrous female, the male pig must also be physically capable of mounting. Housing conditions may affect the physical ability to mount. Wells (1966) compared group vs individual confinement of boars on pasture and concrete. Concrete lameness was cited as a contributing factor in the poor sexual performance of several boars in

mating tests. This condition was periodically observed in several of the boars reared on concrete, particularly the individually raised boars. Unsuccessful attempts to train boars to serve an artificial vagina may have been due in part to the physical condition of some of the boars, particularly those reared on concrete which were periodically hampered by "concrete lameness". Work by Esbenshade et al. (1979) demonstrated little, if any, effect upon soundness when comparing pasture-lot and total confinement housing. Confinement boars reared on concrete slotted floors had superior front leg soundness scores at eight of nine observations, however the difference was only significant at 170 days of age. No differences were detected in rear leg soundness scores.

Hemsworth et al. (1977a) studied the effect of individual vs group rearing on the sexual behavior of boars. All the boars were housed indoors on concrete floors. Hemsworth observed that permanently grouped boars exhibited markedly better physical condition than that of males housed individually, which they attributed to the likely increased exercise that would occur in a group due to the larger area to move about and the physical interactions occurring between animals. They suggest that an improved physical condition should increase the working potential and life of a breeding boar, however they do not describe the "physical conditions" observed and it is not known if a lameness problem was encountered. Fredeen and Sather (1978) investigated the relationship between joint damage and rearing pigs in confinement. Three populations of pigs comprising 645 boars, 171 gilts, and 119 barrows were used for the study. All the pigs were reared in confinement during a post weaning test period commencing at 56 days of age and concluding when the animals were slaughtered at live weights ranging from 82 to 116 kg. Following slaughter, the degree of joint damage was assessed routinely by dissection of the left foreleg and subjective scoring of the cartilage surfaces and synovial fluid. The pigs were housed under four

types of conditions--(1) littermate pairs; (2) individual penning; (3) group of four per pen; and (4) groups of six per pen. All the pens had concrete floors and were bedded with wood shavings. Degree of damage was not related to terminal weight per se but was directly related to duration of confinement. Fredeen and Sather (1978) observed the greatest evidence of damage occurred under conditions of individual confinement and the least under conditions of group feeding. They suggested that this difference may be associated with degree of activity during confinement since the pigs housed in groups were generally more active than those housed individually.

MATERIALS AND METHODS

Experiment I

Fifteen Yorkshire boars from five litters were used for this experiment. All pigs were farrowed within a 16 day period in January and February, 1980, and were approximately 12 weeks old when allotted to treatments by litter. Boars were reared under three rearing conditions (described below) in the KSU swine testing barn and fed an ad libitum 15 percent crude protein diet (table 1) until 25 weeks of age. Thereafter, the boars were housed in adjacent individual pens (1.2m by 4.6m). Each boar was evaluated in a mating test on one of two consecutive days at 2 week intervals for a total of four tests. The experiment was terminated after the last mating test.

Rearing Conditions from Twelve Weeks of Age

All boars were reared in the same open front, solid concrete floor finishing building. Grouped and individually raised boars were randomly assigned (by litter) to adjacent pens. All pens were separated by a solid wood partition three feet high. The partition partially restricted visual and physical contact with other pigs. Individual pens measured 1.2m by 4.6m and group pens were 2.4m by 4.6m. No attempt was made to restrict auditory or olfactory contact.

Treatments

Five boars were reared in individual pens from 12 to 25 weeks of age. Since all boars were group reared before 12 weeks, this treatment is designated GII (group penned weaning to 12 weeks; individually penned 12 to 19 weeks and individually penned 19 to 25 weeks). Another five boars, initially reared as a group from 12 to 19 weeks of age, were separated at 19 weeks and placed in individual pens (GGI). The third group of boars remained together for the entire rearing period (GGG). At approximately

TABLE 1. COMPOSITION OF RATION FED TO BOARS IN EXPERIMENTS I AND II

Ingredient	International reference number	Percent of ration	
		Nursery[a]	Grower[a]
Grain Sorghum	4-04-444	81.70	
Yellow Corn	4-02-935		69.65
Soybean Meal (44%)	5-04-604	10.00	26.25
Fish Meal (Menhaden)	5-02-009	1.25	
Meat & Bone Scraps	5-09-332	5.00	
Dicalcium Phosphate		.90	1.75
Limestone			1.00
Salt		.50	.50
KSU Vitamin Premix[b]		.50	.50
Trace Mineral Premix[c]		.05	.10
Tylan-10[d]		.10	
TNA-290[e]			.25
		100.00	100.00

[a]Provided as a pelleted diet. Calcium and phosphorus percentages were .838 and .690 as calculated from NRC 1980 tables for nursery diet. Growing ration provided as a pelleted diet. Calcium and phosphorus percentages were .812 and .745 as calculated from NRC 1980 tables.

[b]Provided the following per kilogram of complete diet: Vitamin A 4410 I.U.; Vitamin D_3 330 I.U.; Vitamin E 22 I.U.; Riboflavin 5 mg; d-pantothenic acid 13.2 mg; Niacin 27.5 mg; Vitamin B_{12} 24.3 mg; and choline chloride 508 mg.

[c]Trace mineral (mg) provided per kilogram of complete nursery diet: Mn 20: Fe 20; Zn 20; Cu 2; I .6; and Co .2. Trace mineral (mg) provided per kilogram of complete growing diet: Mn 10; Fe 10; Zn 10; Cu 1; I .3; and Co .1.

[d]Provided the following per kilogram of complete growing diet: Tylan .022 grams.

[e]Provided the following per kilogram of complete nursery diet: Terramycin .55 grams; Neomycin .55 grams; and Arsanilic acid .49 grams.

25 weeks of age, all boars were penned individually and remained in these pens until the completion of the four mating tests (see table 2).

Behavior Observations

Between 12 and 25 weeks of age, all boars in group pens were observed for one half hour each day, 4 days per week. Observation periods were alternated between morning and afternoon for each observation day. All observations were by the same observer and only one pen was observed at a time. The following (presumably) sexual behaviors were recorded: naso-nasal contact; nosing the sides of other boars; sheath sniffing; anal sniffing; "chanting" (short series of characteristic grunts); chomps (frequently with foaming of the mouth); mounting; extension of penis; thrusting; rectal intromission; and ejaculation.

Weight Gain and Feed Consumption

Boars were weighed at 12, 19 and 25 weeks of age. Feed consumption per pen was also recorded. Total weight gain, average daily gain, feed consumption and feed per gain were calculated for each boar (or pen of boars) at 25 weeks of age.

Mating Tests

Mating tests were conducted on 2 consecutive days beginning at 29 weeks of age at consecutive 2 week intervals until the boars were 35 weeks old. Tests were conducted from August 21 to October 3, 1980, and were early in the morning or late in the evening to minimize temperature effects. Estrus was induced in ovariectomized gilts with a subcutaneous injection of estradiol benzoate (4mg/head) 96 hours before the mating test. Gilts were checked for behavioral estrus with a mature boar and only those exhibiting standing estrus were used. The mating test consisted

TABLE 2. EXPERIMENTAL DESIGNS

Experiment I

Treatments	Rearing periods 12-19 wks.	19-25 wks.	No. assigned per treatment
GII	I[a]	I	5
GGI	G[b]	I	5
GGG	G	G	5

Experiment II

Treatments	Rearing periods 6-12 wks.	12-27 wks.	No. assigned per treatment
IG	I	G	8
GI	G	I	8
II	I	I	8
GG	G	G	8

[a]I - Individually reared.

[b]G - Group reared.

of a 5 minute familiarization period for the boar in the mating pen (2.3m by 7.8m). During the familiarization period and the mating test, visual contact with other pigs was prevented by a solid partition. Following the familiarization period, an estrous gilt was placed in the mating pen for 15 minutes. During the test, two independent observers recorded the following behavioral activities of the boars and their times of occurrence: naso-nasal contact; nosing the side of the gilt; ano-genital sniffing; chomping; chanting; mounting; extension of the penis; thrusting; intromission; and ejaculation. A third observer served as timekeeper and recorded reaction time to first mount; interval from first mount to ejaculation; time spent mounting while not ejaculating; duration of ejaculation; and time spent nosing the gilt's side. After each copulation, the gilt was removed and a fresh receptive gilt was introduced and the test continued until a total of 15 minutes had elapsed. A boar was considered to have achieved a copulation with a gilt when the duration of ejaculation was at least 1.5 minutes. Each boar was given a libido score following each test according to the following criteria:

1. No interest in the gilt.
2. Some interest, no mount.
3. Mounting (correct orientation).
4. Mounting, extension, thrusting.
5. Mounting, extension, thrusting and ejaculation.

Soundness

Each boar was assigned a soundness score at each mating test (table 3). Two boars became lame and were unable to complete all four mating tests.

Experiment II

Thirty-two Yorkshire boars from eight litters were used for this experiment. Soon after allotment, one individually penned

boar was found to have only one descended testis and was removed from the experiment. All pigs were farrowed within an 8 day period in July, 1980, and were weaned at approximately 6 weeks of age and allotted to treatments by litter. Boars were reared in two treatment groups in the KSU nursery and fed ad libitum a 17.6 percent corn soybean diet (table 1) until 12 weeks when they were moved to the KSU Boar Test Facility for the remainder of the study and fed a 15 percent crude protein diet ad libitum until 27 weeks. After 27 weeks of age, boars were individually fed 2.3 kg/head/day until the study was completed.

Mating tests were conducted beginning at 29 weeks of age for all boars which were considered structurally sound (soundness score of at least 3⁻; table 3). Each mating test was conducted over 2 consecutive days and five tests were conducted at 2 week intervals.

Rearing Conditions

Boars were housed in the KSU nursery (plastic slats) from weaning (6 weeks) to 12 weeks of age and in an open front, solid concrete floor, finishing barn for the remainder of the study. From 6 to 12 weeks boars were penned in groups of eight or individually according to treatment (see below). Group pens were 1.5m by 3.3m and individual pens were 1.2m wide by 1.0m to 2.3m long. From 12 weeks to completion of the study, individual boars were penned individually until the last mating test was completed at 37 weeks.

Treatments

The experimental design is given in table 2. Boars were assigned to treatments by litter and were either penned individually from 6 (weaning) to 27 weeks (II); penned individually from 6 to 12 weeks and grouped (8/pen) from 12 to 27 weeks (IG); grouped (8/pen) from 6 to 27 weeks (GG); or grouped (8/pen) from

TABLE 3. SOUNDNESS EVALUATION SCALE

1[a]	Lame and unable to walk more than a short distance.
2	Lame but still mobile; usually with joint swelling evident.
3	Sound (walks without limping) and no swollen joints; structurally incorrect, usually due to excessively crooked (when viewed from the front) or straight (lacking "cushion" when viewed from the side) front legs.
4	Sound, with adequate "cushion" and correctness.
5	Sound and exceptionally correct.

[a]All scores were to the nearest third (i.e. 1^{-}, 1^{o}, 1^{+}) and were assigned by one investigator in Experiment I at each mating test and by three independent investigators in Experiment II when boars were 21, 27, and 37 weeks of age.

6 to 12 weeks and penned individually from 12 to 27 weeks (GI).

Behavior Observations

Between 6 and 27 weeks of age, all boars in groups were observed for one half hour per day, 4 days per week. Observations were conducted in the same manner as Experiment I and the same behavioral activities were recorded.

Weight Gain and Feed Consumption

Body weights were measured approximately every 30 days during the rearing period. Total gain, average daily gain, feed consumption per pen, and feed per gain were computed for each boar (or pen) at the end of the rearing period.

Mating Tests

Mating tests were conducted on 2 consecutive days at 2 week intervals from 29 weeks to 37 weeks of age. A total of five mating tests were performed. Tests were conducted in the same fashion as for Experiment I, except that only one observer was used to record mating behaviors and the time exposed to an estrous gilt was reduced to 10 mintues.

Soundness

Each boar was evaluated for structural soundness at three times during the rearing period. A panel of three evaluators scored soundness for each boar and boars were evaluated at 21, 27 and 37 weeks of age. Seven boars not receiving an average soundness score of 3^{-} (table 3) at 27 weeks were not included in the mating tests. Of 24 boars which began the mating tests, three were unable to complete all five tests because of lameness.

Statistical Analysis

Data was analyzed by analysis of variance. A mixed model using litter as a random variable was used to analyze mating data. If significant differences were detected, means were compared using Duncan's New Multiple Range Test or Probability of Difference.

RESULTS

Experiment I

Sexual Behavior

A pen difference was evident in the total number of sexual acts observed between treatments GGG and GGI during the 7 week observation period. Treatment GGG displayed more sexual activity (table 4). Total sexual acts were determined by totalling the following sexual acts for the actor: naso-nasal contact; side nosing; sheath sniffs; anal sniffs, chants, chomps; and mounts. Mounts during the observation period was correlated with average libido score at 35 weeks of age $r = .761$ $p < .01$; table 5). Sexual activities increased on a per observation period basis at approximately 14 to 16 weeks of age and continued at an elevated level until the end of the rearing period at 25 weeks of age (figure 1).

Growth

No treatment differences were detected for total gain, average daily gain, feed consumption or feed to gain ratio.

Mating Behavior and Libido

Results of mating tests indicate no differences between treatments. A difference between mating tests was detected for side nosings ($p < .10$) naso-nasal contact and total courting acts ($p < .05$), and chants ($p < .001$) and extensions of the penis ($p < .01$) (table 6). A repeatability value of .906 for libido score was obtained for boars completing all four mating tests. This suggests that mating tests provide a means of studying libido and mating ability and possibly predicting the mating performance of a boar in future matings. At 29 weeks of age, 7 out of 15 boars

mounted an estrous female. Litter influenced libido and courting behavior activities. Litter effect may be due to genetic or early environmental influence. No treatment differences were detected for average libido score at 35 weeks of age.

Soundness

No treatment differences were detected for soundness score at 29 weeks of age (table 7).

TABLE 4. BEHAVIORS OBSERVED DURING REARING

Behaviors	Experiment I		Experiment II			
	GGI[b]	GGG[b]	GI[c]	GG[c]	IG[d]	GG[d]
Naso-nasal contacts	19[a]	18[a]	2[a]	-	3a	5a
Side nosings	5	36	-	-	124	272
Anal sniffs	14	15	-	1[a]	29	55
Sheath sniffs	58	133	-	-	593	608
Mounts	16	117	22	13	77	131
Total acts	112	319	24	14	767	1073

[a]Total for all boars in group.

[b]Observation totals for rearing period from 12 to 19 weeks of age.

[c]Observation totals for rearing period from 6 to 12 weeks of age.

[d]Observation totals for rearing period from 12 to 27 weeks of age.

TABLE 5. CORRELATIONS BETWEEN SEXUAL ACTS DURING REARING AND AVERAGE MATING TEST SCORE

Sexual acts	Experiment I[a] Avg. libido score 35 weeks of age	Experiment II[b] Avg. libido score 39 weeks of age
Naso-nasal contacts	-	.226
Nosing side	.280	.456
Sheath sniffs	.463	.194
Anal sniffs	.489	.204
Mounts	.761**	.548*
Total sexual acts	.625	.342

[a]Based on observations from 12 to 19 weeks of age.

[b]Based on observations from 12 to 27 weeks of age.

*$p < .05$; **$p < .01$.

Figure 1.
Behaviors per observation period in experiment I.

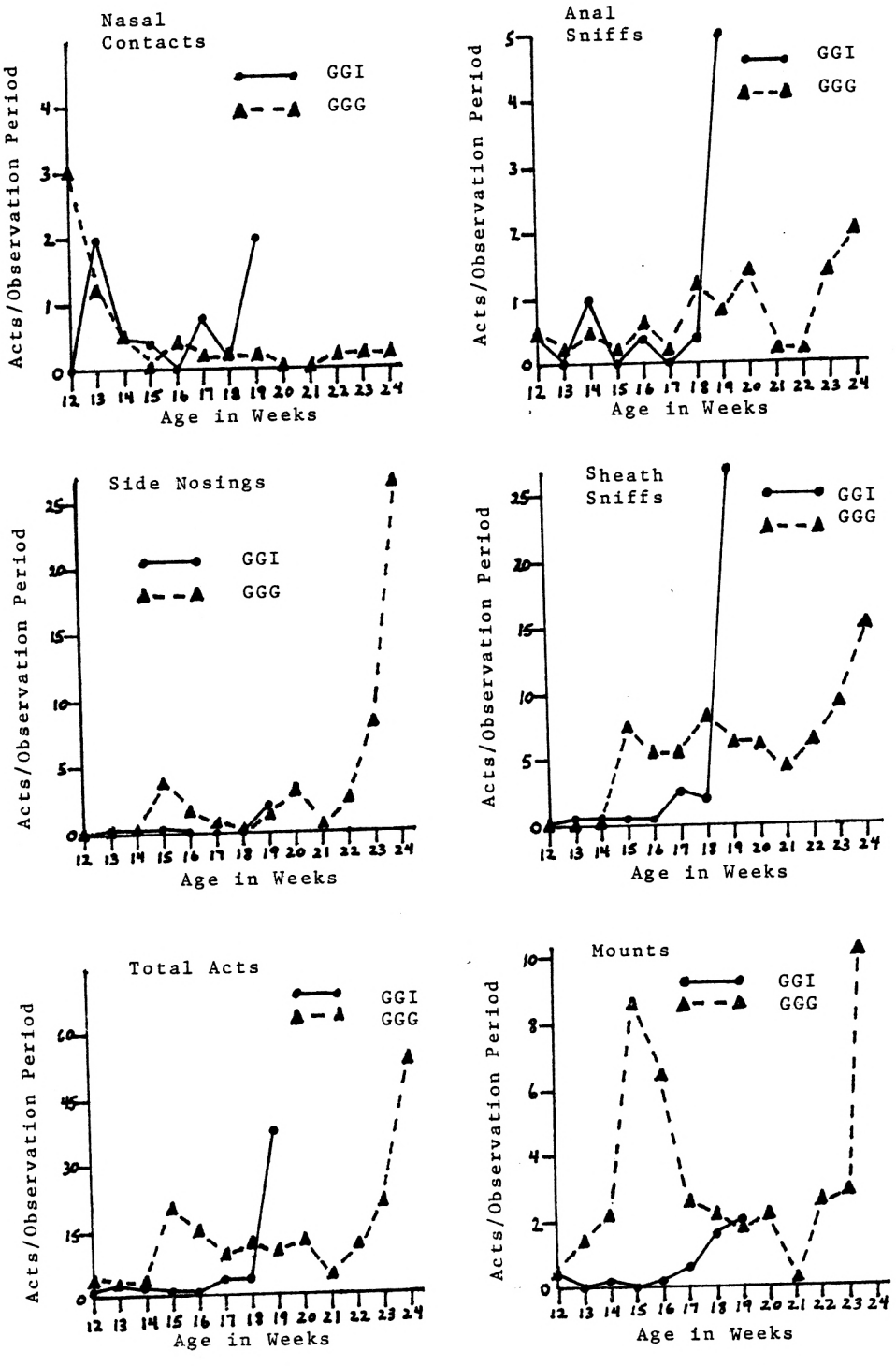

TABLE 6. ANALYSIS OF VARIANCE AMONG BOARS FOR MATING ACTIVITIES AS AFFECTED BY TREATMENT AND MATING TEST IN EXPERIMENT I

Source of variation	D.F.	No. of courting activities[1] Naso-nasal contact M.S.	Side nosings M.S.	Chants M.S.	Extension of penis M.S.	Total courting acts M.S.
Litter	4	2.823	74.387	.688	7.626	475.317
Treatment	2	7.699	12.083	6.249	.025	24.012
Litter x Treatment[2]	8	11.738	126.694	5.951	3.590	508.686
Mating Test[3]	3	10.229*	61.713+	10.604***	12.181**	385.485*
Treatment x Mating Test[3]	6	4.223	22.842	2.432	1.567	69.419
Error	30	3.187	25.616	1.620	2.664	112.417

Mating Test	Behaviors Per Mating Test[4] Naso-nasal contacts	Side nosings	Chants	Extension of penis	Total courting acts
At 29 weeks	5.633[a]	10.267[ab]	1.233[b]	1.067[b]	26.333[b]
31 weeks	3.846[b]	7.962[b]	.538[b]	1.077[b]	22.307[b]
33 weeks	5.577[a]	10.000[ab]	2.769[a]	1.615[b]	30.346[ab]
35 weeks	5.692[a]	12.885[a]	1.577[b]	3.115[a]	35.385[a]

[1]Based on 4 mating tests.

[2]Error term for testing sources listed above.

[3]Mean square error used to test these sources.

[4]Means with the same letter are not significantly different ($p<.05$).

+$p<.10$; *$p<.05$; **$p<.01$; *** $p<.001$.

TABLE 7. ANALYSIS OF VARIANCE AMONG BOARS FOR SOUNDNESS AS AFFECTED BY TREATMENT DURING REARING IN EXPERIMENTS I AND II

Source of variation	D.F. Exp. I	D.F. Exp. II	Soundness score[1] Exp. I 29 weeks M.S.	Exp. II 21 weeks M.S.	Exp. II 27 weeks M.S.
Litter	4	7	2.897	.670**	.673+
Trt.	2	3	.264	.881**	1.022*
Error	8	20	2.093	.191	.277

Treatments	Soundness score during rearing[2] Exp. I 29 weeks	Exp. II 21 weeks	Exp. II 27 weeks
GII	3.732		
GGI	3.732		
GGG	4.130		
IG		3.679[b]	3.388[ab]
GI		3.539[b]	3.015[bc]
II		3.316[b]	2.761[c]
GG		4.153[a]	3.663[a]

[1] Based on average score evaluated by panel of three evaluators in Exp. II and one evaluator in Exp. I.

[2] Means with same letter are not significantly different ($p<.05$).

+ $p<.10$; * $p<.05$; ** $p<.01$.

Experiment II

Sexual Behavior

Pen differences were also present in this experiment. Differences were especially evident in the observation period from 13 to 27 weeks of age. Treatment GG exhibited a greater number of sexual activities than treatment IG (table 4). Total sexual acts were determined in the same manner as Experiment I. Mounts during the rearing period from 13 to 27 weeks of age were correlated which average mating test score at 37 weeks of age ($r = .548$ $p < .05$; table 5). An increase in sexual activity was noticed in the observed boars beginning at 14 to 16 weeks of age and continuing on until the end of the rearing period at 27 weeks (figures 2 and 3).

Growth

Differences in treatments were detected in the period from 6 to 12 weeks of age for weight at 12 weeks ($p < .05$), feed consumption ($p < .10$) and total gain and average daily gain ($p < .01$; table 8). Individually reared boars outperformed group reared boars. No treatment differences were detected from 12 to 27 weeks.

Mating Behavior and Libido

Results from the mating tests show a difference between treatments for naso-nasal contact ($p < .05$); and ano-genital sniffs ($p < .01$; table 9). Mating test differences also were apparent for naso-nasal contact, total courting acts ($p < .05$); side nosing ($p < .01$); and reaction time to first mount ($p < .001$). A repeatability value of .846 for libido score was determined for the boars completing all five mating tests. At the first mating test (age 29 weeks) 17 out of 24 boars mounted the estrous female. Again litter affected libido score and courting behavior. No treatment

Figure 2.

Behaviors per observation period in experiment II.

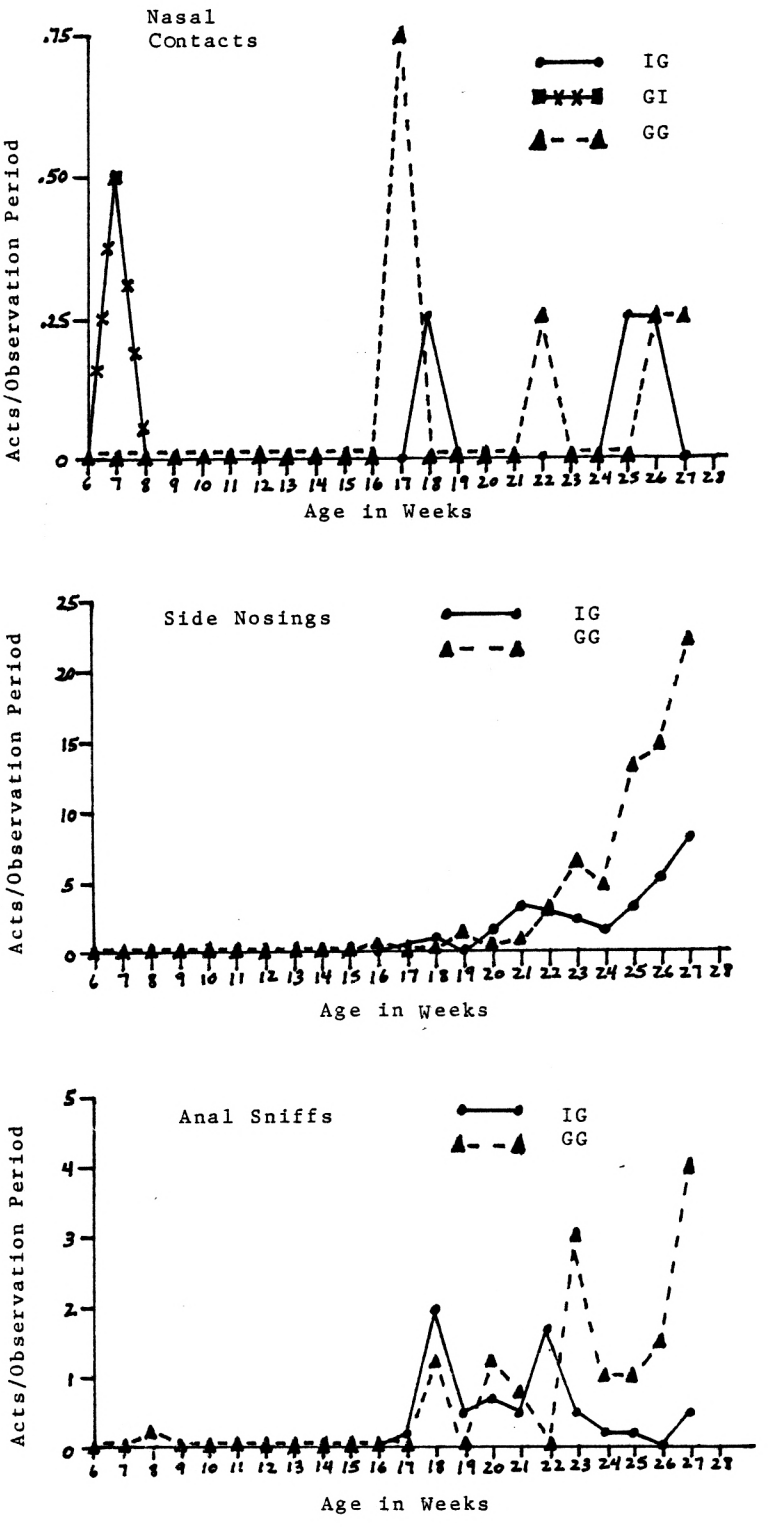

Figure 3.

Behaviors per observation period in experiment II.

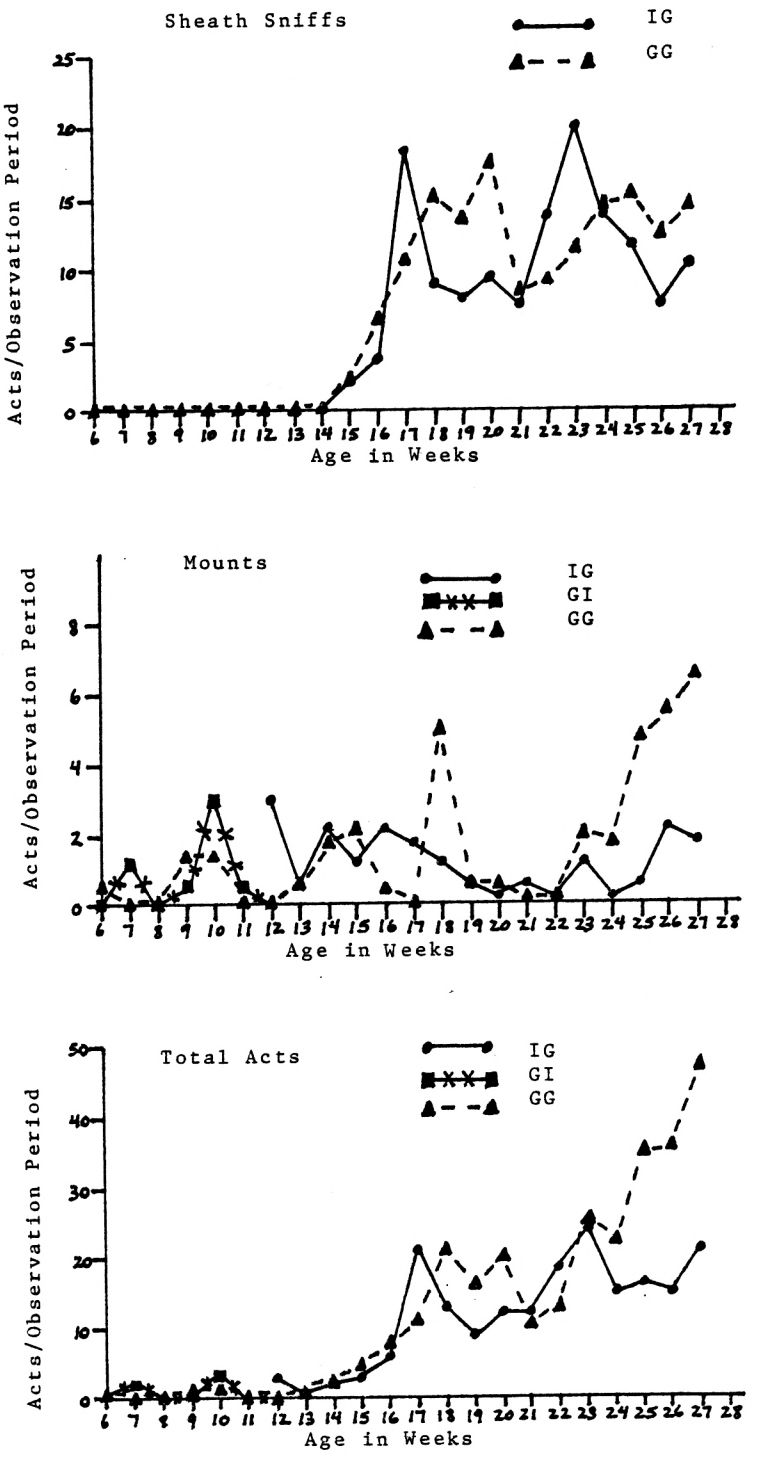

TABLE 8. ANALYSIS OF VARIANCE AMONG BOARS FOR GROWTH AS AFFECTED BY TREATMENT DURING REARING FOR EXPERIMENT II

Source of variation	D.F.	Growth measurements (6-12 wks.) 12 week wt. M.S.	Gain M.S.	Avg. daily gain M.S.
Litter	7	124.500*	44.604	.021
Trt	3	131.066*	149.182**	.070**
Error	20	42.473	27.223	.013

Treatments	Growth measurements[1] 12 week[2] wt.	Gain	Avg. Daily Gain
IG	37.386[a]	27.102[a]	.589[a]
GI	34.432[b]	23.580[b]	.513[b]
II	37.734[a]	26.514[a]	.576[a]
GG	34.176[b]	23.210[b]	.505[b]

[1] Means with same letter are not significantly different ($p < .05$).

[2] All growth means expressed in kilograms.

* $p < .05$; ** $p < .01$.

TABLE 9. ANALYSIS OF VARIANCE AMONG BOARS FOR MATING ACTIVITIES AS AFFECTED BY TREATMENT AND MATING TEST IN EXPERIMENT II

Source of Variation	D.F.	No. of Courting activities[1] Naso-nasal contacts M.S.	Side nosings M.S.	Ano-genital sniffs M.S.	Total courting acts M.S.	Rx time to mount M.S.
Litter	7	33.104	199.258	68.030*	610.641	314096.770**
Treatment	3	96.360*	46.836	108.279**	664.129	47826.343
Litter x Treatment[2]	13	21.170	113.320	18.138	296.022	59944.858
Mating Test[3]	4	34.383*	148.939**	1.653	322.928*	89613.518***
Treatment x Mating Test[3]	12	9.905	25.679	9.986	92.532	14204.434
Error	74	11.541	31.238	8.285	100.455	9928.513

Treatments	Behaviors per treatment[4] Naso-nasal contacts	Side nosings	Ano-genital sniffs	Total courting acts	Rx time to mount
IG	6.108^{c}	14.797^{a}	6.568^{c}	32.419^{c}	205.746^{c}
GI	2.900^{a}	14.083^{a}	2.867^{ab}	26.250^{ab}	96.887^{a}
II	3.000^{ab}	15.286^{a}	2.571^{a}	25.143^{a}	168.771^{bc}
GG	4.727^{bc}	14.045^{a}	3.485^{ab}	29.076^{abc}	144.748^{b}
Mating Test					
At 29 weeks	2.542^{a}	11.562^{a}	3.938^{a}	23.208^{a}	245.750^{d}
31 weeks	3.833^{ab}	13.208^{ab}	4.646^{a}	27.250^{ab}	172.750^{d}
33 weeks	5.000^{ab}	17.313^{d}	4.375^{a}	32.708^{b}	130.046^{abc}
35 weeks	5.545^{ab}	16.523^{bcd}	3.818^{a}	31.795^{b}	128.709^{ab}
37 weeks	5.800^{b}	13.700^{abc}	4.250^{a}	30.150^{b}	83.640^{a}

[1]Based on 5 mating tests.

[2]Error term for testing sources listed above.

[3]Mean square error used to test these sources.

[4]Means with same letter are not significantly different ($p<.05$).

+$p<.10$; *$p<.05$; **$p<.01$; *** $p<.001$.

effects were detected for average libido score at 37 weeks of age.

Soundness

Treatment differences were detected for soundness score at 21 and 27 weeks ($p < .01$ and $p < .05$ respectively; table 7). Continuously grouped (GG) boars had the highest average soundness score at both evaluations.

DISCUSSION

Mating performance was not affected by rearing conditions. Although this study did indicate a pattern of poor mating performance (for example group II in Experiment II consistently performed as one of the two poorest groups; table 9) by the individually reared boars as compared to grouped boars, no statistically significant differences between treatments were present. Auditory and olfactory contact with other pigs may have played a role in the development of sexual behavior among all the boars; however, Hemsworth et al. (1978) showed that most of the effect on individually rearing was due to physical contact with other pigs. Boars in Experiment II encountered soundness problems which reduced the number of boars available for the mating tests. The individually reared group (II) was the most severely affected by lameness and only three out of eight boars in this group were sound enough to be tested for mating performance. The limited number of boars in this group permits only cautious interpretation of continuous individual penning. This study did not demonstrate the significant influence of rearing conditions on sexual behavior as reported by Hemsworth. Hemsworth et al. (1977a) reported that individually reared boars achieved fewer total copulations, exhibited low levels of courting behavior and were slow to mount receptive gilts. They concluded these boars were of low sexual motivation. Although definite treatment effects were not shown, mating test results did show a tendency for the group reared boars to outperform the individually reared boars. This may suggest that social interaction among males is beneficial.

Growth traits were only affected by treatment in Experiment II and then only from 6 to 12 weeks of age. Individually reared boars consumed more feed and gained faster from 6 to 12 weeks of age. Possibly, individually penned boars did not have to adjust to being grouped with strange pigs and did not have to compete for food. No treatment effects were shown in either experiment

from 12 to 27 weeks of age. Hemsworth et al. (1977a) and Thomas et al. (1979) both found no difference in growth rate between individual and group reared boars.

Treatment effects on soundness were demonstrated in Experiment II at 21 and 27 weeks of age ($p<.01$ and $p<.05$ respectively). The continuously grouped boars (GG) had the highest average soundness scores and boars continuously penned individually (II) were the least sound. GG boars possibly benefitted from the opportunity for increased physical activity. Individual penning seemed to have a more severe effect on soundness in Experiment II than Experiment I (compare treatments GII and GI to GGG and GG; table 7) may be due to the extended length of time spent on concrete floors. Fredeen and Sather (1978) reported that the degree of joint damage in pigs reared under confinement was not related to terminal weight but was directly related to duration of confinement. The boars in Experiment II were housed on concrete floors longer than boars in Experiment I. This longer period of time on concrete is a possible cause for the greater incidence of structural unsoundness in Experiment II. The relationship between duration of confinement and soundness suggests that swine producers, after testing boars for growth characteristics, should remove the boars from confinement housing and put them in dirt lots. The benefits of group rearing on soundness reinforces the value of rearing boars in groups.

From 6 to 12 weeks of age, very few of the presumed sexual behaviors were observed and it was difficult to differentiate between playful and sexual behaviors. None of the behaviors observed during this period were positively correlated with average mating test score which suggests that the behaviors were more of a playful nature. However, observations from 12 to 27 weeks of age support a different conclusion. Behavioral activities recorded on a per observation period basis increased at 14 to 16 weeks and continued on an upward trend until the completion of the experiments at 25 to 27 weeks. Boars actively expressed

more interest in other boars, primarily through sheath sniffs. Also, during this period of time, boars would seek out other boars to mount. Mounts recorded from 12 to 27 weeks were correlated with average mating test score in both experiments ($r = .761$ $p < .01$ and $r = .548$, $p < .05$; Experiments I and II, respectively). The increased behavioral activities between boars, specifically in sheath sniffs and total sexual acts, and the correlation between mounts and average mating test score, would suggest the behaviors observed were sexual. Nelssen (1980) reported a strong correlation between mounts observed from 14 to 17 weeks of age and libido score at 6½ months ($r = .55$) and 7½ months ($r = .60$). He also found a strong correlation of sheath sniffs and total sexual acts with libido score. These correlations were not statistically significant in the present experiments although positive correlations for side nosings, anal sniffs, sheath sniffs and total sexual acts with average mating test score was observed. The strong correlations in these experiments and by Nelssen (1980) for mounting after 14 weeks of age, with mating test score suggests learning of this sexual behavior.

The noted increase in sexual behaviors at 14 to 16 weeks of age corresponds to or precedes a rise in testosterone concentration in the boars. FlorCruz and Lapwood (1978) reported an increase in testosterone in the boar's blood stream between 16 and 20 weeks of age. Testosterone acts by facilitating or activating the neural mechanisms concerned with the expression of male sexual behavior. The increased sexual activity may be explained by the testosterone level reaching and exceeding a threshhold point, after which the boars begin to actively express male sexual behavior. Colenbrander *et al.* (1978) reported elevated testosterone levels in the boar beginning after 18 weeks of age which would add additional support for the relationship between testosterone and increased sexual activity from 14 to 27 weeks of age. Swiestra (1976) reported rapid testicular growth from about 70 to 100 days of age. During this period of time, seminiferous tubules in the testes increased in size and sperma-

togenesis became established. The increase in the expression of male sexual behavior appears to follow closely after the initiation of spermatogenesis in the boar.

Behavioral observations during the period from 14 to 27 weeks of age hold the potential for assisting the swine producer in predicting a boar's future mating performance. In this experiment, the more sexually active boars during rearing performed better in mating tests. The consistently strong correlation between mounting activity and average mating test score suggests that this particular sexual behavior may be the best predictor of the boar's future mating performance. Seventeen out of 18 boars (Experiments I and II) observed mounting from 16 to 27 weeks of age, mounted receptive females in the mating tests. By observing the sexual behavior of young boars, swine producers may use these observations as a tool in identifying males with a low or adequate level of libido. These behavioral observations will serve as a predictor of mating performance but exposing the male to an estrous female is the best method of determining libido and mating ability. This study demonstrated that boars are more sexually active during the morning than in the afternoon and that they tended to be active for only 10 to 15 minutes during each observation period. Therefore, I would conclude that a 10 to 15 minute observation period during the morning hours would be the most appropriate time to observe sexual activity. Four observations per week provide an adequate opportunity to study sexual behavior development.

Based on results from this experiment, I would recommend that boars be raised as a group from weaning until they are sold. Group rearing appears to be especially beneficial from 12 to 28 weeks of age when the boar is undergoing rapid physiological changes. Housing boars in groups also promotes better structural soundness.

These experiments have raised questions concerning boar behavior, development of sexual behavior, repeatability of mating test performance, and litter effect on libido and mating perform-

ance. What behavioral activities are good predictors of future mating performance and libido? How many mating tests are necessary to predict libido and mating ability of young boars? What hormonal patterns and changes are occurring during development of sexual behavior? Does development of sexual behavior follow a pattern? Is litter effect on libido due to genetic or early environmental influences? How do rearing conditions affect structural soundness as boars are reared to heavier weights and for longer periods of time? These areas have been probed by these experiments, but more research is needed to study the many factors affecting sexual development, libido and mating ability in boars.

SUMMARY

Experiment I

Fifteen Yorkshire boars were allotted by litter to one of three treatments. Five boars were individually reared (12 to 25 weeks). Five were reared as a group from 12 to 19 weeks of age and then reared individually, and five boars were grouped from 12 to 25 weeks of age. Grouped boars were observed for one-half hour, 4 days per week, from 12 to 19 weeks of age and the incidence of presumed sexual acts (naso-nasal contact, nosing the side, anal sniffs, sheath sniffs, chants, chomps, mounts, extension of the penis, thrusts, and ejaculations) were recorded. A pen difference was noted in the number of total sexual behaviors displayed and mounts. Mounts correlated with average libido score at 35 weeks ($r = .761$, $p < .01$).

At 29, 31, 33 and 35 weeks of age, boars were tested for libido and mating ability by exposure to an estrous gilt. Boars were given a score from 1 to 5, with 1 indicating no sexual interest in the female and 5 indicating interest, mounting, and ejaculation. Treatment did not affect libido score, but litter differences in libido score were detected ($p < .05$). Boars were given a soundness score from 1 to 5 at each mating test, with 1 indicating lame and unable to walk and 5 being sound and exceptionally structurally correct. Treatment did not effect soundness. Mating test affected several courting activities: naso-nasal contract, total courting acts ($p < .05$); chants ($p < .001$); extension of the penis ($p < .01$); and side nosing ($p < .10$).

Experiment II

Thirty-two Yorkshire boars were allotted by litter to one of four treatments. Boars were reared individually (6 to 27 weeks); or group reared 6 to 12 weeks; 12 to 27 weeks; or 6 to 27 weeks of age. All boars were weighed monthly. From 6 to 27 weeks of

age all grouped boars were observed for one-half hour per day and the incidence of sexual acts recorded. A pen difference was detected from 13 to 27 weeks of age for total sexual behaviors displayed. The incidence of sexual activity among grouped boars was observed to increase at approximately 14 to 16 weeks of age and continue to increase until the end of the rearing period at 27 weeks of age. Mounts were correlated with average libido score at 37 weeks ($r = .548$, $p < .05$). Treatment had an effect on soundness score at 21 and 27 weeks of age ($p < .01$ and $p < .05$, respectively).

At 29, 31, 33, 35 and 37 weeks of age, boars were tested for libido and mating ability by exposure to an estrous gilt. Boars were given a libido score from 1 to 5 following each test. Treatment did not affect libido but it did affect courting behaviors such as naso-nasal contact ($p < .05$) and ano-genital sniffs ($p < .01$). Litter influenced libido score ($p < .01$). Mating test affected the following courting acts: naso-nasal contact, total courting acts ($p < .05$); side nosing ($p < .01$) and reaction time to first mount ($p < .001$).

LITERATURE CITED

Beach, F.A. 1968. Coital behavior in dogs. III. Effects of early mating in males. Behavior 30:218.

Booth, W.D. 1980. A study of some major testicular steroids in the pig in relation to their effect on the development of male characteristics in the pubertally castrated boar. J. Reprod. Fert. 59:155.

Colenbrander, B., F. H. deJong, and C.J.G. Wensing. 1978. Changes in serum testosterone concentrations in the male pig during development. J. Reprod. Fert. 53:377.

Dziuk, P.J. 1971. Effects of isolation and confinement on reproduction in swine. Proc. American Pork Congress. Des Moines, Iowa. p.159.

Esbenshade, K.L., W.L. Singleton, E.D. Clegg, and H.W. Jones. 1979. Effect of housing management on reproductive development and performance of young boars. J. Anim. Sci. 48:246.

FlorCruz, S.V. and K.R. Lapwood. 1978. A longitudinal study of pubertal development in boars. Inter. J. of Andrology 1:317.

Fredeen, H.T. and A.P. Sather. 1978. Joint damage in pigs reared under confinement. Can. J. Anim. Sci. 58:759.

Gerall, A.A. 1963. An exploratory study of the effect of social isolation variables on the sexual behavior of male guinea pigs. Anim. Behav. 11:274.

Gerall, H.D., I.L. Ward, and A.A. Gerall. 1967. Disruption of the male rat's sexual behavior induced by social isolation. Anim. Behav. 15:54.

Gray, R.C., B.N. Day, J.F. Lasley, and L.F. Tribble. 1971. Testosterone levels of boars at various ages. J. Anim. Sci. 33:124.

Hafez, E.S.E. 1980. Reproduction in Farm Animals (4th Ed.) P.475. Lea and Febiger, Philadelphia.

Hemsworth, P.H., J.K. Findlay, and R.C. Beilharz. 1978. The importance of physical contact with other pigs during rearing on the sexual behavior of the male domestic pig. Anim. Prod. 27:201.

Hemsworth, P.H., R.G. Bailharz, and D.B. Galloway. 1977a. Influence of social conditions during rearing on the sexual behavior of the domestic boar. Anim. Prod. 24:245.

Hemsworth, P.H., C.G. Winfield, R.G. Beilharz, and D.B. Galloway. 1977b. Influence of social conditions post-puberty on the sexual behavior of the domestic male pig. Anim. Prod. 25:305.

Illius, A.W., N.B. Haynes and G.E. Lamming. 1976. Effects of ewe proximity on peripheral plasma testosterone levels and behavior in the ram. J. Reprod. Fert. 48:25.

Joshi, H.S. and J.I. Raeside. 1973. Synergistic effects of testosterone and oestrogens on accessory sex glands and sexual behavior of the boar. J. Reprod. Fert. 33:141.

Mason, W.A. 1960. The effects of social restriction on the behavior of rhesus monkeys. I. Free social behavior. J. Comp. Physiol. Psychol. 53:582.

Mattner, P.E. 1980. Gonadal hormone control of male sexual behavior. Reviews in Rural Science. 4:11.

Nelson, D.A. 1976. Boar management for the veterinarian. Proc. Int. Pig Vet. Soc. June 22-24, 1976. Ames, Iowa.

Nelssen, J.L. 1980. Effects of exposure to mature females on sexual development in young boars. Master's Thesis. Kansas State University, Manhattan.

Osborne, H.G., L.G. Williams, and D.B. Galloway. 1971. A test for libido and serving ability in beef bulls. Aust. Vet. J. 47:465.

Signoret, J.P. 1980. Mating behavior of the pig. Reviews in Rural Science 4:75.

Signoret, J.P. 1971. The reproductive behavior of pigs in relation to fertility. Vet. Rec. 88:34.

Signoret, J.P. 1970. Swine behavior in reproduction. Proc. Sym. Effect of Disease and Stress on Reproductive Efficiency in Swine. University of Nebraska College of Agriculture, Lincoln, Nebraska.

Sorenson, A.M., Jr. 1979. Animal Reproduction Principles and Practices. P. 140. McGraw-Hill Book Co., New York.

Swiestra, E.E. 1976. Testicular development and establishment of spermatogenesis in the boar. Proc. Int. Pig Vet. Soc. June 24-26, 1976. Ames, Iowa.

Thomas, H.R., H.G. Kattesh, J.W. Knight, F.C. Gwazdauskas, T.N. Meacham, and E.T. Kornegay. 1979. Effects of housing and rearing on age at puberty and libido in boars. Anim. Prod. 28:231.

Wells, B.H. 1966. The effect of group vs individual confinement on the reproductive and behavioral patterns in young boars in pasture-lots and on concrete. MS Thesis, Dept. of Anim. Sci., Virginia Polytechnic Institute.

Wiggins, E.L., A.C. Warnick, R.H. Grummer, L.E. Casida, and A.B. Chapman. 1951. Variation in puberty phenomena in inbred boars. J. Anim. Sci. 10:494.

Zenchak, J.J. and G.C. Anderson. 1980. Sexual performance levels of rams (Ovis aries) as affected by social experience during rearing. J. Anim. Sci. 50:167.

A P P E N D I X

TABLE 1. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT I

Source	Mating activities									
	Naso-nasal contacts	Side nosings	Ano-genital sniffs	Chomps	Chants	Mounts	Extensions of penis	Thrusts	Penetrations	Copulations
Litter										
10	4.583	13.458	8.250	3.625	1.167	6.667	2.667	2.208	.583	.417
22	4.875	10.292	6.792	.917	1.667	5.083	2.417	1.625	.833	.667
23	5.417	7.417	6.833	1.167	1.375	.167	.833	.000	.000	.000
29	6.222	8.222	2.889	.500	1.333	2.056	.778	.278	.000	.000
34	5.167	11.889	10.389	.556	2.167	1.000	1.500	.500	.389	.222
Treatments										
CII	5.412	9.029	7.088	1.412	.676	2.529	1.618	.647	.235	.176
GGI	5.853	11.824	6.588	2.000	2.412	3.618	1.824	1.059	.176	.118
GGG	4.475	10.025	7.475	1.000	1.475	3.300	1.650	1.200	.675	.500

TABLE 1 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT I

Litter x Treatment	Mating activities									
	Naso-nasal contacts	Side nosings	Ano-genital sniffs	Chomps	Chants	Mounts	Extensions of penis	Thrusts	Penetrations	Copulations
10 GII	5.750	8.875	4.875	4.750	.000	2.750	1.250	1.125	.250	.250
10 GGI	3.875	11.875	9.000	3.750	1.000	7.500	3.375	3.000	.750	.500
10 GGG	4.125	19.625	10.875	2.375	2.500	9.750	3.375	2.500	.750	.500
22 GII	5.375	12.250	11.125	.000	.875	7.875	3.250	1.625	.750	.500
22 GGI	8.125	11.625	6.750	2.125	3.750	2.750	1.375	.875	.000	.000
22 GGG	1.125	7.000	2.500	.625	.375	4.625	2.625	2.375	1.750	1.500
23 GII	6.000	6.000	5.250	.375	.000	.000	1.000	.000	.000	.000
23 GGI	4.875	9.750	6.375	2.125	2.500	.500	1.250	.000	.000	.000
23 GGG	5.375	6.500	8.875	1.000	1.625	.000	.250	.000	.000	.000
29 GII	5.500	1.000	5.500	1.500	.000	.000	.000	.000	.000	.000
29 GGI	6.250	16.750	5.000	.375	3.000	4.625	1.750	.625	.000	.000
29 GGG	6.375	1.500	.125	.375	.000	.000	.000	.000	.000	.000
34 GII	4.500	11.000	7.500	.500	2.000	.125	1.375	.000	.000	.000
34 GGI	7.000	1.000	3.500	.500	.000	.000	.000	.000	.000	.000
34 GGG	5.375	15.500	15.000	.625	2.875	2.125	2.000	1.125	.875	.500
Mating Test										
29 wk.	5.633	10.267	6.067	1.767	1.233	2.067	1.067	.667	.367	.333
31 wk.	3.846	7.962	6.192	1.231	.538	2.423	1.077	.769	.308	.231
33 wk.	5.577	10.000	7.615	.962	2.769	3.423	1.615	1.077	.385	.308
35 wk.	5.692	12.885	8.577	1.769	1.577	4.885	3.115	1.462	.462	.231

TABLE 1 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT I

Source	Mating activities									
	Naso-Nasal contacts	Side nosings	Ano-genital sniffs	Chomps	Chants	Mounts	Extensions of penis	Thrusts	Penetrations	Copulations
Treatment x Mating Test										
GII 29 wk.	5.100	6.300	5.500	1.700	.800	.700	.600	.200	.200	.200
GII 31 wk.	5.000	8.000	6.000	.875	.250	2.250	.875	.375	.250	.250
GII 33 wk.	4.750	8.875	7.125	.875	1.125	3.250	1.250	.875	.250	.250
GII 35 wk.	6.875	13.625	10.125	2.125	.500	4.375	4.000	1.250	.250	.000
GGI 29 wk.	6.900	14.000	5.100	2.500	2.400	3.700	1.200	.500	.000	.000
GGI 31 wk.	3.375	7.875	5.125	1.875	.875	3.500	1.250	.875	.000	.000
GGI 33 wk.	6.625	11.250	9.000	1.500	4.250	1.750	1.625	1.250	.250	.250
GGI 35 wk.	6.250	13.625	7.500	2.000	2.125	5.500	3.375	1.750	.500	.250
GGG 29 wk.	4.900	10.500	7.600	1.100	.500	1.800	1.400	1.300	.900	.800
GGG 31 wk.	3.300	8.000	7.200	1.000	.500	1.700	1.100	1.000	.600	.400
GGG 33 wk.	5.400	9.900	6.900	.600	2.900	4.900	1.900	1.100	.600	.400
GGG 35 wk.	4.300	11.700	8.200	1.300	2.000	4.800	2.200	1.400	.600	.400

TABLE 1 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT I

Source	Mating activities							
	Courting acts	Rx time to[1] 1st mount	Interval 1st[1] mount to ejaculation	Time[1] mounting	Time[1] nosing side	Duration of ejaculation	Total Time for ejaculation	Libido
Litter								
10	37.667	155.658	67.617	127.975	33.092	170.067	170,067	4.333
22	29.625	296.933	109.467	83.333	17.442	218.783	305.767	4.000
23	22.375	852.708		.000	11.575			2.083
29	20.111	629.167		12.089	36.667			2.444
34	31.389	534.256	37.750	18.233	43.311	212.950	212.950	2.889
Treatment								
GII	26.235	538.071	162.633	40.924	18.729	209.267	209.267	2.941
GGI	31.647	475.571	81.950	58.159	30.729	296.400	296.400	3.118
GGG	27.775	445.125	54.022	56.210	31.215	170.933	228.922	3.500

TABLE 1 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT I

Source	Mating activities							
	Courting acts	Rx time to[1] 1st mount	Interval 1st[1] mount to ejaculation	Time[1] mounting	Time[1] nosing side	Duration of ejac-ulation	Total time for ejaculation	Libido
Litter x Treatment								
10 GII	27.000	309.900	47.000	72.300	23.525	150.600	150.600	3.750
10 GGI	36.750	61.675	81.950	178.300	17.000	296.400	296.400	4.500
10 GGC	49.250	95.400	64.933	133.325	58.750	92.333	92.333	4.750
22 GII	37.500	136.275	220.450	101.625	11.200	238.600	238.600	4.500
22 GGI	35.125	685.750		41.675	16.275			2.500
22 GGG	16.250	68.775	53.975	106.700	24.850	208.875	339.350	5.000
23 GII	17.625	900.000		.000	4.250			1.750
23 GGI	26.125	758.125		.000	17.425			2.500
23 GGG	23.375	900.000		.000	13.050			2.000
29 GII	13.500	900.000		.000	5.200			2.000
29 GGI	33.500	290.625		27.200	79.900			3.250
29 GGG	8.375	900.000		.000	1.300			1.750
34 GII	26.000	715.625		.000	39.325			2.000
34 GGI	12.000	900.000		.000	.000			2.000
34 GGG	41.625	261.450	37.750	41.025	58.125	212.950	212.950	4.000
Mating Test								
29 wk.	26.333	490.000	148.000	40.860	27.667	192.550	230.825	3.133
31 wk.	22.308	480.054	35.033	36.785	25.300	170.733	170.733	3.231
33 wk.	30.346	451.192	76.100	58.369	31.892	232.850	283.300	3.308
35 wk.	35.385	513.708	45.500	73.746	23.585	181.733	237.400	3.154

TABLE 1 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT I

Source	Mating activities							
	Courting acts	Rx time to[1] 1st Mount	Interval 1st[1] mount to ejaculation	Time[1] mounting	Time[1] nosing side	Duration of ejaculation	Total time for ejaculation	Libido
Treatment x Mating Test								
GII 29 wk.	20.100	637.300	342.500	16.520	18.980	238.200	238.200	2.400
GII 31 wk.	22.750	526.375	47.000	27.425	20.825	150.600	150.600	3.250
GII 33 wk.	26.000	469.700	98.400	75.875	16.725	239.000	239.000	3.250
GII 35 wk.	37.625	494.100		49.975	18.325			3.000
GGI 29 wk.	32.400	444.760		54.800	33.140			3.200
GGI 31 wk.	22.625	502.325		50.775	26.875			3.000
GGI 33 wk.	34.375	473.675	118.400	43.700	40.000	361.500	361.500	3.000
GGI 35 wk.	37.000	489.225	45.500	84.200	22.300	231.300	231.300	3.250
GGG 29 wk.	26.500	387.940	83.167	51.260	30.880	177.333	228.367	3.800
GGG 31 wk.	21.700	425.180	29.050	33.080	27.620	180.800	180.800	3.400
GGG 33 wk.	30.600	418.400	43.800	56.100	37.540	165.450	266.350	3.600
GGG 35 wk.	32.300	548.980	45.500	84.400	28.820	156.950	240.450	3.200

[1]All means measured in seconds.

TABLE 2. LEAST SQUARES MEANS FOR GROWTH OF BOARS DURING REARING IN EXPERIMENT I

	Growth measurements[1]											
	12-19 weeks						19-25 weeks					
Source	12 wk. wt.	19 wk. wt.	Gain	ADG	Feed cons.	F/G	19 wk wt.	25 wk. wt.	Gain	ADG	Feed cons.	F/G
Litter												
10	45.303	78.712	33.409	.836			78.712	111.818	33.106	.751		
22	28.182	57.273	29.091	.729			57.273	82.879	25.606	.582		
23	34.697	67.197	32.500	.814			67.197	104.242	37.045	.842		
29	33.030	63.258	30.227	.756			63.258	92.954	26.697	.676		
34	33.333	68.712	35.379	.885			68.712	110.606	41.894	.953		
Treatment												
GII	33.636	64.909	31.273	.783	80.545	1.176	64.909	99.682	34.773	.790	86.136	1.120
GGI	33.818	64.818	31.000	.776	83.636	1.227	64.818	97.455	32.636	.743	75.636	1.053
GGG	37.273	71.364	34.091	.853	85.455	1.141	71.364	104.364	33.000	.750	101.545	1.400

[1]All least squares means expressed in kilograms.

TABLE 3. MEANS FOR SOUNDNESS OF BOARS DURING REARING IN EXPERIMENT I

Source	Soundness score 29 weeks of age
Litter	
10	4.777
22	4.997
23	2.997
29	3.667
34	2.887
Treatment	
GII	3.732
GGI	3.732
GGG	4.130

TABLE 4. MEANS FOR AVERAGE LIBIDO SCORE OF BOARS IN EXPERIMENT I

	Average libido score
Source	35 weeks of age
Litter	
10	4.333
22	4.000
23	2.083
29	2.375
34	3.000
Treatment	
GII	3.000
GGI	3.188
GGG	3.450

TABLE 5. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT II

Source	Mating activities								
	Naso-nasal contacts	Side nosings	Ano-genital sniffs	Mounts	Extensions of penis	Thrusts	Penetrations	Copulations	Courting acts
Litter									
37	2.375	8.313	6.000	4.000	2.688	2.563	1.750	1.000	20.688
38	5.400	12.750	4.375	4.400	2.900	2.675	1.000	.450	26.925
39	3.400	11.933	4.467	12.000	6.733	6.600	1.533	.600	31.800
41	6.536	22.179	7.964	2.321	1.786	.714	.000	.000	39.000
42	4.500	18.658	4.632	6.974	2.447	2.447	.895	.421	34.763
44	3.800	13.500	3.500	.000	.000	.000	.000	.000	20.800
47	4.139	13.417	2.972	4.778	3.444	3.000	1.500	.500	25.306
51	4.167	11.533	.467	7.267	4.067	3.733	1.267	.600	23.433
Treatment									
IG	6.108	14.797	6.568	4.946	2.932	2.743	.892	.378	32.419
GI	2.900	14.083	2.867	6.400	3.517	2.967	1.100	.467	26.250
II	3.000	15.286	2.571	4.286	2.786	2.143	.357	.143	25.143
GG	4.727	14.045	3.485	6.818	3.697	3.606	1.485	.667	29.076

TABLE 5 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT II

Source		Mating activities: Naso-nasal contacts	Side nosings	Ano-genital sniffs	Mounts	Extensions of penis	Thrusts	Penetrations	Copulations	Courting acts
Litter x Treatment										
37	IG	3.800	10.700	7.500	4.600	2.800	2.500	.800	.600	26.600
37	GI									
37	II									
37	GG	.000	4.333	3.500	3.000	2.500	2.667	3.333	1.667	10.833
38	IG	9.100	13.400	6.600	4.200	3.000	3.200	1.200	.600	33.300
38	GI	6.300	16.600	4.100	5.600	3.400	3.000	1.200	.400	32.600
38	II	2.800	10.600	3.200	4.400	2.800	2.200	.800	.200	21.000
38	GG	3.400	10.400	3.600	3.400	2.400	2.300	.800	.600	20.800
39	IG	2.200	8.600	6.800	8.200	3.800	3.800	1.800	.800	25.800
39	GI	2.800	11.400	4.400	9.600	5.800	5.800	.600	.400	28.200
39	II									
39	GG	5.200	15.800	2.200	18.200	10.600	10.200	2.200	.600	41.400
41	IG	10.000	17.750	12.500	.000	.000	.000	.000	.000	40.250
41	GI	1.800	21.300	3.700	6.100	4.800	2.000	.000	.000	32.900
41	II									
41	GG	8.500	26.600	8.600	.400	.200	.000	.000	.000	44.100
42	IG	8.800	23.100	9.600	5.200	2.500	2.600	.800	.400	46.700
42	GI	1.600	15.400	4.400	7.900	1.700	2.000	1.200	.400	29.300
42	II	2.375	19.750	2.125	1.250	.500	.500	.000	.000	25.500
42	GG	4.800	16.600	1.900	12.400	4.700	4.300	1.400	.800	35.700
44	IG	3.800	13.500	3.500	.000	.000	.000	.000	.000	20.800
44	GI									
44	II									
44	GG									
47	IG	4.333	21.333	7.333	5.667	4.333	3.000	2.000	.000	38.667
47	GI	2.300	4.600	.400	4.800	3.600	4.000	3.200	1.200	12.100
47	II	3.700	16.400	2.300	6.600	4.600	3.400	.200	.200	29.000
47	GG	6.300	14.500	3.600	2.400	1.600	1.600	.800	.400	26.800
51	IG	6.900	13.200	.200	11.000	7.000	6.400	.800	.400	31.300
51	GI	2.600	15.200	.200	4.400	1.800	1.000	.400	.400	22.400
51	II									
51	GG	3.000	6.200	1.000	6.400	3.400	3.800	2.600	1.000	16.600

TABLE 5 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT II

Source	Mating activities								
	Naso-nasal contacts	Side nosings	Ano-genital sniffs	Mounts	Extensions of penis	Thrusts	Penetrations	Copulations	Courting acts
Mating Test									
29 wk.	2.542	11.563	3.938	5.167	3.063	2.375	1.167	.458	23.208
31 wk.	3.833	13.208	4.646	5.563	2.938	2.646	1.167	.375	27.250
33 wk.	5.000	17.313	4.375	6.021	3.688	3.604	1.042	.458	32.708
35 wk.	5.545	16.523	3.818	5.909	3.432	3.114	1.000	.500	31.795
37 wk.	5.800	13.700	4.250	6.400	3.350	3.200	.850	.500	30.150
Treatment x Mating Test									
IG 29 wk.	2.688	11.938	6.688	4.500	2.438	2.000	1.125	.625	25.813
IG 31 wk.	4.438	13.125	7.000	4.250	2.125	1.938	.875	.500	28.813
IG 33 wk.	7.750	17.750	5.813	5.125	3.875	3.750	.625	.125	36.438
IG 35 wk.	9.143	16.143	6.429	5.286	3.286	3.143	1.143	.429	37.000
IG 37 wk.	7.167	15.333	7.000	5.833	3.000	3.000	.667	.167	35.333
GI 29 wk.	1.250	9.833	2.417	2.833	3.167	2.167	1.333	.500	16.333
GI 31 wk.	3.167	15.750	5.417	6.750	3.667	3.667	1.667	.167	31.083
GI 33 wk.	2.917	16.083	3.500	8.167	4.917	4.500	1.000	.333	30.667
GI 35 wk.	3.333	16.750	.833	5.417	2.167	1.333	.833	.667	26.333
GI 37 wk.	3.833	12.000	2.167	8.833	3.667	3.167	.667	.667	26.833
II 29 wk.	1.167	12.167	3.000	5.000	3.667	2.333	.333	.000	21.333
II 31 wk.	1.667	12.667	1.667	4.333	2.667	1.333	.333	.000	20.333
II 33 wk.	3.500	22.667	4.000	3.333	1.333	1.333	.333	.333	33.500
II 35 wk.	3.667	18.833	2.667	5.667	3.667	3.333	.333	.000	30.833
II 37 wk.	6.000	7.500	1.000	2.500	2.500	2.500	.500	.500	17.000
GG 29 wk.	4.071	12.357	2.500	8.000	3.429	3.000	1.429	.429	26.929
GG 31 wk.	4.643	11.357	2.571	6.571	3.357	3.143	1.429	.571	25.143
GG 33 wk.	4.286	15.571	3.643	6.357	3.429	3.643	1.857	1.000	29.857
GG 35 wk.	4.500	15.583	4.333	7.250	4.750	4.750	1.333	.667	31.667
GG 37 wk.	6.333	15.833	4.667	5.833	3.667	3.667	1.333	.667	32.667

TABLE 5 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT II

Source	Mating activities						
	Rx time to 1st mount[1]	Interval 1st mount to ejaculation[1]	Time mounting[1]	Time nosing side[1]	Duration of ejaculation[1]	Total time spent ejaculating[1]	Libido[1]
Litter							
37	41.563	94.950	168.213	26.200	218.633	302.167	4.750
38	74.385	113.619	161.050	34.375	141.144	154.325	4.600
39	58.853	202.240	211.887	40.473	134.280	153.940	4.667
41	413.329		43.107	97.314			2.429
42	146.937	110.122	142.542	124.816	149.367	190.667	4.000
44	600.000		.000	95.100			2.000
47	112.622	187.845	193.506	44.089	166.882	199.555	4.500
51	90.007	205.090	206.907	60.013	242.000	263.500	4.267
Treatment							
IG	205.746	188.547	145.989	61.130	130.247	147.558	3.919
GI	96.887	165.729	167.987	67.997	182.453	203.594	4.167
II	168.771	60.225	151.771	98.079	170.025	170.025	3.786
GG	144.748	130.800	153.864	52.503	193.473	246.495	4.303

TABLE 5 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT II

Source	Mating activities						
	Rx time to[1] 1st mount	Interval 1st[1] mount to ejaculation	Time[1] mounting	Time[1] nosing side	Duration of[1] ejaculation	Total time[1] spent ejaculating	Libido
Litter x Treatment							
37 IG	52.640	106.733	160.560	32.420	245.000	245.000	4.600
37 GI							
37 II							
37 GG	23.100	83.167	180.967	15.833	192.267	359.333	5.000
38 IG	52.460	108.125	156.260	19.800	69.300	122.025	4.400
38 GI	44.400	164.140	157.060	46.480	124.980	124.980	5.000
38 II	119.880	58.967	159.220	24.500	151.533	151.533	4.200
38 GG	80.800	96.950	171.660	46.720	225.400	225.400	4.800
39 IG	66.620	199.300	253.460	2.440	105.160	128.760	5.000
39 GI	74.620	87.000	190.380	58.860	209.150	209.150	4.400
39 II							
39 GG	35.320	283.967	191.820	60.120	132.900	159.100	4.600
41 IG	600.000		.000	69.575			2.000
41 GI	154.220		117.620	117.100			3.200
41 II							
41 GG	523.100		3.080	99.720			2.000
42 IG	155.900	79.750	133.820	168.000	122.650	122.650	4.000
42 GI	90.120	132.000	177.460	37.640	174.800	174.800	4.200
42 II	344.200		16.700	242.250			2.750
42 GG	36.980	108.900	217.020	74.860	143.650	236.575	4.800
44 IG	600.000		.000	95.100			2.000
44 GI							
44 II							
44 GG							
47 IG	102.600	407.900	194.267	87.067	17.600	17.600	4.333
47 GI	37.160	237.560	239.620	6.840	213.840	285.720	5.000
47 II	77.320	64.000	252.380	56.320	225.500	225.500	4.200
47 GG	229.400	101.650	88.060	43.320	130.850	130.850	4.400
51 IG	53.340	316.450	259.660	26.700	168.450	168.450	4.800
51 GI	180.800	119.450	125.780	141.060	232.450	232.450	3.200
51 II							
51 GG	35.880	136.550	235.280	12.280	320.325	374.075	4.800

TABLE 5 Continued. MEANS FOR MATING ACTIVITIES OF BOARS IN EXPERIMENT II

Source	Mating activities						
	Rx time to[1] 1st mount	Interval 1st[1] mount to ejaculation	Time[1] mounting	Time[1] nosing side	Duration of[1] ejaculation	Total time[1] spent ejaculating	Libido
Mating Test							
29 wk.	245.750	161.492	150.104	72.317	151.183	190.783	3.917
31 wk.	172.300	147.131	151.508	74.663	197.446	216.454	4.167
33 wk.	130.046	175.614	157.175	63.792	182.371	209.621	4.083
35 wk.	128.709	157.300	150.441	55.064	136.300	166.915	4.136
37 wk.	83.640	116.420	166.145	56.875	180.800	215.980	4.100
Treatment x Mating Test							
IG 29 wk.	233.550	195.200	147.613	68.325	124.480	150.420	4.125
IG 31 wk.	210.188	143.575	134.025	64.100	247.225	267.525	4.000
IG 33 2k.	204.975	300.275	154.288	63.425	68.550	68.550	3.750
IG 35 wk.	225.486	174.250	150.500	43.343	77.400	106.900	4.000
IG 37 wk.	140.750	67.000	143.450	65.267	139.800	139.800	3.667
GI 29 wk.	258.950	169.650	139.500	84.967	166.900	185.625	4.000
GI 31 wk.	90.783	263.200	197.100	88.400	101.733	101.733	4.167
GI 33 wk.	43.050	229.200	184.917	66.317	237.267	237.267	4.167
GI 35 wk.	43.367	84.825	109.400	65.617	209.700	248.575	4.000
GI 37 wk.	48.283	107.433	209.017	34.683	192.767	235.767	4.500
II 29 wk.	340.567	35.800	119.200	102.367	24.000	24.000	3.667
II 31 wk.	262.333	104.800	183.000	156.000	41.600	41.600	4.000
II 33 wk.	108.667	36.300	78.567	100.667	389.000	389.000	3.667
II 35 wk.	45.600		196.167	71.233			4.000
II 37 wk.	45.650	64.000	197.000	41.150	225.500	225.500	3.500
GG 29 wk.	207.743	123.750	175.286	53.157	249.500	385.400	3.714
GG 31 wk.	160.286	88.800	118.914	40.100	246.220	279.400	4.429
GG 33 wk.	128.143	88.933	170.386	46.243	196.367	259.950	4.571
GG 35 wk.	142.700	201.720	168.550	50.100	124.700	149.600	4.500
GG 37 wk.	74.550	160.975	135.683	75.917	181.150	236.850	4.333

[1]All means measured in seconds.

TABLE 6. LEAST SQUARE MEANS FOR GROWTH OF BOARS DURING REARING IN EXPERIMENT II

	Growth measurements[1]											
	6-12 weeks						12-27 weeks					
Source	6 wk wt.	12 wk wt.	Gain	ADG	Feed cons.	F/G	12 wk. wt.	27 wk. wt.	Gain	ADG	Feed cons.	F/G
Litter												
37	11.591	38.182	26.591	.577			38.182	130.000	91.818	.874		
38	9.886	34.318	24.432	.531			34.318	124.432	90.114	.858		
39	11.645	35.980	24.335	.529			35.980	131.291	95.439	.908		
41	11.705	37.614	25.909	.563			37.614	132.670	95.057	.906		
42	11.477	36.534	25.057	.545			36.534	129.659	93.125	.886		
44	10.455	36.875	26.420	.574			36.875	134.659	97.784	.931		
47	11.477	37.557	26.080	.567			37.557	127.352	90.666	.863		
51	8.409	30.398	21.989	.479			30.398	119.886	89.432	.852		
Treatments												
IG	10.284	37.386	27.102	.589	56.392	.947	37.386	132.500	95.114	.906	297.473	1.423
GI	10.852	34.432	23.580	.513	43.268	.832	34.432	127.500	93.040	.886	303.892	1.489
II	11.220	37.734	26.514	.576	58.344	1.000	37.734	128.980	91.745	.873	301.591	1.486
GG	10.966	34.176	23.210	.505	40.255	.786	34.176	125.995	91.818	.875	276.764	1.368

[1]All least square means expressed in kilograms.

TABLE 7. MEANS FOR SOUNDNESS OR BOARS DURING REARING IN EXPERIMENT II

	Soundness score	
Source	21 weeks of age	27 weeks of age
Litter		
37	3.720	2.888
38	4.275	3.693
39	4.073	3.927
41	3.445	3.110
42	3.583	3.388
44	2.890	2.470
47	3.940	3.220
51	3.635	3.250
Treatment		
IG	3.679	3.388
GI	3.539	3.015
II	3.316	2.761
GG	4.153	3.663

TABLE 8. MEANS FOR AVERAGE LIBIDO SCORE OF BOARS IN EXPERIMENT II

Source	Average libido score 37 weeks of age
Litter	
37	4.800
38	4.600
39	4.667
41	2.400
42	3.938
44	2.000
47	4.475
51	4.267
Treatment	
IG	3.888
GI	4.167
II	3.717
GG	4.343

INFLUENCE OF SOCIAL CONDITIONS DURING REARING ON THE SEXUAL BEHAVIOR, MATING ABILITY AND LIBIDO OF YORKSHIRE BOARS

by

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Fifteen Yorkshire boars were reared from 12 to 25 weeks of age, according to three penning treatments: individually, grouped then individually, and grouped for the entire rearing period (Experiment I). Thirty-two Yorkshire boars were reared from 6 to 27 weeks of age in four treatments: individually, grouped to 12 weeks then individually, individually to 12 weeks then grouped, and grouped for the entire rearing period (Experiment II). All boars were assigned to treatments by litter. All boars were weighed monthly. Groups were observed one-half hour, 4 days per week, and the incidence of presumed sexual acts toward other boars (naso-nasal contact, nosing the side, anal sniffs, sheath sniffs, chants, chomps, mounts, extension of the penis, thrusts, penetrations, and ejaculations) were recorded. An increase in sexual activity was noted beginning at 14 to 16 weeks of age and continuing on until the end of the rearing period. Mounts during the observation periods 12 to 19 weeks (Experiment I) and 12 to 27 weeks (Experiment II) were correlated with average libido score ($r = .761$, $p < .01$; and $r = .548$ $p < .05$; Experiments I and II, respectively). Mating tests were conducted on 2 consecutive days at 2 week intervals. A libido score of 1 to 5 was given each boar, with 1 indicating no interest in the female and 5 indicating mounting, extension of the penis, thrusting and ejaculation. Treatment had no effect on libido score. Mating test did affect mating behavior activities. A litter effect on libido was apparent in both Experiments ($p < .10$ and $p < .01$; Experment I and II, respectively). Repeatability values of .906 and .846 were obtained for boars completing all the mating tests in Experiments I and II. Experiment II treatments affected soundness at 21 and 27 weeks of age ($p < .01$ and $p < .05$, respectively) with boars reared individually from 6 to 27 weeks having the lowest soundness scores.