To the Graduate Council:

I am submitting herewith a thesis written by Dearl Douglas Lampley entitled "The Effects of Late Gestation Feeding of Dichlorvos to Sows on Sow Productivity and Pig Performance." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Science.

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THE EFFECTS OF LATE GESTATION FEEDING OF DICHLORVOS TO SOWS ON SOW PRODUCTIVITY AND PIG PERFORMANCE

A Thesis

Presented for the

Master of Science

Degree

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ABSTRACT

Data from 113 crossbred Duroc, Hampshire, Yorkshire and Landrace litters were used to study the effects of feeding 1 gram of dichlorvos daily to the gilt or sow for the last 30 days of gestation on the productivity traits of the sow and the performance traits of the pigs from her litter. There were 1127 pig births from 9 farrowings during 1980 included in this study. Pigs were ear notched, weighed and needle teeth clipped on day one. Male pigs were castrated on day three. The pigs were weaned at 4 weeks of age, weighed and placed in the pig nursery. The largest one-third of the pigs by weight were randomly assigned to 4 nursing pens, the middle third to 4 pens and the light-weight one-third to the remaining 4 pens. After about 50 days in the nursery, the pigs were weighed and moved to the finishing barns.

No significant differences were found in sow productivity and pig performance traits between the control and dichlorvos treatment groups when all data were pooled from the 9 farrowing groups. However, there was a tendency for dichlorvos litters to perform better than control litters in all performance traits measured except total number of pigs born, number of pigs born alive and number of pigs weaned per litter.

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CHAPTER I

INTRODUCTION

The value of a brood sow is measured in her ability to farrow a large litter of pigs, to wean a heavy litter and to rebreed on schedule. At birth, each live pig represents a potential market hog with an opportunity to yield a profit to the producer. Mortality in baby pigs averages about 20 to 30 percent among pigs farrowed alive and represents a two fold loss of feed (sow feed and pig feed) as well as potential profits. A sow eats an average of 70 to 100 pounds of feed during gestation for each pig she farrows (Fairbanks _et al_., 1945). For each pig found dead at birth, approximately two bushels of corn are wasted beyond recovery. No swine producer would knowingly destroy that amount of feed.

Several researchers have shown that feeding the sow 1 gram of 2, 2-dichlorvinyl dimethyl phosphate (an effective anthelmintic, commonly known as dichlorvos) per day during the last quarter of gestation will increase her productivity by decreasing the number of pigs born dead per litter, increasing pig birth weight, decreasing mortality from birth to market age and increasing daily gain. At present, the mode of action of dichlorvos has not been determined. It has been proven that the anthelmintic properties of the chemical are not responsible for its effect on sow productivity and pig performance. The most widely accepted theory is that the anticholinesterase action of dichlorvos cause the parametrial arteries of the uterus to dilate and, therefore, blood flow to the uterus and the unborn pigs increases. The pigs increase in weight and vigor due to the additional nutrients they receive. Smaller, weaker pigs, which are more likely to die during parturition, will have a greater chance of surviving due to the increased weight they gain inutero. The vigor instilled in the pigs during gestation lasts throughout their lives, and they have lower mortality rates and become faster growers.

The objective of this study was to evaluate the effects of feeding dichlorvos to sows and gilts during the last 30 days of gestation on the sows' productivity and the performance of their litters.

CHAPTER II

LITERATURE REVIEW

I. FACTORS INFLUENCING SOW PRODUCTIVITY AND PIG PERFORMANCE

Litter Size

Litter size is the most important aspect of sow productivity and one of the most important aspects of the total swine productive scheme. An average of several economic studies of swine production revealed that the number of pigs born alive to be 2.5 times more important to hog production than any other factor. This is due to the fact that a larger number of live pigs per litter results in more efficient utilization of gestation feed, an increased probability of marketing more pigs, more efficient utilization of overall investment and the opportunity of greater profits for the producer.

In order for a large litter of pigs to be born alive, a large number of ova must be fertilized during copulation, and a higher percentage of those embryos must survive to parturition. Baker *et al*. (1958) found breed to significantly increase the average number of corpora lutea in pregnant Chester White gilts by 1.4 compared to Poland China gilts, but breed in Baker's study had no effect on the number of pigs born per litter. This is in disagreement with Menzies-Kitchin (1937), Lush and Mollin (1942) and Omtvedt *et al*. (1965) who have shown breed of dam to influence litter size.

Diehl *et al*. (1978) stated that nutrition of the gestating dam must be adequate to insure against embryonic death and subsequent reductions in pig numbers. In this case, overfeeding can be just as harmful, if not more so than underfeeding. Vitamin levels as well as percent crude protein and energy levels will alter the number of pigs a female farrows (Anderson, 1949). The feeding of antibiotics to gravid swine in attempts to enhance litter size has been shown to have no affect according to DePape et al. (1953).

Age of the dam and/or her parity are cited by several researchers to significantly affect litter size at birth. Lush et al. (1933) found that dams one year of age gave birth to an average of 1.0 pig less than the overall herd average and two year olds had an average of 0.5 pig less than herd average. Unpublished work from the Ames Plantation Research Unit of The University of Tennessee, Knoxville paralleled these findings and suggested that the differences in litter size due to parity were a function of the following parity groupings which were significantly different ($P < .001$) from each other: first litter sows, second litter sows, third through fifth litter sows and sixth and above litter sows. The average numbers of pigs farrowed per litter were 9.2, 9.6, 10.5 and 10.8 for first litter sows, second litter sows, third through fifth litter sows and sixth and above litter sows, respectively. (At first appearance, the differences between the performance of the sixth and above parity group over first litter sows seems great, but when it is considered that only the best performing females will be kept for six and more farrowings, then the magnitude of the differences diminishes somewhat). This trend held true for litter size throughout the growing stage and until marketing.

The studies of England and Spurr (1969) with gestating females in individual and group confinement resulted in no differences in litter size when compared to those gestating in outside lots. However, it was noted that confinement caused problems with the mating process.

Season of the year is an influence on litter size according to Lush _et al_. (1933) and Omtvedt _et al_. (1965).

Birthweight

The advantage of heavy birth weights for pigs is not completely obvious. In fact, it may appear to be a disadvantage when it is considered that the basic goal of producers is to market large numbers of pigs per sow per year, and birth weight and litter size are negatively correlated (Lush _et al_., 1933). The benefit of heavier birth weights is in the additional livability of heavier pigs over lightweight pigs. Krider and Carroll (1971) found preweaning mortality to be approximately 50 percent higher in smaller, weaker pigs. This is in agreement with Fredeen and Plank's (1963) work which resulted in a 44 percent preweaning mortality for pigs lighter than 2.5 pounds.

Nutritional levels of the gestating dam are of great importance for pig birthweight. Sows fed 3000 kilocalories of metabolizable energy during gestation gave birth to pigs an average of 0.71 pound lighter than sows receiving 7500 kilocalories of metabolizable energy in a study reportedby Frobish _et al_. (1973). This energy level is more important in the last quarter of gestation when the fetus reaches its maximum growth rate (Hafez, 1975). Altering vitamin levels also influenced birth weight according to Anderson (1949), but different protein levels (Hafez, 1975) and use of antibiotics (DePape _et al_., 1953) had no significant effects.

Omtvedt *et al*. (1965) reported breed of sire, breed of dam, age of the dam and season of the year to effect birthweight.

England and Spurr (1969) found confinement of gestating sows to have no influence on pig birthweight as compared to pigs farrowed from sows gestated in outside lots.

Mothering Phase Factors

The dam effects her offspring through her genetic contribution, her prenatal and the postnatal environment she provides. Maternal performance should be considered in 2 parts; namely, the reproductive phase and the mothering phase. Milk production and age of dam are 2 of the most influential aspects of the mother phase. Donald (1939) reported sow milk production to be an important factor in the growth of the nursing pig. Lodge and McDonald (1959) found the greater percentage of variation for weaning weight at eight weeks of age to be attributed to creep feed rather than sow's milk. Robison (1972) stated that milk production appears inadequate to explain differences between litter weight means where creep feed is available. A reasonable explanation for these results is offered by Lodge and McDonald (1959), Ahlschwede and Robison (1971) and Robison (1972). They stated that pigs nursing low milk producing sows were found to eat creep feed sooner to meet their nutritional requirements than pigs nursing high milk producing sows.

II. REVIEW OF DICHLORVOS RESEARCH

The use of dichlorvos as an enhancer of sow productivity has resulted in varied and inconclusive findings.

Singh et al. (1968) found a dosage of 800 milligrams of dichlorvos per head per day to decrease the number of pigs born dead by 0.5 pig per litter, increase the average birthweight by 0.3 pound per pig, increase the number of pigs weaned per litter by 0.8 pig and increase the average weaning weight by 3.0 pounds per pig for 12 treated sows compared to 12 control sows.

Foster (1968) reported a study involving 442 sows and gilts fed 800 milligrams of dichlorvos daily for the final 3 to 6 weeks of gestation. This treatment resulted in 0.24 fewer still born pig per litter, 0.66 pound heavier litter birth weight and decreased pig mortality of 3.9 percent from birth to 4 weeks of age.

A 1968 North Carolina State University report involved 472 sows, half of which received dichlorvos at a rate of 400 milligrams per day. Dichlorvos was administered either 3 weeks prior to breeding through farrowing or from 21 day to 42 days before parturition. Individual pig and litter birth weights and pig weaning weights were significantly greater for pigs from treated dams. Although not significant, there was a trend for treated dams to produce more live and fewer stillborn pigs (Robison and Moncol, 1969).

England and Day (1971) reported from their work involving 199 females that litters from gilts and first treatment sows had a 0.23 pound heavier litter birth weight and 6.2 percent better pig survival rate to weaning than the control litters. The treated group received 800 milligrams of dichlorvos plus 6 pounds of ration from the ninety-first day of gestation through the day of farrowing. Treated litters also showed a higher percentage of pigs gaining weight more rapidly.

Sows treated with 40 milligrams of dichlorvos per kilogram of body weight daily yielded 0.5 more live pig per litter, 0.25 pound increase in litter birth weight and 24.69 pound increase in litter weaning weight in a study conducted by Young et al. (1973).

Hays et al. (1969) of the University of Kentucky found no evidence of increased sow productivity from 52 sows fed 0.8 gram of dichlorvos per head per day for the last 21 days of gestation over those 48 sows fed no dichlorvos.

Litters from 101 females that received dichlorvos at a dosage rate of 800 milligrams per head per day for the last 21 to 30 days of pregnancy were the basis for a report by Siers et al. (1974). Their results were as follows: total number of pigs born per litter was not significantly different; number of pigs born alive per litter increased 9.3 percent; mean birth weight increased 11 percent; number weaned increased 16.5 percent and litter market weight increased 12.4 percent over those litters serving as controls. These results are in agreement with Stanton et al. (1974) whose study involved 100 sows fed 1 gram of dichlorvos per head per day for an average of 34 days prior to farrowing.

Siers et al. (1976) reported that dichlorvos treatment of 50 lightly parasitized sows resulted in more and heavier pigs from birth until market. They also stated that the colostrum milk of the dams receiving dichlorvos was higher in lipid content. Danielson et al. (1977) disagreed with the latter finding.

Siers et al. (1977) found that treating sows 30 days prior to farrowing with 1 gram of dichlorvos resulted in improved sow productivity by improving the performance of those litters over the nontreated litters in the following ways: increased number of pigs born alive per litter (2.3 percent); increased pig birth weight (9.6 percent); improved survival rate and improved growth rates to market weight.

Young et al. (1979) reported that dichlorvos had the same effect on sow productivity for parasitized females as it did for non-parasitized females. Dichlorvos treated dams yielded 0.5 more live pig per litter at birth at an average of 0.13 pound heavier. Weaned pigs from treated litters were 1.1 pounds heavier.

CHAPTER III

EXPERIMENTAL PROCEDURE

Data for this study were collected from January 1980 to June 1981 from the swine herd at Ames Plantation, Grand Junction, Tennessee.[1]

I. EXPERIMENTAL ANIMALS

Crossbred Duroc, Hampshire, Landrace and Yorkshire gilts and/or sows and their litters from 9 farrowings during 1980 in the confinement unit (system three) at Ames Plantation were utilized in this research project.

II. MATERIALS

The confinement unit included a 24-crate farrowing barn, 12-pen nursery and 2 finishing barns which had 12 pens each. Sows were bred and gestated in pasture lots until the completion of a breeding and gestation barn in August 1980. From that time, all dams were bred and gestated in confinement.

The 24-crate farrowing barn was an environment controlled building with 5 x 7 feet farrowing crates equipped with cup waterers, sow feed bowls and pig creep feeders. Each crate had electrically heated concrete for pig comfort. The anterior 12 inches and the posterior 30 inches of the floor of each crate were slatted.

The 12-pen nursery was a totally enclosed environment controlled unit with supplemental heat and nipple-type waterers. Pens measured

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[1]The University of Tennessee, Knoxville is a beneficiary of a perpetual trust under the terms of the will of the late Julia C. Ames.

8 x 8 feet and featured total slatted floors over a manure collection pit.

Two modified open front, curtain-sided barns were utilized to finish the hogs for market. Each building measured 25 x 102 feet equipped with 12 pens measuring 8 x 20 feet including an 8 foot slat section over a pit, 4-hole Smidley fenceline feeders, nipple-type waterers and water sprinklers for summer cooling.

The gestation barn was a modified open front, curtain-sided building measuring 25 x 136 feet with gestation crates. The gestation crates measuring 2 feet wide by 7 feet in length were equipped with a concrete trough in the front to serve as both a feed and water bowl. A section of concrete slats 2 x 2.5 feet, was located at the rear of each crate. Water sprinklers were used for cooling.

Pasture lots were approximately 3 acres in size consisting of orchardgrass, fescue and ladino clover. Sows had free access to water from bowl-type waterers.

III. FEEDING AND MANAGEMENT

The sows and gilts for each farrowing group were weighed and sorted into 2 uniform experimental groups according to breed, parity and weight approximately 30 days prior to parturition. One group received 1 gram of dichlorvos per head per day plus 4 pounds of a 15.8 percent crude protein ration (Table 1). The contents of the sow and swine vitamin premixes are presented in Tables 2 and 3, respectively. The other group received the same ration in the same amounts, but received no dichlorvos. Those females gestated outside were placed in lots so that the 2 groups were adjacent to each other.

TABLE 1. COMPOSITION OF RATIONS

	Nursery	Grower	Finisher	Sow Gestation	Sow Nursing
Yellow Corn	1197	1462	1540	1500	1200
SBM (44%)	500	460	410	225	400
Tankage(50%)	--	--	--	175	--
Alfalfa Meal	--	--	--	--	100
Wheat Bran	--	--	--	--	200
Dried Whey	200	--	--	--	--
Swine Premix	100[1]	75[2]	50[2]	100[1]	100[1]
Synthetic Lysine	3	--	--	--	--
Aureomycin	--	3	--	--	--
Total Weight, lbs.	2000	2000	2000	2000	2000
Crude Protein, %	17.35 (+ added lysine)	16.41	15.64	15.78	16.31

[1]Sow vitamin premix (Table 2).

[2]Swine 50 vitamin premix (Table 3).

TABLE 2. CONTENTS OF SOW VITAMIN PREMIX

Nutrient	Amount	
Vitamin A	80,000	UPS Units
Vitamin D-3	20,000	IC Units
Vitamin E	100	Int. Units
Riboflavin	80	Mgs.
d-Panththenic Acid	200	Mgs.
Niacin	400	Mgs.
Choline Chloride	4,000	Mgs.
Vitamin K	20	Mgs.
Vitamin B-12	300	Mcg.
Lysine (added)	0.25%	
Methionine (added)	0.25%	
Calcium (Ca), Maximum		18.0%
Calcium (Ca), Minimum		15.0%
Phosphorus (P), Minimum		7.5%
Salt (NaCl), Maximum		8.4%
Salt (NaCl), Minimum		7.0%
Zinc (Zn)		0.24%
Iron (Fe)		0.24%
Manganese (Mn)		0.16%
Copper (Co)		0.024%
Cobalt (Co)		0.004%
Iodine (I)		0.0014%
Selenium (Se)		0.0002%

Ingredients

Vitamin A supplement, D-Activated Animal Sterol (source of Vitamin D-3), Vitamin E supplement, Riboflavin supplement, Calcium Pantothenate, Niacin, Vitamin B-12 supplement, BHT (a preservative), Zinc Oxide, Ferrous Sulfate, Manganous Oxide, Copper Oxide, Cobalt Carbonate, Ethlyenediamine Dihydriodide, Menadionine Sodium Bilsulfite Complex, (source of Vitamin K), Sodium Selenite, Sodium Bentonite, Dicalcium Phosphate, Defluorinated Phosphate, Salt, Distillers Dry Solubles, Yeast Culture, Dehydrated Alfalfa Meal, Dried Whey, Potassium Magnesium Sulfate, Calcium Carbonate, L-Lysine, DL Methionine, Fish Meal.

TABLE 3. CONTENTS OF SWINE 50 VITAMIN PREMIX (WITH ADDED SELENIUM)

Nutrient	Amount	
Vitamin A	80,000	USP Units
Vitamin D-3	20,000	IC Units
Vitamin E	100	Int. Units
Riboflavin	80	Mgs.
d-Pantothenic Acid	200	Mgs.
Niacin	400	Mgs.
Choline Chloride	4,000	Mgs.
Vitamin K	20	Mgs.
Vitamin B-12	300	Mcs.
Lysine (added)	0.25%	
Methionine (added)	0.25%	
Calcium (Ca), Maximum		30.0%
Calcium (Ca), Minimum		25.0%
Phosphorus (P), Minimum		9.0%
Salt (NaCl), Maximum		18.0%
Salt (NaCl), Minimum		15.0%
Zinc (Zn)		0.24%
Iron (Fe)		0.24%
Manganese (Mn)		0.16%
Copper (Cu)		0.024%
Cobalt (Co)		0.024%
Iodine (I)		0.0014%
Selenium (Se)		0.00027%

Ingredients

Vitamin A supplement, D-Activated Animal Sterol (source of Vitamin D-3), Vitamin E supplement, Riboflavin supplement, Calcium Pantothenate, Niacin, Vitamin B-12 supplement, BHT (a preservative), Zinc Oxide, Ferrous Sulfate, Manganous Oxide, Copper Oxide, Cobalt Carbonate, Ethylenediamine Dihydriodide, Menadionine Sodium Bisulfite Complex, (source of Vitamin K), Sodium Selenite, Sodium Bentonite, L-Lysine, DL Methionine, Calcium Carbonate, Dicalcium Phosphate, Defluorinated Phosphate, Salt, Yeast Culture, Potassium Magnesium Sulfate.

Dams were weighed and brought into the farrowing barn 3 days before the first sow was due to farrow. Within 6 to 24 hours of birth, all pigs had their needle teeth clipped and were identified (ear notched), weighed to one-tenth pound and injected with 1 millimeter of iron. Male pigs were castrated and all pigs were tail-docked on day three. A commercial 18 percent crude protein pelleted creep feed was made available to the pigs at 7 days of age. Nursing sows were fed a 16.3 percent protein fortified ration (Table 1) at the daily rate of 1 pound of feed for each suckling pig plus 3 to 5 pounds of additional feed for the sow.

The pigs were weaned at about 4 weeks of age, weighed, placed in the pig nursery and fed a 17.35 percent crude protein ration (Table 1). The heaviest one-third of the pigs by weight were randomly assigned to the 4 nursery pens at the rear of the barn. The lightest third and the medium third of the pigs were placed in the center of the barn and the front of the barn, respectively. The pigs were divided in this manner due to a structural flaw in the design of the nursery which caused temperature variations between the front and rear sections of the barn. The pigs from each treatment group were randomly and equally assigned to a weight group and were subsequently moved to a finishing barn and placed on a 16.4 percent crude protein ration (Table 1) after approximately 50 days in the nursery. The ration was changed to a 15.6 percent crude protein ration (Table 1) at approximately 130 days of age and remained at that level until the pigs were marketed.

IV. METHODS OF ANALYSIS

After the data from all farrowings were complete, all litter and sow records were checked. Sows and their litters were omitted from analysis for any of the following reasons:

1. Diseased sow and/or litter in the farrowing house.
2. Physiological disorders of the sow during parturition and/or lactation.
3. Unknown parity and/or breed of the dam.
4. Unusually higher numbers of pigs lost during lactation.
5. A parity or breed group with insufficient numbers, thus having the potential to bias the analysis.

The Statistical Analysis System (SAS) developed by Barr and Goodnight (1979) was utilized to determine if differences existed between control and dichlorvos treated dams and litters. The least-squares of SAS was utilized to produce descriptive statistics of the variables used to characterize animal performance.

The Generalized Linear Models (GLM) procedure was utilized to determine the effects of dichlorvos independently of parity of dam[2], breed of dam, farrowing group and number of pigs weaned per litter. The first underlying model was used to describe the dependent variables that were unaffected by the size of the litter. The second was used to describe those dependent variables which were affected by litter size.

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[2]Parity of dam was designated for each sow in the following manner: first litter sows received a parity status of 1; second litter sows received a 2; and third, fourth and fifth litter sows received a 3.

1. $Y = \mu$ + farrowing group + breed of dam + parity of dam + treatment + treatment x farrowing group + treatment x breed of dam + treatment x parity of dam.

The dependent variables (Y) included sow prefarrowing weight, sow farrowing weight, sow gain from 30 days prefarrowing to farrowing, average pig birth weight, total number of pigs born, number of pigs born alive, number of pigs born dead, average percent of pigs weaned per litter, average pig nursery weight, average daily gain in nursery, average market weight, average daily gain from nursery to market and average number of days required to reach 230 pounds.

2. $Y = \mu$ + farrowing group + breed of dam + parity of dam + treatment + litter size at weaning + treatment x farrowing group + treatment x breed of dam + treatment x parity of dam.

The dependent variables (Y) for this model were average daily gain from birth to weaning, adjusted 28-day pig weight, sow weaning weight and sow weight loss from farrowing to weaning.

CHAPTER IV

RESULTS AND DISCUSSION

I. DESCRIPTION OF THE SOWS

Sow weights and weight changes from about 30 days prior to parturition to the day of weaning were used as measures of sow weight gain or loss and body condition. Table 4 contains the least-squares means for sow weights at each weigh period and weight changes between each weigh period forall sows. Sows fed dichlorvos gained more weight during the last quarter of gestation and were heavier at farrowing and weaning. However, these results were not different ($P > .05$). It was also observed that the dichlorvos-treated sows had a slicker appearance (brighter, smoother hair coat) and experienced fewer problems with constipation upon entering the farrowing house than did control sows. These findings were not observed when sows were gestated in confinement.

The 30-day pre-farrow weight less the mean weight of the control sows resulted in a total weight loss of 34 pounds (342-308) while the dichlorvos sows experienced a net weight loss of 35 pounds (346-311). It is of interest to note that the control sows gained 8.9 pounds versus 14.0 pounds for the dichlorvos sows during the 30-day pre-farrow period. Yet, total litter weight (Table 5) at parturition varied only .7 pound between the control sows (9.8 pigs x 3.3 pounds per pig = 32.3 pounds) and the dichlorvos sows (9.7 pigs x 3.4 pounds per pig = 33.0 pounds). The difference in pre-farrow weight gain of 5.1 pounds (8.9 versus 14.0 pounds), although not significant, seems to be more coincidental. One

TABLE 4. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW WEIGHTS AND SOW WEIGHT CHANGES

	Control	Dichlorvos
No. of sows	54	59
30-day prefarr. wt., lbs.	342 ± 6	346 ± 6
Farrowing wt., lbs.	351 ± 6	360 ± 6
Wt. change in gestation, lbs.	8.9 ± 1.8	14.0 ± 1.7
Wean wt., lbs.	308 ± 6	311 ± 5
Wt. change, lbs. from farrowing to weaning	42.6 ± 3.3	48.6 ± 3.1

TABLE 5. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS

	Control	Dichlorvos
Birth-weaning		
No. of litters	54	59
Total born	544	583
Total born per litter	9.8 ± .32	9.7 ± .30
No. born alive per litter	9.4 ± .32	9.4 ± .29
No. born dead per litter	.39 ± .13	.37 ± .12
Avg. birth wt., lbs.	3.3 ± .08	3.4 ± .08
Avg. adj. 28-day wt., lbs.	16.8 ± .43	17.3 ± .41
ADG, lbs.	.48 ± .01	.50 ± .01
No. weaned per litter	8.1 ± .30	8.1 ± .27
Percent weaned of born alive	86.9 ± 2.4	87.3 ± 2.2
Nursery phase		
No. of litters	51[a]	50[a]
No. alive	395	385
No. alive per litter	7.7 ± .30	7.9 ± .30
Percent death loss	4.10 ± 1.65	2.50 ± 1.56
Avg. final nursery wt., lbs.	36.8 ± 1.14	39.1 ± 1.14
ADG, lbs.	.57 ± .02	.61 ± .02
Growing-finishing phase		
No. of litters	51[a]	50[a]
No. marketed	351	353
Percent marketed	72.0 ± 3.0	79.2 ± 3.0
No. marketed per litter	6.8 ± .33	7.3 ± .32
ADG, lbs.	1.20 ± .02	1.21 ± .02
Days to 230 lbs.	237 ± 5	228 ± 5

[a]Data from the nursery and growing-finishing phases of pigs from Group IX were unavailable and therefore omitted from the data.

of the theories supporting the use of dichlorvos in the pre-farrow sow ration suggests that a greater blood supply is directed to the uterus and its fetuses. It may be possible that this physiological function results in additional products of reproduction other than pig weight per se. This study did not attempt to weigh the products of reproduction other than the newborn pigs.

II. DESCRIPTION OF THE PIGS

Table 5 summarizes the least-squares means for pig numbers, weights, average daily gain and survival rates for all farrowing groups. Tables 6 through 14 contain the same information for each of the 9 farrowing groups.

The summary analysis (Table 5) resulted in nonsignificant differences in favor of the dichlorvos treatment for all pig performance and sow productivity factors except total number of pigs born per litter, number born alive per litter and number of pigs weaned per litter.

Birth to Weaning

Nonsignificant differences were observed between control and dichlorvos litters for all of the sow productivity and pig performance traits measured from birth to weaning in the overall comparison. Dichlorvos litters tended to have a slight advantage in all the parameters measured except total number of pigs born per litter, pigs born alive per litter and pigs weaned per litter.

In the individual group studies, dichlorvos litters had several significant advantages. Number of pigs born alive per litter in

TABLE 6. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP I (FEBRUARY FARROWING)

	Control	Dichlorvos
<u>Birth-weaning</u>		
No. of litters	8	4
Total born	91	43
Total born per litter	11.2 ± .86	10.4 ± 1.08
No. born alive per litter	10.8 ± .84	10.2 ± 1.06
No. born dead per litter	.43 ± .35	.27 ± .44
Avg. birth wt., lbs.	2.9 ± .22	3.1 ± .28
Avg. adj. 28-day wt., lbs.	19.8 ± .86	20.4 ± 1.04
ADG, lbs.	.60 ± .03	.61 ± .03
No. weaned per litter	8.2 ± .79	9.8 ± .99
Percent weaned of born alive	76.6 ± 6.3^{a}	96.3 ± 7.9^{d}
<u>Nursery phase</u>	72	39
No. alive	72	39
No. alive per litter	7.8 ± .80^{a}	9.9 ± 1.02^{b}
Percent death loss	5.33 ± 4.17	- .51 ± 5.28
Avg. final nursery wt., lbs.	38.0 ± 3.1^{a}	44.9 ± 3.9^{b}
ADG, lbs.	.49 ± .06^{c}	.68 ± .08^{d}
<u>Growing-finishing phase</u>		
No. marketed	71	37
Percent marketed	69.2 ± 8.1^{c}	93.8 ± 10.3^{d}
No. marketed per litter	7.5 ± .86^{a}	9.5 ± 1.09^{b}
ADG, lbs.	1.13 ± .05	1.20 ± .06
Days to 230 lbs.	242 ±14	226 ± 18

^{a,b}Least-squares means in the same row superscripted with different letters are different ($P < .1$).

^{c,d}Least-squares means in the same row superscripted with different letters are different ($P < .05$).

TABLE 7. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP II (MARCH FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	5	6
Total born	45	62
Total born per litter	8.3 ± 1.08[a]	10.9 ± .90[b]
No. born alive per litter	7.7 ± 1.07[c]	10.8 ± .88[d]
No. bcrn dead per litter	.59 ± .44	.08 ± .37
Avg. birth wt., lbs.	3.6 ± .28	3.5 ± .23
Avg. adj. 28-day wt., lbs.	17.1 ± 1.02[a]	15.1 ± .90[b]
ADG, lbs.	.48 ± .03	.42 ± .03
No. weaned per litter	7.4 ± 1.00	8.8 ± .82
Percent weaned of born alive	94.3 ± 8.0	82.2 ± 6.6
Nursery phase		
No. alive	39	50
No. alive per litter	7.7 ± 1.02	8.4 ± .85
Percent death loss	- 3.71 ± 5.28	5.07 ± 4.37
Avg. final nursery wt., lbs.	45.8 ± 3.9[a]	37.9 ± 3.2[b]
ADG, lbs.	.76 ± .08	.67 ± .07
Growing-finishing phase		
No. marketed	36	46
Percent marketed	90.0 ± 10.3	70.9 ± 8.5
No. marketed per litter	7.2 ± 1.09	7.8 ± .90
ADG, lbs.	1.31 ± .06[a]	1.18 ± .05[b]
Days to 230 lbs.	251 ± 18	240 ± 15

[a,b]Least-squares means in the same row superscripted with different letters are different ($P < .1$).

[c,d]Least-squares means in the same row superscripted with different letters are different ($P < .05$).

TABLE 8. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP III (APRIL FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	7	9
Total born	63	83
Total born per litter	8.8 ± .89	9.2 ± .71
No. born alive per litter	8.1 ± .88	9.2 ± .70
No. born dead per litter	.73 ± .37	.13 ± .29
Avg. birth wt., lbs.	3.4 ± .23	3.1 ± .19
Avg. adj. 28-day wt., lbs.	18.4 ± .88	17.6 ± .76
ADG, lbs.	.54 ± .03	.52 ± .03
No. weaned per litter	7.5 ± .82	8.0 ± .65
Percent weaned of born alive	94.7 ± 6.6	89.1 ± 5.2
Nursery phase		
No. alive	47	72
No. alive per litter	7.1 ± .84	8.1 ± .67
Percent death loss	4.26 ± 4.36	- .52 ± 3.47
Avg. final nursery wt., lbs.	36.6 ± 3.2	37.8 ± 2.5
ADG, lbs.	.54 ± .06	.62 ± .05
Growing-finishing phase		
No. marketed	38	64
Percent marketed	71.9 ± 8.5	80.7 ± 6.8
No. marketed per litter	6.0 ± .90	7.2 ± .72
ADG,lbs.	1.19 ± .05	1.20 ± .04
Days to 230 lbs.	239 ± 14	229 ± 12

TABLE 9. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP IV (JUNE FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	6	5
Total born	67	52
Total born per litter	11.4 ± .98	10.0 ± .99
No. born alive per litter	11.0 ± .96	9.8 ± .97
No. born dead per litter	.39 ± .40	.15 ± .41
Avg. birth wt., lbs.	3.3 ± .25	3.5 ± .26
Avg. adj. 28-day wt., lbs.	20.8 ± .99	20.7 ± .96
ADG, lbs.	.62 ± .03	.61 ± .03
No. weaned per litter	10.7 ± .90	9.4 ± .91
Percent weaned of born alive	97.9 ± 7.2	94.6 ± 7.2
Nursery phase		
No. alive	60	46
No. alive per litter	10.8 ± .93	9.3 ± .94
Percent death loss	- 1.96 ± 4.82	.44 ± 4.84
Avg. final nursery wt., lbs.	27.4 ± 3.5[c]	38.1 ± 3.5[d]
ADG, lbs.	.32 ± .07[a]	.49 ± .07[b]
Growing-finishing phase		
No. marketed	54	42
Percent marketed	92.0 ± 9.4	86.4 ± 9.4
No. marketed per litter	10.0 ± 1.00	8.5 ± 1.00
ADG, lbs.	1.25 ± .06	1.32 ± .06
Days to 230 lbs.	227 ±16	213 ±16

[a,b]Least-squares means in the same row superscripted with different letters are different ($P < .1$).

[c,d]Least-squares means in the same row superscripted with different letters are different ($P < .05$).

TABLE 10. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN THE GROUP V (JULY FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	8	6
Total born	83	53
Total born per litter	10.5 ± .93[a]	8.4 ± .96[b]
No. born alive per litter	10.3 ± .91	8.2 ± .94
No. born dead per litter	.27 ± .38	.13 ± .39
Avg. birth wt., lbs.	3.3 ± .24	3.6 ± .25
Avg. adj. 28-day wt., lbs.	10.4 ± .95[c]	13.8 ± .97[d]
ADG, lbs.	.25 ± .03[c]	.36 ± .03[d]
No. weaned per litter	6.4 ± .85	7.2 ± .88
Percent weaned to born alive	63.4 ± 6.8[c]	90.5 ± 7.0[d]
Nursery phase		
No. alive	56	44
No. alive per litter	5.7 ± .88	7.3 ± .92
Percent death loss	8.23 ± 4.54	.10 ± 4.79
Avg. final nursery wt., lbs.	35.7 ± 3.3	39.6 ± 3.5
ADG, lbs.	.70 ± .07	.68 ± .07
Growing-finishing phase		
No. marketed	50	41
Percent marketed	47.4 ± 8.8[c]	85.3 ± 9.3[d]
No. marketed per litter	4.7 ± .94[a]	6.8 ± .99[b]
ADG, lbs.	1.26 ± .05[a]	1.38 ± .06[b]
Days to 230 lbs.	232 ±15	206 ±16

[a,b]Least-squares means in the same row superscripted with different letters are different ($P < .1$).

[c,d]Least-squares means in the same row superscripted with different letters are different ($P < .01$).

TABLE 11. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP VI (AUGUST FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	3	5
Total born	27	45
Total born per litter	9.2 ± 1.29	8.8 ± .97
No. born alive per litter	9.1 ± 1.27	8.2 ± .93
No. born dead per litter	.02 ± .53	.57 ± .39
Avg. birth wt., lbs.	4.0 ± .33	3.7 ± .25
Avg. adj. 28-day wt., lbs.	15.9 ± 1.24	15.6 ± .94
ADG, lbs.	.43 ± .04	.42 ± .03
No. weaned per litter	90.3 ± 9.5	83.7 ± 7.0
Nursery phase		
No. alive	22	34
No. alive per litter	8.7 ± 1.21	6.8 ± .89
Percent death loss	- 6.26 ± 6.27	- .62 ± 4.60
Avg. final nursery wt., lbs.	43.2 ± 4.6	42.1 ± 3.4
ADG, lbs.	.74 ± .90	.68 ± .07
Growing-finishing phase		
No. marketed	16	32
Percent marketed	74.3 ± 12.2	79.0 ± 9.0
No. marketed per litter	6.8 ± 1.30	6.5 ± .95
ADG, lbs.	1.19 ± .07[a]	1.03 ± .05[b]
Days to 230 lbs.	222 ± 21	231 ±15

[a,b]Least-squares means in the same row superscripted with different letters are different (P < .05).

TABLE 12. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP VII (SEPTEMBER FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	7	9
Total born	72	92
Total born per litter	10.1 ± .81	10.1 ± .71
No. born alive per litter	9.1 ± .80	9.3 ± .69
No. born dead per litter	.99 ± .33	.77 ± .29
Avg. birth wt., lbs.	3.3 ± .21	3.4 ± .18
Avg. adj. 28-day wt., lbs.	15.0 ± .81[e]	17.2 ± .70[f]
ADG,lbs.	.42 ± .03[e]	.50 ± .02[f]
No. weaned per litter	7.4 ± .74	7.0 ± .64
Percent weaned of born alive	82.4 ± 6.0	78.1 ± 5.2
Nursery phase		
No. alive	44	59
No. alive per litter	5.8 ± .76	6.6 ± .66
Percent death loss	20.19 ± 3.94[e]	7.18 ± 3.43[f]
Avg. final nursery wt., lbs.	30.0 ± 2.9	29.8 ± 2.5
ADG, lbs.	.44 ± .06	.44 ± .05
Growing-finishing phase		
No. marketed	37	53
Percent marketed	55.4 ± 7.7	68.3 ± 6.7
No. marketed per litter	4.8 ± .82	5.9 ± .71
ADG, lbs.	1.02 ± .05[c]	1.14 ± .04[d]
Days to 230 lbs.	268 ±13[a]	240 ±11[b]

[a,b]Least-squares means in the same row superscripted with different letters are different ($P < .1$).

[c,d]Least-squares means in the same row superscripted with different letters are different ($P < .05$).

[e,f]Least-squares means in the same row superscripted with different letters are different ($P < .01$).

TABLE 13. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO MARKET FOR DICHLORVOS AND CONTROL LITTERS IN GROUP VIII (NOVEMBER FARROWING)

	Control	Dichlorvos
Birth-Weaning		
No. oflitters	7	6
Total born	71	61
Total born per litter	10.3 $\pm$ .84	10.0 $\pm$ .88
No. born alive per litter	10.2 $\pm$ .82	9.4 $\pm$ .86
No. born dead per litter	.11 $\pm$ .34	.62 $\pm$ .34
Avg. birth wt., lbs.	2.8 $\pm$ .22[a]	3.4 $\pm$ .22[b]
Avg. adj. 28-day wt., lbs.	17.3 $\pm$ .83	17.7 $\pm$ .84
ADG, lbs.	.52 $\pm$ .03	.51 $\pm$ .03
No. weaned per litter	8.5 $\pm$ .77	7.7 $\pm$ .80
Percent weaned of born alive	85.1 $\pm$ 6.1	81.7 $\pm$ 6.4
Nursery phase		
No. alive	55	41
No. alive per litter	8.2 $\pm$ .79	6.8 $\pm$ .82
Percent death loss	6.69 $\pm$ 4.10	8.85 $\pm$ 4.26
Avg. final nursery wt., lbs.	37.7 $\pm$ 3.0	42.4 $\pm$ 3.1
ADG, lbs.	.59 $\pm$ .06	.67 $\pm$ .06
Growing-finishing phase		
No. marketed	49	38
Percent marketed	75.4 $\pm$ 8.0	69.3 $\pm$ 8.3
No. marketed per litter	7.4 $\pm$ .85	6.3 $\pm$ .88
ADG, lbs.	1.28 $\pm$ .05[a]	1.21 $\pm$ .05[b]
Days to 230 lbs.	214 $\pm$14	239 $\pm$14

[a,b]Least-squares means in the same row superscripted with different letters are different ($P < .05$).

TABLE 14. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FROM BIRTH TO WEANING[a] FOR DICHLORVOS AND CONTROL LITTERS IN GROUP IX (DECEMBER FARROWING)

	Control	Dichlorvos
Birth-weaning		
No. of litters	3	9
Total born	25	92
Total born per litter	8.7 ± 1.30	10.0 ± .72
No. born alive per litter	8.7 ± 1.28	9.4 ± .71
No. born dead per litter	- .03 ± .53	.61 ± .30
Avg. birth wt., lbs.	3.2 ± .33	2.8 ± .19
Avg. adj. 28-day wt., lbs.	17.0 ± 1.24	17.2 ± .76
ADG, lbs.	.49 ± .04	.51 ± .03
No. weaned per litter	8.3 ± 1.19	8.3 ± .67
Percent weaned of born alive	97.7 ± 9.6	89.9 ± 5.3

[a]Data from the nursery and growing-finishing phases of pigs from Group IX were unavailable and therefore omitted from the data.

dichlorvos litters in group II was 10.8 pigs as compared to 7.7 pigs for control litters ($P < .05$). This is in agreement with Young et al. (1973). Dichlorvos pigs in group VIII were .60 pound heavier ($P < .05$) at birth than pigs from non-treated sows. In groups V and VII the treated sows produced pigs with higher adjusted 28-day weights ($P < .05$) and higher average daily gains ($P < .05$) which agrees with the research of Singh et al. (1968) and Robison and Moncol (1969). Pig survival rates at weaning were 19.7 percent ($P < .05$) and 27.1 percent ($P < .01$) greater for dichlorvos litters over controls in groups I and V, respectively.

Nursery Phase

Litters from dichlorvos treated sows produced a small but insignificant advantage over control litters in all measurements of nursery performance (Table 5, page 21). In group I, average daily gains in the nursery were .49 pound and .68 pound, respectively, for control and dichlorvos litters ($P < .05$). This agrees in part with the findings of improved growth rate of dichlorvos pigs from birth to market by Siers et al. (1977). In group IV, control pigs were an average of 10.7 pounds lighter than dichlorvos pigs at the end of the nursery phase ($P < .05$). Mortality in the nursery was less for pigs from dichlorvos litters in group VII ($P < .01$).

Average daily gains of dichlorvos nursery pigs in groups I and IV and final nursery weights of dichlorvos pigs in group I were greater than those of the controls at levels which approached significance. However, in group II the controls had heavier nursery weights which approached a significant difference from the dichlorvos pigs.

Finishing Phase

A non-significant trend for dichlorvos litters to produce faster growing pigs, more pigs per litter and higher survival rates in the finishing phase was observed in the total analysis. The work of England and Day (1971) is in agreement with these findings. Advantages of 24.6 percent ($P < .05$) and 37.9 percent ($P < .01$) were found for percent marketed for dichlorvos litters in groups I and V, respectively. Daily gains in the finishing phase were higher for the control litters in groups II, VI and VIII ($P < .05$). However, in group V the dichlorvos pigs were the faster gainers ($P < .05$). In addition, the greater average daily gains in groups II and VII for dichlorvos pigs approached significance. Other differences in the finishing phase which approached significance in favor of pigs from dichlorvos litters were pigs marketed per litter in groups I and V and daily gains in group V. However, in group II, daily gains were in favor of the control group ($P < .1$).

Daily gains in the finishing phase were abnormally low for treatment and control pigs as a result of overcrowding in the barns.

III. BREED OF DAM EFFECTS ON PIGS FROM CONTROL AND DICHLORVOS LITTERS

The effects of breed of dam upon dichlorvos treatment were accounted for by examining least-squares means between control and dichlorvos litters. Since all sows were crossbreeds, the breed of dam was determined to be the breed of her sire. Results of this analysis are presented in Tables 15 and 16.

There were no differences ($P > .05$) found between dichlorvos and control litters from birth to market from Duroc, Hampshire or Landrace

TABLE 15. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FOR BREED OF DAM EFFECTS BETWEEN CONTROL AND DICHLORVOS LITTERS FROM BIRTH TO WEANING

	No. sows	No. born alive per litter	No. born dead per litter	Avg. birth wt., lbs.	Avg. adj. 28-day wt., lbs.	ADG, lbs.	No. weaned per litter	Percent weaned of born alive
Duroc[a]								
Controls	24	9.4 ± .50	.46 ± .21	3.4 ± .13	17.2 ± .58	.49 ± .02	8.6 ± .47	91.5 ± 3.8
Dichlorvos	17	8.8 ± .55	.39 ± .23	3.4 ± .14	17.6 ± .60	.51 ± .02	8.3 ± .51	93.8 ± 4.1
Hampshire[a]								
Controls	11	9.2 ± .68	.50 ± .28	3.3 ± .18	15.8 ± .70	.44 ± .02	7.3 ± .63	82.6 ± 5.1
Dichlorvos	18	10.0 ± .52	.40 ± .22	3.2 ± .14	16.5 ± .60	.47 ± .02	7.9 ± .48	80.6 ± 3.9
Landrace[a]								
Controls	19	9.7 ± .51	.22 ± .21	3.3 ± .14	17.6 ± .61	.51 ± .02	8.3 ± .48	86.8 ± 3.9
Dichlorvos	24	9.3 ± .44	.32 ± .19	3.5 ± .12	17.7 ± .49	.51 ± .02	8.2 ± .41	87.6 ± 3.3

[a]Breed of dam determined by breed of her sire.

TABLE 16. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FOR BREED OF DAM EFFECTS BETWEEN CONTROL AND DICHLORVOS LITTERS IN THE GROWING AND FINISHING PHASES

	No. sows	No. alive per litter in nursery	Percent death loss in nursery	Avg. final nursery wt., lbs.	Nursery ADG, lbs.	Percent marketed of born alive	No. marketed per litter	Finishing ADG, lbs.	Days to 230 lbs.
Duroc[a]									
Controls	23	8.4 ± .51	1.59 ± 2.64	38.5 ± 1.93	.61 ± .04	79.5 ± 5.1	7.5 ± .55	1.28 ± .03	221 ± 9
Dichlorvos	13	8.3 ± .60	.65 ± 3.07	40.3 ± 2.25	.66 ± .05	90.1 ± 6.0	8.0 ± .64	1.24 ± .04	218 ± 10
Hampshire[a]									
Controls	11	6.7 ± .62	7.50 ± 3.23	36.5 ± 2.36	.56 ± .05	63.8 ± 6.3	6.0 ± .67	1.13 ± .04	261 ± 11[b]
Dichlorvos	16	7.7 ± .53	2.80 ± 2.72	38.4 ± 1.98	.59 ± .04	70.8 ± 5.3	6.7 ± .56	1.15 ± .04	238 ± 9[c]
Landrace[a]									
Controls	18	8.1 ± .50	3.19 ± 2.58	35.5 ± 1.89	.55 ± .04	72.6 ± 5.0	7.0 ± .53	1.20 ± .03	228 ± 9
Dichlorvos	21	7.7 ± .46	4.05 ± 2.38	38.4 ± 1.74	.60 ± .04	76.8 ± 4.6	7.1 ± .49	1.23 ± .03	228 ± 8

[a]Breed of dam determined by breed of her sire.

[b,c]Least-squares means superscripted with different letters are different (P < .1).

sired sows. However, litters from dichlorvos-treated Hampshire sows reached market weight 23 days before litters from control Hampshire sows. This difference approached significance.

IV. PARITY OF DAM EFFECTS ON PIGS FROM CONTROL AND DICHLORVOS LITTERS

Least-squares means were used to compared the performance traits of control and dichlorvos pigs within sow parity groups (Tables 17 and 18).

There were no significant differences in sow productivity or pig performance from birth to weaning between pigs from treatment and control gilts. This finding disagrees with England and Day (1971) who found pigs from gilts treated with dichlorvos to have heavier birth weights and better survival rates to weaning. However, dichlorvos fed gilts produced litters that performed better in the growing-finishing phase than did controls. Dichlorvos gilts averaged 1.5 more pigs ($P < .05$) coming out of the nursery and 2.2 pigs more marketed per litter for an average of 24 percent more pigs marketed of those born alive per litter ($P < .01$). Pigs from dichlorvos gilts also had a lower death loss in the nursery ($P < .1$).

Pigs from second litter sows on dichlorvos did have an advantage over the controls from birth to weaning by having 2.4 pounds heavier average adjusted 28-day weights and .08 pound greater average daily gains ($P < .01$). This superiority carried over into the growing-finishing phases where dichlorvos-treated second-parity sows produced litters that averaged 6.94 percent less death loss in the nursery ($P < .05$), gained .13 pound faster ($P < .05$) and weighed 9.1 pounds more coming out of the nursery ($P < .01$), marketed 5.3 percent more pigs of those born alive and reached market weight in 24 days less time than the controls.

TABLE 17. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FOR PARITY OF DAM EFFECTS BETWEEN CONTROL AND DICHLORVOS LITTERS FROM BIRTH TO WEANING

	No. sows	No. born alive per litter	No. born dead per litter	Avg. birth wt., lbs.	Avg. adj. 28-day wt., lbs.	ADG, lbs.	No. weaned per litter	Percent weaned of born alive
1st litter gilts								
Controls	18	8.9 ± .56	.40 ± .24	3.1 ± .15	15.9 ± .59	.45 ± .02	7.2 ± .53	82.3 ± 4.2
Dichlorvos	18	9.0 ± .54	.42 ± .23	3.1 ± .14	15.9 ± .58	.46 ± .02	8.1 ± .51	90.4 ± 4.1
2nd litter sows								
Controls	19	10.2 ± .60^{a}	.27 ± .25	3.3 ± .16	16.1 ± .67^{e}	.45 ± .02^{e}	8.4 ± .56	84.2 ± 4.5
Dichlorvos	16	8.9 ± .57^{b}	.22 ± .24	3.5 ± .15	18.5 ± .63^{f}	.53 ± .02^{f}	7.9 ± .53	89.9 ± 4.2
3rd, 4th and 5th litter sows								
Controls	17	9.2 ± .70	.50 ± .29	3.6 ± .19	18.6 ± .73^{a}	.54 ± .02^{a}	8.6 ± .66	94.3 ± 5.2^{c}
Dichlorvos	25	10.2 ± .44	.47 ± .19	3.4 ± .12	17.3 ± .52^{b}	.50 ± .02^{b}	8.3 ± .42	81.7 ± 3.3^{d}

^{a,b}Least-squares means superscripted with different letters are different ($P < .1$).

^{c,d}Least-squares means superscripted with different letters are different ($P < .05$).

^{e,f}Least-squares means superscripted with different letters are different ($P < .01$).

TABLE 18. LEAST-SQUARES MEANS AND STANDARD ERRORS OF SOW AND LITTER PERFORMANCE FOR PARITY OF DAM EFFECTS BETWEEN CONTROL AND DICHLORVOS LITTERS IN THE GROWING AND FINISHING PHASES

	No. sows	No. alive per litter in nursery	Percent death loss in nursery	Avg. final nursery wt., lbs.	Nursery ADG, lbs.	Percent marketed of born alive	No. marketed per litter	Finishing ADG, lbs.	Days to 230 lbs.
1st litter gilts									
Controls	16	6.5 ± .59[c]	8.50 ± 3.03[a]	32.1 ± 2.21	.45 ± .05	61.2 ± 5.9[e]	5.4 ± .63[e]	1.16 ± .04	247 ± 10
Dichlorvos	15	8.0 ± .58[d]	1.63 ± 3.02[b]	33.2 ± 2.20	.52 ± .04	85.2 ± 5.9[f]	7.6 ± .62[f]	1.16 ± .04	235 ± 10
2nd litter sows									
Controls	19	7.7 ± .54	8.17 ± 2.81[a]	36.0 ± 2.10[c]	.58 ± .04[c]	66.3 ± 5.5[c]	6.7 ± .58	1.16 ± .03[a]	245 ± 9[c]
Dichlorvos	15	7.7 ± .56	1.23 ± 2.91[b]	45.1 ± 2.13[d]	.71 ± .04[d]	81.6 ± 5.7[d]	7.0 ± .60	1.23 ± .03[b]	221 ± 10[d]
3rd, 4th and 5th litter sows									
Controls	16	9.0 ± .71	-4.38 ± 3.64[c]	42.3 ± 2.66	.68 ± .05	88.4 ± 7.1[c]	8.3 ± .76	1.29 ± .04	218 ± 12
Dichlorvos	20	7.9 ± .48	4.64 ± 2.48[d]	38.9 ± 1.81	.62 ± .04	70.8 ± 4.8[d]	7.3 ± .51	1.22 ± .03	228 ± 8

[a,b] Least-squares means superscripted with different letters are different ($P < .1$).

[c,d] Least-squares means superscripted with different letters are different ($P < .05$).

[e,f] Least-squares means superscripted with different letters are different ($P < .01$).

Differences which approached significant levels were found for dichlorvos-treated second-litter sows for death loss in the nursery, finishing average daily gain and days to 230 pounds. Number of pigs born alive were greater for controls in this parity group ($P < .1$).

In third, fourth and fifth-litter sows the trend was for the controls to perform better than the dichlorvos group from birth to market. Percent weaned for control litters was 94.3 as compared to 81.7 for the dichlorvos-treated group ($P < .05$). The control litters had 9.01 percent less death loss in the nursery and marketed 17.6 percent more of the pigs born alive ($P < .05$). Average adjusted 28-day weight and daily gains in the nursery for control litters in this parity group approached significance as compared to the dichlorvos litters.

It is the author's opinion that the inconsistency of significance of treatment among parity groups is due to experimental error caused by confounding of breed of dam, parity and dam and treatment within the different farrowing groups.

CHAPTER V

SUMMARY

Data from 113 crossbred Duroc, Hampshire, Yorkshire and Landrace litters were used to study the effects of feeding dichlorvos to the sow during the last 30 days of gestation on sow productivity and pig performance. Least-squares means of performance traits were used to analyze each farrowing group, all farrowing groups combined, the differences within parity of dam and the differences within breed of dam.

There were 1127 pig births from 9 farrowings at Ames Plantation duirng 1980 included in this study. Sows were weighed and sorted into 2 experimental groups 30 days prior to farrowing according to parity, weight and breed. All sows were fed about 4 pounds of feed per day. One group received 1 gram of dichlorvos per head per day from that time to farrowing day. Sows were weighed again at farrowing and weaning. The pigs were ear notched, weighed and needle teeth clipped on day one. On day 3 male pigs were castrated. The pigs were given access to an 18 percent crude protein pelleted creep feed at 7 days of age. Lactating sows were fed 3 to 5 pounds of a 16.3 percent fortified crude protein ration plus 1 pound additional feed for each nursing pig per day.

The pigs were weaned at about 4 weeks of age, weighed and placed in the nursery. The largest one-third of the pigs by weight were randomly assigned to 4 nursing pens, the middle third to 4 pens and the lightweight one-third to the remaining 4 pens. The pigs were subsequently moved to the finishing barns after about 50 days in the nursery. The pigs were weighed at weaning, upon leaving the nursery and at market age.

Analysis resulted in no significant differences between litters from control and dichlorvos treated sows for any of the performance traits measured in the overall study. However, the litters in the dichlorvos group tended to perform better than the controls in every parameter measured, but pig numbers at birth and at weaning.

Breed of dam differences were found to be non-significant between dichlorvos and control litters, but litters from Hampshire dams in the dichlorvos group approached significance over control Hampshire litters in days to 230 pounds.

Several parity of the dam differences between treatment groups were found. Pigs from dichlorvos treated gilts performed better in the growing-finishing phases than the controls. Pigs from dichlorvos second-litter sows out-performed the controls from the same parity group at weaning, in the nursery and by reaching market weight in fewer days. Third, fourth and fifth-litter sows in the control group weaned a higher percentage of pigs, lost a lower percentage in the nursery and marketed a higher percentage of pigs than did the dichlorvos group.

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VITA

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