To the Graduate Council:

I am submitting herewith a thesis written by Susan Jo Bentley entitled "The Effects of Tylosin on Egg Production, Feed Efficiency, and Egg Quality of Single-Combed White Leghorn Hens." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Science.

Robert L. Tugwell

Robert L. Tugwell, Major Professor

We have read this thesis
and recommend its acceptance:

J. P. Hitchcock

R L Murphree

Accepted for the Council:

L Evans Tark

Vice Chancellor
Graduate Studies and Research

Ag-VetMed
Thesis
78
.B447
cop.2

THE EFFECTS OF TYLOSIN ON EGG PRODUCTION, FEED EFFICIENCY, AND EGG QUALITY OF SINGLE-COMBED WHITE LEGHORN HENS

A Thesis
Presented for the
Master of Science
Degree
The University of Tennessee, Knoxville

Susan Jo Bentley

December 1978

1371444

ACKNOWLEDGMENTS

My appreciation goes to the Elanco Company for supplying the antibiotic used in this research. Much gratitude also goes to Dr. Ronald Johnson, Animal Science Department Head, for making this program possible.

Many thanks is given to Mr. George McGhee for his technical assistance and great help in the collection of data. Additional thanks goes to Drs. Bletner, Shirley and Goan for the advice and information they provided.

Dr. Joe Mauldin is worthy of my many thanks for his review of the first draft of this thesis and excellent advice on writing technique. I am also very grateful for the help of Drs. Murphree and Hitchcock for their guidance in my Master's program and their many suggestions for this thesis.

I wish most of all to express my sincere thanks to Dr. Robert Tugwell, who, as my major professor, provided guidance, encouragement and motivation that deserves far more acknowledgment than I can find words for here.

My deepest gratitude goes to my parents for their continual interest, encouragement and support in this program.

And finally, I joyfully express thanksgiving to God in whom I "live and move and have my being" (Acts 17:28a). It is to Him that I dedicate this thesis.

ABSTRACT

The purpose of this study was to evaluate the effect of tylosin on production and egg quality of caged Single-Combed White Leghorn hens under experimental conditions. The antibiotic was administered at the rate of 50 grams per ton of feed to 140 birds while an equal number of hens were fed the basal diet.

Data were collected over a 4 month period. The results of this experiment indicated that tylosin did not significantly ($P<.05$) effect egg production, feed efficiency, or any of the egg quality characteristics (egg shell thickness, albumen height, egg weight, Haugh units, and blood spots or meat spots).

CRANESEY CREST

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
II.	LITERATURE REVIEW	2
	History of Antibiotics	2
	Use of Antibiotics in Animal Feeds	3
	Effects of Antibiotics on Egg Production and Feed Efficiency	7
	Effects of Antibiotics on Egg Quality	8
	Blood and Meat Spots	9
	Tylosin: History-Properties	10
	Effects of Tylosin on *Mycoplasma Gallisepticum*	11
	Tylosin: In Absence of Known Infection	12
III.	EXPERIMENTAL PROCEDURES	14
	Experimental Animals	14
	Experimental Design	14
	Diet Composition	15
	Methods of Data Collection	15
	Analysis of Data	20
IV.	RESULTS AND DISCUSSION	21
	Production Performance	21
	Egg Quality	23
	Conclusion	24
LIST OF REFERENCES		26
VITA		33

CHAPTER I

INTRODUCTION

For several years the growth-promoting properties of antibiotics have been recognized. However, research dealing with the effects of various antibiotics on the production of laying hens is inconclusive. This may be due to dissimilar effects caused by different antibiotics in different environments.

Particularly lacking at this time is information on the effects of the antibiotic tylosin on production. Most poultry research with this antibiotic has been concerned with its possible control of infections caused by *Mycoplasma gallisepticum* (MG). Presently, tylosin's effectiveness against MG is questionable. Even more uncertain, though, is tylosin's influence on poultry production. Therefore, this experiment was conducted to determine tylosin's effectiveness as a stimulant of layer production and efficiency.

CHAPTER II

LITERATURE REVIEW

A. HISTORY OF ANTIBIOTICS

In 1877, it was noted by Pasteur and Joubert that aerobic bacteria antagonized the growth of *Bacillus anthracis*. However, it was not until 8 years later, that Babes (1885) interpreted experiments on microbial antibiosis. He postulated that this antagonistic association was due to production of an inhibitory chemical substance by certain organisms.

Gratia and Doth (1924) extracted a lytic substance from mold and used it successfully in the treatment of staphlococcal skin infection. After this venture, a systematic search was begun for antagonistic microorganisms from natural sources.

The antagonistic properties of molds and fungi, when finally confirmed, led to the discovery of penicillin by Fleming in 1929. This particular research was notable for its clarity and completeness in detail.

As more antibiotics were discovered, it was found that some were more effective against gram negative or gram positive bacteria, while other broad spectrum antibiotics were effective against wide ranges of both gram negative and gram positive bacteria. Both types of antibiotics were found effective at non-toxic levels (Scott, *et al.*, 1976).

B. USE OF ANTIBIOTICS IN ANIMAL FEEDS

Moore, *et al.* (1946) was the first to report that chicks grew more rapidly on diets containing the antibiotic streptomycin. Nevertheless, it was not until 4 years later that this fact was again studied (Stokstad and Jukes, 1950).

Further studies led to the accepted practice of adding antibiotics to animal feeds on a regular basis for their potential growth and production stimulation. When thus used they are accordingly classified as nonnutritive additives and growth promotants (Nutrient Requirements of Poultry, 1977).

The growth promoting effects of antibiotics in poultry are mainly concerned with decreasing a highly variable environmental condition referred to collectively as the "environmental disease level." This level may be present in varying forms and degrees of severity. The problem may be confined to the gastrointestinal tract, or it may involve a systemic infection. Sometimes both types of infection may be involved, either simultaneously or in successive stages (Scott, *et al.*, 1976).

No single mode of action, then can explain the growth promoting effects of antibiotics under a wide range of conditions. Research indicates that the kind and extent of the disease level has the greatest influence on which kinds and amounts of antibiotics will produce positive results over the controls (Scott, *et al.*, 1976). Scott, *et al.*, 1976 discussed

five different ways antibiotics may act and interact as production stimulants. While using their categorizations as a basis, various researcher's studies on antibiotics will be reviewed.

Antibiotics may favor the growth of nutrient-synthesizing and inhibit that of nutrient-destroying microorganisms. Scott suggested that this would be most helpful in borderline deficiencies because of additional nutrients made available through this synthesis. The avian microorganism most commonly implicated with this decreased growth effect is *Clostridium welchii* (Lev and Forbes, 1959; Lev, *et al.*, 1957; Sieburth, *et al.*, 1951). Among other microorganisms of this type are *Clostridium perfrigens* (Stutz, *et al.*, 1976) and *Streptococcus faecalis* (Huhtanen and Pensack, 1965).

Eyssen and DeSomer (1963a) attributed the growth stimulatory effect of antibiotics to the suppression of detrimental intestinal gram positive microorganisms. They found that the addition of 20 ppm virginiamycin (active on gram positive microorganisms) resulted in improved intestinal absorption and stimulation of growth. Eyssen and DeSomer (1963b) also observed a positive correlation between the activity of an antibiotic as a growth promotant and the influence of an antibiotic on intestinal fat absorption of chicks on purified diets. This provided further evidence that growth stimulation was due to suppression of gram positive

intestinal bacteria which interfere with the absorption of nutrients. The findings of Groschke (1950), Pensack (1963) and Huhtanen and Pensack (1965) agree with those of Eyssen and DeSomer (1963a, b).

Antibiotics may inhibit the growth of microorganisms that produce excessive amounts of ammonia and other toxic nitrogenous waste products in the intestine. Visek, *et al.* (1972) proposed that antibiotics alter intestinal bacteria so that less urease is produced and thus less ammonia is formed wherever body fluids containing urea contact bacterial urease. This suggested that antibiotics decrease hydrolysis of ^{14}C-urea in the intestine of rats and, in turn, reduce production of urease by intestinal microorganisms. Braude, *et al.* (1955) suggested that a thickened intestinal wall may result from toxins produced by detrimental microorganisms. He demonstrated that these microbes could be eliminated by feeding low levels of antibiotics. This suggestion supports the next point.

Antibiotics may improve availability or absorption of certain nutrients. Nelson, *et al.* (1963) linked increased efficiency of absorption of calorigenic nutrients with an increase in metabolizable energy and a decrease in intestinal weight. This agrees with Pepper, *et al.* (1953), Coates *et al.* (1955) and Jukes, *et al.* (1956) who found that when antibiotics were fed to chicks, the intestinal weight was significantly

reduced. The length of the gut, and the amount of fat and moisture of the intestinal wall remained the same, with no morphological changes taking place. Jukes, *et al.* (1956) found the effects to be reversable when antibiotics were removed from the diets. The change in intestinal weight in their studies did not appear to be related to the amount of feed consumed by the chickens.

Antibiotics may improve feed or water consumption. Whether this improvement is a primary effect or one due to a better state of health brought about by the use of antibiotics is difficult to ascertain. Fowler and Quisenberry (1968), Deacon and Patterson (1966), Carlson (1959), Eoff, *et al.* (1962) and Potter, *et al.* (1971) reported that the feeding of various antibiotics to laying hens or turkeys increased feed intake, probably resulting in an increase in water consumption (Goodman and Schein, 1974).

Antibiotics may prevent or cure actual pathological diseases which occur either in the intestinal tract or systemically. Black and Bratzter (1952) observed little improvement in energy of nitrogen utilization when antibiotics were fed with nutritionally adequate diets. Forbes and Park (1959) later reported that when chicks were hatched and raised in the absence of bacteria and fungi, they grew 18 to 25 percent faster than similar chicks reared in the

"animal room." Pencillin, however, failed to elicit a growth response in either germ-free chicks or those in the animal room. On the other hand, when diets of chicks were supplemented with intestinal contents from chicks reared where responses to penicillin were regularly obtained, a growth response occurred. With the rise in disease level, the therapeutic effect of pencillin was increased.

Titus and Fritz (1971) also noted that an antibiotic often will improve egg production if the disease level of the premises is high. They postulated that antibiotics that are effective as growth stimulants for chicks may also improve egg production under appropriate conditions.

C. EFFECTS OF ANTIBIOTICS ON EGG PRODUCTION AND FEED EFFICIENCY

Minimal effects have been noted on production characteristics of laying hens when antibiotics were fed continuously at a low level (1-4g/ton; 4-15 ppm, Berg, *et al.*, 1952; Brown *et al.*, 1953; Peterson and Lampman, 1952; Sherwood and Milby, 1954; Sunde, *et al.*, 1952). It was concluded by Damron *et al.* (1966) that supplementation of the diet with low levels of antibiotics is of little benefit when the hens are healthy and producing at a high rate.

High levels (greater than 30g/ton) of antibiotics fed continuously have trended toward improved performance, although in most studies, the improvement has been

nonsignificant (Elam, *et al.*, 1953; Balloun, 1954; Eoff, *et al.*, 1962; Potter, *et al.*, 1963; Yu, *et al.*, 1972).

An improvement in egg production, feed conversion and body weight during a period of heat stress was found in breeder turkey hens fed high levels of oxytetracycline (Deacon and Patterson, 1966). However, in many cases of long term antibiotic feeding (high and low levels) there was a disappearance in response over time. The greatest response was observed during peak production (Waibel, *et al.*, 1954; Libby, and Schaible, 1955; McGinnis, *et al.*, 1958; Heth and Bird, 1962).

D. EFFECTS OF ANTIBIOTICS ON EGG QUALITY

Most of the reports dealing with the feeding of antibiotics to laying hens for nonpathological purposes deal with egg production and feed efficiency. Of some importance are the effects of antibiotics on egg quality. Few studies have included data on this parameter.

Berg, *et al.* (1952) in one of three experiments with laying hens reported that the use of antibiotics at low levels (4-15 ppm) had no effect on the specific gravity of eggs or egg shell smoothness. The studies of Guenther and Carlson (1964) yielded very similar results. Egg size, shell thickness and Haugh units were not significantly effected by the feeding of antibiotics. Peterson and Lampman (1952) also found that egg weight was not improved.

E. BLOOD AND MEAT SPOTS

The presence of blood and meat spots poses a very serious problem for the egg industry because eggs with these spots cannot be marketed. Blood spots occur as a result of the rupture of a small blood vessel in the follicular sac at the time of ovulation. Small blood clots will appear with some adhering to the ovum as it passes through the oviduct and with the completed egg containing these blood spots. In addition, some blood spots from the oviduct may adhere to the yolk. The incidence is related to many things: genetics, feed, age of hen and others (North, 1972).

Certain strains of chickens show a high incidence of blood spots in their eggs (Scott, 1978). However, the main factor known to effect blood spot formation is Vitamin A. With a deficiency of this vitamin, a marked increase in blood spots occur. In addition, a marginal deficiency of Vitamin K has been shown to decrease spotting. The reason for this may be due to the blood diffusing throughout the egg rather than forming a clot (Scott, *et al.*, 1976).

Any tissue that is sloughed from the follicular wall or the oviduct may also be included in part of the developing egg as it passes through the oviduct. These bits of tissue darken with age and are known as meat spots. Many blood spots darken as well, and are often called meat spots (North, 1972).

Few studies have included data on the relationship between the number of meat-blood spots and the use of antibiotics. Berg, *et al.* (1952) reported that the feeding of low levels of antibiotics did not effect the number of blood and meat spots observed.

F. TYLOSIN: HISTORY-PROPERTIES

In the 1950's a missionary in Thailand collected soil samples and sent them to the United States in hopes of finding a new antibiotic. Tylosin, as a result, was obtained from soil isolates identified as strains of *Streptomyces fradiae* (McGuire, *et al.*, 1961).

Tylosin was found to be markedly active against gram positive bacteria, certain gram negative bacteria and mycobacteria. Administered as a tartrate salt, it was effective both orally and parenterally (McGuire, *et al.*, 1961). Berkman *et al.* (1960) in a study of tylosin's toxicity, absorption and excretion in the chicken found tylosin to be nontoxic. Following subcutaneous administration of 25 mg tylosin per kg body weight, blood concentration of the antibiotic peaked at 15 and 30 minutes and declined to zero by 24 hours. Tylosin was found to be eliminated via the urinary and biliary tracts of the chicken. Attempted recovery of the total dose was highly variable following both oral and parenteral treatment.

G. EFFECTS ON TYLOSIN ON *MYCOPLASMA GALLISEPTICUM*

Mycoplasma gallisepticum (MG) infection is commonly called CRD (chronic respiratory disease) of chickens and infectious sinusitis of turkeys. Its symptoms are respiratory rales, coughing, nasal discharge and frequently in turkeys, sinusitis. The clinical characteristics are usually slow to develop, and the disease has a long course. The economic losses due to down-grading of carcasses, reduced feed and egg production efficiency and increased medication costs are additional factors which make this one of the most serious diseases confronting the poultry industry (Yoder, 1978).

Yoder (1978) listed those antibiotics found to be active against MG as streptomycin, spiramycin and tylosin. Siegmund (1973) suggested that tylosin seems to be the most effective of the antibiotics used against MG and recommended its use for that purpose.

The research of Barnes, *et al.* (1961) supports this view. Under experimental conditions, tylosin was found to be effective in controlling MG infections. They suggested that the value of tylosin for the control of CRD under field conditions was yet to be established. Olesiuk, *et al.* (1965) reached a similar conclusion.

Bains (1974) tested tylosin and various other antibiotics under commercial conditions. Tylosin at all treatment

levels gave superior economic gain and control of the clinical signs of CRD. He suggested that a single treatment with tylosin was more economical than two treatments.

It should be noted that tylosin and spiramycin resistant strains of MG have developed, as well as those somewhat resistant to streptomycin and erthromycin (Fahey, 1957; Domermuth, 1958, 1960; Kiser, *et al.*, 1961; Yoder, *et al.*, 1961; Kuniyasu, *et al.*, 1974; and Truscott, *et al.*, 1974).

H. TYLOSIN: IN ABSENCE OF KNOWN INFECTION

Gard and Means (1959) found that tylosin, when fed at the level of 20g/ton on a continuous basis, slightly improved egg production and feed efficiency of layers. With the same dosage in the feed, Atkinson (1966) found the performance of turkeys was also slightly improved.

Gard and Means (1959) conducted three separate experiments with White Plymouth Rock chicks (1 day to 8 weeks), battery-housed chicks (1 day to 6 weeks) and 44-week-old White Leghorn hens (for 112 days). The growth and feed efficiency of the Plymouth Rocks were significantly increased with tylosin added to the feed at the 4g/ton level. For the chicks, slight, but nonsignificant improvements were obtained in feed efficiency and growth at the 4 or 10g/ton level. In addition, at 20g/ton, the caged layers had slightly improved percent hen-day production and feed per dozen eggs.

Yoder (1978) in reference to tylosin stated, "In many cases it is doubtful if the small increase in weight gain or egg production and moderate reduction of carcass condemnation is sufficient to cover the cost of treatment."

It is beyond the scope of this thesis to consider the economics of feeding tylosin. Yet, it is within this author's limitations to determine the extent of tylosin's effectiveness as a stimulant of layer production and efficiency. It was with this purpose in mind that the following study was conducted.

CHAPTER III

EXPERIMENTAL PROCEDURES

A. EXPERIMENTAL ANIMALS

Single-Combed White Leghorn chicks were obtained from a local commercial hatchery. For 20 weeks they were maintained under identical conditions and fed the same diet at the Poultry Research Farm of The University of Tennessee. They were vaccinated for Marek's disease at the hatchery and were debeaked and vaccinated at the farm for infectious bronchitis, Newcastle disease (3 doses for Newcastle-bronchitis at 8 days, 38 days, 16 weeks of age) and fowl pox (1 dose at 10 weeks). In addition, a coccidiostatic drug was given for the first 14 weeks. At monthly intervals, a serum plate test for MG was conducted from randomly selected pullets from individual growing pens. All of these tests proved negative.

Two-hundred and eighty of these pullets were chosen at random for use in this experiment. Just prior to the commencement of this study, they were moved to the Poultry Service Laboratory on the Agricultural Campus of the University.

B. EXPERIMENTAL DESIGN

The experimental design was chosen to determine the response with and without tylosin. In two environmentally

identical rooms at the Poultry Service Laboratory, 80, 250mm by 450mm cages with individual waterers were set up. This consisted of 4 rows of 20 cages each with a double-deck arrangement. Two birds were randomly assigned to each cage. The cages were then sectioned into 24 lots with 12 lots at random placed on each treatment. No culling was done.

C. DIET COMPOSITION

The basal experimental diet was formulated to supply all the nutritional requirements of the White Leghorn hen. The composition of this diet is shown on Table I. Tylosin was the only test variable (0 or 50 grams per ton). The 50 grams of tylosin per ton of feed was within the levels allowed by the FDA for the feeding of chickens for nonpathological purposes* (1976 Feed Additive Compendium).

D. METHODS OF DATA COLLECTION

Following a brief adjustment period, the birds were placed on experimental diets as assigned. Thereafter, eggs were gathered daily and recorded for each lot (replicate). Feeding records were also kept on a daily basis.

---

*FDA does, however, allow 8,000-1,000 grams per ton in broiler and replacement diets for a short period during MG outbreaks.

TABLE I

NONVARIABLES USED IN EXPERIMENTAL DIET

FEEDSTUFF		PERCENT IN DIET
Yellow Corn		65.425
Soybean Meal, 48.5% Protein		20.000
Alfalfa Meal		5.000
Defluorinated Rock Phosphate		1.750
Ground Limestone		6.800
Salt		0.500
Manganese Sulfate		0.025
Vitamin Mix*		0.50
Calculated Analysis		
Crude Protein %		16.61
Metabolizable Energy Cal/kg.		2942.24
Calcium %		3.22
	Total	Available
Phosphorus	.6234	.4075

*Vitamin mix supplied the following amounts per kilogram of diet: 2,498 IU of Vitamin A; 3000 ICU of Vitamin D_3; 455 mg of riboflavin; 25.00 mg. of niacin; 441 mg. of choline; 4.76 mg. of pantothenic acid and 6.6 mg of Vitamin B_{12}.

Once a week eggs were gathered by lot for the purpose of quality testing. This involved determining:

A. Egg weight using a gram scale

B. Egg shell thickness by specific gravity readings

C. Albumen height using a micrometer

D. Number of blood and meat spots.

Eggs were weighed individually to the nearest tenth of a gram. When calculating Haugh units, these determinations were converted to ounces.

Specific gravity of eggs was determined according to Shirley's (1973) guidelines. Eggs were submerged into a series of salt solutions of increasing concentrations. The solution in which a given egg floated was the specific gravity of that egg. Table II shows the comparison of specific gravity of salt solutions for these determinations.

Albumen heights were measured in millimeters for the purpose of determining break-out quality. Figure I shows the relationship of this measurement to Haugh units* and the USDA quality score for 2 ounce eggs.

Meat and blood spots were easily seen on the surface of the egg. By the use of a clear glass break-out table with

---

*Specific numeral value assigned and recognized for the measurements of albumen quality by official inspectors and graders (Card and Nesheim, 1972).

TABLE II

SPECIFIC GRAVITY OF SALT WATER SOLUTIONS FOR EGG SPECIFIC GRAVITY DETERMINATIONS*

Specific Gravity	Score
1.068	0
1.072	1
1.076	2
1.080	3
1.084	4
1.088	5
1.092	6
1.096	7
1.100	8
(Sink in 1.100 solution)	9

*Scores used in the Sixteenth Tennessee Random Sample Laying Test. H. V. Shirley, 1973. Eggs floating in the various specific gravity solutions are given the corresponding score except eggs which sink in the 1.100 specific gravity solution are scored 9.

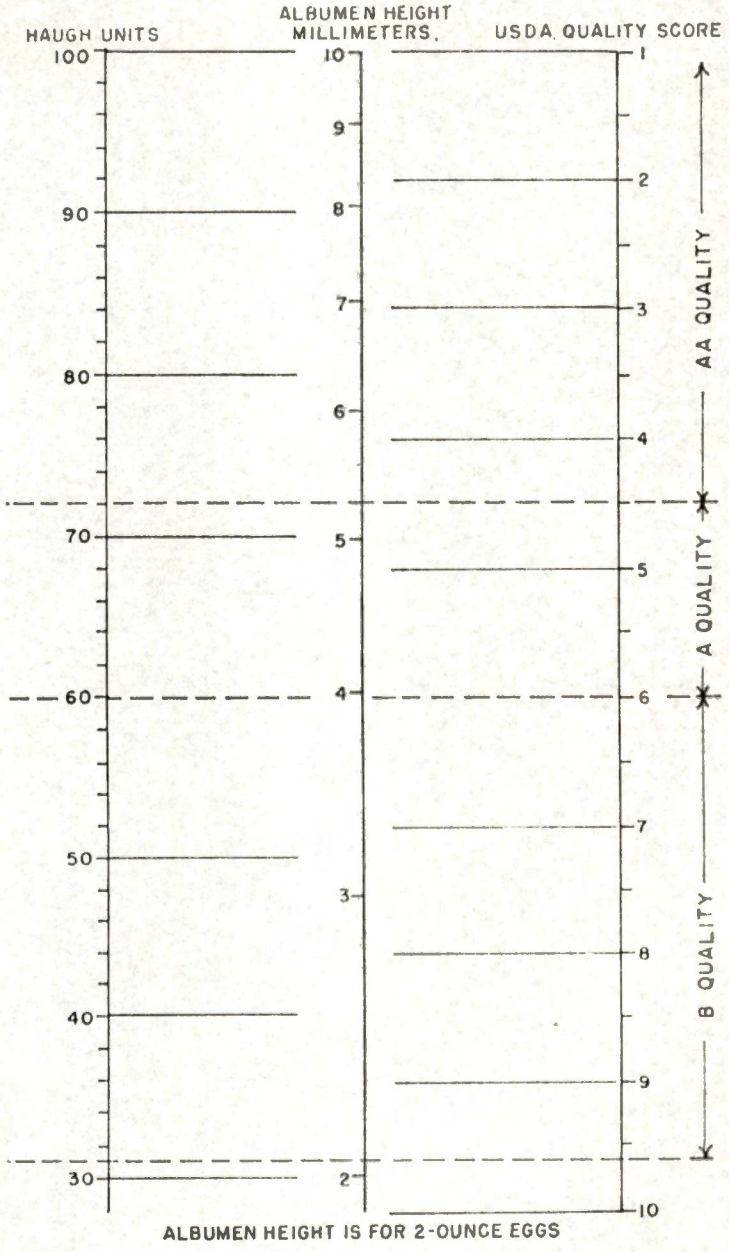


Figure I. Relationship between Haugh units, albumen height, and USDA Quality Score for 2-ounce eggs.

mirrors to view all sides of the egg; all spots could be readily detected.

Along with the data described above, records of mortality were kept. Necropsies were performed at the laboratory facility. In addition, preliminary and final weights of the birds were recorded. The duration of the experiment was 4 months.

E. ANALYSIS OF DATA

Data were analyzed by the calculation of means for the treatments. Student's t-test and the Chi-square test were used to determine if the means were significantly different (Sokal and Rohlf, 1969).

CHAPTER IV

RESULTS AND DISCUSSION

A. PRODUCTION PERFORMANCE

When laying hens fed tylosin at the 50g/ton level were compared with hens on a basal diet without tylosin, no significant differences ($P<.05$) were detected in production performance (Table III). However, the percent production as calculated on a hen day basis approached significance ($P<.1$) as did daily feed consumption. On the other hand, feed per egg on a hen day basis and the total body weight gains were not significant.

Tylosin slightly improved ($P<.1$) egg production. This agrees with Gard and Means (1958, 1959) and Atkinson (1966) who found some improvement in production. When compared to other studies with antibiotics fed at high levels (greater than 30g/ton) tylosin acted in a similar way, causing a slight increase in egg production (Elam, *et al.*, 1953; Balloun, 1954; Eoff, *et al.*, 1962; Potter, *et al.*, 1963; Yu, *et al.*, 1972).

Differences in daily feed consumption on a gram per hen basis also approached significance. However, it was the basal diet that afforded better efficiency. When calculated on a feed per egg per day unit the differences were nonsignificant even at the 0.1 level. These results disagree with Gard and Means (1959) who found feed efficiency was improved in

TABLE III

EFFECT OF TYLOSIN ON PERFORMANCE

Treatment	% Production (Hen-Day Basis)	Daily Feed Consumption (g/hen)	Grams of Feed/Egg (Daily/Basis)	Total Body Weight Gain (g.)
Basal	65.8[a]	129.11[a]	167.19	190.35
Basal + 50g tylosin/ton	71.7[b]	140.21[b]	165.99	196.84

[a,b]Indicates significant differences in means within columns at the P<.1 level.

layers fed tylosin. These findings also differ from previous studies with other antibiotics (Elam, *et al.*, 1953; Balloun, 1954; Eoff, *et al.*, 1962; Potter, *et al.*, 1963; Yu, *et al.*, 1972).

The poultry industry is basically interested in increased efficiency in producing eggs. Although tylosin did cause a slight increase in egg production, it also increased feed consumption. Taking into account the cost of feeding tylosin as well as the above facts, it could be questioned whether tylosin's addition for improved production performance is an economically sound practice (Yoder, 1978).

The fact that hens fed tylosin did not lose weight supports earlier evidence that it is a nontoxic antibiotic (Berman, *et al.*, 1960). These findings agree with Brown, *et al.* (1953) and Peterson, *et al.* (1952). Had a toxicity been present less feed would have been consumed. This would have caused a smaller gain by the tylosin fed birds, or possibly, a loss in weight.

Mortality between groups did not differ. Deaths occurring during the study were not related to the experimental treatment.

B. EGG QUALITY

The effect of tylosin fed at the 50g/ton level on egg quality was nonsignificant at $P < .05$ for all parameters

(Table IV). When Haugh units were calculated, eggs from both groups were scored an 84. This according to USDA grade standards would mean that birds fed tylosin and those on the basal diet were producing AA eggs (Scott, *et al.*, 1976). Three previous studies on various antibiotics reported similar results (Berg, *et al.*, 1952; Guenter and Carlson, 1954; Peterson and Lampman, 1952).

The total number of meat spots and blood spots for both groups did not differ significantly (Table IV). This finding agrees with Berg, *et al.*, (1952).

C. CONCLUSION

The results of this study indicated that when tylosin was fed at the level of 50 gram per ton, it did not significantly effect ($P<.05$) egg production, feed efficiency or any of the egg quality characteristics.

TABLE IV

EFFECT OF TYLOSIN ON EGG QUALITY

Treatment	Ave. Egg Weight (g)	Ave. Albumin Ht. (mm)	Ave. Specific Gravity	Ave. Haugh Units	% Meat Spots	% Blood Spots
Basal	55.37	67.61	4.43	84	2.17	2.73
Basal + 50g. Tylosin/Ton	55.29	68.39	4.48	84	1.79	3.80

CRANES CREST

LIST OF REFERENCES

LIST OF REFERENCES

Atkinson, R. L., C. F. Hall, J. W. Bradley and J. H. Quisenberry, 1966. Effect of tylosin on the reproductive performance of turkeys and the growth rate of their offspring. Poultry Sci. 46: 735-742.

Bains, B. S., 1974. The economic appraisal of the control of chronic respiratory disease in meat chickens. Poultry Sci. 53: 2059-2065.

Babes, V., 1885. J. Conn. Mid. Prat. Paris 7, 321. Quoted in Basis of Chemotherapy, Work, J. S. and Work, E., Interscience Pub. 1948. In: Goldberg, H. S., 1959. Antibiotics; their chemistry and non-Medical uses. D. Van Nostrand Comp., Inc., New York, N. Y. p. 2.

Balloun, S. L., 1954. Effect of high level aureomycin feeding on rate of egg production. Poultry Sci. 33: 867-869.

Barnes, L. E., E. E. Ose, and L. F. Ellis, 1961. Tylosin treatment of experimental *Mycoplasma gallisepticum* infections of chickens and turkeys. Antimicrobial Agents Annual 1960: 605-611.

Berg, L. E., J. S. Carver, G. E. Bearse and J. McGinnis, 1952. Antibiotics in the nutrition of laying hens. Washington Agric. Exp. Sta. Bul. 534.

Berkman, R. N., E. A. Richards, R. L., Vanduyn and R. M. Kline, 1960. The pharmacology of tylosin, a new antibiotic, in the chicken. In: Gray, Tabenkin and Bradley, Editors, 1961. Antimicrobial Agents Annual 1960. Plenum Press, New York, N. Y. p. 595-604.

Black, A. and J. W. Bratzter, 1952. The effects of vitamin B_{12} supplement, vitamin B_{12} and streptomycin on the metabolism of the rat. J. Nutrition, 47: 159-176.

Braude, R., M. E. Coates, M. I. C. Davies, G. F. Harrison and K. G. Mitchell, 1955. The effect of aureomycin on the gut of the pig. Brit. J. Nutr. 9: 363-368.

Brown, J. A., A. R. Robblee and D. R. Clardinin, 1953. The use of penicillin in breeding rations. Poultry Sci. 32: 576-578.

Card, L. E. and M. C. Nesheim, 1972. Poultry Production. Lea and Febiger, Philadelphia, Penn. p. 296-295, p. 284.

Carlson, C. W., 1959. An observation with glucosamine and other additives in a diet for laying hens. Poultry Sci. 38: 1193-1194.

Coates, M. E., M. K. Davies and S. K. Kon, 1955. The effect of antibiotics on the intestine of the chick. Brit. J. Nutr. 9: 110-119.

Damron, B. L., P. W. Waldroup and R. H. Harms, 1966. Effects of arsanilic acid, NF-180, antibiotics and a fermentation product on the performance of caged layers. Poultry Sci. 45: 151-155.

Deacon, L. E. and E. B. Patterson, 1966. The effect of oxytetracycline on the performance of turkey breeder hens. Poultry Sci. 45: 1053-1058.

Domermuth, C. H., 1958. *In Vitro* resistance of avian PPLO to antibacterial agents. Avian Diseases, 2: 442-449.

Domermuth, C. H., 1960. Antibiotic resistance and mutation rates of *Mycoplasma*. Avian Diseases 4: 456-466.

Elam, J. F., R. L. Jacobs and J. R. Couch, 1953. The effect of prolonged feeding of antibiotics upon the performance of laying hens. Poultry Sci. 32: 792-795.

Eoff, H. J., R. E. Davies, T. M. Ferguson and J. R. Couch, 1962. Studies on the influence of terephthalic acid and broad spectrum antibiotics on egg production and egg shell coloration in caged layers. Poultry Sci. 41: 1036-1041.

Eyssen, H. and P. DeSomer, 1963a. The mode of action of antibiotics in stimulating growth of chicks. J. Exp. Med. 117: 127-138.

Eyssen, H. and P. DeSomer, 1963b. Effects of antibiotics on growth and nutrient absorption of chicks. Poultry Sci. 42: 1373-1379.

Fahey, J. E., 1957. Infectious sinusitis of turkeys caused by antibiotic resistant pleuro-pneumonia like organisms. Vet. Med. 52: 305-307.

Feed Additive Compendium, 1976. Miller Publishing Company, Minneapolis, Minnesota. p. 324-326.

Fleming, A., 1929. On the antibacterial action of cultures of a penicillin with special reference to their use in the isolation of *B. influenzae*. Brit. J. Exp. Path. 10: 226. In: Goldberg, H. S., 1959. Antibiotics: their uses. D. Van Nostrand Comp., Inc., New York, N. Y. 1959. p. 3.

Forbes, M., J. T. Park, 1959. Growth of germ-free and conventional chicks: effects of diet, dietary pencillin and bacterial environment. J. Nutrition 67: 69-84.

Fowler, J. C. and J. H. Quisenberry, 1968. Increasing summer feed consumption of commercial layers. Poultry Sci. 47: 1673 (Abstract).

Gard, D. I. and T. M. Means, 1959. The effects of hygroycin B, tylosin and procaine penicillin on chick growth and on layer performance. Poultry Sci. 38: 1207 (Abstract).

Goodman, I. J., M. W. Schein, 1974. Birds, Brain and Behavior. Academic Press, New York, N. Y., p. 107.

Gratia, A. and Doth, S., 1924. Propriet's Bacteriolytiques De Certaines Moisissures. Compte. Rendu Biol. Pair, France. 91: 1442. In: Goldberg, H. S., 1959. Antibiotics: their chemistry and nonmedical uses. D. Van Nostrand Compl., Inc., New York, N. Y., p. 2-3.

Groschke, A. C., 1950. Relation of growth stimulating properties of antibiotics to unidentified growth factors required by the chick. Poultry Sci. 29: 760.

Guenther, E. and C. W. Carlson, 1964. Antibiotics in laying hen diets. Poultry Sci. 43: 1324 (Abstract).

Heth, D. A. and H. R. Bird, 1962. Growth response of chicks to antibiotics from 1950-1961. Poultry Sci. 41: 755-760.

Huhtanen, C. N. and J. M. Pensack, 1965. The role of *streptococcus faecolis* in the antibiotic growth effect in chickens. Poultry Sci. 44: 830-834.

Jukes, H. G., D. C. Hill and H. D. Branion, 1956. Effect of feeding antibiotics on the intestinal tract of chicks. Poultry Sci. 35: 716-723.

Kiser, J. S., F. Popken and J. Clemente, 1961. The development of resistance to spiramycin, streptomycin and chlortetracycline by *Mycoplasma gallisepticum* in chick embryos. Avian Diseases, 5: 283-291.

Kuniyasu, C., Y. Yoshida and M. Takano, 1974. Spiramycin-tylosin-resistance strains of *Mycoplasma gallisepticum* isolated from breeding chickens and pipped eggs. Natl. Inst. Anim. Health Q. 14: 48-53.

Lev, M., C. A. E. Briggs and M. E. Coates, 1957. The gut flora of the chick 3. Difference in cecal flora between "infected," "uninfected" and penicillin fed chick. Brit. J. Nutr. 11: 364-372.

Lev, M. and M. Forbes, 1959. Growth response to dietary penicillin of germ-free chicks and of chicks with a defined intestinal flora. Brit. J. Nutr. 13: 78-84.

Libby, D. A. and P. J. Schaible, 1955. Observations on growth responses to antibiotics and arsenic acids in poultry feeds. Science 121: 733-734.

Moore, P. R., H. Evenson, T. D. Luckey, E. McCoy, C. A. Elevehjem and E. B. Hart, 1946. Use of sulfasuxidine, streptothricine and streptomycin in nutritional studies with the chick. J. Biol. Chem. 165: 437-441.

McGinnis, J., L. H. Merrill, R. E. Fry and L. S. Jensen, 1958. Use history of antibiotics as related to their efficacy in promoting growth of turkeys. Poultry Sci. 37: 810-813.

McGuire, J. M., W. S. Boniece, C. E. Higgins, M. M. Hoehn, W. M. Stark, J. Westhead and R. N. Wolfe, 1961. Tylosin, a new antibiotic: I. Microbiological studies. Antibiot. and Chemother. 11: 320-327.

Nelson, F. E., L. S. Jenson and J. McGinnis, 1963. Studies on the stimulation of growth by dietary antibiotics. Poultry Sci. 42: 909-912.

North, M. C., 1972. Commercial Chicken Production Manual. The Avi Publishing Co., Inc., Westport, Conn. p. 26, 285, 382.

Nutrient Requirements of Poultry, 1977. National Academy of Sciences, Washington, D. C. p. 10.

Olesuik, O. M., H. Van Rockel and N. K. Chandiramani, 1965. Control of experimental *Mycoplasma gallisepticum* infection in young chickens with tylosin and other antibiotics. Avian Diseases 9: 67-77.

Pasteur, L. and Joubert, S. F., 1877. Chimie Phisiologique Carbon et Septocemi. C. R. Soc. de Biol. 85: 101. In: Goldberg, H. S., 1959. Antibiotics: their chemistry and nonmedical uses. D. Van Nostrand Comp., Inc., New York, N. Y., 1959. p. 2.

Pensack, J. M., 1963. The malabsorption syndrome in chicks. Proc. 18th Annual Texas Nutritional Conference. 18: 119-131.

Pepper, W. F., S. J. Slinger and I. Motzok, 1953. Effect of aureomycin on the niacin and manganese requirements of chicks. Poultry Sci. 32: 656-660.

Peterson, C. F. and C. E. Lampman, 1952. Value of antibiotics in rations for egg production. Poultry Sci. 31: 1067-1069.

Potter, L. M., F. A. Ryan and L. D. Matterson, E. P. Singsen and J. Flustohowiez, 1963. Effects of erthyromycin on performance of laying hens. Poultry Sci. 42: 1400-1406.

Potter, L. M., J. R. Shelton and L. G. Melton, 1971. Effects of bacitracin, a fermentation residue, selenium and corn distillers dried grains in diets of young turkeys. Poultry Sci. 50: 1619 (Abstract).

Scott, M. L., 1978. Nutritional deficiency diseases. In: Hofstad, M. S., B. W. Calnek, C. F. Helmboldt, W. M. Reid and H. W. Yoder, Jr., Editors, 1978. Diseases of Poultry. Iowa State University Press, Ames, Iowa, p. 54.

Scott, M. L., M. C. Nesheim and R. J. Young, 1976. Nutrition of the chicken, 2nd Ed. M. L. Scott and Associates, Ithaca, N. Y., p. 385-387.

Sherwood, D. H. and T. T. Milby, 1954. Further tests with antibiotics for laying and breeding hens. Poultry Sci. 33: 1031-1033.

Shirley, H. V., 1973. The sixteenth Tennessee random sample laying test. A comparison of the performance of 13 strains of layers in cages as influenced by laying diets. Univ. of Tenn., Knoxville, Tenn.

Sieburth, J. McN., J. Gutierreg, J. McGinnis, J. R. Sleth and B. H. Schneider, 1951. Effect of antibiotics on intestinal microflora and on growth of turkeys and pigs. Proc. Soc. Expl. Biol. Med. 76: 15-18.

Siegmund, O. H., Editor, 1973. *The Merck Veterinary Manual*, 4th ed. Merck and Co., Inc., Rahway, N. J. p. 1054.

Sokal, R. R. and F. J. Rohlf, 1969. Biometry. W. H. Freeman and Company, San Francisco, California, p. 220-223.

Stokstad, E. L. R. and T. H. Jukes, 1950. Further observations on the "animal protein factor." Proc. Soc. Exper. Biol. Med. 73: 523-525.

Stutz, W. M. and F. R. Judith, 1976. The effects of diet and antibiotic on the intestinal flora of the chick. Poultry Sc. 55: 2098 (Abstract).

Sunde, M. L., J. G. Holpin and W. W. Cravens, 1952. The effect of vitamin B_{12} supplements on egg production and hatchability. Poultry Sci. 31: 617-620.

Titus, H. W., J. C. Fritz, 1971. The Scientific Feeding of Chickens, 5th Ed. The Interstate Printers and Publishers, Inc., Danville, Illinois. p. 32-35.

Truscott, R. B., A. E. Ferguson, H. L. Ruhnke, J. R. Pettit, A. Robertson and G. Speckmann, 1974. An infection in chickens with a strain of *Mycoplasma gallisepticum* of low virulence. Can. J. Comp. Med. 38: 341-343.

Visek, W. J., J. M. Baron and D. M. Swritz, 1972. Urea metabolism and intestinal ureolytic activity of rats fed antimicrobial agents. J. Pharmacol. Exptl. Therap. 126: 359-365.

Waibel, P. E., O. J. Abbott, C. A. Bowman and H. R. Bird, 1954. Disappearance of growth response of chicks to dietary antibiotics in an "old" environment. Poultry Sci. 33: 1141-1146.

Yoder, H. W., 1978. Mycoplasma gallisepticum infection. In: Hofstad, M. S., B. W. Calnek, C. F. Helmboldt, W. M. Reid and H. W. Yoder, Jr., Editors, 1978. Diseases of Poultry. Iowa State University Press, Ames, Iowa. p. 236-237, p. 246.

Yoder, H. W., Jr. C. L. Nelson and M. S. Hofstad, 1961. Tylosin, an effective antibiotic for treatment by PPLO turkey sinusites. Vet. Med. 56: 178-180.

Yu, W. C. Y., J. C. Gilbreath, R. E. Corstreet, R. D. Morrison, 1972. The effects of antibiotics on the reproductive performance of female turkeys. Poultry Sci. 51: 273-277.

VITA

Susan Jo Bentley was born in Lexington, Kentucky on November 14, 1954. She attended several public schools throughout Kentucky and Tennessee and was graduated from Hixson High School in Chattanooga in 1972. She entered The University of Tennessee in September of 1972. Between her junior and senior years (June to December 1975), Miss Bentley worked as an assistant agriculturalist in Colombia, South America with Wycliffe Bible Translators. In December of 1976, she was graduated from the University with a Bachelor of Science degree in Agriculture.

In January 1977, Miss Bentley entered the Graduate School of The University of Tennessee. She received a research assistantship in Animal Science in June of that year.

After graduation with a Master of Science degree in Animal Science in December 1978, she will be going to Nigeria with Sudan Interior Mission as a specialist in poultry. Her future plans are to continue with this organization as a career missionary.