AN ABSTRACT OF THE THESIS OF

Gregory D. Simpson for the degree of Master of Science in Poultry Science presented on July 22, 1985

Title: Studies with Broilers Reared on Different Floor Types With and Without Padded Roosts

Redacted for Privacy

Abstract Approved: ________________________________

I. Performance and Carcass Quality of Broilers Raised on Wire Flooring With and Without Padded Roosts

Two experiments were performed with broilers raised on wire flooring with and without padded roosts to study the effects of bird performance and carcass quality. Each experiment had 480 straight-run commercial broilers divided equally into two treatments and reared on wire with and without padded roosts. At 49 days of age, body weights were taken and feed conversions were calculated. Birds were observed for percent mortality, percent deformed legs, percent breast blisters, percent feather follicle infection (folliculitis) and foot pad dermatitis. In Experiment 1, percent incidence breast blisters was the only parameter with a significant difference (P<.05) between birds on plain wire and birds reared on wire with
padded roosts. In Experiment 2, no significant differences were observed in the parameters measured between the birds reared on wire with and without padded roosts.

II. Performance and Carcass Quality with Broilers Reared On Wire Flooring, Plastic Inserts, Wood Slats and Plastic Coated Expanded Metal Flooring Each With and Without Padded Roosts

Commercial straight-run broilers were reared on non-litter flooring in two experiments. Experiment 1 had (control on wire; wire with padded roosts; wood slats; wood slats with padded roosts; plastic insert over wire; plastic insert over wire with padded roosts; plastic coated expanded metal; plastic coated expanded metal with padded roosts) to study the effects on broiler performance and carcass quality.

In Experiment 1, mean body weights, foot pad dermatitis, feed conversion and percent incidences of mortality, deformed legs and body fat were not significantly different among the treatments. Feather soilage score and percent incidence of feather follicle infection were significantly higher (P<.05) for broilers reared on wood slats with and without padded roosts compared to those reared on wire and plastic inserts. Percent incidence breast blister was significantly higher
(P<.05) for controls on wire than all other treatments.

In Experiment 2, mean body weights, feed conversion and percent incidences of feather follicle infection, deformed legs and mortality were not significantly different among treatments. Feather soilage score was significantly lower (P<.05) with birds reared on wire both with and without padded roosts than those on expanded metal. Foot pad dermatitis scores and percent incidence breast blisters were significantly higher (P<.05) among controls on wire than birds on wire with padded roosts and birds on expanded metal. Percent incidence of indented keels was significantly higher (P<.05) with birds reared on floors with roosts than those without roosts.
STUDIES WITH BROILERS REARED ON DIFFERENT FLOOR TYPES WITH AND WITHOUT PADDED ROOSTS

by

Gregory D. Simpson

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My deepest gratitude and appreciation go to my wife Joyce, my daughter, Amber, and my late son, Jesse. The happiness my family gave me is the major inspiration to fulfill this major undertaking.

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Many thanks to Mr. Mark Bland and Dr. Robert Buckner for their assistance and friendship.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td></td>
</tr>
<tr>
<td>GENERAL INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>3</td>
</tr>
<tr>
<td>II.</td>
<td></td>
</tr>
<tr>
<td>REVIEW OF LITERATURE</td>
<td>4</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>12</td>
</tr>
<tr>
<td>III.</td>
<td></td>
</tr>
<tr>
<td>PERFORMANCE AND CARCASS QUALITY OF BROILERS RAISED ON WIRE FLOORING WITH AND WITHOUT PADDED ROOSTS</td>
<td>16</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>17</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>17</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>19</td>
</tr>
<tr>
<td>RESULTS AND DISCUSSION</td>
<td>22</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>26</td>
</tr>
<tr>
<td>IV.</td>
<td></td>
</tr>
<tr>
<td>PERFORMANCE AND CARCASS QUALITY WITH BROILERS REARED ON WIRE FLOORING, PLASTIC INSERTS, WOOD SLATS AND PLASTIC COATED EXPANDED METAL FLOORING EACH WITH AND WITHOUT PADDED ROOSTS</td>
<td>28</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>29</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>30</td>
</tr>
<tr>
<td>MATERIALS AND METHODS</td>
<td>31</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS, cont.

RESULTS AND DISCUSSION .......................... 35
FOOTNOTES ......................................... 41
REFERENCES ......................................... 42

V. BIBLIOGRAPHY ..................................... 44
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>III. 1</td>
<td>COMPOSITION OF BROILER STARTER AND FINISHER FEEDS</td>
</tr>
<tr>
<td>III. 2</td>
<td>PERFORMANCE DATA OF BROILERS REARED ON WIRE WITH AND WITHOUT PADDED ROOSTS FROM 3 TO 7 WEEKS OF AGE (EXPERIMENT 1)</td>
</tr>
<tr>
<td>III. 3</td>
<td>PERFORMANCE DATA OF BROILERS REARED ON WIRE WITH AND WITHOUT PADDED ROOSTS FROM 3 TO 7 WEEKS OF AGE (EXPERIMENT 2)</td>
</tr>
<tr>
<td>IV. 1</td>
<td>COMPOSITION OF BROILER STARTER AND FINISHER FEEDS</td>
</tr>
<tr>
<td>IV. 2</td>
<td>PERFORMANCE DATA OF BROILERS REARED ON FLOORINGS WITH AND WITHOUT PADDED ROOSTS TO 7 WEEKS OF AGE (EXPERIMENT 1)</td>
</tr>
<tr>
<td>IV. 3</td>
<td>PERFORMANCE DATA OF BROILERS REARED ON FLOORINGS WITH AND WITHOUT PADDED ROOSTS AND WITH AND WITHOUT DRUGS TO 7 WEEKS OF AGE (EXPERIMENT 2)</td>
</tr>
</tbody>
</table>
CHAPTER I
STUDIES WITH BROILERS REARED ON DIFFERENT FLOOR TYPES WITH AND WITHOUT PADDED ROOSTS

INTRODUCTION

Considerable interest has been shown in the last few years with rearing broilers on raised floors. There are several reasons for this interest. First, the increasing shortage and the high cost for the litter materials may make rearing broilers by alternate means more feasible. The most popular litter materials used in the Pacific Northwest are wood shavings and sawdust which have doubled in cost since 1975 (Reece et al., 1971; Henderson, 1983). Second, bird densities during rearing can be increased in existing buildings rather than expanded into newly constructed broiler buildings (Reece et al., 1971; Proudfoot et al., 1979). McDaniel (1981) reported approximately 25 percent more birds can be grown in a house with suspended flooring than on litter flooring. Third, there was two cents per bird savings realized with the elimination of coccidiostats. Fourth, the bird showed more weight gain (McDaniel, 1981). Other reasons given were: broilers raised on suspended flooring had less problems with dust and ammonia (Randall, 1982; Hefferman, 1982; Henderson, 1983); drinkers and feeders were kept
free of litter; birds were cleaner; litter was not being consumed by the birds; the disease build-up in litter was avoided (Reece et al., 1971); and the time saving and trouble of placing the litter in and removing it from the house after the birds have gone to market was eliminated (Randall, 1982).

Many floor types have been studied as alternatives to litter. The most prevalent problem which arises with all of these alternative floor types is the incidence of breast blisters which can downgrade the carcass. Other problems are foot and leg disorders, indented keels and folliculitis.

The purpose of this study was to compare the performance of straight-run broilers reared on four different floor types. The floor types were: steel wire flooring (mesh of 2.54 cm sq.) with and without plastic mat inserts placed over the wire flooring; wood slats (2.54 cm wide spaced 2.54 cm apart) and plastic coated expanded metal flooring. Each of the floor types was used with and without padded roosts. Birds raised on the expanded metal flooring were fed rations with and without antibiotics.
REFERENCES


CHAPTER II

STUDIES WITH BROILERS REARED ON DIFFERENT FLOOR TYPES
WITH AND WITHOUT PADDED ROOSTS

REVIEW OF LITERATURE

Carcass quality, use of roosts and elimination of drugs from the feed with broilers reared on non-litter flooring will be reviewed.

Part A.

Carcass Quality Resulting from Broilers Raised
On Non-Litter Flooring

Carcass quality can be affected by breast blisters, leg or foot problems and folliculitis. These abnormalities have been reported by various investigators when broilers were reared on non-litter flooring.

Breast blisters were the most prevalent problem with non-litter flooring. Reece et al. (1971) suggested that resilience of floor material is an important factor to consider for reducing breast blisters in broilers and that the floor material should be comparable to litter.

What exactly is a breast blister? O'Neil (1943)
described a formation (breast blister) as being found between the keel bone and the skin of the breast. The skin above the formation becomes movable, often with few or no feathers, thinned out, glossy and gives the appearance of being thickened. Breast blisters vary in size and shape somewhat similar to a small bean with others having an oval shape, with a length (parallel to the keel) of seven centimeters or more, and cross diameter (perpendicular to the keel) of two centimeters. When opened, the cyst-like formations are found to be filled with a sterile viscous fluid which usually is brownish but in some cases distinctly red due to a fresh hemorrhage. A microscopic examination shows the walls of the cyst consisted of three kinds of connective tissue: very loose connective tissue which is mesenchyma; white fibrous connective tissue and fibrous cartilage. From an anatomical and histological point of view, O'Neil (1943) also suggested that the cyst-like formation might be considered a bursa synovalis. This suggests the need for protection against pressure or friction. The cystic formations occur in a place where the skin is pressed against the keel bone by the weight of the resting bird. Thus, an interposed bursa would protect the skin against pressure from above, and could possibly protect the keel from pressure, due to the hard surface substituting the litter floor. Hodgson and Gutteridge (1941) and Kondra and Cavers (1947) also presented
evidence that keel blisters are largely a defense mechanism. The blister is usually a pocket of amber fluid under the skin, presumably formed through irritation caused by contact with roosts, wire floors and wet litter. Koonz et al. (1963) reported that blister development was prevented through the removal of part of the keel bone. Males were more commonly afflicted than females (Kondra and Cavers, 1947; Stephenson et al., 1960). Kondra and Cavers (1947) found that slow feathering chickens were more susceptible to breast blisters than fast feathered birds. Funk and Savage (1956) concluded that feather covering of the breast was an important factor in preventing breast blisters. Lloyd et al. (1971) showed that broilers weighing 1.70 and 1.81 kilograms reared on wire floor had incidences of 21.7 and 27.3 percent breast blisters, respectively. Reece et al. (1971) showed that colder temperatures significantly increased the incidence of breast blisters.

The use of different litter materials also have predisposed to breast blisters in broilers. Smith (1956) and Wabeck (1984) found that birds maintained on whole corn cobs had a higher incidence of breast blisters than birds raised on either wood shavings or sawdust, or ground corn cobs. Using the most popular litter materials in the Northwest, wood shavings, can predisposed birds to breast blisters especially when the shavings become caked and
hardened. Proudfoot et al. (1979) reported that broilers raised on wood shavings at bird densities of 9.27, 7.44, 5.55 and 3.42 square decimeters per bird resulted in 18, 26, 26, and 40 percent incidence of breast blisters for males and 5, 5, 11 and 16 percent incidence for females, respectively.

A variety of flooring materials have been investigated for several years in an attempt to find a better type on which to raise broilers. The use of some flooring materials resulted in a higher incidence of breast blisters than floors plus litter (McDaniel, 1981). Wire flooring is the most popular replacement for litter flooring but has also caused the highest incidence of breast blisters. Koonz et al. (1963) suggested that wire floors encourage blister development. Reed et al. (1966) reported breast blister incidence of 70 percent from broilers raised on 2.54 square centimeters plastic coated wire. They also showed that raising broilers on 2.54 centimeters wood slats resulted in 33 percent incidence of breast blisters with no decrease after painting the slats with epoxy paint. However, wood slats covered with .64 cm of sponge rubber reduced the incidence down to 14 percent. Peterson et al. (1971) found 34 percent breast blister incidence in females and 69 percent with males when grown on slatted floors whereas 64 percent with females and from 82 to 100 percent breast blisters with males when grown on
wire. These investigators concluded that flat wooden slat flooring is more suited for maintaining broilers than wire flooring. Welch et al. (1970) found breast blister incidence to be from 68 to 91, from 55 to 82, from 60 to 67, and from 2 to 10 percent with broilers reared on wire floors, wood slats, plastic mesh and litter, respectively. Andrews and Goodwin (1973) recorded 2, 17 and 77 percent breast blisters with broilers raised on slatted wood floors, plastic mats and wire, respectively. May et al. (1982) reported 17, 82, 4.6 and 56 percent incidences of breast blisters with broilers raised on litter, wire, plastic mats and plastic cage liners over wire floors, respectively. Reece et al. (1971) reported that broilers raised on plastic mats made of Dupont 60 PDS 36 Vexor netting (3 mm thick) resulted in 60 percent of the males and 26 percent of the females developing breast blisters. Koonz et al. (1963) suggested that rearing of birds on rubber pads retarded breast blister formation. McCune and Dellman (1968) reduced the incidence of breast blisters by raising broilers on 2.5 cm thick polyurethane bats. Plastic coated expanded metal flooring was reported to have reduced breast blisters considerably in broilers (McDaniel, 1981).

Another problem resulting from rearing broilers on wood-slatted, wire and plastic mat floors is the high incidence of leg abnormalities, including foot pad
dermatitis and perosis. Andrews et al. (1974) reported incidence of 2 percent, from 4 to 9.2 percent, and from 8.5 to 15 percent of deformed legs with broilers raised on wood slats, wire and plastic mat flooring, respectively. Randall (1982) suggested that wood slats warp in time resulting in trapped and damaged legs. Feather soiling has been reported as being a problem with birds raised on plastic mats. May et al. (1982) reported feather soiling to be greater for birds raised on plastic mats than those raised on wire, with the incidence increasing when birds are fed coccidiostats. Along with feather soiling came the problem of folliculitis (Andrews et al. 1974). Follicle infection appears as small pimples in the breast area around the keel. Males are found to have a higher incidence of folliculitis due to the heavier weight of the males. May et al. (1982) reported broilers raised on plastic mats had a higher incidence of follicle infection than birds on litter or wire flooring. Flooring materials (mats, expanded metal) with a greater surface area resulted in a higher incidence of folliculitis than flooring with a small surface area. This concept assumes that the moisture absorbing ability of the floors are similar.
Part B.

Using Roosts to Improve Carcass Quality of Broilers Raised On Non-Litter Flooring

Very little research has been reported with broilers reared on non-litter flooring with roosts. It is thought that the bird's instinct to roost had been bred out of the commercial broiler strains. Hughes and Elson (1977) found that broilers kept in floor pens would use perches only when floor space was scarce. This was governed by the age and the size of the birds and by the bird density. The number of broilers perching at 8 weeks of age seemed to be such that the density of the birds on the floor was maintained at 17 birds per meter. Hughes and Elson (1977) also found that 30 percent of the birds using the perches were males. Lill (1968) and Abdou et al. (1973) also found that males spent more time on roosts than hens. Lurcher and Hurnik (1984) suggest that hens may have a behavioral need to roost. However, Faure and Jones (1982) found no sex differences in perching behavior. Wire mesh perches were used more than the wood roosts. Also certain strains of domestic fowl perched more in the afternoon than mornings.

One possible benefit in using perches would be to allow broilers reared on wire floors an alternative to the
wire flooring which might reduce the incidence of foot disorders. Perches were found to decrease foot damage in caged broiler breeders (Anonymous, 1977). Twenty-seven percent of 8 week-old broilers used perches provided to them at any one time. Almquist (1982), reported perches reduced the incidence of leg problems with birds raised in cages. Birds with perches also gained more weight but had the same feed conversion. Lurcher and Hurnik (1984) reported beneficial effects on hen well being by reducing foot injuries. A possible problem with raising birds, with available roosts, was noted by Shoffner and Canfield (1956). Broilers raised up to 49 days on wire flooring along with the wooden roosts had a ten percent incidence of crooked keels and 30 percent of the birds had breast blisters. Roosting contributed to the incidence of crooked keels and breast blisters.
REFERENCES


CHAPTER III

PERFORMANCE AND CARCASS QUALITY OF BROILERS RAISED ON
WIRE FLOORING WITH AND WITHOUT PADDED ROOSTS

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Oregon State University
Corvallis, Oregon 97331

1Oregon Agricultural Experiment Station Technical Paper No. Research conducted in partial fulfillment of the requirement for the degree of Master of Science.
ABSTRACT

Two experiments were performed with broilers raised on wire flooring with and without padded roosts to study the effects on bird performance and carcass quality. Each experiment had 480 straight-run commercial broilers divided equally into two treatments and reared on wire with and without padded roosts. At 49 days of age, body weights were taken and feed conversions were calculated. Birds were observed for percent incidences of mortality, deformed legs, breast blisters, folliculitis and foot pad dermatitis. In Experiment 1, the percent incidence of breast blisters was significantly lower (P<.05) in broilers reared on plain wire with padded roosts compared with broilers on plain wire without roosts. No significant differences with and without padded roosts were observed in mean body weights, feed conversion, foot pad dermatitis, and percent incidences of mortality, deformed legs and folliculitis. In Experiment 2, no significant differences with broilers reared on wire with and without padded roosts were observed in mean body weight, feed conversion, foot pad dermatitis, and percent incidences of mortality, deformed legs, breast blisters and folliculitis.

INTRODUCTION

Considerable interest has been shown in the last few
years with rearing broilers on raised floors. There are several reasons for this interest. First, the increasing shortage and the high cost for the litter materials make rearing broilers by alternate means more feasible (Reece et al., 1971; Henderson, 1983). Second, bird density during rearing can be increased in existing buildings (Reece et al., 1971; Proudfoot et al., 1979). Third, there is a two cents per bird savings from the elimination of coccidiostats, and more weight gain (McDaniel, 1981). Other reasons given were: broilers raised on non-litter flooring had less problems with dust and ammonia (Randall, 1982); drinkers and feeders were kept free of litter; birds were cleaner; and the disease build-up in litter is removed from direct contact with the birds (Reece et al., 1971).

Wire flooring has been the primary substitute for litter flooring but has caused problems with carcass quality. Koonz et al. (1963) suggested that wire floors favor blister development. Andrews et al. (1974) reported 4 and 9 percent deformed legs with broilers raised on wire.

The use of roosts or perches have been shown to improve leg quality. Such usage of perches decreased foot damage in caged broiler breeders (Anonymous, 1977). Almquist (1982) reported that perches reduced the incidence of leg disorders with birds raised in cages.

The purposes of these two experiments were to compare
broiler performance and carcass quality of straight-run broilers reared from 3 to 7 weeks of age on wire floors (mesh of 2.54 cm sq.) with and without padded roosts. The roosting space for Experiment 1 and 2 was 7.6 and 13.1 linear cm per bird, respectively.

MATERIALS AND METHODS

Four hundred and eighty straight-run commercial broiler chicks were reared on wire floor pens in a windowless positive pressure house in each of two experiments. Each experiment had two treatments with each treatment consisting of three replicates. The two treatments were: birds reared on wire (mesh of 2.54 cm sq.) without and with padded roosts. The roosts were constructed using wooden slats (5.1 cm x 5.1 cm x 2 m). On top of each wooden roost, 1.27 cm of foam rubber was fastened with duct tape. Three roosts were spaced 61 cm apart in each roost pen in Experiment 1, and five roosts were spaced 40 cm apart in each roost pen for Experiment 2. The roosting space were 7.6 and 13.1 linear cm per bird for Experiment 1 and Experiment 2, respectively. The padded roosts were placed in the pens from 3 to 7 weeks of age. In each of the two experiments, the treatments were randomly assigned to the six pens. Eighty chicks were placed in each of the 6 pens (2.1 m x 2.1 m/pen) giving
each bird 550 cm$^2$ of floor space. A wire screen (1 m x 1 m, with a mesh of 1.27 cm$^2$) was placed on top of the flooring in each pen for the first three weeks. Corrugated cardboard was placed on top of one-fourth of the floor directly below the heat lamps for the first two days to prevent draft.

The birds were brooded using electric infrared heat lamps up to three weeks of age, and warm room brooding from three to seven weeks of age using electric space heaters. The room temperature dipped to a low of 15$^\circ$C in the winter months. Incandescent lights were provided 24 hrs a day throughout the growing period. Water and feed were provided *ad libitum*. The chicks were fed a well fortified, balanced starter mash up to three weeks of age, and a balanced finisher mash from three to seven weeks of age (Table III. 1). The two feeds contained zinc-bacitracin (40g/ton) and were free of coccidiostats.

Mean body weight gain, feed conversion and incidences of foot pad dermatitis, mortality, breast blisters, deformed legs and folliculitis were determined for the 3-7 week period. The first four traits were observed prior to sending the birds to the processing plant. Foot pad dermatitis was scored from 1 to 5 (1 = negative, 5 = severe) for individual birds. Leg abnormalities were considered as any indication of crippling of the bird due to perosis. The incidences of breast blisters and
TABLE III. 1 Composition of broiler starter and finisher feeds

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<tr>
<th>Ingredients</th>
<th>Starter</th>
<th>Finisher</th>
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<tr>
<td>Corn, Yellow</td>
<td>58.35</td>
<td>63.52</td>
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<tr>
<td>Soybean meal, 47.5% CP</td>
<td>32.25</td>
<td>27.50</td>
</tr>
<tr>
<td>Meat meal w/bone ml, 50% CP</td>
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<td>5.00</td>
</tr>
<tr>
<td>Fat, animal</td>
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<td>2.00</td>
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<tr>
<td>Alfalfa meal, dehy, 17% CP</td>
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<tr>
<td>Defluo. Rock Phos.</td>
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<td>.25</td>
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<tr>
<td>Limestone flour</td>
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<td>.13</td>
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<tr>
<td>Salt, iodized</td>
<td>.25</td>
<td>.25</td>
</tr>
<tr>
<td>Trace min. mix1</td>
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<td>.05</td>
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<tr>
<td>Vitamin premix2</td>
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<tr>
<td>D, L methionine</td>
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<tr>
<td>Baciferm (40g/lb)³</td>
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Calculated analyses

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<tr>
<td>Crude Protein, %</td>
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<td>21.37</td>
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<td>Met. energy, kcal/kg</td>
<td>3022</td>
<td>3086</td>
</tr>
<tr>
<td>Calcium, %</td>
<td>.97</td>
<td>.82</td>
</tr>
<tr>
<td>Avail. Phos., %</td>
<td>.48</td>
<td>.44</td>
</tr>
<tr>
<td>Meth. + Cyst., %</td>
<td>.88</td>
<td>.80</td>
</tr>
<tr>
<td>Zinc Bacitracin, g/ton</td>
<td>40.00</td>
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</tr>
</tbody>
</table>

1Supplies per kg of feed: calcium, 97.5 mg; manganese, 60 mg; iron, 20 mg; iodine, 1.2 mg; zinc, 27.5 mg; cobalt, 0.2 mg.; copper, 2 mg.

2Supplies per kg of feed: Vitamin A, 3300 I.U.; vitamin D₃, 1100 I.C.U.; riboflavin, 3.3 mg; d-pantothenic acid, 5.5 mg; niacin, 22 mg; choline, 191 mg; vitamin B₁₂, 5.5 mg; vitamin E, 1.1 I.U.; menadione bisulfite complex, 0.55 mg; folacin, 0.22 mg.

3Provided gratuitously by International Mineral and Chemical Corporation, Mundelein, IL 60060.
folliculitis were observed by a USDA inspector on the processing line at the Fircrest Processing Plant, Creswell, Oregon. All birds that died were submitted to the Veterinary Diagnostic Laboratory in the College of Veterinary Medicine for examination. Statistical analyses were done by one-way analysis of variance using the Fisher test (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The data for Experiment 1 are presented in Table III. 2). No significant differences in the suggested incidences of mortality deformed legs, foot pad dermatitis, folliculitis, mean body weight gain and feed conversion were observed among the treatments.

The incidence of breast blisters was significantly lower for broilers reared in the padded roost pens than the pens with no roosts. Reed et al. (1966) also observed decreased incidence of breast blisters using sponge rubber on top of wood slats. The resilience of the sponge rubber is close to that of litter (Reece et al., 1971).

The results of Experiment 2 are presented in Table III. 3. No significant differences were observed between the two treatments in any of the parameters considered. Even with an increase in the roosting space in this experiment, breast blister incidence was not significantly
TABLE III. 2. Performance data of broilers reared on wire with and without padded roosts from 3 to 7 weeks of age (Experiment 1)\(^1\)

<table>
<thead>
<tr>
<th>Floor Type</th>
<th>Padded Roost</th>
<th>Body wt. gain (g)</th>
<th>Feed Conv.</th>
<th>Breast Blist.</th>
<th>Foot pad Score*</th>
<th>Folliculitis (%)</th>
<th>Deformed Legs (%)</th>
<th>Mortality (%)</th>
</tr>
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<tr>
<td>Wire</td>
<td>-</td>
<td>1490(^a)</td>
<td>2.23(^a)</td>
<td>34.1(^a)</td>
<td>2.0(^a)</td>
<td>0(^a)</td>
<td>8.8(^a)</td>
<td>18.2(^a)</td>
</tr>
<tr>
<td>Wire</td>
<td>+</td>
<td>1500(^a)</td>
<td>2.3(^a)</td>
<td>22.7(^b)</td>
<td>1.9(^a)</td>
<td>0(^a)</td>
<td>8.3(^a)</td>
<td>10.8(^a)</td>
</tr>
</tbody>
</table>

\(^1\)Mean values in each column with different superscripts are significant at (P<0.05).

*Based on a score of: 1 = no dermatitis
5 = very severe dermatitis
TABLE III. 3. Performance data of broilers reared on wire with and without padded roosts from 3 to 7 weeks of age (Experiment 2)\(^1\)

<table>
<thead>
<tr>
<th>Floor Type</th>
<th>Padded Roost</th>
<th>Body wt. gain</th>
<th>Feed Conv.</th>
<th>Breast Blist.</th>
<th>Foot pad Score*</th>
<th>Folliculitis</th>
<th>Deformed Legs</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire</td>
<td>-</td>
<td>1440(^a)</td>
<td>2.08(^a)</td>
<td>72.3(^a)</td>
<td>1.81(^a)</td>
<td>0(^a)</td>
<td>4.9(^a)</td>
<td>5.6(^a)</td>
</tr>
<tr>
<td>Wire</td>
<td>+</td>
<td>1460(^a)</td>
<td>2.06(^a)</td>
<td>54.7(^a)</td>
<td>1.59(^a)</td>
<td>0(^a)</td>
<td>3.2(^a)</td>
<td>4.7(^a)</td>
</tr>
</tbody>
</table>

\(^1\)Mean values in each column with different superscripts are significant at (P<0.05).

\*Based on a score of: 1 = no dermatitis
5 = very severe dermatitis
reduced. This could have been due to the lower room temperature during Experiment 2. This experiment was conducted during January and February. The electric space heaters were not capable of maintaining a room temperature similar to Experiment 1 where the incidence of breast blisters was much lower. Experiment 1 was carried out in November and early December when the weather was not too cold. Reece et al. (1971) showed that colder temperatures significantly increased the incidence of breast blisters, possibly due to the increase huddling of the birds on the wire flooring of both treatment groups.

Experiment 1 also had a higher mortality than in Experiment 2. There was a high incidence of staphylococcal arthritis (Staphylococcus aureus) diagnosed involving the hock joints of the birds in Experiment 1. The wire floors were disinfected with a quaternary ammonia solution prior to Experiment 2.

The use of padded roosts lowered the incidence of breast blisters in broilers raised on wire flooring as demonstrated by both experiments; however, the practicality of using padded roosts to lower the incidence of breast blisters in a commercial broiler operation must be further demonstrated.
REFERENCES


CHAPTER IV

PERFORMANCE AND CARCASS QUALITY WITH BROILERS REARED ON WIRE FLOORING, PLASTIC INSERTS, WOOD SLATS AND PLASTIC COATED EXPANDED METAL FLOORING EACH WITH AND WITHOUT PADDED ROOSTS

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Department of Poultry Science
Oregon State University
Corvallis, Oregon 97331

1Oregon Agricultural Experiment Station Technical Paper
No. Research conducted in partial fulfillment of the requirement for the degree of Master of Science.
Commercial straight-run broilers were reared on non-litter flooring in two experiments to study the effects on broiler performance and carcass quality. Experiment 1 consisted of three non-litter floor types (wire, wood slats and plastic inserts over wire) with and without padded roosts and Experiment 2 consisted of two non-litter floor types (wire and plastic coated expanded metal) with and without padded roosts. The birds were fed feed with and without drugs for the plastic coated expanded metal floor types.

In Experiment 1, mean body weights, foot pad dermatitis, feed conversion and percent incidences of mortality, deformed legs and body fat were not significantly different among the treatments. Feather soilage score and percent incidence of folliculitis were significantly higher (P<.05) for broilers reared on wood slats with and without padded roosts compared to those reared on wire and plastic inserts. Percent incidence breast blister was significantly higher (P<.05) for controls on wire than all other treatments.

In Experiment 2, mean body weights, feed conversion and percent incidences of folliculitis, deformed legs and mortality were not significantly different among the treatments. Feather soilage score was significantly lower
(P<.05) with birds reared on wire both with and without padded roosts than those on expanded metal. Foot pad dermatitis score and percent incidence breast blisters were significantly higher (P<.05) among controls on wire than birds on wire with padded roosts and birds on expanded metal. Percent incidence of indented keels was significantly higher (P<.05) with birds reared on floors with roosts than those without roosts.

Wood slats and plastic coated expanded metal flooring with padded roosts showed some promise as non-litter floor types for rearing broilers.

INTRODUCTION

In the last few years, studies with rearing broilers on flooring other than on litter have increased because of economical and managerial reasons in the commercial broiler industry. Litter shortage and high cost (Reece et al., 1971; Henderson, 1983); savings from eliminating the use of coccidiostat, more broilers reared in an existing house area (Reece et al., 1971; Proudfoot et al., 1979); more broiler growth (McDonald, 1981); less dust and ammonia within the houses (Randall, 1982); feeders and waterers free of litter (Reece et al., 1971), and less bird contact with the fecal material (Reece, 1971) were some of the reasons.
Non-litter flooring may cause severe economic problems also. Koonz et al. (1963) suggested that wire floors favor breast blister development. Reed et al. (1966) reported breast blister occurrence of 33 percent when broilers were raised on wood slats; however, covering the slats with .64 cm of sponge rubber reduced the incidence of breast blisters to 14 percent. Besides breast blisters, leg disorders have been of concern for broilers reared on non-litter flooring. Andrews et al. (1974) reported that broilers raised on wire had between 4 and 9 percent deformed legs.

Roosts or perches have been shown to improve leg quality. Perches decreased foot damage in caged broiler breeders (Anonymous, 1977), and perches reduced the incidence of leg disorders with birds raised in cages (Almquist, 1982).

The purposes of these two experiments were to compare performance and carcass quality of straight-run broilers reared on wire floors (mesh of 2.54 cm sq.), wood slats, plastic inserts and plastic coated expanded metal floorings with and without padded roosts.

MATERIALS AND METHODS

Three hundred and sixty straight-run commercial broiler chicks were reared in raised pens in a windowless
positive pressure house in each of these two experiments. The chicks were divided equally and randomly placed in each of the 18 pens (1.1 m x 1.1 m). This allowed each bird a floor space of 550 cm². The pen floors were of four types; wire (mesh of 2.54 cm sq.), plastic inserts placed directly on the wire flooring, wood slats (1.9 cm x 5.1 cm x 50 cm) spaced 1.9 cm apart, and plastic coated expanded metal. All pens had a galvanized wire screen (mesh 1.27 cm sq.) placed directly on top of the floorings for the first three weeks. Corrugated cardboard was placed on top of one-fourth of the floor directly below the heat lamps for the first two days to prevent draft. At the end of the third week, 3 of the 6 pens of each floor type had three padded roosts (spaced 18 cm apart) placed directly on the flooring. The roosts were constructed of wood slats (5.1 cm x 5.1 cm x 50 cm). On the top of each wooden roost, 1.27 cm of foam rubber was fastened with duct tape.

The birds were brooded using electric infrared heat lamps up to three weeks of age and warm room brooding to seven weeks of age using electric space heaters. The room temperature dipped to a low of 15°C in the winter months. Incandescent lighting was provided 24 hrs a day throughout the grow period. Water and feed were provided ad libitum. The chicks were fed a well fortified balanced starter mash up to three weeks of age, and a balanced finisher mash from 3 to 7 weeks of age (Table IV. 1). Feeds in both
## TABLE IV. 1. Composition of broiler starter and finisher feeds

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Starter</th>
<th>Finisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn, Yellow</td>
<td>58.35</td>
<td>63.52</td>
</tr>
<tr>
<td>Soybean meal, 47.5% CP</td>
<td>32.25</td>
<td>27.50</td>
</tr>
<tr>
<td>Meat meal w/bone ml, 50% CP</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Fat, animal</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Alfalfa meal, dehy, 17% CP</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Defluo. Rock Phos.</td>
<td>.42</td>
<td>.25</td>
</tr>
<tr>
<td>Limestone flour</td>
<td>.35</td>
<td>.13</td>
</tr>
<tr>
<td>Salt, iodized</td>
<td>.25</td>
<td>.25</td>
</tr>
<tr>
<td>Trace min. mix$^1$</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>Vitamin premix$^2$</td>
<td>.20</td>
<td>.20</td>
</tr>
<tr>
<td>D, L methionine</td>
<td>.10</td>
<td>.10</td>
</tr>
<tr>
<td>Baciferm (40g/lb)$^3$</td>
<td>.05</td>
<td>.05</td>
</tr>
</tbody>
</table>

**Calculated analyses**

- **Crude Protein, %**: 23.13, 21.37
- **Met. energy, kcal/kg**: 3022, 3086
- **Calcium, %**: .97, .82
- **Avail. Phos., %**: .48, .44
- **Meth. + Cyst., %**: .88, .80
- **Zinc Bacitracin, g/ton**: 40.00, 40.00

---

$^1$Supplies per kg of feed: calcium, 97.5 mg; manganese, 60 mg; iron, 20 mg; iodine, 1.2 mg; zinc, 27.5 mg; cobalt, 0.2 mg.; copper, 2 mg.

$^2$Supplies per kg of feed: Vitamin A, 3300 I.U.; vitamin D$_3$, 1100 I.C.U.; riboflavin, 3.3 mg; d-pantothenic acid, 5.5 mg; niacin, 22 mg; choline, 191 mg; vitamin B$_12$, 5.5 mg; vitamin E, 1.1 I.U.; menadione bisulfite complex, 0.55 mg; folacin, 0.22 mg.

$^3$Provided gratuitously by International Mineral and Chemical Corporation, Mundelein, IL 60060.
experiments were free of coccidiostats. Zinc bacitracin (40 grams/ton) was fed to all birds in the first experiment but was absent in the drug free treatment in Experiment 2.

In each of the two experiments, the treatments were randomly assigned to 18 pens by a randomized block design. Within each of the three blocks (six pens) the six treatments were randomly assigned. In the first experiment the six treatments were: 1) controls on wire (mesh 2.54 cm sq.); 2) wire with padded roosts; 3) wood slats (1.9 cm x 5.1 cm x 50 cm) spaced 1.9 cm apart; 4) wood slats with padded roosts; 5) plastic inserts placed over wire; 6) plastic inserts with padded roosts. In the second experiment, the treatments were: 1) controls on wire; 2) wire with padded roosts; 3) plastic coated expanded metal flooring; 4) plastic coated expanded metal flooring with padded roosts; 5) expanded metal flooring and drug free diet; 6) expanded metal flooring with padded roosts and drug free diet.

At seven weeks of age males and females were weighed separately, and the remaining feed weighed back. Feather soilage and foot pad dermatitis were also scored at this time. Feather soilage was scored from 1 to 5 (1 = negative; 5 = severe). Foot pad dermatitis was scored similarly from 1 to 5. Five females and five males were randomly selected from each pen, leg banded and then taken
to the Poultry Science Department processing facilities. The birds were processed and the incidences of breast blisters and folliculitis were observed and recorded. In the first experiment, percent internal fat was determined by weighing the abdominal leaf fat and fat surrounding the gizzard. Percent incidence of indented keels was determined by visual inspection of the keels in the second experiment.

All mortality was sent for diagnosis to the Oregon State University Veterinary Medicine Diagnostic Laboratory.

Two-way analysis of variance was carried out in the first experiment to determine the significance and interaction between floor type and roosts. Duncan's new multiple range tests were used to separate significant treatment means. In the second experiment a three-way analysis of variance was run to determine the significance and interaction between floor type, roosts and diet (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

In Experiment 1, there was no floor type x roosts interaction; therefore, the data from all treatments were pooled and one-way analysis of variance was calculated. Table IV. 2 presents the data of Experiment 1. In Experiment 1, mean body weights, foot pad dermatitis, feed
TABLE IV. 2. Performance data of broilers reared on floorings with and without padded roosts to 7 weeks of age (Experiment 1)1

<table>
<thead>
<tr>
<th>Floor types</th>
<th>Padded roosts</th>
<th>Body wts. (g)</th>
<th>Feed conv. (%)</th>
<th>Mort. (%)</th>
<th>Deformed legs (%)</th>
<th>Breast blist. (%)</th>
<th>Foot pad score2</th>
<th>Polliculitis (%)</th>
<th>Internal fat (%)</th>
<th>Feather soilage score3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire</td>
<td>No</td>
<td>2102a</td>
<td>2.02a</td>
<td>4.6a</td>
<td>6.0a</td>
<td>91.7a</td>
<td>1.5a</td>
<td>0a</td>
<td>31.5a</td>
<td>1.1a</td>
</tr>
<tr>
<td>Wire</td>
<td>Yes</td>
<td>2107a</td>
<td>2.02a</td>
<td>6.3a</td>
<td>13.8a</td>
<td>45.8b</td>
<td>1.3a</td>
<td>0a</td>
<td>30.4a</td>
<td>1.1a</td>
</tr>
<tr>
<td>Plastic</td>
<td>No</td>
<td>2093a</td>
<td>2.03a</td>
<td>3.0a</td>
<td>6.7a</td>
<td>62.5ab</td>
<td>1.4a</td>
<td>4.2a</td>
<td>35.9a</td>
<td>1.3a</td>
</tr>
<tr>
<td>Plastic</td>
<td>Yes</td>
<td>2061a</td>
<td>1.96a</td>
<td>6.3a</td>
<td>6.6a</td>
<td>54.2ab</td>
<td>1.3a</td>
<td>8.3ab</td>
<td>31.2a</td>
<td>1.3a</td>
</tr>
<tr>
<td>Wood slat</td>
<td>No</td>
<td>2125a</td>
<td>1.97a</td>
<td>6.3a</td>
<td>8.6a</td>
<td>25.0b</td>
<td>1.3a</td>
<td>20.8bc</td>
<td>33.2a</td>
<td>2.0b</td>
</tr>
<tr>
<td>Wood slat</td>
<td>Yes</td>
<td>2079a</td>
<td>2.00a</td>
<td>8.3a</td>
<td>9.3a</td>
<td>25.0b</td>
<td>1.3a</td>
<td>33.3c</td>
<td>31.3a</td>
<td>2.1b</td>
</tr>
</tbody>
</table>

1Mean values in each column with different superscripts are significant at (P<0.05).
2Based on a score of: 1 = No dermatitis
   5 = Very severe dermatitis
3Based on a score of: 1 = No feather soilage
   5 = Severe feather soilage
conversion and percent incidences of mortality, deformed legs and body fat among the treatments were not significantly different. Feather soilage score and percent incidence of folliculitis were significantly higher \( (P<.05) \) for broilers reared on wood slats than those reared on wire and plastic inserts. Percent incidence of breast blister was significantly higher \( (P<.05) \) for controls on wire than all other treatments.

In Experiment 2, there was no floor type x roost x diet interaction; therefore, the data from all treatments were pooled and one-way analysis of variance was calculated. Table IV. 3 presents the performance data for Experiment 2. Mean body weights, feed conversion and percent incidences of folliculitis, deformed legs and mortality were not significantly different among treatments. Feather soilage score was significantly lower \( (P<.05) \) with birds reared on wire than those on expanded metal. The significantly higher feather soilage score and thus the significantly higher incidence of folliculitis could possibly have been caused by the build-up of feces that had accumulated between the expanded metal flooring and the wire flooring that was left in place 5 cm beneath the expanded metal flooring. Foot pad dermatitis score and percent incidence of breast blisters were significantly higher \( (P<.05) \) among the control on wire than either birds on wire with padded roosts or birds on expanded metal.
TABLE IV. 3. Performance data of broilers reared on floorings with and without padded roosts, and with and without drugs to 7 weeks of age (Experiment 2)

<table>
<thead>
<tr>
<th>Floor types</th>
<th>Drugs fed</th>
<th>Padded roosts</th>
<th>Body wts.</th>
<th>Feed conv.</th>
<th>Mort.</th>
<th>Deformed legs</th>
<th>Breast blister</th>
<th>Foot pad score²</th>
<th>Polliculitis</th>
<th>Indent keels</th>
<th>Feather soilage score³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>(g)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Ex Met</td>
<td>Yes</td>
<td>Yes</td>
<td>2107ᵃ</td>
<td>2.18ᵃ</td>
<td>4.6ᵃ</td>
<td>4.4ᵃ</td>
<td>16.7ᵃ</td>
<td>1.0ᵃ</td>
<td>12.5</td>
<td>41.7ᵃ</td>
<td>1.9ᵃ</td>
</tr>
<tr>
<td>Ex Met</td>
<td>No</td>
<td>Yes</td>
<td>2057ᵃ</td>
<td>2.23ᵃ</td>
<td>1.3ᵃ</td>
<td>7.7ᵃ</td>
<td>12.5ᵃ</td>
<td>1.1ᵃ</td>
<td>20.8</td>
<td>29.2ᵃ</td>
<td>1.8ᵃ</td>
</tr>
<tr>
<td>Ex Met</td>
<td>Yes</td>
<td>No</td>
<td>2134ᵃ</td>
<td>2.25ᵃ</td>
<td>6.0ᵃ</td>
<td>5.3ᵃ</td>
<td>37.5ᵃ</td>
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<td>8.3</td>
<td>0ᵇ</td>
<td>2.1ᵃ</td>
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<tr>
<td>Ex Met</td>
<td>No</td>
<td>No</td>
<td>2061ᵃ</td>
<td>2.25ᵃ</td>
<td>1.7ᵃ</td>
<td>6.3ᵃ</td>
<td>33.3ᵃ</td>
<td>1.1ᵃ</td>
<td>16.7</td>
<td>0ᵇ</td>
<td>1.9ᵃ</td>
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<tr>
<td>Wire</td>
<td>Yes</td>
<td>Yes</td>
<td>2088ᵃ</td>
<td>2.12ᵃ</td>
<td>10.0ᵃ</td>
<td>4.3ᵃ</td>
<td>45.8ᵃ</td>
<td>1.1ᵇ</td>
<td>4.2</td>
<td>41.7ᵃ</td>
<td>1.2ᵇ</td>
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<tr>
<td>Wire</td>
<td>Yes</td>
<td>No</td>
<td>2107ᵃ</td>
<td>2.27ᵃ</td>
<td>4.0ᵃ</td>
<td>6.7ᵃ</td>
<td>87.5ᵇ</td>
<td>1.3ᵇ</td>
<td>0</td>
<td>0ᵇ</td>
<td>1.2ᵇ</td>
</tr>
</tbody>
</table>

1Mean values in each column with different superscripts are significant at (P<0.05).
2Based on a score of: 1 = No dermatitis
5 = Very severe dermatitis
3Based on a score of: 1 = No feather soilage
5 = Severe feather soilage
Percent incidence of indented keels was significantly higher (P<.05) with birds reared on floors with roosts than those without roosts. The elimination of zinc bacitracin (40g/ton) had no influence in the parameters observed above.

Considerable improvement in carcass quality was observed in these two experiments when birds were raised on wood slat floors and plastic coated expanded metal flooring. A decrease in breast blister development was also demonstrated when padded roosts were placed in the pens. This observation is in agreement with the observation of other investigators (Reed et al., 1966). The overall carcass quality of the birds could be reduced because of the occurrence of indented keels that was caused by the roosts. Plain wire demonstrated its drawbacks in both experiments with breast blister development. Similar observations were found by Koonz et al. (1963). The plastic coated expanded metal flooring seems to be better for broiler growth performance and carcass quality when compared to the floor types studied in these two experiments. It may be justifiable to change the general practice of raising broilers on litter to that of raising broilers on non-litter flooring. This reasoning has been mentioned earlier. The only limiting factor of such a grow-out system would be the high capital investment required. Broiler growers in the United States
seem to be content with their rearing practices at the present time, whereas other developing nations are showing considerable interest in non-litter systems such as broilers on suspended flooring and/or growing cages.
FOOTNOTES

2. Provided gratuitously by B. L. DOWNEY COMPANY, 1200 S. 54th Avenue, Cicero, IL 60650
REFERENCES


CHAPTER V

BIBLIOGRAPHY


