Deciding When to
MARKET BROILERS

W. B. Back
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Many Oregon producers of commercial broilers would do well to market heavier birds.

IN DETERMINING the most profitable age and weight to market commercial broilers, producers should take into consideration both production and market conditions:

PRODUCTION FACTORS

Efficiency in feeding: Feed fast-growing birds to heavier weights. It may pay to feed cockerels longer than pullets before marketing.

Broiler-feed price ratio: Under a favorable ratio, feed birds longer to heavier weights. Under an unfavorable ratio sell lighter birds.

Lots per year: Maximum returns above feed costs do not always add up to the highest income above cash costs. The number of lots produced per year affects net profits.

Risks: Risks the producer must face in feeding birds to point of maximum return include fluctuation in selling prices, mortality, and reduction in rate of gain in weight.

MARKET FACTORS

At the present time, consumers have a preference for birds between 2\(\frac{1}{2}\) and 3\(\frac{1}{2}\) pounds live weight. Producers will do well to take advantage of any opportunity to market heavier birds.

Notes

Broiler-production publications used in this study
COMMERCIAL BROILER PRODUCTION, a relatively new and rapidly expanding industry, increased in the United States more than 2,000 per cent in the last twenty years. In 1934 this country raised only 34 million birds for broilers, these largely the excess cockerels produced jointly with the raising of replacements for laying flocks. By 1951, however, production had reached 792 million broilers, an increase of 23 times over 1934. Specialization mainly brought about this phenomenal growth.

In Oregon, production of broilers increased more rapidly in the 1934-51 period than in the U. S. as a whole. Oregon poultrymen expanded their broiler production from 120,000 birds in 1934 to 5,854,000 birds in 1951. Even though this rate of growth is about twice that of the whole country, Oregon produced less than 1 per cent of the total broilers raised in the U. S. in 1951. A small number of poultrymen with specialized broiler enterprises produce most of Oregon's broilers.

Broiler-production Problems

Success in a broiler enterprise depends upon many things, including "luck" in hitting the prices right at market time. Broiler prices do fluctuate in unpredictable ways and an individual producer can do little about them. Most growers would place fluctuating prices at the top of the list in ranking the problems faced in production and marketing of broilers.

Aside from the price factor, success with the broiler enterprise over time depends mainly upon the efficiency with which birds utilize feed for growth. Feed makes up 60-70 per cent of the cost of growing broilers. How to increase gains per pound of feed is a major producer problem. Much progress in feed efficiency has taken place in the past 10 to 15 years. However, many producers fail to obtain the feed conversions essential for success with the enterprise over time.

Another problem in broiler production is choosing the best age and weight to market the birds. Income from the broiler enterprise can be affected by decisions on time of marketing. The average live weight per broiler sold in Oregon in 1951 and 1952 was 3 pounds. (See notes.) Whether it pays to market birds heavier or lighter than 3 pounds is a problem of considerable significance to broiler producers and to the broiler industry.

Most of the past research in broiler production has been concerned with the general problem of increasing feed efficiency. More research on this problem of feed efficiency would benefit the broiler growers and the broiler in-

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dustry. The question of the most profitable age and weight to market birds has received a limited amount of attention in past broiler research. This study was aimed at contributing more to our knowledge on the proper age and weight to market broilers. The intent was to develop some guides producers could use in making their marketing decisions.

Determining Time of Marketing

In addition to feed efficiency, broiler-feed price ratio, and number of lots produced per year, other factors influence a producer in his marketing decisions. A producer considers price and mortality risks and the nature of the market demand for broilers in deciding when to market.

The factors affecting time of marketing fall into two categories: production factors and market factors.

The production factors are those considerations a producer would take into account in deciding when to sell his birds if he is at liberty to reach the decision on his own: (1) feed efficiency, (2) broiler-feed price ratio, (3) number of lots per year, and (4) risk.

Often the processor or purchasing agent for a processing firm helps the producer decide when to market his birds. Such influence exercised by agents of the market is performed for two major reasons: (1) to obtain a steady supply of birds in the market channels, and (2) to obtain birds of the size which consumers desire. The demand for birds of different weight classes is the market factor of particular concern to producers. The best time to market, figured on the basis of the production factors, may not be the best time from the standpoint of market demand.

Although it is necessary to take market demand into account when discussing the production factors, no effort is made to analyze the various ramifications of consumer demand and the market in this report. Such growth of broilers

Differences in feed efficiency of birds result in different growth schedules. Six growth schedules derived from experimental data show marked differences in feed efficiency for straight run birds and between cockerels and pullets. Results obtained by Oregon broiler growers range from about 8.5 to 11 pounds feed to obtain 3-pound birds.

In Figure 1, marked difference in growth of birds can be noted among high-, medium-, and low-growth schedules. The same can be noted in Figure 2 between pullets and cockerels.

The low-growth schedule approximates results being obtained by broiler growers up to about 1940. The high-growth schedule reflects advances in development of strains for broiler production, composition of broiler rations, and management practices. It takes about 12.5 pounds feed and 92 days to get a 3-pound broiler on the low-growth schedule. A 3-pound bird is obtained on about 8.5 pounds feed and 68 days on the high-growth schedule. The high-growth schedule approximates results being obtained by broiler growers up to about 1940. The high-growth schedule reflects advances in development of strains for broiler production, composition of broiler rations, and management practices. It takes about 12.5 pounds feed and 92 days to get a 3-pound broiler on the low-growth schedule. A 3-pound bird is obtained on about 8.5 pounds feed and 68 days on the high-growth schedule. On the basis of current standards, low mortality, and a minimum of feed wastage would be necessary to duplicate the high-growth schedule in practice. The high-growth schedule checks closely with recent experimental results on broiler feeding at Oregon State College. In this experiment with...
2,000 birds, the average feed consumption was 8.6 pounds to obtain a 3-pound bird. The birds reached an average weight of three pounds in about 10 weeks.

Many poultrymen are aware of differences in feed efficiency between cockerels and pullets. Few experiments have been conducted, however, for the purpose of measuring this difference. The differences in growth shown in Figure 2 do not vary greatly from the results obtained in the Oregon State College experiment with the 2,000 birds. In the recent experiment at the college, cockerels weighed 3.42 and pullets 2.82 at 10 weeks. This is a difference of .6 pound. Comparable results from Figure 2 give an average difference of .67 pound between sexes.

Feed required per pound gain varies considerably among Oregon broiler enterprises. Feed conversions for 17 enterprises studied in 1952 ranged from 2.75 to 3.58. This range in feed conversions compares with growth ranging from about half way between the derived medium and low schedules to the high-growth schedule. Some of this variation can be attributed to differences in mortality and feed wastage. However, other basic factors contribute to the variation in feed efficiency obtained by Oregon broiler

Figure 1. High, medium, and low growth schedules.
growers. Mortality and feed wastage were held to a minimum in the experiments which were used to derive the growth schedules.

**Additional Growth and Feed Efficiency**

Efficiency with which birds use feed for growth decreases as weight increases. This decline in efficiency has a bearing on the most profitable age and weight to sell birds.

The differences in growth as shown in Figures 1 and 2 and the change in rate of growth with increases in age and weight of the birds, both have important effects on the most profitable time to market.

Ordinarily the efficiency with which birds convert feed into growth is expressed as average pounds feed consumed per pound total live weight. Feed efficiency expressed in this manner increases as the age and weight of the birds increase. That is, birds become less efficient users of feed with increase in age and weight. Feed required per pound of gain in successive, short feed-consumption intervals provided a clearer picture on the change in feed efficiency than do average figures. This change in efficiency over the life of the bird can be observed from data on additional gains per pound of additional feed.

![Figure 2. Cockerel, pullet, and average cockerel and pullet growth schedules.](image)
consumed, or feed required per pound gain over the range of marketable weights.

Figures 3 and 4 show both the additional growth resulting from each pound increment of feed and pounds of feed required per pound of gain from 6 to 16 pounds cumulative feed consumption. For each of the growth schedules, additional growth declines and feed required per pound gain increases as feed consumed increases. The decline in additional growth is due mainly to the increase in feed required for body maintenance as birds become larger.

**Broiler-Feed Price Ratio**

The price of broilers divided by the price of feed per pound is the broiler-feed ratio.

Expression of the price of feed and price of broilers as a ratio is a convenient way of taking these factors into account in determining when to market the birds. This ratio, as usually expressed, is determined by dividing price of broilers per pound by cost of feed per pound. The ratio refers to the number of pounds of feed which has the same value as a pound of broiler. The ratio would be 5 for a feed cost of 6 cents per pound when broilers bring 30 cents a pound (30¢ ÷ 6¢). The broiler-feed price ratio decreases as the cost of feed increases relative to the price of broilers. Fluctuations in the price of broilers and feed bring about changes in the feed-broiler price ratio. The ratio has ranged from about 4.5
to 5.0 in Oregon most of the time during the past 3 years, when based on the price of high energy broiler feed. The appropriate ratio for an individual producer depends upon his feed cost and price he receives for broilers.

**Price Ratio and Feed Conversion as Marketing Guides**

Feed efficiency and broiler-feed price ratio are the two most important production factors to take into account in determining when to market.

These are the only factors to consider in figuring the point of maximum returns above feed cost on a lot of birds. About two-thirds of the cost of growing broilers is feed cost. Since feed is the most important variable cost in producing broilers, the cumulative returns above feed cost over the range of marketable weights is the most important consideration in when to sell birds. The effect of costs other than feed and labor on time of marketing will be discussed in another section of this report. Labor makes up less than 10 per cent of the cost of growing broilers. Therefore, a small change in labor cost with variations in time of marketing will make little if any difference in the most profitable ages and weights to sell.

At some point in the life of a broiler the gains in weight may become too low to pay for the feed it is eating. So long as additional gains are worth more than the additional feed required to get those gains, returns above feed cost are increasing. A
maximum return above feed cost occurs when the additional gains are worth the same as the feed required to get these additional gains.

Feed efficiency and broiler-feed price ratio determine the point of maximum returns above feed cost.

For feed at $6.20 per hundredweight and broilers at 28¢ per pound, the point at which the value of additional gains and additional gains balance is in the vicinity of 13 pounds feed on the high-growth schedule. At this feed consumption level the birds weigh an average of 4.12 pounds. For the same assumed feed and broiler prices, maximum returns above feed cost on the medium- and low-growth schedules would be at 10 and 7 pounds feed consumption and average weights of 2.98 and 1.92 respectively.

Pullets reach the point of maximum returns above feed cost about two weeks sooner than do the cockerels.

Differences in feed conversion between cockerels and pullets as shown in Figures 2 and 4 result in different times of marketing to maximize returns above feed cost. Pullets reach the point of maximum returns above feed cost in about 78 days and at a weight of 2.71 pounds for the broiler-feed price ratio of 4.52 ($6.20 feed and 28¢ broilers). Cockerels reach the point of maximum returns above feed cost about 2 weeks later and at a weight of over 4 pounds per bird.

From the pounds of feed per pound gain and broiler-feed price ratio comparison it is evident that birds utilizing feed more efficiently should be fed to heavier weights. This also means marketing the more efficient birds at higher ages.

The marketing of pullets before cockerels, or slow-growing birds before fast-growing birds, is contrary to usual practice of broiler growers. The usual practice is to sell cockerels first if the sexes are sold separately, or to sell straight-run birds when a particular average weight is attained (say 3 pounds).

The desire of the processors for a bird near three pounds in live weight is a major limitation to selling pullets before cockerels or to feeding the more efficient users of feed to heavy weights. Processors desire this size bird because it is easier to sell to the consumer. However, the producer can refrain from the practice of "topping the flock," or selling the heavier, faster-growing birds first. More money can be made by selling the sexes together than selling cockerels first. Also, producers may, on occasions, have the opportunity to sell cockerels or straight-run birds gaining weight rapidly at heavier weights than usually marketed. When this opportunity occurs, it would pay to sell pullets before selling the cockerels, or to feed straight run birds to near the "break-even" point on additional feed cost and values of additional growth.

When feed is cheap relative to the price of broilers, profits are higher. Feed is cheap relative to the price of broilers when the broiler-feed price ratio is high.

In addition to changing the level of profits, different broiler-feed price ratios have an effect on the ages and weights to market for highest income. It is more profitable to market birds at lighter weights when feed is expensive relative to broiler prices (broiler-feed price ratio relatively low). On the other hand, it is more profitable to market at heavier weights when feed is cheap relative to price of broilers. The 4.52 ratio applied in the preceding discussion probably is lower than usually experienced by Oregon broiler
growers. Thus, the estimates of the proper ages and weights to market for the different growth schedule are conservative.

**Sampling Birds to Estimate Gains in Weight**

A major problem of producers is the estimation of additional growth of the birds.

One solution to this problem is to weigh a sample of birds at regular intervals. Such sampling should be performed in a way to cause the least disturbance to the birds. Most producers who weigh samples of birds do so at weekly or bi-weekly intervals starting about the sixth week.

Another method is to sample birds when a specified quantity of feed has been consumed, such as a ton or half ton. Sampling on feed consumption intervals aids in the keeping of feed consumption records in the form most useful for appraising the progress being made by the birds. It is more valuable to know how the birds are progressing from the standpoint of weight at different levels of feed consumption than weight at different ages. Perhaps both age and feed consumption can be recorded with the records on sample weights.

The following are approximately the sample sizes needed to be reasonably confident of being within 5% of the true average weight per bird in a lot:

<table>
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<tr>
<th>Lot size</th>
<th>Straight run</th>
<th>Sexed*</th>
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<tbody>
<tr>
<td>500</td>
<td>45</td>
<td>38</td>
</tr>
<tr>
<td>1000</td>
<td>81</td>
<td>62</td>
</tr>
<tr>
<td>2000</td>
<td>136</td>
<td>90</td>
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</table>

* Either cockerels or pullets

A smaller sample is required in a lot of sexed birds (either cockerels or pullets) than a lot of straight-run because of less variation in weights within one sex. Percentage-wise, sample size needed to get the same degree of accuracy decreases as the size of the lot increases. These sample sizes were worked out on the basis of the variation in weights of individual birds in the recent growth and feed consumption study at Oregon State College.

If a producer desires greater accuracy than the indicated 5%, the above sample sizes should be increased. These sample sizes are intended only to be rough guides on appropriate number of birds to weigh per sample.

**Number of Lots Per Year**

Maximum returns above feed cost do not always add up to the highest income above cash costs. More lots per year can be produced by selling each brood slightly short of maximum returns above feed cost; income from the greater number of broods per year compensates for the reduction taken in returns above feed cost. Producers who practice raising 4 lots per year may find it necessary to sell short of maximum returns above feed cost in order to produce the four lots.

The effects of broiler-feed price ratio and feed efficiency were discussed as factors to take into account in deciding when to sell a brood of broilers. These two factors jointly determine the point of maximum returns above feed cost per brood. In some circumstances, maximum returns above feed cost per brood do not add up to the highest income above cash costs in a year. It may pay some producers to market each brood short of the point of maximum returns above feed cost. This depends upon the number of lots produced per year.

The reason why the number of lots per year influences times of marketing is its effect on number of birds produced per year and consequently upon the annual out-of-pocket costs. Cash costs for chicks, brooding, litter, etc.,
vary with the number of chicks raised per year. These costs add up to about 20 cents per bird. More lots can be raised per year by reducing the market ages and weights of each lot below the point of maximum returns above feed cost. Cutting down on market ages for each brood will decrease feed cost per bird raised, but will increase total cash costs other than feed for the year’s operation. One also has to take into account the total value of birds produced in a year when marketed at different ages and weights in figuring time of marketing each brood to get the highest net income per year.

The number of lots produced per year can be fixed or variable, depending upon the production system in practice. Many Oregon broiler producers practice growing a fixed number of lots per year, with four lots per year the usual practice under this system. Other systems in practice are: (1) all in-all out (handling one brood at the time as in fixed system but number of broods per year variable), and (2) continuous system—overlapping of broods.

The data in Tables 1 and 2 were constructed to show how the variation in age and weight birds are marketed can affect number of lots possible, cash cost, and returns above cash cost per year under the continuous system of production. The same data would be applicable to the all in-all out system if the number of lots per year are variable. These data were for an enterprise with facilities to handle 5,000 birds at one time. The same price per pound (28¢) is assumed for birds of the various weights. A feed cost of $6.20 per hundredweight is assumed.

The high-growth schedule is used for constructing the data in Table 1 and the medium-growth schedule is used for Table 2. Possible differences in the effect of mortality upon net income with variation in number of lots per year are not taken into account in these computations. Also the effect of variations in chick and miscellaneous cash costs are not taken into account.

For the high-growth schedule the highest returns above cash cost per year figures to be for birds marketed when 11 pounds of feed per bird has been consumed. Birds weigh an average of 3.662 pounds at this feed consumption level. This is about ½ pound lighter than the market weight figured earlier which would maximize returns above feed cost. Still, the birds are heavier than the weight at which most broilers are now marketed. About 4.3 lots per year would be produced to obtain the maximum returns above cash cost for the birds of high growth.

In case of medium growth (Table 2) maximum return above cash cost occurred at the same weight per bird as figured earlier for maximum returns above feed cost. This is because the increments in feed (and weight) used were too large to detect small differences in these. It is evident that maximum returns above feed cost more nearly coincides with maximum returns above all cash costs per year for slow growing birds than for fast growing birds. That is, the continuous production system has a greater influence on time of marketing for birds with the higher feed efficiency.

The effect of different growth schedules on income from a broiler enterprise is evident from a comparison of the returns above cash cost in Tables 1 and 2. The same can be noted in Table 3. In Table 2, (medium-growth schedule) all the returns above cash cost per year for a 5,000 bird
Table 1. ESTIMATED RETURNS ABOVE CASH COST PER YEAR FOR BIRDS OF HIGH GROWTH MARKETED AT DIFFERENT WEIGHTS—CONTINUOUS PRODUCTION.¹

<table>
<thead>
<tr>
<th>Feed consumed per bird</th>
<th>Weight per bird</th>
<th>Possible lots per year</th>
<th>Total cash cost per year²</th>
<th>Gross value of birds raised per year¹</th>
<th>Return above cash cost per year</th>
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<tr>
<td>6</td>
<td>2.267</td>
<td>5.718</td>
<td>$16,353</td>
<td>$18,148</td>
<td>$1,795</td>
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<td>7</td>
<td>2.547</td>
<td>5.336</td>
<td>16,915</td>
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¹ Based upon broiler growing facilities to handle 5,000 birds.
² Based upon feed at $6.20 per hundredweight, and chick and miscellaneous cash cost of 20¢ per bird.
³ Based upon broiler prices of 28¢ per pound.

enterprise were small. Income from the enterprise with some market weights failed to meet out-of-pocket costs for birds marketed under 2.5 and over 3.6 pounds per bird. It is doubtful whether any producer could stay in the broiler business if operating a 5,000 bird enterprise with a medium growth schedule and with prices and costs as assumed for Table 2 even though he marketed birds between 2.5 and 3.6 pounds in weight. The maximum he could expect for labor, management, and fixed investment would be less than $300 per year. Returns above cash cost per year with the high growth schedule run $2,000 to $3,000 higher. This clearly reflects the im-

Table 2. ESTIMATED RETURNS ABOVE CASH COST PER YEAR FOR BIRDS OF MEDIUM GROWTH MARKETED AT DIFFERENT WEIGHTS—CONTINUOUS PRODUCTION.¹

<table>
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<tr>
<th>Feed consumed per bird</th>
<th>Weight per bird</th>
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¹ Based upon broiler growing facilities to handle 5,000 birds.
² Based upon feed at $6.20 per hundredweight, and chick and miscellaneous cash cost of 20¢ per bird.
³ Based upon broiler prices of 28¢ per pound.
importance of feed-efficiency in success with the broiler enterprise.

Four or less lots per year is practiced in Oregon by many producers. Less than four lots per year is a practice of some producers who are part-time broiler growers or for some reason are irregular in starting new broods.

It may be necessary for producers to sell birds slightly short of maximum returns above feed cost in a four-lot-per-year system. This is particularly true when operating with high feed efficiency and a favorable broiler-feed price ratio.

The data in Table 3 were constructed in the same way as Tables 1 and 2 except the number of lots per year was fixed at four. Returns above cash cost increase for high growth birds up to maximum weight that can be obtained and still produce 4 lots per year.

The results in Table 3 indicate that it pays to feed birds to about 12 weeks of age or to the point of maximum returns above feed cost, whichever comes sooner, under a system of 4 lots per year. Twelve weeks is about the maximum age each lot can be fed and still produce 4 lots per year.

When less than four lots per year are produced, cash costs other than feed will have little if any effect on time of marketing. The birds could be fed longer than 12 weeks without interfering with plans to start the next brood.

**Effect of Risk on Time of Marketing**

Risks the producer must face include fluctuations in selling prices, mortality, and low gains in weight. Producers often sell birds sooner than the estimated most profitable ages and weights to market because of the risk element.

Because future prices, rates of growth, and mortality cannot be predicted accurately, the broiler producer incurs a risk in prolonging the feeding period on a lot of birds after they attain marketable weights. There are possibilities of both financial gains and losses through changes in the production factors. It is natural for a producer to consider the chances of finan-

<table>
<thead>
<tr>
<th>Feed consumed per bird</th>
<th>Weight per bird</th>
<th>Total cash cost, high and medium growth</th>
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<td>*</td>
<td>18,880</td>
<td>21,840</td>
</tr>
</tbody>
</table>

* Cannot produce 4 lots per year for birds of medium growth beyond about 11 pounds cumulative feed consumption per bird.

1 Based upon broiler growing facilities to handle 5,000 birds.

2 Based upon feed at $6.20 per hundredweight, and chick and miscellaneous cash cost of 20¢ per bird.

3 Based upon broiler prices of 28¢ per pound.
cial loss more important than the chances of a gain if the feeding period is lengthened on a lot of birds. This is because his investment per bird is increasing rapidly as the feeding period increases and consequently the chances of large losses increase. Thus, it is natural for poultrymen to market birds of lighter weights than figured to be most profitable because of the risk element in prolonging the feeding period.

Producers will vary in their estimate of the risk in feeding birds of marketable weight longer and in the amount of risk they can afford or are willing to take. Only the individual producer can decide for himself how to weigh risk in his marketing decisions.

### Making the Marketing Decision

On the basis of the feed efficiency obtained by Oregon producers and broiler-feed price ratios usually experienced, birds should be sold at heavier weights than the customary practice.

The average weight of broilers sold in Oregon in 1951 and 1952 was 3 pounds. This is the market weight figured to be the most profitable for the medium-growth schedule. However, most Oregon broiler growers get better growth than the medium-growth schedule used in the preceding analysis. On the basis of the production factors, broiler growers getting results near the high-growth schedule should be selling straight-run birds at 3½ to 4½ pounds in weight (depending upon production system and broiler-feed price ratio). The cockerels in a brood of straight-run birds weighing 4 pounds per bird would average about 4½ pounds in weight.

The production factors point to the need for selling pullets before cockerels.

Producers do not have the opportunity to base their marketing decisions exclusively upon the production factors. Whether pullets are sold before cockerels, or slow-growing birds before fast-growing birds, depends to a considerable degree upon the market. It is necessary, therefore, to take market demand into account in the concluding statements below.

In case of low feed efficiency—the medium-growth schedule or lower—the market demand will have little if any effect on the best time to market birds.

Feed and other costs in relation to price of broilers usually are such that slow-growing birds cannot be fed to the heavy weights profitably. Therefore, the production factors provide the basis for market decisions on birds making a low rate of growth.

Currently, the opportunity to sell heavy birds is limited. There is an inconsistency in the size consumers desire to purchase and the size most profitable to produce. The increase in feed efficiency the past few years is a major factor in this problem. Consumer demand for heavy birds has not increased at the same rate as progress in feed efficiency. The opportunity to sell heavy birds may be limited until such time as consumer demands for these increase.

Under the current market demand situation, it will pay producers with efficient growing birds to take advantage of any opportunity to sell heavier broilers. It will pay to sell pullets before cockerels if the opportunity to do so exists. The selling of straight-run birds (cockerels and pullets together) is preferable from the standpoint of the producer to topping the flock of selling cockerels first.
Notes


Page 5. The published data on broiler growth used included the following:
A. E. Tomhave, "Broiler feeding experiments," Delaware Agricultural Experiment Station Bulletin 210, 1938.
H. O. West, "Broiler production," Mississippi Agricultural Experiment Station Bulletin 370, 1942.
Thompson and associates, "Broiler production," Oklahoma Agricultural Experiment Station Circular C-134.
C. I. Draper and R. J. Evans, "Soybean oil meal in the broiler ration," Washington Agricultural Experiment Station Circular 19, 1944.
Division of Animal Husbandry, Maine Department of Agriculture, "Fifth Maine egg production and broiler test. Summary of three hatches," mimeograph, 1951.

All these studies reported one or more observations on age, weight, and feed consumption for one or more lots of birds. The data were classified into different rates of growth and statistical techniques were used to derive the growth schedules. Card and Scott reported an experiment on the growth of cockerels and pullets and made an economic interpretation similar to that contained in this bulletin.


Acknowledgment: The author wishes to express his appreciation to members of the Departments of Poultry Husbandry and Agricultural Economics for helpful suggestions on presenting the results of this study.