Bulletin 510-S

Floor Space and Feeder Space

as factors in finishing turkeys for market

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Floor Space and Feeder Space as factors in finishing turkeys for market

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Introduction

The purpose of this bulletin is to make available knowledge gained through turkey management research at the Colorado Agricultural Experiment Station. A portion of the funds provided for this work was obtained from the turkey growers themselves through grants-in-aid from the Colorado Turkey Federation and the National Turkey Federation. Support was also provided by State and Federal funds allocated to the Agricultural Experiment Station.

In a summary survey taken in 1955 from 36 turkey growers in Colorado, representing 200,048 turkeys, some interesting management factors were unveiled as to the amount of feeder, waterer, and floor space used for commercial turkeys. A great variation was observed, with many growers providing what might appear to be an excessive amount, while others appeared to use a very limited amount. The grower has found it increasingly difficult to delineate between equipment and building costs when these are projected on a per bird basis as they relate to the actual requirements of the turkey.

The research reported represents an attempt to provide data concerned with critical management factors, floor space, and feeder space of turkeys reared in confinement. This work was initiated because it was felt by the workers that this area was in immediate need of investigation, particularly in view of the recent shift from range rearing to complete confinement of pole-type housing.

In addition, as the turkey industry expands and more birds are raised on larger production units the industry must pay more attention to management practices. It is increasingly important that the turkey grower become more efficient in his methods of

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management. It is felt that the application of information from management research programs will be of great benefit to those who apply the results.

Many of the disease, management, and associated problems related to quality of the carcasses produced may be traced back to original management conditions. Overcrowding and the factors which accompany overcrowding may trigger disease organisms to an active outbreak which otherwise may not have presented a major problem.

The work reported has been carried out on what the commercial producer considers a small number of birds; however, one should consider that many detailed measurements have been recorded.

The information contained herein should be considered as a "norm" or guide line which, to date, has not been available. These research findings may be modified to meet local conditions of temperature, moisture, air movement, and size of bird, according to the best judgment of the management pattern.

Previous Work and Importance of Problem

Various accepted floor space allocations for growing turkeys have been summarized by Marsden and Martin (1955) and have been widely applied. Wyne *et al.*, (1956) carried out an extensive study of floor space requirements of poults reared to 8 weeks of age. No significant differences in rate of growth were reported in this study when birds were allocated 3.2 or 5.5 square feet of floor space, 0.9 inches of waterer space, and 1.6 to 3.2 linear inches of feeder space. Wyne *et al.*, (1960) further reported that 1.5 inches of feeder space was adequate for growth of large-type white turkeys from 8 to 16 weeks of age, while 1 inch of feeder space appeared adequate after 16 weeks of age.

There appears to be some lack of coordinated research concerning floor space requirements of turkeys during the latter portion of the growing period. In addition, the economic aspect of commercial turkey production in pole buildings is based on the efficient utilization of space. This is determined by gain in body weight, livability, and market grade of the bird produced. Confinement rearing of this type has also emphasized the need for information concerning the relationship of feeder and waterer space requirements to efficient production.

Since extensive studies and observations on the relationship of floor space to feeder and waterer space in commercial broiler production have indicated some direct relationships economically, it was thought to be important to investigate these same factors in turkey growth in view of the growing importance of confinement rearing of turkeys.

Procedure and Results

A commercial strain of Broad Breasted Bronze turkeys was employed throughout a series of studies conducted over a 3-year period. These birds were obtained as day-old poults and reared together until 15 weeks of age in pens of approximately 150 poults each. They were fed the Colorado Agricultural Experiment Station 28 percent protein turkey starter diet until 8 weeks of age and then a 20 percent protein all-mash growing diet (table 1) until the termination of the study.

All birds were weighed individually at the initiation of study at 15 weeks of age, again at 20 weeks of age, and at the termination of the study. The termination of the study for hens was 23 weeks of age; for toms, 25 weeks of age. The sexes were reared separately in pens 16 feet by 36 feet. These extended completely across the width of a pole house.

Market grades and finish scores were assigned after birds were processed at a commercial processing plant. Carcass grades were recorded as given by a USDA approved grader, and finish score was assigned on the basis of finish. Five is the greatest degree of finish and one is the least value.

Waterer space was allocated on the basis of 1 linear inch per bird in all trials. Feeder space was allocated at 2 linear inches per bird except where comparisons were made between two and four linear inches of feeder space. In trial 4, feeder space comparisons were made between 2.0, 0.75, 0.50, and 0.25 linear inches for males; and 2.0 and 0.75 linear inches for females.

In the first two trials, feeders used in the pole house were the round, bulk, and hanging types. In the dry lot pens, porch-type feeders were used together with round, bulk feeders similar to those used in the pole house. The bulk feeders were employed to provide the majority of feeder space in the pole house.

In the third trial, porch-type hanging feeders were used, and birds were confined to pens 16 feet by 13 feet. Dry lot confinement birds were assigned comparable feeder space and waterer space to those birds in the pole house with yard space allocated at a rate of 12.8 square feet per bird and shelter space at 0.92 square feet per bird. Feeder space was allocated at the rate of 2 linear inches and 4 linear inches in order to obtain a comparison of the effects of doubled feeder space. Data were analyzed according to the "t" test and Analysis of Variance technique (Snedecor, 1946).

Samples of five different types of litter materials were distributed among the pens so that each pen contained three different samples in each of two trials. These materials were separated by wood dividers. Samples were

TABLE 1. Composition of diets.

Ingredients	Starter	Grower	Finisher
Ground corn	440	690	930
Ground milo	440	640	640
Brewers dried yeast	40	60	-----
Soybean oil meal (44%)	720	320	220
Fish meal (70%)	100	60	-----
Meat and bone scrap (50%)	100	100	50
Dehydrated alfalfa meal (17%)	40	50	50
Dried whey	40	-----	-----
Limestone	40	60	50
Dicalcium phosphate	-----	-----	50
Steamed bone meal	30	10	-----
Salt, Iodized	10	10	10
Total	2000	2000	2000
Vitamin Mix/ton of ration			
Vitamin A, I.U.	5,600,000	7,400,000	5,000,000
Vitamin D_3, I.C.U.	1,200,000	1,600,000	1,200,000
Vitamin B_{12} mg	4	-----	8
Vitamin E gm	8	13.2	8
Riboflavin gm	0.8	2.4	2.6
Niacin gm	30.7	40.5	40.0
Calcium Pantothenate gm	3.4	5.4	5.0
Choline Chloride (25%) gm	1720	3264	920
$MnSO_4$ oz	7	11	7
Methionine lb	1	-----	1
Aureomycin gm	10	-----	-----
Calculated percent protein	27.8	20.0	14.2

placed in different positions in the various pens in order to minimize pen position effects.

Litter samples were stirred with a roto-tiller each time the birds were weighed during the experimental period. Litter moisture was determined by grinding and drying samples in a drying oven until constant weights were obtained. Samples compared with wood shavings were wood chips (made from slabs of waste lumber processing), shredded sugar cane, peat moss, and flax straw.

Since preliminary studies at this station (Moreng, 1959) indicated that 3 square feet may crowd toms but may be adequate for hens, a series of trials were designed to investigate further the impact of floor space and feeder space on growth and development of market turkeys during the latter part of their rearing period.

Trial 1 was initiated in September 1958. The detailed design and the results of this trial are recorded in table 2. A rather consistent pattern of gain in body weight was obtained in this study as floor space allocations were increased for both sexes. It is interesting to note from the data that the greatest response in growth was obtained in the period from 20 weeks to market. Birds on the highest floor space allocations in both cases gained the greatest body weight.

Application of the "t" test to the data revealed that hens at 3 and 4 square feet were significantly heavier in body weight than those at 2 square feet. A highly significant increase in body weight at market age was obtained for toms at 5 square feet when compared to birds reared at 3 square feet. Livability in all groups was very high, and variation from group to group is not considered appreciable on the number of turkeys involved.

Market grade and yield of the turkeys on the various floor space allotments are shown in table 3. Once again the birds responded in a positive manner to the increased floor space allocation. This was particularly evident among the toms where grade A carcasses increased from 65.95 percent at 3 square feet to 85.08 percent at 5 square feet per bird.

This observation is also supported by the higher finish scores when a greater amount of floor space was allocated. Yield, including shrink, was greatest for toms at 5 square feet and for hens at 2 square feet although there was little difference in this figure among the three groups of hens. Total litter moisture was increased as floor space was decreased. Litter moisture was slightly higher in pens of toms than in pens of hens.

The second trial of the study was initiated in June 1959 and was designed to study the effects of increased floor space allotments on toms and a decreased floor space allotment on hens. This design was based upon the

TABLE 2. Performance of B. B. Bronze turkeys at various floor space allotments from 15 weeks to market, trial 1.

Sq. ft. floor space per bird	Total No. birds	Feed Efficiency[1]	Sex	Av. pounds gain in body weight			Av. market weight[2]	Livability (percent)
				15-20 wks.	20 wks. to market	15 wks. to market		
2	288	6.4	F	3.6	1.8	5.4	13.7	99.0
3	192	5.9	F	4.0	2.3	6.3	14.8**	99.0
4	144	6.0	F	3.7	2.8	6.5	15.1**	97.9
3	192	6.8	M	6.9	4.2	11.3	22.0	97.9
4	144	6.4	M	6.8	5.3	12.1	22.3	97.9
5	115	6.4	M	6.8	5.8	12.6	22.9**	97.4

[1]Pounds of feed per pound of gain.
[2]Market age—hens, 23 weeks; toms, 25 weeks.
**Significant to .01 level.

TABLE 3. Market grade and yield of B. B. Bronze turkeys on various floor space allotments from 15 weeks to market, trial 1.

Sq. ft. floor space per bird	Total No. birds	Sex	Yield[1] (percent)	Av. finish score[2]	Grade A carcasses (percent)	Total litter moisture (percent)
2	288	F	82.94	3.24	93.86	52.1
3	192	F	82.64	3.32	90.86	45.2
4	144	F	82.46	3.49	96.40	44.1
3	192	M	75.89	3.89	65.95	55.2
4	144	M	76.16	3.98	78.98	49.6
5	115	M	82.81	4.03	85.08	46.8

[1]Includes shrink.
[2]Finish scored from a low of 1 to high of 5.

results of trial 1, which indicated that hens could possibly be crowded more and toms should be allowed more room than had been planned in that study. A comparison was also made in this study between birds reared in the pole house and those reared under outside dry lot conditions.

Waterer space was held constant in all pens at 1 linear inch per bird. The experiment also included a comparison of the two different levels of feeder space. As in trial 1, feeder space was allocated at 2 linear inches per bird. However, in order to check the validity of this allotment, feeder space was doubled in some cases. Thus, in certain pens, feeder space was allocated at the rate of 4 linear inches per bird.

The design and a portion of the results of this experiment are outlined in table 4. It can be noted that the average pounds gain for males in the dry lot was greater when feeder space was doubled. In the pole house, gains were improved for males but not for females when 4 inches of feeder space were used. Females at 3 square feet had a greater market body weight than birds at 2 square feet. Toms gained more at 6 square feet than at 5 square feet in the pole house when feeder space was constant.

TABLE 4. Relationship of floor space and feeder space to growth of B. B. Bronze turkeys, trial 2.

Sq. ft. floor space per bird	Total No. birds	Av. pounds gain in body weight			Av. market weight[1]	Livability (percent)
		15-20 wks.	20 wks. to market	15 wks. to market		
		Dry Lot—Females				
12.8	125	4.3	1.6	5.9	13.5	99.2
12.8[2]	125	4.0	1.8	5.8	13.7	100.0
		Pole House—Females				
2.0	288	3.7	1.3	5.0	13.4	100.0
2.0[2]	288	3.6	1.3	4.9	13.5*	98.6
3.0	192	3.6	1.5	5.1	13.7**	99.5
		Dry Lot—Males				
12.8	125	5.8	6.0	11.8	22.6	96.8
12.8[2]	125	6.0	6.3	12.3	22.7	97.6
		Pole House—Males				
5.0	115	5.2	6.0	11.2	22.9	100.0
5.0[2]	115	7.7	6.5	14.2	23.5*	98.3
6.0	95	6.3	6.3	12.6	22.8	99.0

[1]Market age—hens, 23 weeks; toms, 25 weeks.
[2]These pens had double the feeder space provided in other groups.
*Significant to .05 level.
**Significant to .01 level.

Figure 1. Pole sheds should be constructed tot provide maximum draft-free ventilation and adequate natural illumination. White-painted steel has proven effective in reducing summer heat. All-weather sheds may be provided with removable side panels.

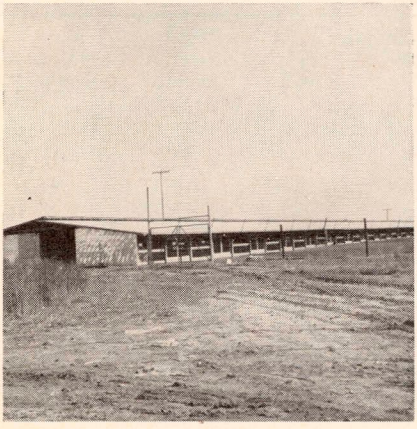

Figure 2. A pole shed may be used to provide complete confinement or it may be used in association with a yard as shown above.

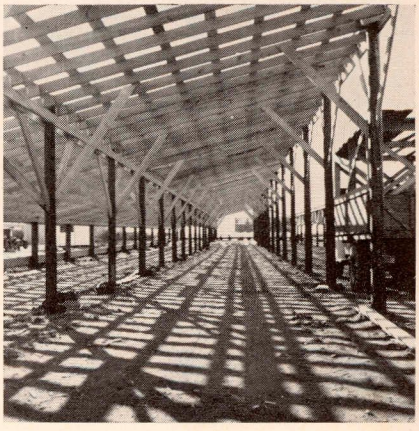

Figure 3. Structural strength and adequate roof support are important. Note braces from poles to prevent movement of building due to wind.

The data indicate that additional feeder space was of greatest importance. However, it should be pointed out that, at 15 weeks, the toms in this portion of the study averaged approximately 1 pound lighter in body weight than toms in the other groups. Thus, the high gain in body weight from 15 weeks to market may have been due in part to a compensatory gain during this period. The major portion of this gain took place in the period from 15 to 20 weeks of age. It is of further interest to note that the majority of the final differences in body weight recorded was most evident in the period 20 weeks to market.

Percent livability was high in all groups and comparable between treatments with no trends in evidence.

Table 5 contains the data obtained on the relationship of floor space and feeder space to feed efficiency, market characteristics, and litter moisture in trial 2. As can be seen from these data, there were slight differences in finish score and percent grade A carcasses on the dry lot and among the males in the pole house.

Both the percent grade A carcasses and finish score increased when feeder space was doubled or when an additional square foot of floor space was allotted in the pole house. Feed efficiency for the males showed little

TABLE 5. Relationship of floor space and feeder space to feed efficiency, litter moisture, and market characteristics of B. B. Bronze turkeys, trial 2.

Sq. ft. floor space per bird	Total No. birds	Feed efficiency[2]	Yield (percent)[3]	Av. finish score[4]	Grade A carcasses (percent)	Total litter moisture (percent)
			Dry Lot—Females			
12.8	125	4.84	83.7	3.53	83.1	-----
12.8[1]	125	5.16	82.7	3.60	76.4	-----
			Pole House—Females			
2.0	288	5.64	85.7	3.50	87.6	46.1
2.0[1]	288	6.25	82.6	3.46	76.7	46.5
3.0	192	5.44	80.7	3.61	88.2	41.5
			Dry Lot—Males			
12.8	125	5.26	80.6	3.46	81.5	-----
12.8[1]	125	5.40	81.5	3.50	80.2	-----
			Pole House—Males			
5.0	115	5.27	81.7	3.71	80.0	45.2
5.0[1]	115	4.82	82.8	3.85	89.5	42.7
6.0	95	4.25	83.4	3.73	88.4	30.1

[1]These pens had double the feeder space provided in other groups.
[2]Pounds feed per pound gain.
[3]Includes shrink.
[4]Finish scored from a low of 1 to high of 5.

TABLE 6. Response of B. B. Bronze turkeys to various feeder space allotments from 14 weeks to market, trial 3.

Feeder space (inches)	Total No. birds	Sex	Feed efficiency[1]	Av. pounds gain in body weight: 14-20 wks.	20 wks. to market	14 wks. to market	Av. market weight[2]	Livability (percent)
2.0	41	M	5.73	7.12	5.29	12.41	21.37	97.6
0.75	41	M	5.25	7.48	5.01	12.49	21.56	100.0
0.50	41	M	5.62	7.07	5.21	12.28	21.39	95.1
0.25	41	M	5.44	7.13	4.56	11.69	20.89	97.6
2.0	69	F	5.59	4.64	1.46	6.10	13.02	100.0
0.75	69	F	5.28	4.63	1.43	6.06	12.95	100.0

[1]Pounds feed per pounds gain.

[2]Market age—hens, 23 weeks; toms, 25 weeks.

TABLE 7. Market grade and yield of B. B. Bronze turkeys on various feeder space allotments from 14 weeks to market, trial 3.

Feeder space (inches)	Total No. birds	Sex	Yield[1] (percent)	Av. finish score[2]	Grade A carcasses (percent)
2.0	41	M	78.95	2.9	70
0.75	41	M	78.73	3.1	75
0.50	41	M	77.83	3.1	71
0.25	41	M	78.95	3.4	79
2.0	69	F	82.44	3.0	89
0.75	69	F	82.88	3.2	90

[1]Includes shrink.

[2]Finish scored from a low of 1 to high of 5.

difference in the dry lot when feeder space was doubled. In the pole house, doubling feeder space increased feed efficiency. The additional floor space also resulted in improved feed efficiency over birds at 5 square feet.

Hens under the dry lot conditions showed no increase in percent market grade when feeder space was doubled. Again, in the pole house, very little response to feeder space could be noted in the change in market grade, with a slight decrease when feeder space was doubled but no response to the addition of 1 square foot of floor space. Feed efficiency in the dry lot decreased somewhat with the additional feeder space; this was also true in the pole house and may have been due to wastage. Feed efficiency was increased slightly when an additional square foot of floor space was allocated at 2 linear inches of feeder space.

The third portion of the investigation was designed to obtain preliminary data on feeder space allocation and average gain below 2 linear inches per bird. Among the males (table 6), no differences were found when feeder space was reduced to 0.75 linear inches. However, at 0.50 linear inches there was a slight drop in average gain in weight and a greater reduction at 0.25 linear inches. Females showed a slight reduction at 0.75 linear inches. None of these differences was significant on the basis of the analyses of variance. Feed efficiency followed very closely the pattern of gain in all groups with some evidence of wastage among the toms at 2 linear inches. Livability was comparable in all groups.

Finish scores (table 7) and percent grade A carcasses followed a similar pattern of gain except for a slight unexplainable rise for these factors at 0.25 linear inches for the males. Carcass yield including shrink varied between the treatments.

A comparison of the performance of five different litter materials is outlined in table 8. These data, based on moisture uptake, indicate that the dryness of the products at the start of the study is an important factor in total moisture absorbed. The wood chips (about 2 inches square and one-eighth to one-fourth inch thick) were highest in total moisture; the predried cane litter was lowest. Therefore, they had the lowest and highest moisture uptake respectively when compared to wood shavings in trial 1.

In trial 2, the peat moss had the highest initial moisture and was comparable to the wood shavings in trial 1 in initial moisture and moisture uptake. The ground flax straw and the wood shavings in trial 2 were somewhat comparable to the cane in trial 1, and performed in a similar manner. The data indicate that an average moisture uptake of approximately 35 percent may be obtained from dry litter materials.

Observations indicated no appreciable differences in caking among the materials tested. Decreasing floor space was related to increasing moisture content of most litter materials.

TABLE 8. A comparison of the performance of different litter materials under varied floor space allotments of B. B. Bronze turkeys.

Sq. ft. floor space per bird	Sex	Litter Material	Moisture Percent		Treatment[1] period (weeks)
			Initial	Uptake	
		Trial 1			
2	F	Chips	31.4	23.8	8
		Cane	19.5	33.2	8
		Shav.	16.5	34.9	8
3	F	Chips	33.6	15.4	8
		Cane	9.2	39.1	8
		Shav.	18.9	22.3	8
4	F	Chips	33.3	12.2	8
		Cane	9.9	37.6	8
		Shav.	16.8	25.5	8
3	M	Chips	40.4	15.3	10
		Cane	10.4	47.9	10
		Shav.	20.6	34.0	10
4	M	Chips	35.8	14.4	10
		Cane	16.9	33.9	10
		Shav.	26.4	24.4	10
5	M	Chips	31.2	14.8	10
		Cane	11.1	37.0	10
		Shav.	22.8	26.5	10
		Trial 2			
5	M	Flax Straw	9.8	34.0	8
		Peat Moss	19.8	24.9	8
		Shav.	9.1	38.1	8
5	M	Flax Straw	9.8	31.2	8
		Peat Moss	19.8	27.3	8
		Shav.	9.1	30.9	8
6	M	Flax Straw	9.8	19.3	8
		Peat Moss	19.8	12.4	8
		Shav.	9.1	20.0	8

[1]From 15 weeks to market age of birds.

Economic Implications to the Producer

Considering the strict dollar and cents value of floor space utilization on the basis of this study, and projecting the data to a larger number of birds, some interesting conclusions may be drawn. For example, 3,000 square feet of space in a pole house would house 1,000 turkeys at 3 square feet, 750 at 4 square feet, and so on. Assuming a tom market price of 22 cents per pound and a hen price of 27 cents per pound, live weight, with feed costs at $3.50 per 100 pounds, the figures listed below could be applied, using the data in tables 2 and 3 for the period from 15 weeks to market.

Since the percent grade A hens was uniformly high, all hens were figured as grade A. In the case of toms, percent under grades was included in calculating total income. Since livability was uniformly high, no adjustments for this factor have been included.

POLE HOUSE 3,000 Square Feet

Hens

At 2 sq. ft. per bird

1,500 hens @ 13.7 pounds = 20,550 pounds @ $0.27 = ... $5,548.50

Using:

Average gain	5.4 pounds
Feed efficiency	6.4 pounds feed per pound of gain
Feed cost	$3.50 per 100 pounds

1,500 X 5.4 X 6.4 X $0.035 = ... 1,814.40

Total income over feed costs	$3,734.10
Total income per bird over feed costs	$2.49
Total income per square foot over feed costs	$1.24

At 3 sq. ft. per bird

1,000 hens @ 14.8 pounds = 14,800 pounds @ $0.27 = ... $3,996.00

Using:

Average gain	6.3 pounds
Feed efficiency	5.9 pounds feed per pound of gain
Feed cost	$3.50 per 100 pounds

1,000 X 6.3 X 5.9 X $0.035 = ... 1,300.95

Total income over feed costs	$2,695.05
Total income per bird over feed costs	$2.70
Total income per square foot over feed costs	$0.90

At 4 sq. ft. per bird

750 hens @ 15.1 pounds = 11,325 pounds @ $0.27 = ... $3,057.75

Using:

Average gain	6.5 pounds
Feed efficiency	6.0 pounds feed per pound of gain
Feed cost	$3.50 per 100 pounds

750 X 6.5 X 6.0 X $0.035 = ... 1,023.75

Total income over feed costs	$2,034.00
Total income per bird over feed costs	$2.71
Total income per square foot over feed costs	$0.68

POLE HOUSE 3,000 Square Feet

Toms

At 3 sq. ft. per bird—1,000 Toms

65.95% Grade A	660 X 22.0 pounds =	14,520 pounds @ $0.22 =	$3,194.40
34.05% Grades B & C	340 X 22.0 pounds =	7,480 pounds @ $0.18 =	1,346.40
Total Sales			$4,540.80

Using:

Average gain	11.3 pounds
Feed efficiency	6.8 pounds feed per pound of gain
Feed cost	$3.50 per 100 pounds

1,000 X 11.3 X 6.8 X $0.035 = ... 2,689.40

Total income over feed costs	$1,851.40
Total income per bird over feed costs	$1.85
Total income per square foot over feed costs	$0.62

At 4 sq. ft. per bird—750 Toms

78.98% Grade A	592 X 22.3 pounds =	13,202 pounds @ $0.22 =	$2,904.44
21.02% Grades B & C	158 X 22.3 pounds =	3,523 pounds @ $0.18 =	634.14
Total Sales			$3,538.58

Using:

Average gain	12.1 pounds
Feed efficiency	6.4 pounds feed per pound of gain
Feed cost	$3.50 per 100 pounds

750 X 12.1 X 6.4 X $0.035 = ... 2,032.80

Total income over feed costs	$1,505.78
Total income per bird over feed costs	$2.01
Total income per square foot over feed costs	$0.50

At 5 sq. ft. per bird—600 Toms

85.08% Grade A	510 X 22.9 pounds = 11,679 pounds @ $0.22 =		$2,569.38
14.92% Grades B & C	90 X 22.9 pounds = 2,061 pounds @ $0.18 =		370.98
Total Sales			$2,940.36

Using:

Average gain	12.6 pounds
Feed efficiency	6.4 pounds feed per pound of gain
Feed cost	$3.50 per 100 pounds

600 X 12.6 X 6.4 X $0.035 =	1,693.44
Total income over feed costs	$1,246.92
Total income per bird over feed costs	$2.08
Total income per square foot over feed costs	$0.42

These calculations indicate that crowding the birds will produce the greatest total income from a given area. As can be seen from the projected data, the profit per bird is increased as floor space is increased.

Even though the greatest profits were obtained at the lower floor space allocations, one may question the advisability of rearing birds under these crowded conditions when all other management factors are considered. These factors include the build-up of potential disease hazards as well as the losses from lowered market grades. The size and age of the bird at market time, the correlated management factors, and environmental conditions of temperature and humidity will be major sources of variation in the application of these data and should be considered.

Summary and Conclusion

1. There was little evidence to indicate differences in gain in body weight from 15 weeks to market between hens reared in dry lot or pole house. However, toms gained more in body weight in the pole house.

2. Two square feet of floor space appears to be optimum for hens reared in a pole house and three square feet for toms appears optimum on the basis of total income over feed costs. However, disease potential and market grade losses may be intensified over an extended period. This may prove that crowded conditions are very unfavorable. All related environmental and management factors must be included as important determining guides. Ultimate size and age of bird must also be considered.

3. Doubling feeder space from 2 linear inches to 4 linear inches resulted in significant increases in body weight. Reduction of feeder space indicates that 0.75

linear inches for toms and 0.75 linear inches (the lowest level tested) for hens were comparable. One-fourth of a linear inch resulted in reduced efficiency of production for toms.

4. The litter materials tests indicated that crowding increased litter moisture. Uptake of moisture was found to be greatly influenced by the degree of dryness of the initial sample, with the drier samples taking up the greatest amount of moisture. Samples tested were quite comparable in their performance, with wood chips being the inferior.

5. In applying the results of this research one must consider the general management level of the flock. Stress factors involving environment, market prices, and disease history of the farm should be considered. Data reported, therefore, should be considered as a guide which should provide optimum results the maximum number of times.

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2. Diet formulation by Dr. Paul A. Thornton is gratefully acknowledged.

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