11-1964

B633: The Production of Specific Pathogen Free Broilers in Maine

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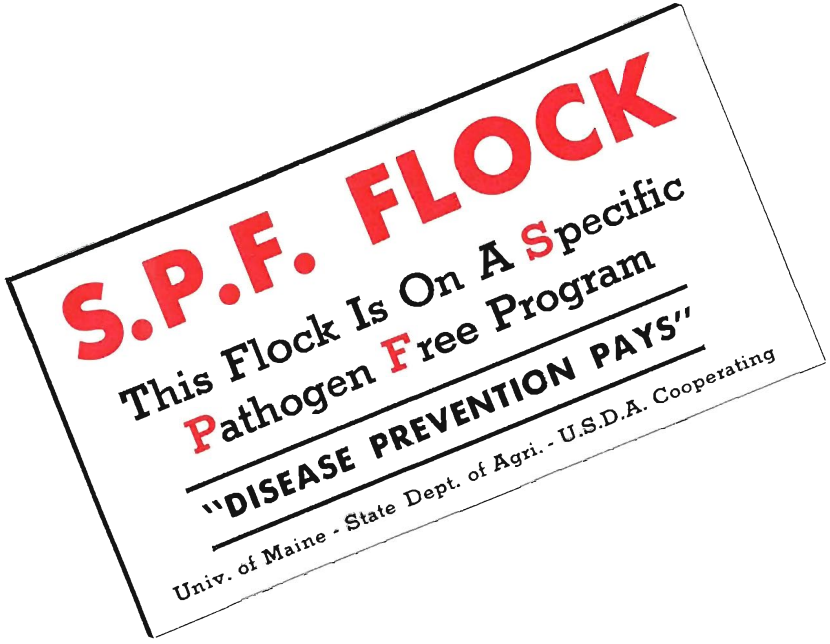
BULLETIN 633 **NOVEMBER 1964**
MAINE AGRICULTURAL EXPERIMENT STATION



ORONO MAINE

Acknowledgments

Due to the field and laboratory detail required to complete this work it is obvious that many persons and many sources of funds were necessary. The poultry industry of Maine was extremely cooperative. The following, to the best of our knowledge, is complete.

Personnel

Each person listed performed some valuable detail. Dr. J. F. Witter, Dr. D. D. Payne, Dr. A. Kalvaitis, Dr. P. Brunet, Prof. M. Gershman, Mr. R. Cuozzo, Mrs. D. Reardon, Miss F. Fling, Mr. V. MacDonald.

Financial Support

Animal Disease and Parasite Research Division of Agricultural Research Service, USDA, under Cooperative Agreement 12-14-100-5305 (45); Animal Disease Eradication Division, Agricultural Research Service, USDA; Maine Broiler Associates; Regional Research Funds under Northeast Regional Project NE-5; and other State and Federal Funds of the Maine Agricultural Experiment Station.

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THE PRODUCTION OF SPECIFIC PATHOGEN FREE (SPF) BROILERS IN MAINE

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INTRODUCTION

This bulletin describes the methods used and results obtained in the production of broiler chickens free of the common poultry diseases.

Income from poultry is twice as large as from any other single crop or animal industry in Maine. Therefore, many people are dependent for a livelihood on this great industry, the ultimate objective of which is always to produce a better quality product for the consumer.

The poultry industry of the United States has shown phenomenal growth during the past 15 years. With this growth have come more disease problems due to poor husbandry practices, such as overcrowding, inadequate ventilation, and poor sanitation. The advent of compulsory poultry inspection at all processing plants by the Agricultural Marketing Service (AMS) of the U. S. D. A. in 1959 pinpointed the major cause of unwholesomeness in poultry. In 1963, for instance, the AMS revealed that out of 45,214,249 birds condemned, 31,788,786, or 71%, were due to disease alone. Of this total loss due to disease, 37.8% was the result of airsacculitis.

The above information is ample to justify the support for an investigation of the various factors responsible for poultry losses and of methods to control these losses.

The general plan of the research was to develop and test a workable program for the control of the various broiler losses represented by AMS condemnation and at the same time improve as many other features of broiler production as possible.

The authors and their colleagues well realize that the "Maine SPF Program" is not perfect and complete in every detail. Much, much more research is necessary. The facts are presented here exactly as they have occurred. However, the following report covering approximately a three-year period, 1961-1964, has given fresh hope and has opened new vistas of potential increase in efficiency by improving growth, lowering feed conversion ratios, lowering mortality, and reducing processing plant condemnations.

It is hoped that this study may serve as a guide to those wishing to eradicate or control some of the common disease problems in broiler production.

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LITERATURE REVIEW

This research was directed toward the control and eradication of the common diseases of poultry, such as *Mycoplasma gallisepticum*-type S_6 (S_6-PPLO), Newcastle disease, pullorum-typhoid, infectious bronchitis, infectious laryngotracheitis, fowl pox, parasites (internal and external), avian encephalomyelitis, and any other disease which could be readily diagnosed. There has been a tremendous amount of supporting research directed toward the production of germfree chickens.[1]* Luckey, for instance, points out that chickens and turkeys which were germfree grew faster for 32 days than did those on conventional diets. Another case was singled out where germfree chickens grew as much as 25% faster than conventional birds. This research has offered very little that could be applied commercially because often only a few birds, usually less than ten, have been studied under various nutritional diets and very expensive elaborate physical conditions.

During the past 15 years many successful attempts have been made to establish colonies of laboratory animals free of certain types of pathogenic agents. These animals are commonly designated as "specific pathogen free—SPF" or, less frequently and incorrectly, called "disease-free." The term "disease-free" is unrealistic because most laboratories are not qualified to diagnose all the pathogens present, and furthermore the animals may be carrying agents which heretofore have not been identified. The SPF animals must be clearly differentiated from the so-called "germ-free" because the latter are raised in a completely sterile environment which must by definition be bacteriologically sterile.

Cockburn[2] stated that the "eradication" of infectious disease as a concept in support of public health has been advanced only within the past two decades, yet it is replacing "control" as an objective. In support of this, he stated that the biologic vector of malaria, the *Aedes aegypti* mosquito, has been successfully eliminated from several South American countries, viz., Brazil, Peru, Bolivia, Ecuador, Columbia and Paraguay. Control of infectious diseases is an unending operation, whereas, after eradication comparatively little effort is required.

Kerr[3] described lessons to be learned from failures to eradicate some human diseases. He elucidated on the fact that the easy part in eradication programs is soon accomplished and that it then becomes a very sophisticated operation requiring administrative and governmental action. He emphasized the high importance of research involving ecology in such diseases as malaria and yellow fever.

A method was described by Young, *et al*[4] in 1955 by which baby pigs were delivered aseptically by hysterectomy and reared in isolation

* Numbers in parentheses indicate references cited on page 14.

on a special diet without colostrum. This was probably some of the early beginnings of the current extensive SPF program in swine in the United States. A later report, in 1959,[5] described the repopulation of an experimental swine herd with SPF stock. These pigs were approximately 30% heavier at 56 days and 25% heavier at 154 days than their predecessors in the same herd. This program has grown from an original 39 SPF pigs obtained by hysterectomy to a total repopulation in November, 1960, of 100 additional farms. All these herds remained free of two serious diseases of swine, viz., atrophic rhinitis and virus pig pneumonia.[6] A similar type of SPF swine study was reported from Canada by Abelseth.[7]

Another report by Grace *et al*[8] described a method of protecting lambs from environmental infections by the use of a hysterectomy technique.

SPF mice were delivered by caesarean section.[9] The mice grew more rapidly than ordinary mice on complete diets and continued to gain weight although at a slower rate when fed deficient diets which caused ordinary mice to stop growing or to lose weight. The SPF mice proved much more susceptible than ordinary mice to certain experimental bacterial infections. In contrast, they were much more resistant than ordinary mice to the lethal effect of large doses of endotoxins.

The control of animal diseases and its relation to international markets as applied to poultry as explained by Anderson[10] in 1964, follows:

> "Intensive, highly specialized methods of production are making livestock products available, in undreamed of quantities, at prices which compete favorably with similar products produced by traditional methods. The result is a broadening of export trade. The poultry industry has established the pattern. Vast quantities of eggs and poultry meat now flow from countries which hitherto never exported them and to countries which in the past could not afford to buy them. Unfortunately, this increased trade has brought with it Newcastle disease to all but a few countries of the world in the past twenty years."

The significance of the above statements by Andersen has been substantiated by research work.[11] This report stated that the virus of Newcastle disease survived in the skin of poultry carcasses stored at 34 to 36°F. for 96 days and in the bone marrow for 308 days. In 1947, for example, a series of Newcastle outbreaks occurred in Great Britain within 13 days of the first large scale importation of table poultry after the war. The virus was isolated from carcasses of chickens, turkeys, ducks and geese.

Accumulated scientific information has given an impetus to the development of chickens and turkeys free of PPLO.

A method of controlling PPLO in turkeys was reported by Rosenwald and Adler in 1962.[12] The same year Cumming reported an eradication program in Australia.[13]

In 1963 Chute and O'Meara reported a PPLO eradication program for Maine.[14] The same authors reported details of an S_6-PPLO testing program for breeding hens in 1964.[15] They outlined extensive field experiments supported by laboratory data which showed it was possible and practical to produce poultry free of S_6-type PPLO, Newcastle disease, and most of the common types of parasites. These studies and one earlier report[16] indicated that S_6-PPLO free chickens grew heavier during the first 9 weeks of age, compared to similar birds under ordinary disease control conditions.

The state of Maine has always been advanced in poultry disease control. Diseases such as pullorum, fowl typhoid, infectious laryngotracheitis and fowl pox have for a long time been quarantined by the Division of Animal Industry (State Department of Agriculture).[17] After 43 years of pullorum-typhoid testing, almost two million breeding hens annually have been tested since 1961 with no reactors having been found.[18]

Maine is very isolated geographically, being bordered by Canada, the Atlantic Ocean and New Hampshire. This offers a nearly ideal opportunity to produce birds free of the common diseases. Only with excellent cooperation from the Divisions ADE, USDA and ADPD of the ARS, the Maine State Department of Agriculture, the University of Maine, and particularly the Maine poultry industry itself, has it been possible and feasible to develop this SPF program for the broiler industry.

MATERIALS and METHODS

To form a practical SPF program it was considered necessary to begin with the usual breeding stock, or broiler chicks, or eggs available regardless of their PPLO status.

It was first decided that to qualify for the SPF program a farm must possess certain physical features to assure a clean and sanitary enterprise. These features for Maine are outlined as follows:

1. Houses must not have dirt floors.
2. Houses must be screened against wild birds (maximum of 1 inch).
3. Houses must be provided with doors that lock and are kept locked at all times.

4. The farm shall have bulk feed facilities with outside filler pipes. No feed delivered shall have been handled in bags.
5. There must be outside oil filling pipes.
6. Poultry houses must be located no closer than 100 ft. to public highways and not closer than 1000 ft. to poultry houses on adjacent premises.
7. The farm must have an approved disposal pit or incinerator for dead birds.
8. Houses must be located at least 1000 ft. from poultry litter piles and other vermin-attracting debris.
9. All houses should have a pan with an approved disinfectant and a stiff brush in the grain room, next to the door. The disinfectant solution should be changed at least once daily. The caretaker must use this to clean his footwear upon entering or leaving the house.
10. Sawdust should be delivered in clean trucks.
11. The house must be thoroughly cleaned and disinfected with an approved disinfectant prior to the introductions of the baby chicks. A list of the approved disinfectants will be provided for the caretaker.
12. Chicks must originate from NPIP flocks (Pullorum-Typhoid Free).
13. No vaccinations or medications can be carried out for the duration of an agreement unless mutually agreed upon by all parties involved.
14. It is reasonable to assume that such medications as coccidiostats (chemicals only) as are currently used will be premixed in the feed prior to delivery.
15. Only one age of birds is permitted on a farm and no pet birds or other poultry allowed.
16. No visitors, servicemen, feedmen, salesmen, or neighbors are to be allowed into the houses at any time.
17. A log book showing date and time must be kept indicating any authorized persons entering houses.
18. No domestic animals shall be permitted to enter the poultry house (e.g., dogs and cats.)
19. No tractors, dump trucks, or other equipment used in connection with the poultry enterprise can be borrowed from or loaned to other farms.
20. Baby chicks shall be delivered in new or disinfected shipping equipment, directly from the hatchery, by attendants wearing disinfected shoes, freshly laundered coveralls, and caps.

21. Caretakers shall not visit premises where other poultry are kept or poultry products are processed.
22. None of the members of the caretaker's household shall work or provide service where poultry is kept or poultry products are processed.
23. Poultry meat and eggs for home consumption shall be purchased in grocery stores only.
24. The cooperator must agree not to sell, trade, lease or otherwise remove or dispose of birds without permission of the disease control agencies, the state government, ADE officer or Department of Animal Pathology, University of Maine. These agencies must be notified 48 hours prior to taking birds to market.
25. Birds removed from the farm must go directly to a processing plant where samples for disease studies will be obtained by appropriate government personnel.
26. Since blood samples or birds will be collected under the supervision of a veterinarian and the methods used are known to be safe, and the birds under the care and management of the cooperator, no liability shall accrue to the disease control agencies in the event of damages or losses or injury incidental to the handling of the flock.
27. The cooperator shall keep and provide the necessary records desired by the disease control agencies.
28. Records of deaths and abnormalities in the health of the flock shall be kept by the caretaker.
29. The disease control agent has the privilege of entering the poultry houses and soliciting the assistance of the caretaker in removing birds for examination and necropsy. He may collect blood samples or perform other duties necessary to fulfill this contract obligation.

After a farm was selected to conform to the above criteria, the chicks were moved there. The chicks were inspected when 4 and 7 weeks old.

At these times representative samples of blood were taken from chicks in the various pens. Blood samples were taken with a sterile syringe directly from the heart, using heparin as an anticoagulant. At market time (8½ to 9½ weeks of age in the case of broilers) blood was collected from 0.25% of the flock before slaughter. The birds were processed and the condemnations were recorded as listed in the inspector's record (A.M.S. Federal Veterinary Inspector).

The blood samples were taken to the laboratory and tested by standard procedures for the following diseases: pullorum and typhoid

(tube test), Newcastle disease (ND) (hemagglutination-inhibition test), infectious bronchitis (IB) (serum neutralization test), and PPLO (serum plate agglutination test, University of Connecticut antigen, as well as tube agglutination test).

Other data obtained on each flock were the average weight per bird at the processing plant, livability (assuming 102 per cent were placed on each farm), and feed conversion (number of pounds of feed to produce a pound of meat).

In all visits to the farm by official personnel it has been the policy to use only freshly laundered coveralls and sterilized rubber boots. It is always the practice to step in a foot-bath containing a disinfectant prior to entering a chicken house and also upon leaving. The same set of clothing and boots is not used on another farm that day. This is exemplified in the photographs.

RESULTS

Table 1 presents the total broiler flocks studied.

Table I—Summary of 143 SPF Broiler Flocks in Maine
For a Two and One-half Year Period

No. Flocks	%	Free of	No. Birds
98	61	Infectious Bronchitis	1,691,410
73	51	PPLO	1,119,357
135	95	Newcastle Disease	2,293,132
143	100	Laryngotracheitis, fowl pox, *S. pullorum* and *S. gallinarium*	2,436,232

Period 10/2/61 to 3/8/64

An extra 297,674 PPLO free birds were screened to determine if clean birds remained free of this disease for 9 weeks. This fact was confirmed. These chicks were hatched from S_6-PPLO free parents and placed on farms not necessarily meeting SPF standards. They were checked on the farms and followed through the processing plants the same as SPF flocks.

These data show that some diseases such as infectious bronchitis are difficult to control. All the chicks for the period of study were not from PPLO negative parents so many would normally be infected.

No evidence of parasitism by roundworms, tapeworms or external parasites was ever observed.

The real proof of disease control is to follow a given farm record over a long period because in an integrated broiler operation it is easy to find a few good or superior flocks every week. Table II shows the results of a farm studied over a period of three years. Note the relative absence of respiratory diseases after the first two flocks. It will be ob-

served that, in three different lots which were marketed and that had had infectious bronchitis, two of these had a higher than normal condemnation rate.

Table III shows the performance of an SPF flock over a two and one-half year period. There are many instances in the broiler industry where a flock has performed much better. However, the point to consider is that this farm has consistently done well under the SPF requirements. The high incidence of condemnations in the last two lots could not be adequately explained. It was known that a very low level of the coccidiostat was used in the feed and that there was pathological evidence of coccidiosis even though the weight and feed conversion of the flock was not materially affected.

Table IV shows still another typical SPF flock. The significant fact appears to be that the flocks will continue to improve over a period of time. It should also be remembered that these are farms studied continuously over long intervals. Table V shows similar data to the previous flocks.

Table VI presents a farm study where a bird with leukosis has never been condemned at the processing plant. This is based on the gross examination of every bird at time of slaughter and further substantiated by a histological examination of any diseased tissue.

Tables VII, VIII and IX show the relationship of various sizes of flocks with no respiratory disease, one respiratory disease, and two respiratory diseases. These data point out the desirability of producing flocks of broilers free of respiratory disease.

One of the major problems not resolved by the SPF program has been the increase in leukosis noted at the processing plant in 9-week old birds. There are some data to indicate that in cases where intestinal coccidiosis was a problem, leukosis was also much higher than where coccidiosis was well controlled.

Infectious bronchitis has continued to be a problem. One case of "infectious bursal agent" was studied in an SPF flock. Three cases of the disease have been encountered.

Table X shows the specific causes of condemnations as inspected by the Agricultural Marketing Service veterinary inspectors. These flocks were taken at random and exemplify the very low incidence of birds condemned for airsacculitis or respiratory disease. In the total of 2,436,232 birds studied in this report no birds have ever been condemned due to parasites, overscald, decomposition or tuberculosis.

Table XI shows three SPF broiler flocks in an integrated company where 253,900 broiler chicks were placed in one week. This type of information is not available over a long period of time. However, it indicates that the SPF flocks compared favorably for this time. These

flocks came from the same source of chicks, used the same feed supply and were under the same general management.

Table XII shows the U. S., State, and SPF averages of condemnations for airsacculitis only. It will be observed that a continual improvement has been accomplished over a long period.

Early in the year 1964 one integrated poultry company established all of its breeding flocks as S_6-PPLO negative. Twenty-five broiler farms (383,748 birds) were studied during February, March, April, and May, the objective being to find out if broiler flocks became positive to PPLO for an average 9-week period. These flocks were tested in the same manner as the SPF flocks, and of the 25 flocks only one became positive to the PPLO test. It is interesting to note that these were roasters and had been kept to 13 weeks of age. These farms did not meet the SPF standards and, in fact, some (7) were considered below the average of broiler flock management.

DISCUSSION

Although direct comparison of the performance of SPF broilers to ordinary broilers is not possible, indirect comparisons indicate an improved performance on the same farm over a long period. It is not realistic to place SPF stock and infected broilers on the same farm for comparison due to the ultimate spread of the infection from infected to clean stock.

In all these studies the SPF data were provided by several different integrated companies. Therefore it is difficult to compare the results of one company with another. The feed formulation is different with every company. The policy of some companies is to feed a very concentrated feed to produce the most rapid growth in the shortest period. Other companies do not do this. Also the current price of ingredients such as corn, soybean, meal, fish meal, etc. influences the quality of the feed. The fundamental objective is to determine the control of diseases and the epizootiology of the various diseases.

Problems have been numerous. The disease infectious bronchitis has been difficult to eradicate. Many times to completely eradicate IB it has been necessary to make a detailed study of the farm to find the sources of infection.

SUMMARY and CONCLUSIONS

1. A total of 2,436, 232 birds in 143 broiler flocks was grown under a rigid isolation and sanitation program over a two and one-half year period.
2. Without any vaccination, 95% remained free of Newcastle disease,

51% free of S_6-PPLO (not all chicks came from free breeder flocks), and 61% free of infectious bronchitis. Infectious bronchitis has been the most difficult to control.

3. In flocks studied over a three-year period on the SPF program, respiratory disease has been practically eliminated as measured by laboratory studies and postmortem examination at time of slaughter.
4. Farms on the SPF program have eliminated respiratory diseases and improved over a three-year period.
5. Flocks without IB, ND or PPLO had better weights, feed conversion, livability, and lower condemnations than flocks with one or all of these diseases.
6. PPLO was found in only one farm (roasters, 13 weeks of age) when S_6-PPLO free chicks were placed on 25 farms (383,748 birds) of average management and environment. This indicated that broiler flocks will remain free of the disease if free stock is placed on the farm.

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APPENDIX A

Table II—Flock Performance of an SPF Grower

Date	No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
11/23/61	8,000	+	–	+	100.8%	3.63	2.15	0.2%
2/3/62	8,000	+	–	+	95.2%	3.00	2.27	6.8%
4/23/62	9,200	–	–	–	100.6%	3.52	2.14	0.19%
7/5/62	5,732(*)	–	–	–	95.8%	3.23	2.31	0.21%
9/22/62	7,900	–	–	–	99.4%	4.14 (9-2)†	2.13	0.34%
12/6/62	7,900	–	–	+	99.1%	3.94 (9-1)	2.22	0.88%
2/20/63	7,200	+	–	–	98.8%	3.96 (9-2)	2.15	1.2%
5/7/63	7,000*	–	–	–	99.3%	4.14 (9-1)	2.14	0.028% Males
7/19/63	7,200	–	–	+	97.3%	3.81 (9)	2.11	0.039%
10/11/63	7,700	–	–	–	101.0%	3.90 (8-6)	2.15	0.23%
12/26/63	7,900	–	–	–	98.6%	3.59 (8-4)	2.14	0.53%
3/9/64	7,100*	–	–	–	99.0%	3.72 (9-1)	2.15	0.88%

* S_6-PPLO Free Stock
IB Infectious bronchitis (+ serologically positive) (– serologically negative)
ND Newcastle disease
PPLO Pleuropneumonia-like serological test S_6 antigen
Liv. Number of birds finally slaughtered and based on 102% placement of day-old chicks
Wt. Weight in pounds
† 9-2 indicates the birds were 9 weeks and 2 days of age. Otherwise if no period is shown all birds are 9 weeks of age
Conv. Number of pounds of feed to produce one pound of meat
Cond. Official number of birds condemned by Agricultural Marketing Service, U.S.D.A.

Table III—Flock Performance of an SPF Grower

Date	No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
4/21/62	4,500	–	–	+	100.7%	3.97	2.22	0.28%
9/24/62	5,000	–	–	–	99.6%	3.73 (8-5)	2.16	0.06%
12/5/62	10,100	–	–	–	98.2%	4.16 (9-2)	2.18	0.35%
2/21/63	10,000	+	–	+	99.1%	3.69 (9-1)	2.24	1.8%
5/8/63	11,100	–	–	–	100.6%	3.73 (9)	2.09	0.11%
7/19/63	11,100	–	–	+	95.8%	3.66 (9)	2.21	0.23%
10/10/63	10,270	–	–	–	99.7%	3.91 (9)	2.12	0.34%
12/23/63	11,100	–	–	–	97.0%	3.98 (9)	2.19	2.7% (2.3% leukosis)
3/8/64	10,100	–	–	–	99.3%	3.81 (9-1)	2.19	3.2% (3% leukosis)

(This grower had respiratory problems in every flock with another company. This is his performance under the SPF program).

Table IV—Flock Performance of an SPF Grower

Date	No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
3/21/62	8,600	–	–	–	94.2%	3.21 (9)	2.42	3.0%
6/6/62	14,000	–	–	–	100.0%	3.59 (9)	2.14	0.13%
8/29/62	15,400	–	–	–	100.5%	3.71 (9)	2.17	0.54%
11/12/62	14,300	–	–	–	100.3%	3.73 (9)	2.22	0.32%
1/29/63	16,000	–	–	+	100.2%	3.45 (8-6)	2.21	0.62%
6/24/63	15,400	–	–	+	99.7%	3.48 (9)	2.17	0.15%
9/14/63	12,600	–	–	–	100.0%	3.54 (8-5)	2.14	0.44%
11/30/63	15,400	–	–	+	99.2%	3.81 (9-2)	2.27	0.55%
2/17/64	14,000	–	–	–	97.6%	3.79 (9-1)	2.26	0.34%
5/6/64	15,400	–	–	–	99.6%	3.57 (9-1)	2.20	0.33%

Table V—Flock Performance of an SPF Grower

Date	No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
5/24/62	30,800	–	–	+	99.6%	3.43	2.28	0.76%
10/20/62	28,000	+	–	+	98.8%	4.09 (9-6)	2.18	0.8%
1/10/63	28,200	–	–	–	100.0%	3.80 (9)	2.18	0.61%
3/22/63	30,000	–	–	–	99.6%	3.43 (9)	2.28	1.7%
6/5/63	31,400	–	–	+	98.8%	3.49 (9-2)	2.17	0.10%
8/29/63	25,200	–	–	+	99.3%	3.84 (9)	2.10	0.12%
11/18/63	39,600	–	–	–	99.4%	4.01 (9-2)	2.21	0.25%
2/7/64	36,000	–	–	–	97.8%	4.08 (9-4)	2.33	0.72%
4/24/64	40,300	–	–	–	98.5%	3.35 (9)	2.27	0.68%

Table VI—An SPF Flock Where Leukosis Was Never Observed

Date	No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
2/2/62	12,000	+	–	+	96.8%	3.23	2.16	2.1%
4/21/62	12,000	–	–	+	100.9%	3.56	2.27	0.20%
7/6/62	11,000	–	–	–	100.7%	3.68	2.08	0.28%
9/22/62	11,500	–	–	–	97.5%	3.95	2.21	0.53%
12/6/62	10,800	–	–	–	94.3%	3.71 (9-1	2.24	0.9%
2/20/63	10,800	–	–	–	98.0%	3.94 (9-2)	2.28	0.61%
5/8/63	11,800	–	–	–	99.3%	3.64 (9)	2.12	0.085%
7/19/63	11,800	–	–	+	98.2%	3.78 (9)	2.13	0.11%
10/11/63	11,300	–	–	–	99.9%	3.91 (8-6)	2.10	0.30%
12/24/63	11,800	–	–	–	100.5%	3.78 (8-6)	2.18	0.18%
3/9/64	10,800	–	–	–	100.0%	3.73 (9-1)	2.15	0.14%

Table VII—Results of Flocks[1] Without Respiratory Disease

No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
10,100	–	–	–	99.3%	3.81 (9-1)	2.19	3.2% (3% for leukosis)
10,800	–	–	–	100.0%	3.73 (9-1)	2.15	0.14%
7,100	–	–	–	99.0%	3.72 (9-1)	2.15	0.88%
27,500	–	–	–	99.4%	3.70 (9)	2.24	0.45%
9,700	–	–	–	97.7%	3.55 (8-6)	2.13	0.00064%
11,800	–	–	–	99.3%	3.64 (9)	2.12	0.085%
11,100	–	–	–	100.6%	3.73 (9)	2.09	0.11%
7,000 (males)	–	–	–	99.3%	4.14 (9-1)	2.14	0.028%
17,600	–	–	–	99.9%	4.21 (10)	2.50	0.63%
28,800	–	–	–	97.6%	4.12 (9-4)	2.24	0.30%
10,800	–	–	–	98.0%	3.94 (9-2)	2.28	0.61%
28,200	–	–	–	100.0%	3.80 (9)	2.18	0.61%

[1] All taken at the same time period.

Table VIII—Results of Flocks[1] With S_6—PPLO ONLY

No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
16,000	–	–	+	99.4%	3.85 (9-1)	2.27	1.4%
20,000	–	–	+	99.9%	4.12 (9-3)	2.26	0.27%
23,800	–	–	+	99.7%	3.72 (9-1)	2.34	0.70%
27,000	–	–	+	98.6%	3.69 (8-5)	2.24	2.1%
29,200	–	–	+	99.4%	3.71 (8-6)	2.22	0.49%
15,400	–	–	+	99.2%	3.81 (9-2)	2.27	0.55%
25,200	–	–	+	99.3%	3.84 (9)	2.10	0.12%
8,700	–	–	+	96.4%	3.70 (9-2)	2.27	1.2%
7,900	–	–	+	99.1%	3.94 (9-1)	2.22	0.88%
12,000	–	–	+	100.9%	3.56	2.27	0.20%

[1] All taken at the same time period.

Table IX—Results of Flocks[1] With S_6-PPLO and Infectious Bronchitis

No. Birds	IB	ND	PPLO	Liv.	Wt. & age	Conv.	Cond.
29,700	+	–	+	97.9%	3.89 (9)	2.27	1.6%
31,000	+	–	+	97.0%	3.54 (9-2)	2.33	2.2%
9,000	+	–	+	96.6%	2.97 (7-4)	2.21	1.1%
17,000	+	–	+	98.6%	3.59 (9-2)	2.27	1.1%
16,000	+	–	+	98.0%	3.14 (9)	2.43	18.8%
22,500	+	–	+	98.7%	3.96 (9-5)	2.37	2.3%
28,000	+	–	+	98.8%	4.09 (9-6)	2.18	0.8%
15,000	+	–	+	–	3.55 (9-4)	2.32	6.9%
14,000	+	–	+	97.6%	3.55 (9-4)	2.32	1.0%
28,000	+	–	+	100.1%	3.54 (9)	2.26	0.44%
8,500	+	–	+	97.5%	4.23 (10-2)	2.29	1.3%
25,000	+	–	+	87.2%	3.10	2.54	10.0%

[1] All taken at the same time period.

Table X—Specific Causes of Condemnations in SPF Broiler Flocks

Flock size	% Condemned due to disease	Number of head condemned by cause							
		–Leukosis	Sept. Tox.	Air Sac	Inflam. proc.	Tumors	Bruises	Cadavers	Contamination
10,000	0.5	26	24	3	2	—	1	2	9
20,000	0.49	28	52	2	14	—	2	4	10
17,000	0.21	14	15	1	6	—	2	6	2
8,800	0.79	51	10	2	6	—	—	—	—
36,000	0.3	28	56	3	19	1	4	8	5
22,900	0.75	101	39	2	26	2	5	6	4
28,100	0.175	6	28	1	12	1	2	3	5
10,800	0.18	3	12	—	3	—	1	3	1
7,200	0.22	1	14	—	1	—	—	—	—

Age average 9 weeks.
None condemned due to parasites, overscald, decompositions or TB.

Table XI—Comparison of SPF Flocks to Non-SPF Flocks in the Same Company for One Week

Farm	Age	Number	Av. wt. lbs.	% Livability	% Condemnations
*SPF A	9-2	12,300	3.98	99.6	0.52
*SPF B	9-2	11,300	3.77	99.9	0.53
C	9-3	36,300	3.77	99.8	1.23
D	9-2	23,200	3.75	89.4	1.56
E	9-4	26,500	3.88	99.8	1.80
F	9-2	33,300	3.86	99.8	0.79
G	9-4	38,500	3.84	99.6	0.87
H	9-4	38,000	3.89	99.3	2.15
I	9-3	23,100	3.73	95.4	2.39
*SPF J†	9-2	11,400	3.93	83.8	0.39

Age—9-2 = 9 weeks 2 days of age.
* These were SPF flocks.
† 2300 birds smothered.

Table XII—Comparison of the Number of Birds Condemned* for Airsacculitis from U. S., Maine, and SPF Flocks

DATE	U. S. No. BIRDS	%	MAINE No. BIRDS	%	S.P.F. No. BIRDS	%
Jan. '62	2,012,828	1.63	19,633	.37	45	.17
Feb. '62	1,736,956	1.54	20,809	.48	100	.25
Mar. '62	1,886,818	1.37	21,486	.46	1,834	2.39
Apr. '62	1,565,817	1.08	24,416	.497	545	1.57
May '62	1,553,488	.89	28,073	.48	2,289	2.50
June '62	1,044,700	.61	13,060	.25	230	.23
July '62	802,306	.49	11,664	.217	18	.02
Aug. '62	881,414	.51	13,796	.24	21	.03
Sept. '62	681,393	.49	10,690	.23	58	.06
Oct. '62	881,445	.55	26,522	.46	22	.01
Nov. '62	1,140,065	.85	11,357	.26	14	.019
Dec. '62	1,592,606	1.24	10,906	.21	32	.03
Jan. '63	2,372,293	1.57	14,519	.26	608	.639
Feb. '63	1,908,923	1.56	18,058	.409	115	.098
Mar. '63	1,762,229	1.28	11,298	.238	17	.011
Apr. '63	1,427,322	.95	17,737	.33	2,081	1.37
May '63	1,139,134	.68	21,781	.39	4	.005
June '63	991,508	.59	8,459	.16	98	.165
July '63	1,070,181	.59	7,489	.125	557	.32
Aug. '63	1,076,524	.61	10,572	.18	26	.024
Sept. '63	884,851	.57	6,469	.125	3	.004
Oct. '63	1,017,282	.64	13,891	.245	28	.024
Nov. '63	1,076,051	.85	10,159	.215	5	.019
Dec. '63	1,944,667	1.35	10,521	.198	131	.100
Jan. '64	2,821,758	1.81	15,779	.28	186	.16
Feb. '64	2,523,941	1.81	16,289	.34	81	.08
Mar. '64	2,402,496	1.61	16,654	.31	194	.17
Apr. '64	1,826,376	1.14	18,282	.32	50	.04
May '64	1,271,124	.76	15,815	.26	40	.03
June '64	1,082,810	.59	8,563	.14	10	.007
July '64	989,300	.56	7,558	.13	47	.04

* The SPF birds are included in the Maine State averages and these, in turn, are all included in the U. S. National averages. These figures are taken from monthly AMS reports.

SCORE SHEET

S. P. F POULTRY HOUSE CLEAN-UP

Farm..... Date..... Company.....

Value			% Score
15%	Bldg. vicinity and entrance area— free of debris and litter	Good.....Fair.....Poor.....	.....
5%	Windows and Screens		
	Outside	Clean..... Dusty..... Feathered.....	.....
5%	Inside	" ..... " ..... "	.....
5%	Roof Vents	" ..... " ..... "	.....
30%	Floors	Free of litter ..... Washed.....	
		Traces " " ..... Cracks full.....	.....
		Disinfected	
5%	Stairs	Free of debris.....Free of litter & feathers.....	.....
10%	Walls	Clean..... No Droppings on edges.....	
		Soiled.....	
		Dirty .....Droppings on projections.....	.....
5%	Beams	Dry Cleaned..... Dust.....	
		Wet Cleaned..... Caked.....	.....
5%	Ceilings	No cobwebs..... Cobwebs.....	.....
5%	Feed from previous flock	In hopper..... In bags.....	
	In the building.....	Out of building..... Off farm.....	.....
5%	Waterers	Well washed..... Poorly washed..... Dirty.....	.....
5%	Feeders	Clean..... Dusty..... Fecal Contamination.....	.....
		TOTAL	.....

Comments: (Disinfectant used and method of application) .....

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.....

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Inspector.....

Prepared by Dept. of Animal Path., Univ. of Maine—1964

EPIDEMIOLOGICAL SURVEY OF SPF BROILER FLOCKS IN MAINE

GROWERS' NAME.....

BREEDER FLOCK NO. OR SOURCE.....

CHICK BOXES: NEW.....USED.....

DEBEAKING .....AGE.....

MEDICATIONS .....

SCREENED WINDOWS.....TYPE OF FLOOR.....

LOCKS ON DOORS.....KEPT LOCKED.....

DISTANCE FROM HIGHWAY.....DISTANCE FROM OTHER POULTRY HOUSES.....

FOOT PAN AT EACH ENTRY.....LOCATION.....

USED BY OWNER.....

DISINFECTANT USED (NAME).....

SOLUTION CHANGED: REGULARLY.....MOST OF THE TIME.....

SELDOM.....

BULK FEED.....OUTSIDE OIL PIPES.....

DISPOSAL OR INCINERATOR.....

VISITORS RECORD.....IS IT BEING USED?.....

CONDITION OF LITTER.....

VENTILATION: GOOD.....FAIR.....POOR.....

IS BUILDING CLEANED AND DISINFECTED BETWEEN FLOCKS?.....

A. TYPE OR NAME OF DISINFECTANT USED.....

PETS ON FARM.....

AMOUNT OF FEED LEFT OVER FROM PREVIOUS FLOCK.....

A. WHEN FED.....

B. WAS ANY FEED TRANSFERRED FROM ONE HOUSE TO ANOTHER?.....

RODENT PROBLEM..... CONTROL.....

HAS ANY DISEASE PROBLEM DEVELOPED DURING GROWING PERIOD?..... WHAT AGE.....

NAME OF SERVICEMAN.....

COMMENTS .....

OFFICIAL.....

Return this copy to Pullorum-Typhoid Testing Service Office, Hitchner Hall, University of Maine, Orono, Maine 04473.

APPENDIX B

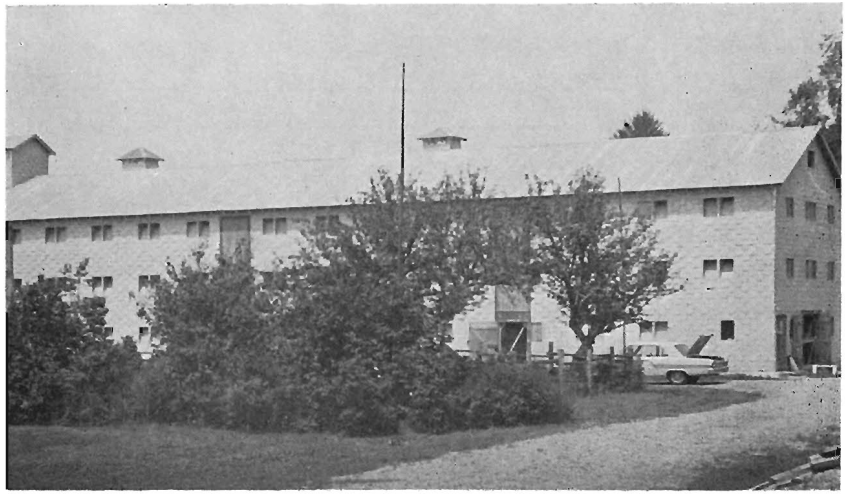

FIGURE 1. Typical Maine broiler growing house.

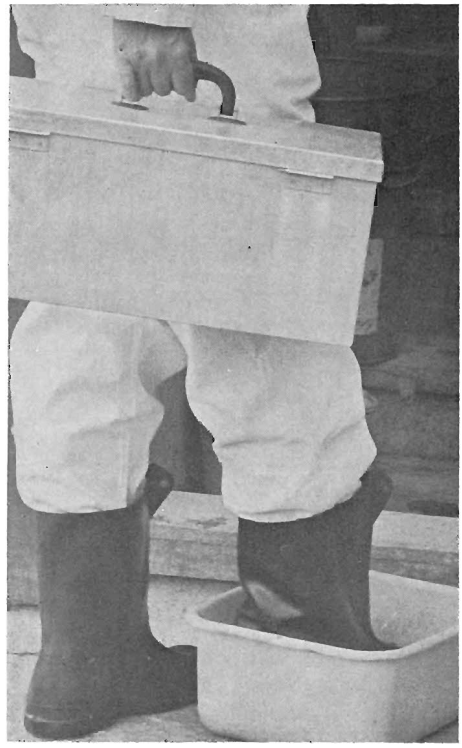

FIGURE 2. Veterinarian preparing to enter chicken house washes his boots in disinfectant. Metal kit holds his bleeding equipment.

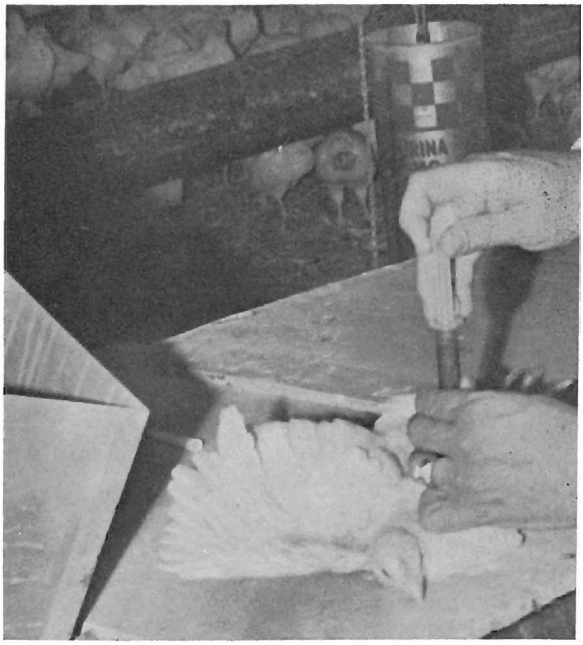

FIGURE 3. Sterile blood sample being drawn from heart of chicken.

FIGURE 4. Signs currently in use on broiler house entry doors.

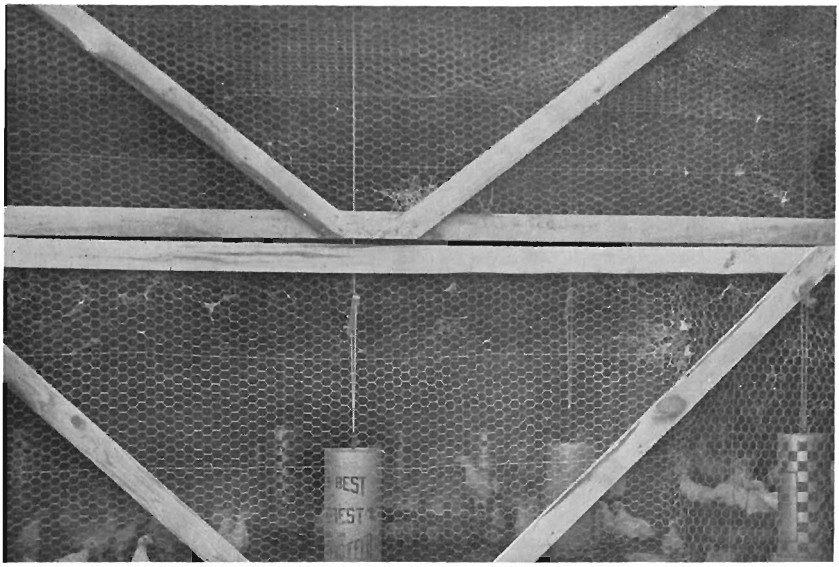

FIGURE 5. Screened for summer ventilation.

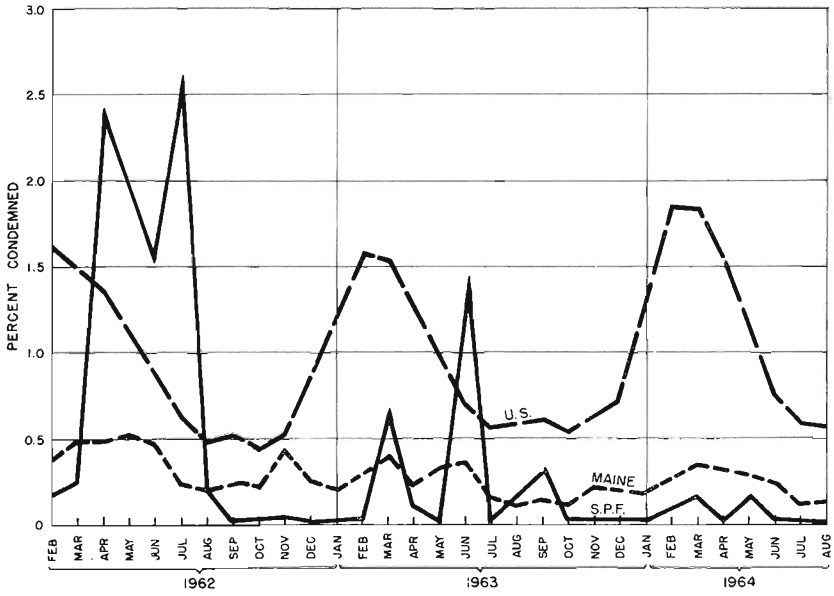

FIGURE 6. Graph showing comparison of U. S., Maine and SPF condemnations for airsacculitis.