THE EFFECTS OF WASHING EGGS ON HATCHABILITY

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Raymond George Young

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By

RAYMOND GEORGE YOUNG

AN ABSTRACT

Submitted to the College of Agriculture
Michigan State University of Agriculture and
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Department of Poultry Husbandry

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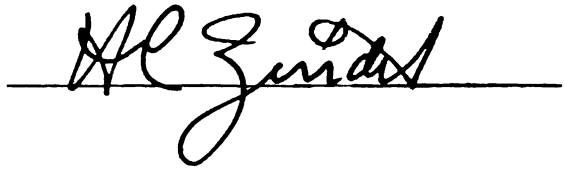
Approved 

ABSTRACT

The problem of how to handle dirty hatching eggs confronts all hatchery operators. This study attempted to learn the possible effects of washing and dry cleaning on the hatchability of eggs. Both chicken and turkey eggs were subjected to cleaning by either washing or dry abrasive cleaning. Controls included both naturally clean and dirty eggs.

The washing and dry cleaning treatments did not show any deleterious effect on hatchability in either chicken or turkey eggs. In the preliminary test for the chicken eggs, there was no significant difference even though one of the treatments, the dry cleaner, showed a 5.15 percent difference in hatchability and a 3.39 percent difference was noted for the eggs washed in the Egg Queen cleaner.

In the second trial, the eggs washed in the Egg Queen showed a 9.94 percent difference from the clean control which was statistically significant. This trial revealed no significance other than the forgone.

In both the preliminary and the second tests involving turkey eggs, no significant differences were noted. These results were comparable to those obtained with the chicken eggs. The washed eggs hatched slightly better than the control or unwashed and this difference was not significant.

It can be concluded from this study that cleaning either chicken or turkey eggs does not interfere with hatchability under conditions maintained in these tests.

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INTRODUCTION

The problem of dirty eggs is present to a greater or lesser extent on all poultry farms where eggs are produced. Winter, Burkart and Wettling (1952) estimate that ten to twenty-five percent of the eggs produced under average farm conditions are soiled at time of gathering. Consequently, many eggs produced require some degree of cleaning, primarily by the producer, prior to marketing. In practice, however, the upper range of twenty-five percent can be increased by such factors as wet litter, dirty nesting material, infrequent gathering or not enough nests for the number of birds. These factors may be grouped under one heading - management.

Many hatcherymen are confronted with this problem of dirty eggs; there is much indecision as to whether to market them, wash them and then set them, or set them as they are. Their hesitation arises from the belief that hatchability of the eggs will be adversely affected by washing. Some hatcherymen are washing eggs to help control their sanitation and disease problems in the incubator, and others do it for the esthetic value. Marshall and Cruickshank (1938) provided a theoretical promise that washed eggs might hatch better than unwashed eggs. They reasoned that the removal of part of the cuticle by washing reduces the effective evaporation surface around the pores of egg shell, thereby reducing evaporation.

For years, many producers thought the only way to clean eggs, and still maintain the quality, was to use some dry form of abrasive. Two outstanding abrasives, steel wool and sandpaper, were used and probably still are today.

Washing has never been too popular. As far back as 1920, researchers of that time found that washing produced an inferior product. Jenkins (1920), Sharp and Bryant (1934) noted that washing eggs increases spoilage by increasing the size of the pores and allowing bacteria to enter. As a result, most eggs were hand cleaned. In the early forties, various types of egg cleaning machines came on the market. Included in these types were: the immersion or bubbler type, the rotating disks or brush type and the rotary spray type washer; all of which use water. For the dry cleaning, automatic machines using abrasive belts were developed. Most machines on the market today will fall into one of these classifications. Figures I, II, III, and IV show types of machines used in this study.

Winter (1953) found that losses from soiled eggs are high, and egg cleaning so time consuming, that many manufacturers, investigators, and some poultrymen are developing fast, safe, and economical methods of washing eggs. The great strides made in detergent-sanitizers are aiding in the development of those methods.

REVIEW OF LITERATURE

There is much literature demonstrating both for and against washing eggs which are to be marketed or held in storage. Jenkins, Hepburn, Swan and Sherwood (1920) cleaned eggs by washing in water and dilute sulfuric acid. Spoilage ranged from 6.6 percent in the unwashed controls to 14.4 percent in eggs washed in water. The eggs were held in cold storage six to eleven months. Funk (1938) found that eggs cleaned in a 0.5 to 1.0 percent solution of sodium hydroxide could be held in storage with preservation of quality equal to naturally clean eggs.

Gillespie, Scott and Vickery (1950) washed soiled eggs in water; high level chlorine solution (5000 p.p.m.); a 0.1 percent Fixanol (a cationic detergent); one percent formalin and sodium hydroxide and held the eggs six to eight weeks at room temperature. The high level chlorine solution, 0.1 percent Fixanol and one percent formalin reduced spoilage.

Miller, Joukousky, and Kraught (1950), washed soiled eggs in a water solution of black rot organisms. Part of them were dipped in sanitizers, one percent Roccal (quaternary ammonium compound) solution and 0.5 percent pentachlorophenol. The sanitizers reduced spoilage a little. The one percent Roccal reduced the bacteria from several million per ml. to zero.

Pino (1950) submerged eggs momentarily in a one percent detergent-sanitizer solution (Nacconal N.R., an anionic detergent-sanitizer with organic sulfonete) at a temperature of 140°F. and then rinsed by spraying with tap water. They were air dried and stored at 60°F. for four weeks. The eggs maintained internal quality equal to that of untreated eggs when kept under the same storage conditions.

Starr, Lorenz, and Ogasawara (1952) observed no difference in the keeping quality of eggs washed in warm water or an alkaline detergent, two percent trisodium phosphate, an anionic detergent or chlorox than in water alone.

Miller (1954) washed dirty eggs in water, a detergent, or a combination of washing and treatment with sodium hydroxide, Roccal, lactic acid or sulfurous acid, and found none of the treatments more effective in preventing penetration and growth of spoilage bacteria at a given storage temperature, than storing the eggs which were stored dirty. Some eggs in this experiment were thermostabilized. These showed a lower percentage containing spoilage bacteria than any other eggs in this experiment.

Winter, Burkart, Clements, and MacDonald (1955) found that detergent-sanitizers, detergents and water were most effective in the order named in reducing the number of bacteria on the egg shell surface.

There have been very few investigations to determine the effect of washing eggs on hatchability. Funk (1938)

found that eggs could be washed in a solution of one-half of one percent concentrated lye in water without injuring hatchability. In further studies on hatchability, Funk (1940, 1942) observed that washed eggs and eggs that had been soiled with poultry droppings and then washed, hatched as well as unwashed clean eggs.

Pritsker (1941) noted that increasing the internal pressure by increasing egg temperature during washing, resulted in fewer infected eggs, thus increasing hatchability. He used a 0.5 percent formalin solution.

Funk and Forward (1949) found that soiled, cooled eggs washed in a ten percent Roccal solution at room temperature and held one to fourteen days hatched as well as clean, unwashed eggs held and incubated under similar conditions. Pino (1950) and Rhodes and Godfrey (1950) found no reduction in hatchability when eggs were properly washed and dried. Huston, Palmer and Carmon (1957) concluded that properly washed clean or dirty eggs hatch as well as unwashed eggs. A detergent was used throughout their study.

The present study was designed to evaluate the effects on hatchability of cleaning soiled eggs with the aid of a detergent-sanitizer, using two different washing methods and dry cleaning chicken eggs.

PROCEDURE

The eggs used in this study were obtained from two different sources. In the preliminary test both chicken eggs and turkey eggs were obtained from the University Farms. The chicken eggs for the final test were obtained from a commercial poultry breeder-hatcheryman in the University city area. Eggs in all four of the tests were handled in the same manner, except for the specific treatment procedures.

The chicken eggs were divided into four groups on the preliminary test and five groups on the second test. The groups in the preliminary test were: Group 1 - Washer A., Group 2 - Washer B., Group 3 - Dirty Control, Group 4 - Clean Control, and Group 5 - Dry Cleaner.

The first group of eggs was washed in a water solution of a commercial detergent sanitizer[1]. The second group was washed in a similar manner with a special commercial detergent-sanitizer[2]. A special detergent-sanitizer was developed for the particular egg washing machine because of the machine's water action which caused other compounds to

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[1]Haviland Egg detergent-sanitizer quaternary ammonium compound manufactured by Haviland Products, Grand Rapids, Michigan.

[2]A special non-foaming detergent-sanitizer was used in the Egg Queen washing machine. It is distributed by Chore-Time Equipment, Inc., Milford, Indiana.

foam excessively. Eggs in the third group were naturally dirty from fecal material, broken eggs and nest litter, the purpose of which, was to test the soiling effect on hatchability. A fourth group consisted of naturally clean eggs as gathered from the nests. The fifth group of eggs was dry cleaned on a commercial dry cleaner. The holding period was three days for the chicken eggs and four days for the turkey eggs. All eggs were held at 60°F. until set. The number of eggs in each group is shown in the tables.

Due to a lack of sufficient number of turkey eggs, the eggs were divided into three groups for treatment instead of five. Again, the first group of eggs was washed in a solution containing a commercial detergent-sanitizer. The second group was washed in a similar manner with a special commercial detergent. A third group consisted of naturally clean eggs. Approximately 150 eggs were used in each group (Tables III and IV).

Two different types of egg-washing machines were used throughout the study. See Figures 1 and 2. A specific detergent-sanitizer was used in each machine. The egg-washing machine was cleaned, filled with water and allowed to reach a maximum temperature of 110°F.; two ounces of the detergent-sanitizer were dissolved in eight gallons of water. A basket of eggs was placed into the solution; washed for five minutes, and removed to dry before a fan for fifteen minutes. Both chicken and turkey eggs were washed in the same manner and stored in 60°F. until trayed and placed

in an incubator.

All eggs were set in a commercial type incubator, electrically heated and controlled. On the eighteenth day of incubation the eggs were removed and candled for fertility. The fertile eggs were transferred to hatching trays. Eggs containing early and late dead embryos were removed at this time. All other infertile eggs, including rots or molds which developed from cracked eggs, were removed. At the time of hatching, the remaining dead embryos were recorded. Both the infertile eggs and the eggs containing dead embryos were broken out and held under the ultra-violet lamp (black light) to detect any sour eggs due to bacteria which fluoresce.

The turkey eggs in this study came from Broad Breasted Bronze hens which were used on another University nutritional experiment. Therefore, the eggs were randomized to eliminate differences in hatchability due to diet.

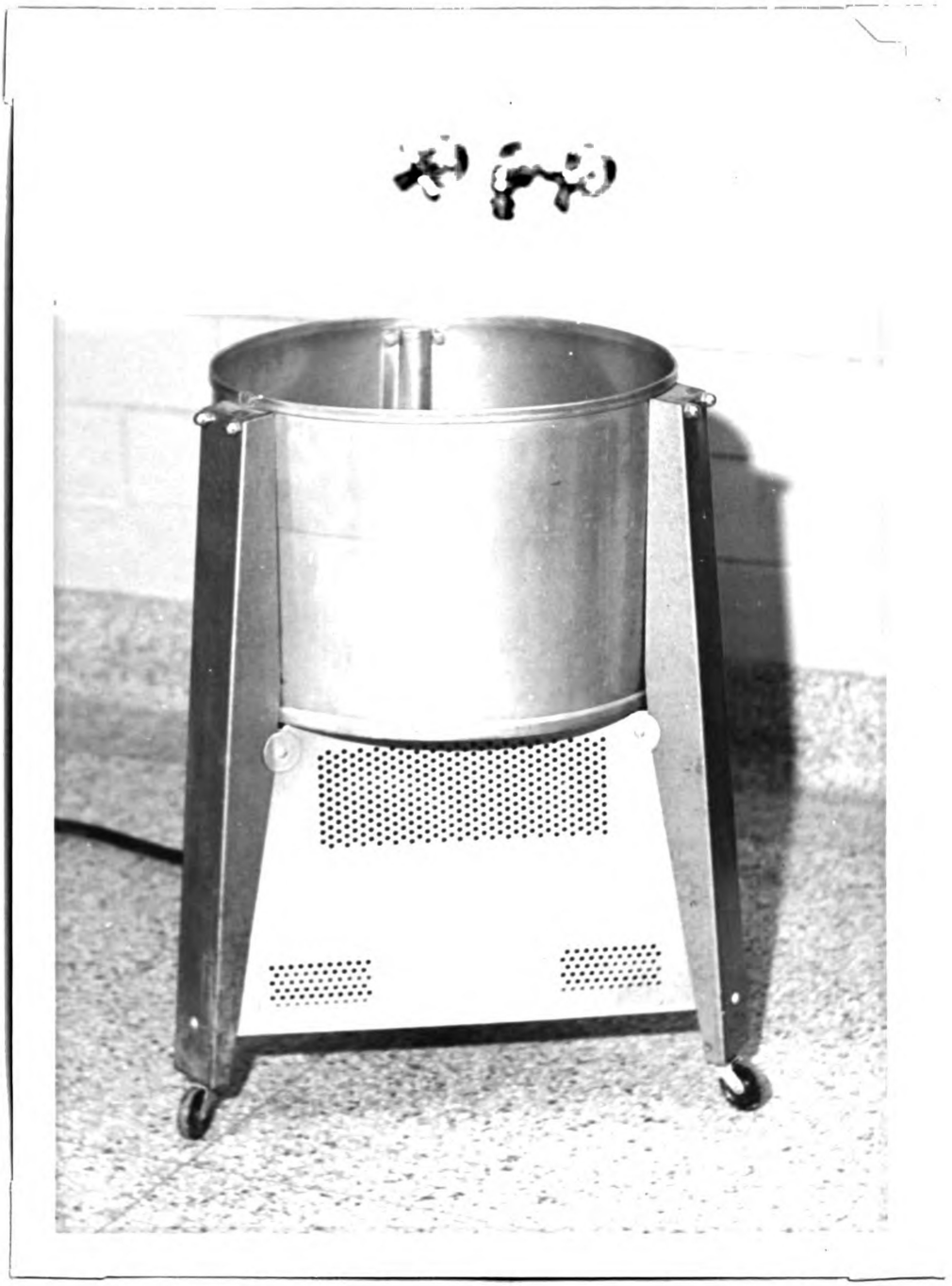

FIGURE I. Keenco Egg Washer Model 750. Air-Jet Action. Washer A, manufactured by Keen Manufacturing Company, Vineland, New Jersey.

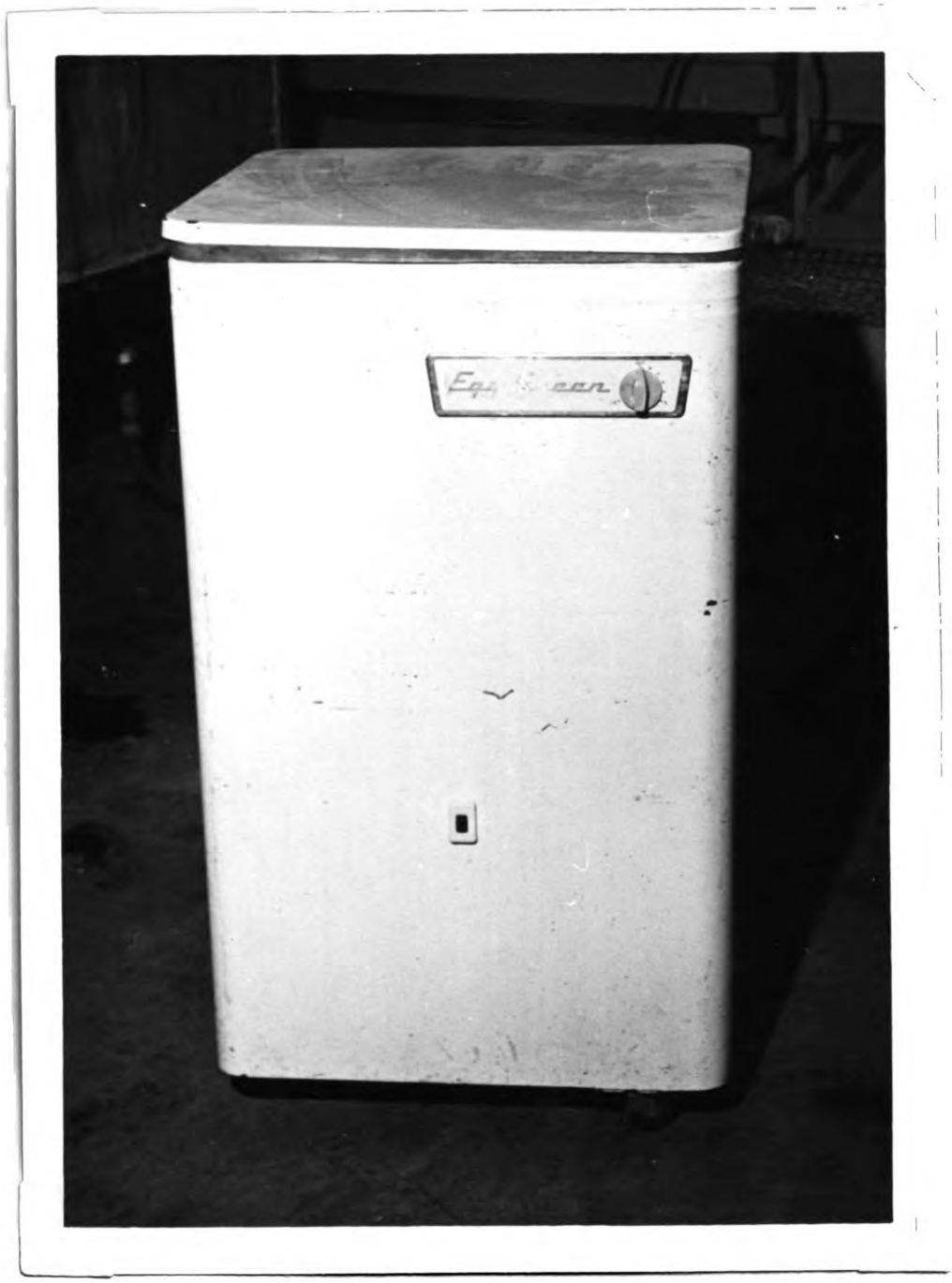

FIGURE II. Egg Queen Washer - Air-Water Jet Action. Washer B. Manufactured by Chore-Time Equipment, Incorporated, Milford, Indiana. Outside view.

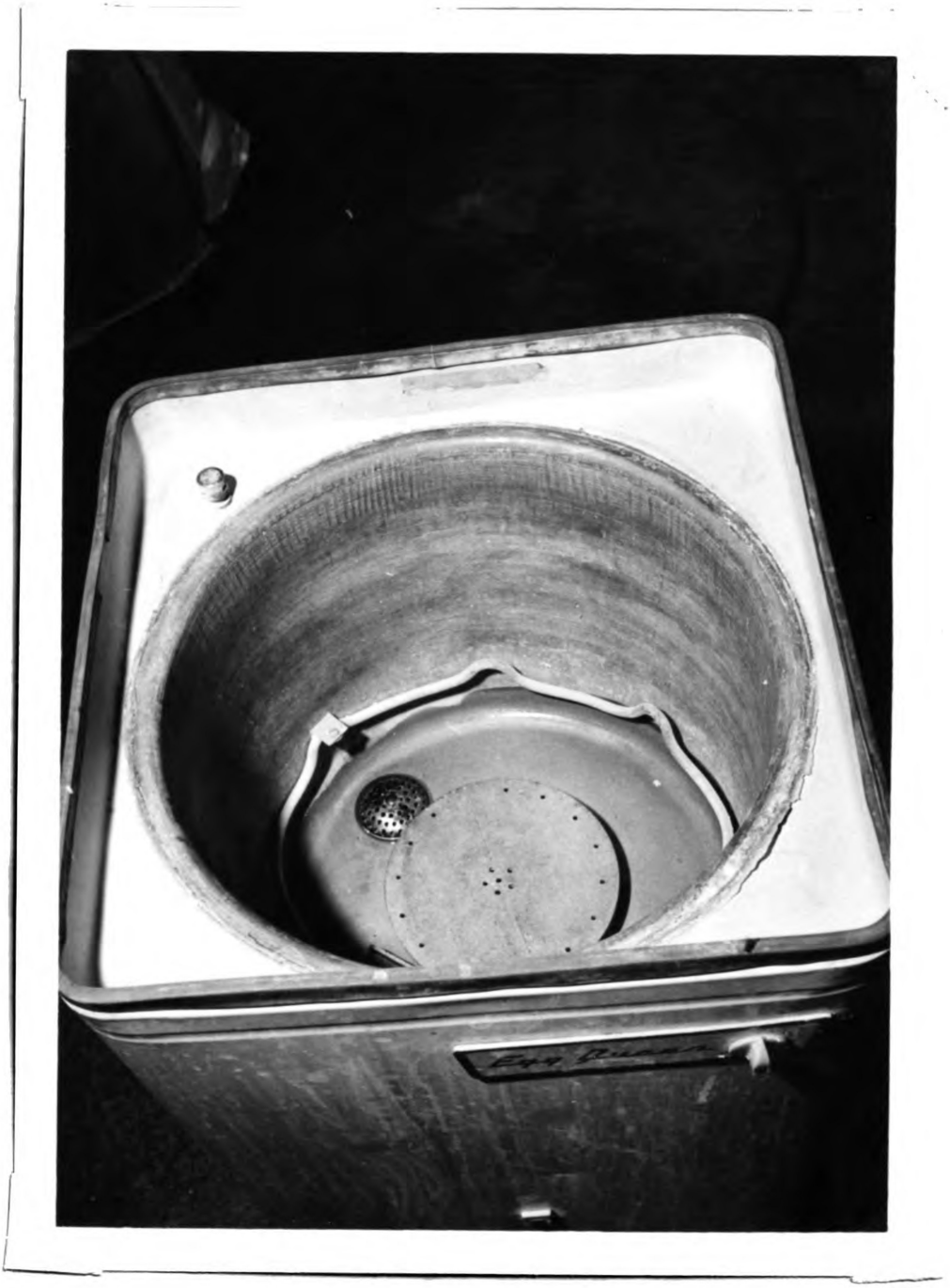

FIGURE III. Egg Queen Washer - Inside view.

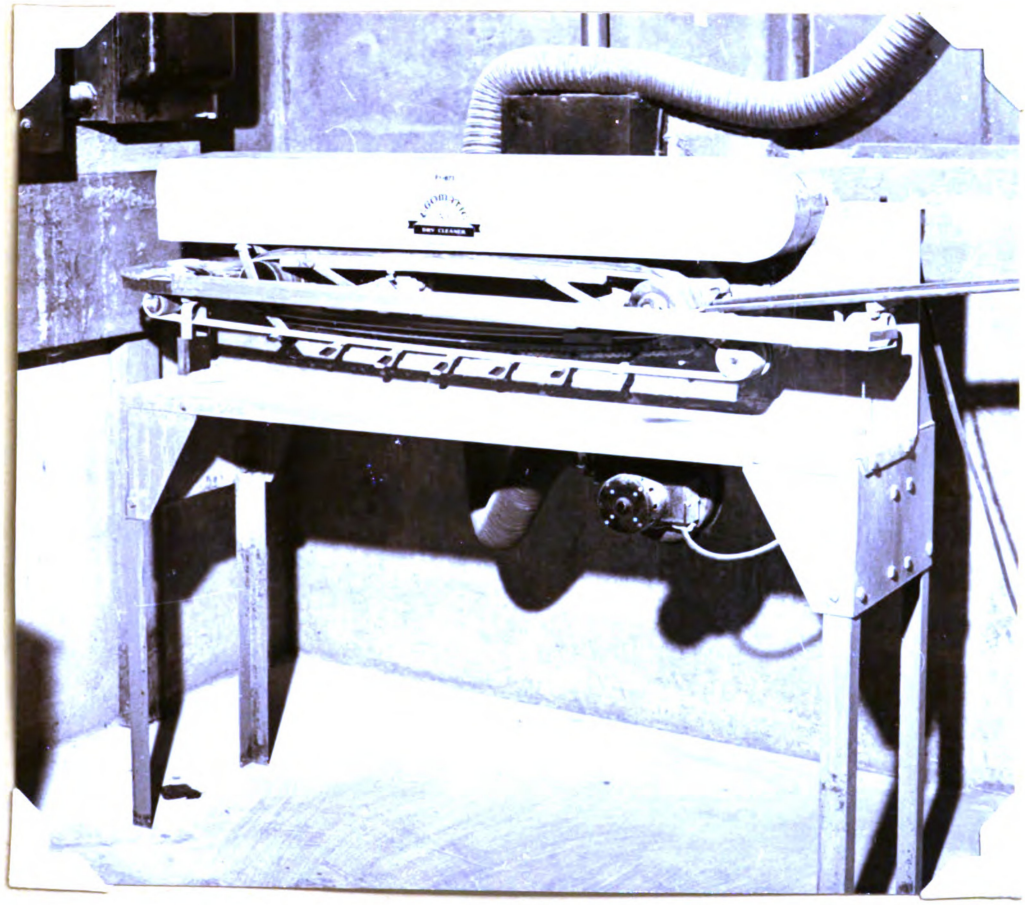

FIGURE IV. Eg-O-Matic Dry Cleaner, Model DC-1A. Cleaning action is with abrasive belts. Manufactured by Otto Niederer & Sons, Incorporated, Titusville, New Jersey.

RESULTS AND DISCUSSION

The Preliminary Test on both chicken and turkey eggs was conducted to determine procedures to be used. A larger number of eggs was used on the Second Test to satisfy requirements for statistical treatment of the results[3].

The percent hatchability, (Table I) shows Group 4 eggs highest with 84.76 percent, followed by Group 2, with 83.00 percent hatchability. Groups 1 and 3 were about equal, 79.25 and 79.61 percent, respectively. Percent hatchability was figured as the number of chicks hatched from the fertile eggs. No significant differences were noted between washing or dry cleaning over the control. The T-values (Table V), have been calculated for the four tests. There was a 3.39 percent difference in hatchability in favor of Group 2 and a 5.15 percent difference in favor of Group 4. There was a total of 450 eggs set and 340 chicks hatched, or a 75.55 percent hatch.

When hatchability is considered in Table II it would appear that the washed eggs, Group 1 86.37 percent and Group 2 87.02 percent, hatched better than Group 4, 77.08 percent, Group 3 83.33 percent, or Group 5 82.57 percent. The washed eggs showed a 9.29 percent difference in favor

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[3]By conference with Dr. W. D. Baten, Agricultural Experiment Station Statistician.

TABLE I

PRELIMINARY TEST ON HATCHABILITY OF WHITE LEGHORN EGGS

Group	Treatment	No. of Eggs Set	Infertile	Fertile Eggs	No. of Chicks	Percent Hatchability
1	Keenco	116	10	106	84	79.25
2	Egg Queen	105	5	100	83	83.00
3	Clean Control	110	7	103	82	79.61
4	Dry Cleaner	119	11	108	91	84.76

TABLE II

SECOND TEST ON HATCHABILITY OF WHITE LEGHORN EGGS

Group	Treatment	No. of Eggs Set	Infertile	Fertile Eggs	No. of Chicks	Percent Hatchability
1	Keenco	322	43	279	241	86.37
2	Egg Queen	321	36	285	248	87.02
3	Dirty Control	326	38	288	240	83.33
4	Clean Control	322	34	288	222	77.08
5	Dry Cleaner	327	40	287	237	82.57

of Group 1 and a 9.94 percent difference in favor of Group 2 over Group 4. When compared to Group 3, differences of 3.04 percent and 3.69 percent respectively, were noted. Group 5 showed a favorable difference of 5.49 percent when compared to Group 4 and only .76 percent with the Group 3. Group 3 had a difference of 6.25 percent over Group 4. It was also noted that soiled eggs hatched satisfactorily under the conditions maintained in this test. Upon statistical analysis of these data, Group 2 was the only one that showed a significant difference in hatchability. There were 1,618 eggs set and 1,188 chicks hatched, or a 73.42 percent hatch.

The results of the second test were quite similar to those of the preliminary test. However, the eggs washed in Group 1 show a 7.12 percent difference in hatchability, (Table II) and Group 4 shows a 2.53 percent decrease, (Table II) when compared to Table I. The dry-cleaned eggs remained about the same. These differences might be explained, in part, on the size of the replication - the Second Test being larger than the First Test.

The data obtained from washing turkey eggs showed similar results to the chicken eggs. In Table III the hatchability of eggs washed in Group 2 showed a 6.6 percent difference when compared to those of Group 3, while Group 1 had a 0.33 percent difference, in favor of Group 3. Throughout the entire test, the eggs washed in the Egg Queen washer were generally higher in percent hatchability than either the Control or the Keenco. However, in Table IV it will be

noted that the data in Group 1 showed a 1.68 percent difference over Group 3; while the eggs washed in Group 2 showed 4.15 percent difference favoring Group 3. The total number of turkey eggs set was 921 with 359 poults hatched or 38.97 percent hatch.

When the data in Tables III and IV were analyzed there was no significant difference in hatchability in either test. Again, as in the First Test for the chicken eggs, the number of eggs used might have some influence, although from a statistical point of view the total number of eggs was sufficient.

In Tables I through IV all of the unhatched eggs were broken out to more accurately determine infertile eggs and early or late embryonic mortality. No attempt was made to correlate early or late embryonic mortality with any treatment. No sour eggs were found in either chicken or turkey eggs.

TABLE III

PRELIMINARY TEST ON HATCHABILITY
OF BROAD BREASTED BRONZE TURKEY EGGS

Group	Treatment	No. of Eggs Set	Infertile	Fertile Eggs	No. of Chicks	Percent Hatchability
1	Keenco	154	29	125	57	37.01
2	Egg Queen	157	33	124	69	43.94
3	Clean Control	158	25	133	59	37.34

TABLE IV

SECOND TEST ON HATCHABILITY
OF BROAD BREASTED BRONZE TURKEY EGGS

Group	Treatment	No. of Eggs Set	Infer- tile	Fertile Eggs	No. of Chicks	Percent Hatcha- bility
1	Keenco	149	38	111	61	54.95
2	Egg Queen	151	37	114	56	49.12
3	Clean Con- trol	152	45	107	57	53.27

TABLE V

T - VALUES FOR TREATMENTS

Treatment	Test I	Test II	Test III	Test IV
Control vs. Dirty		1.31		
Control vs. Egg Queen	0.79	2.40*	1.19	0.07
Control vs. Keenco	0.36	1.63	0.01	0.604
Control vs. Sanded	0.35	1.00		
Dirty vs. Egg Queen		1.09		
Dirty vs. Keenco		0.35		
Dirty vs. Sanded		.34		
Egg Queen vs. Keenco	1.16	.73	1.24	0.67
Egg Queen vs. Sanded	.46	1.32		
Keenco vs. Sanded	0.72	.67		

* Significant difference. T - values of two or greater would be significant.

SUMMARY

1. Washing or dry cleaning either chicken or turkey eggs does not interfere with hatchability under conditions maintained in these tests.
2. The detergent-sanitizer treatments did not affect hatchability in chicken eggs. However, the eggs washed in the Egg Queen washer showed a higher percent hatchability which was significant at the 5% level.
3. The hatchability of the dry cleaned chicken eggs did not differ significantly from the washed eggs.
4. Turkey hatching eggs washed in a similar manner as chicken eggs gave comparable results. The washed eggs hatched slightly better than the control group. This difference was not significant.

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Date Due
