RESEARCH BULLETIN 695 MARCH, 1960

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
J. H. LONGWELL, *Director*

Effect of Pre-Incubation on the Hatchability of Chicken Eggs

E. M. FUNK AND JAMES E. FORWARD

(Publication authorized March 3, 1960)

COLUMBIA, MISSOURI

CONTENTS

This bulletin reports on Department of Poultry Husbandry research project 40, Care of Hatching Eggs

Effect of Pre-Incubation on the Hatchability of Chicken Eggs

E. M. Funk and James E. Forward

PREVIOUS WORK

Jackson (1912) reported that warming eggs before they were incubated improved hatchability. However, his results were with small numbers of eggs and were not generally accepted. Funk (1934) reported results that agreed with those reported by Jackson but his data also were limited and did not gain acceptance. Olsen (1949) obtained improved hatches with eggs pre-heated before incubation. Kosin (1956) reported experiments with rather large numbers of eggs which showed that pre-incubation improved hatching results with both turkey and chicken eggs. Becker and Bearse (1958) reported results with chicken eggs that tended to confirm Kosin's results but their data were not statistically significant.

EXPERIMENTAL

The eggs used in these experiments in 1955 came from hatchery receipts of a local hatchery. They were one to four days old when received. All other eggs were produced on the University Poultry Farm.

The eggs were pre-incubated in a forced draft incubator operated at 99¾° F. and 60 percent relative humidity. Some of the eggs were warmed at room temperature (75°F. to 80°F.) and others in warm (110°F.) water as indicated in the tables.

Eggs were set to hatch at different seasons of the year. Hatching data also was collected on eggs held for different periods of time.

Settings were made at 5:00 p.m. and the chicks removed from the hatching trays 21 days and 15 hours later.

RESULTS AND DISCUSSION

Tables 1 and 2 and Figure 1 show hatching results obtained with eggs produced during the winter and spring of 1955 that were pre-incubated zero, three, six and nine hours two days before they were set. The remainder of the time these eggs were held at 50°F. Since more than 1000 eggs were in each group (Table 1) and more than 1600 eggs were in each lot in the other test (Table 2) these results were statistically significant. Pre-incubation for three, six or nine hours apparently increased the hatch of eggs from 2 to 4 percent.

TABLE 1--EFFECT OF PREINCUBATION ON THE HATCHABILITY OF NEW HAMPSHIRE EGGS. JANUARY 9 TO FEBRUARY 27, 1955.

Treatment	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	1029	80.2
Preincubated 3 hr. at 99 3/4°F. and then held 2 days at 50°F.	1026	83.4
Preincubated 6 hr. at 99 3/4°F. and then held 2 days at 50°F.	1030	82.5
Preincubated 9 hr. at 99 3/4°F. and then held 2 days at 50°F.	1024	82.1

TABLE 2--EFFECT OF PREINCUBATION ON HATCHABILITY OF EGGS LAID BY ARBOR ACRE WHITE ROCKS. MARCH 9 TO JUNE 8, 1955.

Treatment	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	1607	70.1
Preincubated 3 hr. at 99 3/4°F. and then held 2 days at 50°F.	1619	73.4
Preincubated 6 hr. at 99 3/4°F. and then held 2 days at 50°F.	1613	72.5
Preincubated 9 hr. at 99 3/4°F. and then held 2 days at 50°F.	1617	74.2

Though the above tests made in the spring of 1955 appeared conclusive it was deemed advisable to repeat these tests over an extended period of time to determine any seasonal effects. When the tests were repeated 36 hours after laying in December, 1955, and January, 1956, pre-incubation appeared to have little if any effect in improving hatching results of eggs held five to nine days (Table 3).

Tests repeated in April and May (see Tables 4 and 5 and Figures 2 and 3) were designed to determine the effect of pre-incubation on eggs of different ages. These results showed that under the conditions of these tests pre-incubation improved hatching results of eggs held one to five days but did not benefit eggs held six to 10 days. Other tests made during the spring of 1956 (Table 6) showed

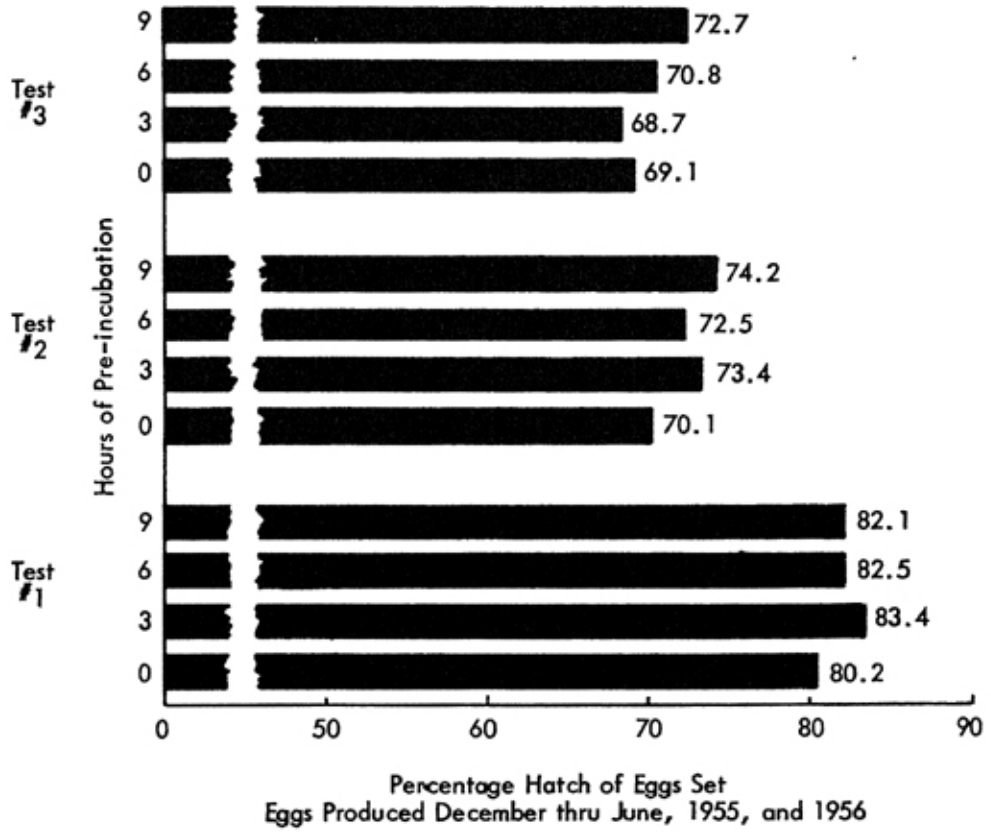

Fig. 1—Effect of pre-incubation on the hatching of eggs produced in winter and spring. Tests 1, 2 and 3 correspond to Tables 1, 2, and 3.

TABLE 3--EFFECT OF PREINCUBATION ON HATCHABILITY OF EGGS HELD 5 TO 9 DAYS AT 50°F. DECEMBER 14, 1955 TO JANUARY 18, 1956.

Treatment	Eggs set	Inf.	Dead 1-5 days	Dead 6-18 days	Dead in shell	No. Hatched	Percentage hatch of eggs set
Controls held at 50°F.	395	11	11	40	60	273	69.1
Preincubated 3 hr. about 36 hrs. after laying.	393	17	10	48	48	270	68.7
Preincubated 6 hr. about 36 hrs. after laying.	394	15	8	35	57	279	70.8
Preincubated 9 hr. about 36 hrs. after laying.	388	22	8	23	53	282	72.7

TABLE 4--EFFECT OF PREINCUBATION ON HATCHABILITY OF EGGS HELD 1 TO 10 DAYS AT 50°F. APRIL 11 TO MAY 2, 1956.

Treatment	Eggs held 1 to 5 days		Eggs held 6 to 10 days	
	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	884	77.1	512	75.8
Preincubated 3 hr. at 99 3/4°F. 16 hrs. after laying.	795	79.6	514	73.7
Preincubated 5 hr. at 99 3/4°F. 24 hrs. before setting.	764	81.9	518	76.4

TABLE 5--EFFECT OF PREINCUBATION 3 HOURS THE DAY AFTER LAYING OR 5 HOURS THE DAY BEFORE SETTING ON HATCHABILITY OF EGGS HELD 1 TO 10 DAYS. APRIL 11 TO MAY 2, 1956. EGGS HELD AT 50°F. BEFORE AND AFTER PREINCUBATION

Days held	Controls held at 50°F.		Preincubated 3 hr. morning after laying		Preincubated 5 hr. day before setting	
	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
1	161	72.7	158	81.6	159	84.3
2	161	82.6	163	81.0	163	81.6
3	96	76.0	94	85.1	96	90.6
4	161	83.2	159	83.0	158	81.6
5	157	80.9	160	80.0	160	85.0
6	151	78.5	151	78.8	152	72.4
7	165	75.7	165	82.4	169	78.7
8	159	81.1	163	73.6	161	77.2
9	157	78.3	159	71.1	155	76.1
10	137	73.7	140	67.9	140	78.6
Total	1505	77.8	1512	78.3	1513	80.2

TABLE 6--EFFECT OF PREINCUBATION ON HATCHABILITY OF EGGS. FEBRUARY 22 TO MARCH 29, 1956.

Treatment	Eggs held 1 to 5 days		Eggs held 6 to 10 days	
	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	479	80.6	349	80.8
Held 3 hr. at 99 3/4°F. morning following laying.	486	81.5	350	74.9
Held 5 hr. at 99 3/4°F. and 4 hr. at 50°F. prior to setting.	490	79.0	348	75.3

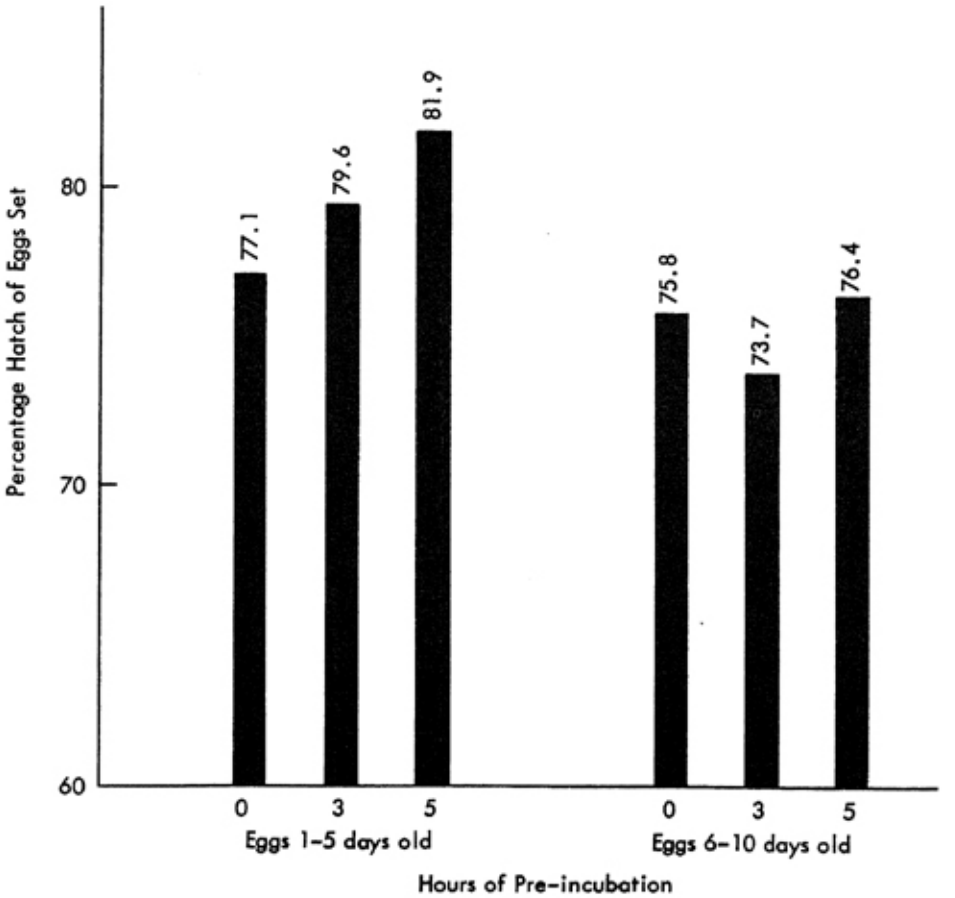

Fig. 2—Effect of pre-incubation on the hatchability of eggs held 1 to 5 days and 6 to 10 days.

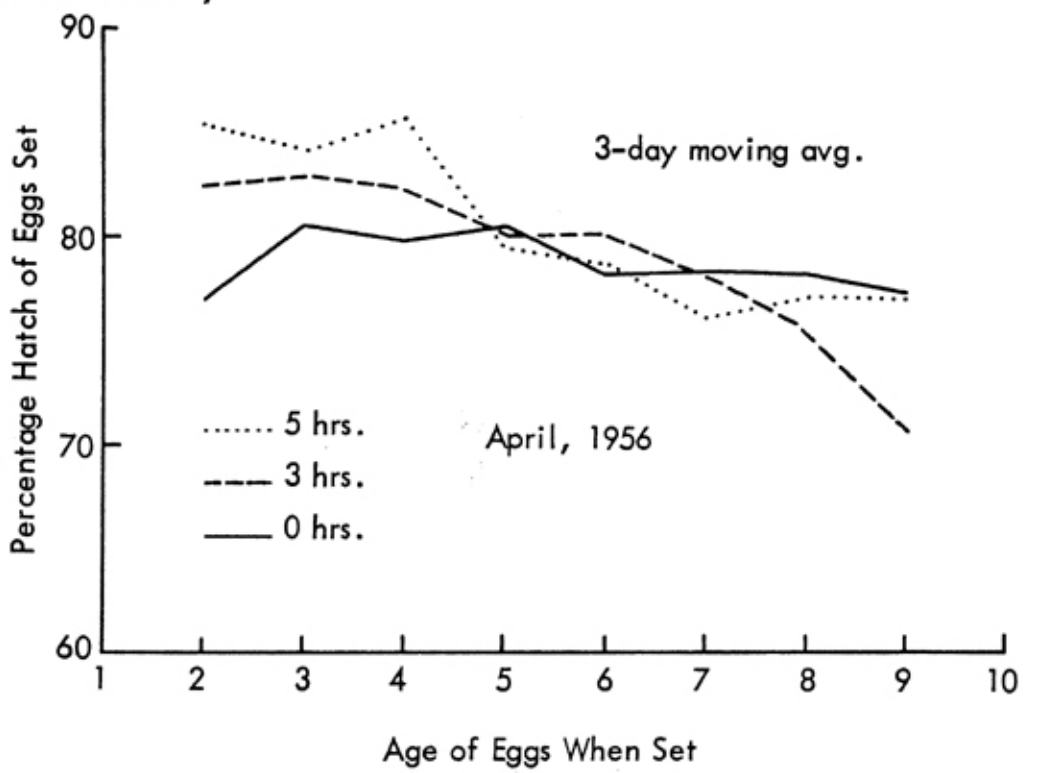

Fig. 3—Effect of pre-incubation on the hatching of eggs held for 1 to 10 days.

no improvement in hatches by pre-incubating eggs held one to five days. Eggs held six to 10 days that were pre-incubated did not hatch as well as the controls.

Table 7 and Figure 4 show the results of pre-incubating eggs produced during the summer months. Under these conditions pre-incubation tended to depress hatching results with eggs held one to five days and also for eggs held six to 10 days. These results indicate that pre-incubation during the summer is not beneficial but may depress hatchability.

TABLE 7--EFFECT ON HATCHABILITY OF PREINCUBATION OF EGGS LAID DURING THE SUMMER (MAY-AUGUST, 1956).

Treatment	Eggs held 1 to 5 days		Eggs held 6 to 10 days	
	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	480	73.8	443	71.3
Held at 50°F. overnight, pre-incubated 3 hrs. at 99 3/4°F. and then held at 50°F.	670	67.5	613	64.8
Held at 50°F. overnight, pre-incubated 5 hrs. at 99 3/4°F. and then held at 50°F.	483	71.0	442	69.7

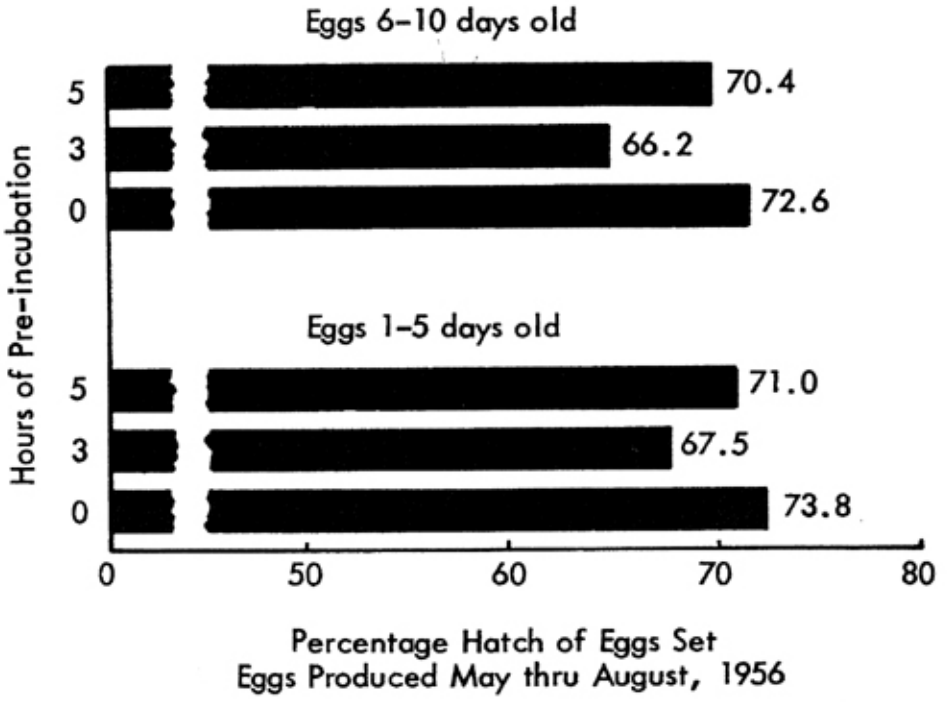

Fig. 4—Effect of pre-incubation on the hatching of eggs produced during the summer months.

Repeated trials during June and July, 1956, (Table 8) failed to show any improvement in hatches by a single pre-incubation for three or five hours. However, repeated pre-incubation for three hours at five day intervals showed some improvement.

TABLE 8--EFFECT OF PREINCUBATION ON HATCHABILITY OF EGGS HELD 1 TO 20 DAYS FROM JUNE 20 TO JULY 18, 1956.

Treatment	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	616	76.3
Held 3 hr. at 99 3/4°F. day following laying.	620	73.5
Held 5 hr. at 99 3/4°F. one day before setting.	626	76.5
Warmed 3 hr. at 99 3/4°F. at 5 day intervals while held.	619	78.8

The spring, 1956, (Table 9) tests were designed to determine if pre-incubation the day after laying or 24 hours before setting was more beneficial. Results indicated that pre-incubation soon after laying was not effective but pre-incubation 24 hours before setting improved hatching by 1.7 percent over the controls.

TABLE 9--EFFECT OF PREINCUBATION ON HATCHABILITY OF EGGS HELD FOR 1 TO 10 DAYS. TOTAL OF 6 HATCHES APRIL 11 TO JULY 18, 1956.

Treatment	No. Eggs	Percentage hatch of eggs set
Controls held at 50°F.	2670	76.9
Preincubated 3 hr. at 99 3/4°F. day after laying and then held at 50°F.	2673	76.6
Preincubated 5 hr. at 99 3/4°F. 24 hrs. before setting.	2690	78.6

Table 10 shows results of tests planned to determine if eggs should be kept warm (75°F. to 80°F.) over night before cooling. The eggs held overnight hatched 1.5 percent better (79.0 percent to 77.5 percent) than eggs placed in the cooler the day laid.

TABLE 10--EFFECT OF DELAYED COOLING ON HATCHABILITY OF EGGS HELD FOR 1 TO 10 DAYS. APRIL 11 TO JULY 18, 1956.

Treatment	No. Eggs	Percentage hatch of eggs set
Eggs placed in cooler (50°F.) 5:00 P.M. day laid	2682	77.5
Eggs held at room temperature (75°F.) until 8:00 A.M. day after laying and then held at 50°F.	2712	79.0

In another test (Table 11) 78.5 percent of eggs held at room temperature overnight before placing in the cooler hatched, compared with 76.9 percent for eggs placed in the cooler the day laid.

TABLE 11--EFFECT OF DELAYED COOLING OF HATCHING EGGS ON HATCHABILITY OF EGGS. APRIL 11 TO MAY 2, 1956.

Treatment	Eggs set	Percentage hatch of eggs set
Placed in cooler 50°F. day laid and held 1 to 10 days.	1618	76.9
Held for 16 hrs. at room temperature (75°F.) before placing in cooler.	1652	78.5

In another test designed to answer this question eggs were gathered three times daily and hatching records kept on each gathering (Table 12). The eggs that were placed in the cooler soon after gathering hatched more chicks than the eggs held overnight at room temperature before cooling.

TABLE 12--EFFECT OF COOLING HATCHING EGGS SOON AFTER LAYING ON HATCHABILITY OF EGGS LAID BY VANTRESS X ARBOR ACRE WHITE ROCKS. EGGS HELD 0 TO 13 DAYS. MAY-JULY, 1959.

	Eggs held in cases at room temperature (75°F. to 80°F.) until 8:30 a.m. following day laid. Then held in cooler.		Placed in cooler soon after gathering 3 times daily.	
Time gathered	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
9:00 A.M.	842	81.4	841	81.9
11:00 A.M.	815	81.6	810	82.4
3:00 P.M.	758	78.6	760	82.5
Total	2415	80.6	2411	82.3

During the spring and summer of 1956 the value of rapid warming of eggs in water at 110°F. for five minutes immediately before setting was tested. Tests made from March 29 to April 11, 1956, (see Table 14) indicated that such warming was beneficial for eggs held one to five days but not for eggs held six to 10 days. Repeated tests (Table 15) running into the summer failed to show any beneficial results. Apparently pre-warming eggs that were produced during the summer and held one to 14 days did not improve hatching results.

TABLE 13--EFFECT OF COOLING HATCHING EGGS SOON AFTER LAYING ON HATCHABILITY OF EGGS PRODUCED BY VANTRESS X ARBOR ACRE WHITE ROCKS. EGGS HELD 0 TO 13 DAYS. MAY-JULY, 1959.

	Eggs held in cases for 24 hrs. at room temperature (75°F. to 80°F.). Then held in cooler.		Placed in cooler soon after gathering 3 times daily.	
Time gathered	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
9:00 A.M.	672	81.0	688	80.7
11:00 A.M.	607	76.6	595	79.0
3:00 P.M.	806	76.3	818	75.2
Total	2085	77.9	2101	78.1

TABLE 14--EFFECT OF WARMING HATCHING EGGS IN 110°F. WATER IMMEDIATELY BEFORE SETTING ON HATCHABILITY. MARCH 29 TO APRIL 11, 1956.

	Eggs held 1 to 5 days		Eggs held 6 to 10 days	
Treatment	Eggs set	Percentage hatch of eggs set	Eggs set	Percentage hatch of eggs set
Eggs set directly from the cooler	875	77.8	765	76.0
Warmed for 5 minutes in water (110°F.)	883	81.3	778	74.9

TABLE 15--EFFECT OF WARMING HATCHING EGGS IN WATER 110°F. FOR 5 MINUTES IMMEDIATELY BEFORE SETTING. EGGS HELD 1 TO 14 DAYS. APRIL 11 TO JULY 18, 1956.

Treatment	Eggs set	Percentage hatch of eggs set
Controls held at 50°F.	2997	78.2
Held at 50°F. and then warmed 5 minutes in water (110°F.) immediately before setting.	3020	78.9

REFERENCES

Becker, W. A. and G. E. Bearse, 1958. Pre-incubation warming and hatchability of chicken eggs. Poultry Sci. 37:944-948.

Funk, E. M., 1934. Factors influencing hatchability in the domestic fowl. Missouri Agr. Exp. Stat. Bul. 341.

Funk, E. M., 1949. Fertility and Hatchability of Chicken and Turkey Eggs. Edited by L. W. Taylor, John Wiley & Sons, Inc., New York.

Jackson, H. W., 1912. Experiments in incubation. Pennsylvania Agr. Exp. Sta. Bul. 120.

Kosin, I. L., 1956. Studies on pre-incubation warming of chicken and turkey eggs. Poultry Sci. 35:1384-1392.

Olsen, M. W., 1949. Effect of shipment on pre-incubated fertile eggs. Poultry Sci. 28: 731-738.