Sawdust incubator: an alternative traditional hatchery technique for Japanese quails (*Coturnix coturnix japonica*)

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Abstract

A total of 720 fertile quail eggs from a commercial quail breeder farm were incubated in layers of sawdust in a box heated by Kerosene or in an electric incubator. Different depths of sawdust (2, 3 and 4 cm) were compared in the box incubator. This system was also compared with an electric incubator. The proportion of live chicks hatched, as a percentage of fertile eggs set, increased linearly as the depth of sawdust was decreased from 4 to 2 cm. The sawdust incubator gave similar fertility, hatchability, and embryonic mortality values as the electric incubator. Use of sawdust for hatching quail eggs is an alternative option in situations either without electricity or where the power supply is erratic.

Keywords: *hatchability, incubator, kerosene stove*

Introduction

Demand for eggs and Japan quail chicks (*Coturnix coturnix japonica)* is increasing in Indonesia, particularly in the Lombok island. The eggs are used for the preparation of meat balls and the male quail chicks are grown for breeding and bird sound contest in some areas in Lombok. The increasing demand poses challenges for hatchery business to provide quail chicks, facing problems in power supply for heating. The shortages of electricity, irregular or intermittent electricity supply, and frequent power break-downs (Roy et al 2004) have impeded in greater numbers. Therefore, as an alternative strategy, incubators not using electricity are necessary to fulfill such rising demand. Previous studies have shown that low temperature during incubation had a negative effect on embryonic development (Ben-Ezra and Burness 2016) with consequences such as delayed hatching (Bertin et al 2018), early embryonic mortality (Nakage et al 2003) or low survival rate (Laenoi and Buranawit 2016). It means that interrupting power supply during incubation resulted in low hatchability and livability of quail chicks.

Yet another advantage of having non-electric incubators is that smallholders who live in remote and rural areas would be able to develop this hatching business without fear for power outages. Previous studies have shown that the traditional system of hatching operation used rice husk (Dessie 1995; Roy et al 2004; Sumy et al 2012) and sand (Sumy et al 2012; Kassu and Beyero 2015) as the heaters, which gave more than 50% hatchability in backyard chickens (Sumy et al 2012). However, sawdust as a medium for egg placement and warming has not been explored previously. Sawdust is very cheap and useful for small farmers who do not have access to capital. In the light of the above, a study was carried out to determine the optimal thickness of sawdust as a heater medium in a traditional incubator.

Materials and methods

Hatching eggs and experimental design

The eggs used in this study were purchased from a commercial quail breeder farm, which maintained the birds with a sex ratio of 1:3 and the eggs were less than 7 days-old. Before being put into the sawdust incubator, the eggs were cleaned using warm water and a soft cloth. The eggs were then numbered and weighed individually with a 0.1 g sensitive electronic scale. The hatching eggs were marked using colored markers and then placed in egg racks with a barrier between each treatment. Fertile eggs (n=1440) were divided into two groups. The first group of 720 fertile eggs was arranged in a completely randomized design involving three different thickness of sawdust and three replicates. The second group was distributed into three batches in a conventional incubation for assessing the hatching performance. The hatching processes were carried out at the same time.

Sawdust incubation

Three kerosene stoves were put in the middle of the hatching box, following Dessie (1995). For creating humidity, a plastic pan was filled with water (Photo 1). The temperature of the sawdust incubator was maintained between 37.5 and 39^{o}C with relative humidity between 70 and 75%.

The frame of the incubator (90 cm long and 70 cm wide) was made of ordinary wood and fitted with a rack made of iron wire for holding sawdust and eggs (Photo 2). One hatching rack consisted of nine small compartments of size 30 x 23.3 cm. The height of the hatching rack from the floor was 50 cm. The incubator was covered with a black carpet so that the heat of the kerosene stove can spread evenly throughout the incubator room. The experimental variables included three different thicknesses of sawdust (2, 3 and 4 cm). The three small boxes in the incubator were filled with 100, 150 and 200 g of sawdust so as to get the requisite sawdust thicknesses as mentioned.

Eggs were turned twice a day with 12 hour intervals. The eggs were candled on the 5th day. Those eggs showing no embryonic development were calculated as infertile (Photo 3). Candling was repeated on the 10th and 14th days for early and intermediate embryonic mortalities **(**Photo 4). Dead in-shell was calculated for unhatched fertile eggs as late embryonic mortality.

Electricity incubator

For electricity incubator, a small incubator with capacity of 300 eggs was used. We chose plywood material for the conventional incubator as the control (Photo 5) because this is most common in commercial hatching by small-scale operators. Fertile eggs used were from the same source mentioned before.

Photo 1. Kerosene mini stove for heating the sawdust

Photo 2. Sawdust as incubator for quail eggs

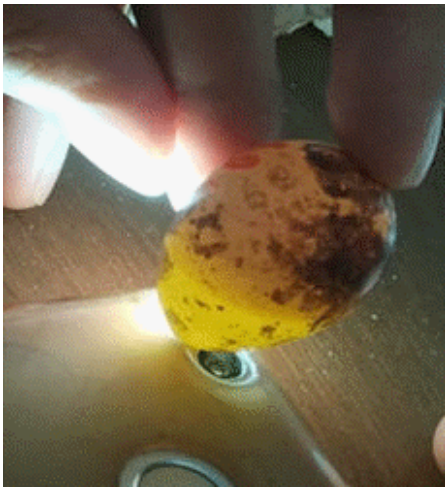

Photo 3. Candling on day 5

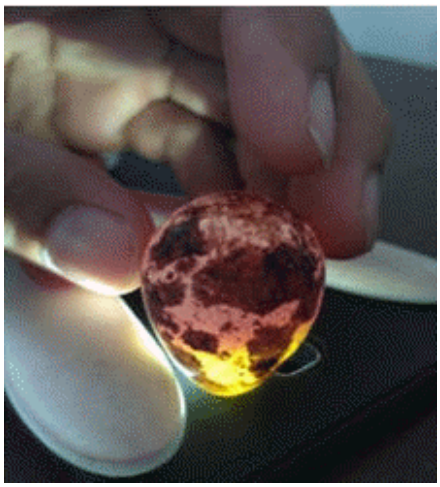

Photo 4. Candling on day 14

Photo 5. The plywood electric incubator

Measurements

Measurements to determine infertility/fertility, early and intermediate embryonic mortalities, were done as in our previous hatching study on local ducks (Indarsih et al 2019). Late mortality was

expressed as dead in-shell at post hatching. Abnormal quail chicks with blindness, open navels, small size (low post-hatching weight), defective shape and other abnormalities (Rashid *et al*. 2009) were culled. Hatchability (fertile egg basis) or HF = number of hatched quail chicks/number of fertile eggs x 100%; hatchability (set egg basis) or HS = number of hatched quail chicks/number of eggs set x100%; early embryo mortality: dead in-germ or DG = number of dead embryo/number of fertile eggs x 100%; dead in-shell or DS = number of dead quail chicks in shell /number of fertile egg x 100%; normal quail chicks = number of normal quail chicks/number of hatched quail chicks x 100%; abnormal quail chicks = number of abnormal quail chicks/number of hatched quail chicks.

Statistical analysis

The data were subjected to analysis of variance (ANOVA) following the General Linear Model (GLM) procedure of SAS (SAS Institute 1985). Mean separation was done using the test of Tukey at 5% significant level. Comparative assessment for sawdust and electric incubators was done using "t" test.

Results and discussion

Hatching performance

The percentage of fertile eggs that resulted in live chicks decreased linearly as the thickness if the sawdust was increased (Table 1; Figure 1). The thinner sawdust layer probably facilitated the penetration of the heat from the kerosene lamps, thus stimulating the embryo development of fertile eggs. Stage of embryonic mortality was not affected by the thickness of the sawdust bed.

Table 1. Effect of different thickness of sawdust as a medium to capture heat from kerosene heaters on hatching performance

	Sawdust thicknesses (cm)			SEM	*p*
	2	3	4		
Hatchability (egg set basis)	70.8	71.5	68.3	7.0	0.28
Hatchability (fertile egg basis)	87.1	81.7	76.8	2.8	0.31
Early embryonic mortality	2.7	2.2	8.5	2.8	0.06
Intermediate mortality	0.9	3.3	2.2	1.5	0.24
Late embryonic mortality	9.3	12.9	12.5	3.3	0.13

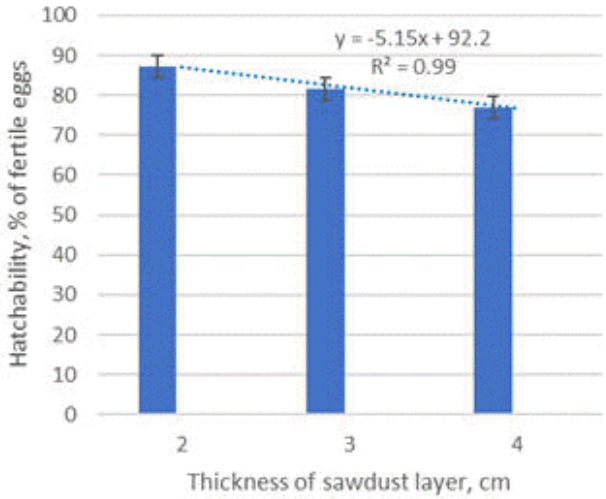

Figure 1. Effect of thickness of sawdust layer on eggs hatched as percent of fertile eggs

There were no differences in hatchability or in stage of embryonic mortality as between the sawdust and the electric incubator (Table 2). This shows that sawdust as a medium for transferring heat from kerosene lamps was comparable to the more controlled conditions in the electric incubator.

Table 2. Hatching performance of quail eggs in the sawdust-kerosene lamp system and in a conventional electric incubator

%	Sawdust	Electric incubator	SEM	*p*
Hatchability (egg set basis)	70.2	75.6	3.5	0.18
Hatchability (fertile egg basis)	81.9	82.4	5.9	0.27
Early embryonic mortality	4.5	2.5	2.6	0.07
Intermediate mortality	2.1	4.0	1.4	0.21
Late embryonic mortality (dead in-shell)	11.6	11.9	4.5	0.12

Conclusions

- In a box with a layer of sawdust as hatching medium, and kerosene lamps as heat source, the proportion of live chicks hatched as a percentage of fertile eggs increased linearly as the depth of sawdust was decreased from 4 to 2 cm.
- The sawdust incubator gave similar fertility, hatchability, and embryonic mortality values as that of an electricity incubator.
- Use of sawdust for hatching quail eggs is an alternative option in situations either without electricity or where the power supply is erratic.

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