Breeder Age Alters Offspring Performance in the Pekin Duck

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Primary Audience: Hatchery Managers, Production Managers, Field Service Technicians, Researchers

SUMMARY

There are reports that age of broiler breeders and turkey breeders can influence offspring performance; however, there are no data to support such possibilities in the Pekin duck. The effects of breeder age (prepeak and postpeak egg production) on fertility and hatchability were evaluated. Additionally, after hatch the effects of breeder age on body weight gain, feed conversion rates, and mortality through 8 d of age were investigated. These data suggest that prepeak breeders (24 wk of age) exhibit lower levels of fertility and reduced hatch of fertile eggs. In addition, ducklings from prepeak breeders display lower body weight gains and higher mortality rates when compared to their counterpart hatched from peak or postpeak breeders.

Key words: hatchability, fertility, breeder age

DESCRIPTION OF PROBLEM

Most previous reports on offspring performance as it relates to breeder age have been about broiler breeders. Scientists have shown decreases in hatchability from 24-wk-old broiler breeders, when compared to peak or later production [1, 2, 3]. In addition, the mortality rate appears to be higher in small chicks from young breeders following placement [4, 5, 6, 7]. Noble et al. [3] suggested that increased mortality rates in embryos from young breeders may be associated with a malfunction of yolk lipid assimilation and mobilization; they [3] reported that this would deny the embryo access to the major nutrients associated with development during the last week of incubation. Yafei and Noble [8] further demonstrated that cystolic liver lipid accumulation is different among embryos from parents of different ages. More specifically, they noted a reduction in liver lipid accumulation in embryos from 25-wk-old breeders compared to those from 35-wk-old breeders. Our group has confirmed the lower-than-expected levels of liver lipid accumulation in duckling from young breeders [9]. Therefore, we investigated the effects of breeder age on fertility, hatchability, mortality, and growth through the first 8 d of life.

MATERIALS AND METHODS

In this study, one Pekin duck breeder flock was monitored from 24 through 47 wk of age.

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Breeders were housed in four identical pens (114 to 120 hens and 21 to 23 drakes per pen) and reared under standard industry practices. Average egg size was determined at 24, 31, and 47 wk of age. At each of the sampling times, 100 eggs per breeder pen were collected over an 8-d period and then stored for 4 d. After storage, eggs were randomized across breeder pens and trays within the incubator so that day of collection and position within the incubator were given equal consideration. This procedure was repeated for each breeder period. The incubator had a dry bulb temperature of 37.5°C and 30.0°C wet bulb. Eggs were transferred to the hatcher on Day 23 with an initial temperature and relative humidity equal to the setter; however, over the 5-d period (between Days 23 to 28), the temperature was gradually lowered to 36.3°C. Dry bulb temperature and relative humidity were monitored on a daily basis for the incubator and hatcher. There were no differences noted in incubator or setter conditions (temperature or relative humidity) at each of the breeder periods examined.

**Experimental Procedures**

Eggs collected at each period were incubated under identical conditions using the same commercial setter and hatcher [10]. The percentage of fertile eggs from 24-, 31-, and 47-wk-old breeders was calculated as 
\[
\frac{(\text{total number of eggs} - \text{number of clear eggs})}{\text{total number of eggs}} \times 100
\]
Percentage hatch was determined as 
\[
\frac{\text{number of eggs that hatched}}{\text{number of fertile eggs}} \times 100
\]

After hatch, ducklings were transported to a grow-out facility. Eleven straight-run ducklings were placed into eight replicate pens, which represented a density similar to that used in industry. Ducklings were given access to feed and water ad libitum. Diets were identical for all pens and met or exceeded the National Research Council [11] requirements for ducks. Pen body weights and feed conversion were recorded at 3 and 8 d of age. The feed conversion rates were adjusted for mortalities. Mortality was recorded daily. The short interval, i.e., 8 d, was based upon our past experience to determine duckling quality; we observe very few mortalities after 7 d of age unless there is a disease problem.

**Statistical Analyses**

A completely randomized design was used [12]. The data collected were analyzed using a one-way ANOVA. For body weight and feed efficiency a split-plot in time evaluated breeder age, duckling age, and the interaction between breeder and duckling age. The PROC MIXED procedure of SAS software was used [13]. For categorical data (fertile vs. not fertile or hatch vs. not hatched)
FIGURE 2. Effect of hen age (24, 31, and 47 wk of age) on duckling body weight through 8 d of age. Bars within a day of age that lack common letters differ significantly \( (P < 0.05) \).

RESULTS

In this study, egg weight significantly increased \((74.7 \pm 0.8 \text{ g}, 83.2 \pm 0.8 \text{ g}, \text{ and } 93.8 \pm 0.8 \text{ g})\) as a function of breeder age (24, 31, and 47 wk of age, respectively). In addition to the young breeders (24 wk of age) laying the smallest eggs, they produced significantly fewer fertile eggs and a lower hatch, when compared to 31- or 47-wk-old breeders (Figure 1).

Regardless of breeder flock age, there were no significant differences in feed conversion rates (data not shown) through 8 d of age or in duckling weights at hatch. However, ducklings from 31- and 47-wk-old breeders weighed significantly more than those from 24-wk breeders at 3 and 8 d posthatch (Figure 2). In addition, ducklings from 24-wk-old breeders had significantly higher mortality (18%), when compared to ducklings from 47-wk-old breeders (9%) or 31-wk-old breeders (zero).

DISCUSSION

Numerous studies have documented that hen age and subsequent egg weight are positively correlated [6, 7, 8, 9, 11, 12, 13, 14]. Therefore, it was not surprising to discover a similar trend in Pekin duck breeders. Furthermore, hatching egg size decreased hatchability in 24-wk-old breeders when compared to 31- and 47-wk-old breeders, which supports the results of previous broiler studies [1, 2, 3].

The present study also discovered a positive trend between duckling body weight and breeder age. More specifically, those ducklings from 31- or 47-wk-old breeders grew better than those from a 24-wk-old breeder flock at Days 3 and 8. Shana-
wany [15] suggests that this trend may be due to various factors. Eggs from older flocks are larger in size and, thus, provide more total nutrients to the embryo for growth [16]. Second, embryos from older flocks may use yolk nutrients more effectively than those from young parents. Last, as breeders age, they become more efficient in depositing essential embryonic nutrients. As duck, chicken, or turkey age increases, egg yolk:albumen ratios increase, and a greater proportion of yolk is deposited in the egg at the expense of albumen [14, 17, 18, 19].

The duck embryo is more efficient at using egg energy than the chick embryo [20]. Holub et al. [20], in studies with Beijing ducks, found that a duck egg has more gross energy than a broiler egg prior to incubation. Additionally, the transfer of gross energy is significantly greater in developing duck embryos from a mature breeder flock (31 or 47 wk of age), when compared to ducklings from younger breeders (24 wk of age). We discovered in this same breeder study that embryos and newly hatched ducklings from young breeders (24 wk of age) displayed significantly fewer cholesterol ester droplets in the liver when compared to ducklings from mature breeders [9].

Knizetova et al. [21] determined that Pekin duck hatch weight is positively correlated with early posthatch growth. Furthermore, egg size can increase body weight at market age in some strains of commercial Pekin ducks [22]. It is suggested that the faster growth rate of Pekin ducklings from larger eggs may be related to faster reabsorption of the larger yolk [21]. In the present study, no differences were observed in hatching weight, but rather the growth potential was influenced by breeder flock age. Peebles et al. [23] and Proudfoot et al. [24] demonstrated that increased broiler hatch weight results in increased feed conversion by 49 d of age. In contrast, no differences in feed conversion were noted in the present study (data not shown). In the present study, ducklings from 24- and 47-wk-old breeders had 18 and 9% mortality, respectively, when compared to 0% mortality in ducklings from 31-wk-old breeders.

This finding shows that young breeders produce less fertile eggs. In addition, the percentage hatch of fertile eggs is also significantly less in eggs from young breeders.

CONCLUSIONS AND APPLICATIONS

1. Young breeders exhibit a lower percentage of fertile eggs and hatch of fertile eggs when compared to breeders at peak or postpeak production.
2. Offspring from young breeders grow at a slower rate after hatch when compared to ducklings from peak or postpeak breeders. Also, offspring mortality is highest in ducklings from young breeders.
3. Producers may need to provide enhanced managerial care for offspring from younger breeders or delay the onset of egg production to allow a flock time to mature.

REFERENCES AND NOTES


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