What is the best sex ratio in commercial pekin duck breeding?

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In today's economy, feed price volatility is impacting on the profitability of all companies involved in the livestock industry considerably. There is no exception.

Commercial pekin duck production is suffering all over the world because of this issue. As a result, technical performance becomes, more than ever, a key point to improve competitiveness.

In breeding, the main focus remains the number of offspring produced per breeding female during the entire laying cycle. Fertility is one of the most important indicators to judge and compare breeder numerical productivity. The challenge in regards to fertility rate will be to reach a good rate at peak of lay but also to get a constant fertility rate up to the end of the laying cycle. Males and females distribution has, then, an important impact on fertility rate even if this criterion is not the only one influencing fertility percentage. As far as today's knowledge, the most commonly used sex ratio is one male for 4.5 or 5 females placed at one day old. This balance between males and females gives satisfying results, but if we consider the cost of raising breeders, especially breeder males, would there be an advantage in modifying the sex ratio to make savings on males breeding, while maintaining same offspring productivity? What could be the best sex ratio considering both productivity and breeding costs?

Sex ratio	Number of females	Number of males	Feed cost estimation at €28.8/bird (€)	Potential savings (€)
1/5	10,000	2,000	57,600	
1/5.5	10,000	1,820	52,416	-5,184
1/6	10,000	1,660	47,808	-9,792

Table 1. Potential saving on feed costs for a flock of 10,000 breeder females.

Costs of breeding

Costs of raising breeders can be estimated. Some expenses, like labour cost, housing cost and litter cost vary according to the region of the world where ducks are raised. But some other expenses like day old breeder cost or feeding fees are not so variable.

Taking into account the main cost of raising birds is feed intake, if we base the calculation only on this item we already have significant information and a good indicator of the main cost of the breeder males.

As an example, according to Grimaud Freres Selection standards, parent stock GL50 male will eat:

- About 16kg of feed from day one up to males and females mixing at 17 weeks of age.
- About 1.5kg per week from 17 weeks to depletion at 70 weeks of age for example, which brings us to 80kg per male.

The total feed intake will be 96kg.

Today's average feed price is around €0.30 per kg; feeding cost for one male is then about €28.8.

As an example, Table 1 shows the potential saving on feed cost for a flock of 10,000 breeder hens just by modifying the sex ratio.

For the whole flock, feed saving in this situation is up to about €5,200 increasing the sex ratio of 0.5 female per male and €9800 increasing the sex ratio of one female per male. This is only based on feed cost, which is a significant saving.

On top of that, if the number of males is reduced, keeping the same density, more females can fit in the same duck shed. On a same size flock as above, 285 additional females could fit.

Means and method

Being totally convinced of the necessity of a field test, Grimaud Freres Selection decided to set up a comparative test with several pens with different sex ratio, using the same breeder flock.

	Male (No.)	Female (No.)	Sex ratio
Group 5	62	310	1/5
Group 6	52	310	1/6
Group 7	44	310	1/7

Table 2. Distribution of males and females.

This trial was conducted on Grimaud's grandparent farm in DongNai province south of Vietnam, under challenging conditions for breeding in regard to temperature and humidity level in this area.

In April 2011, a parent flock of 1,000 PS GL30 females and 168 GL50 males produced from a local GP flock was set up inside a 600m² open-windowed duck shed, with no access to a pond and no pad cooling. Birds were raised from one day old up to depletion at 70 weeks of age in the same building, as is commonly practiced in Asia.

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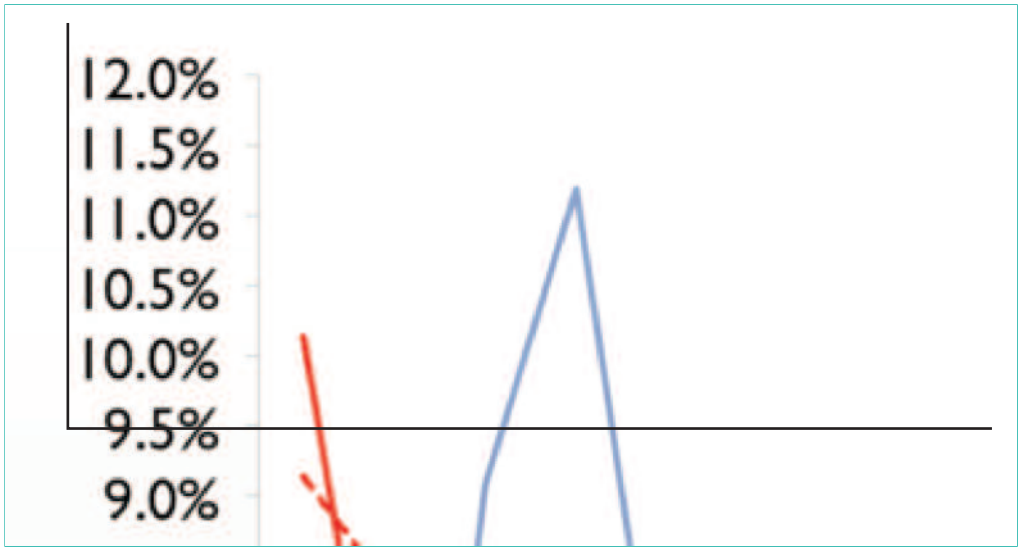
Fig. 1. Weekly percentage of clear eggs. The green curve is the flock with 1/5 sex ratio, blue is the one with 1/6 sex ratio and red is the one with 1/7 sex ratio. The dotted line is showing the tendency curve for each colour respectively.



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Male and females were raised separately, following standard growth profiles recommended by Grimaud until 17 weeks of age. At this stage, breeders were gathered together, for their sexual development and divided into three pens of 310 females with a different male/female balance for each pen (Table 2).

From mixing these three pens were managed completely separately as if they were three different flocks, but still following same growth profile until the onset of lay.

All records during laying production, such as laying rate; fertility rate divided into two parts, early dead embryos and clear eggs; mortality; as well as daily feed intake per bird, were kept scrupulously for each testing flock.

	Average laying rate (%)	Difference versus group 5
Group 5	78.28	
Group 6	74.72	-3.56
Group 7	73.01	-5.27

Table 3. Comparison of average laying performance.

During laying period, all flocks were managed and treated exactly the same way. This rule also applied for the incubation process which was identical for each batch of eggs. Hatching eggs were collected everyday at the same time, even several times per day. They were stored in the same storage room under the same temperature and humidity conditions.

Temperature was about 15-16°C and humidity around 70-80%. Hatching eggs were set in the incubator every week, same day, whatever the batch of origin, so storage never exceeded one week.

Clear eggs rate was determined after a candling carried out after seven days of incubation and early dead embryos rate after a second candling at 14 days of incubation.

In this situation, environmental conditions cannot explain any difference.

Results

Fig. 1 shows weekly evolution of clear eggs percentage from the first week of production up to the last one. Weekly rates were very variable but each batch followed the same tendency respecting logical reasoning.

The flock raised with the highest sex ratio (one male for five females) gave the best performance on that criterion.

At the end of the 42 weeks of egg production, average clear egg rate was 4.20% for group 5, 4.79% for group six and 5.14% for group seven.

Evolution of weekly percentage of dead embryos (Fig. 2) was not contrasting the conclusion issued after clear eggs rate analysis. It barely respects the same logical reasoning, ending up with an average of 3.34% of early dead embryos for group five, 3.41% for group six and 3.51% for group seven for the whole laying cycle. However, gaps between each batch are not as important as for the clear eggs rate.

The balance of males versus females should not have any effect on average weekly laying rate. Laying production is not related to sex ratio.

However, Table 3 shows a noticeable advantage for group 5 in regard to average weekly laying rate compared to the other two groups ending up with a similar laying performance.

In addition, group five had the highest daily feed intake compared to the other groups (Table 4). Daily feed intake was calculated in grams per bird per day so sex ratio should not have any incidence on this criterion. As a fact, in this situation, the difference in laying production can be explained by the highest daily feed intake.

However, there is no absolute certainty that the male/female balance has no influence on the feed consumption as well as on the laying rate!

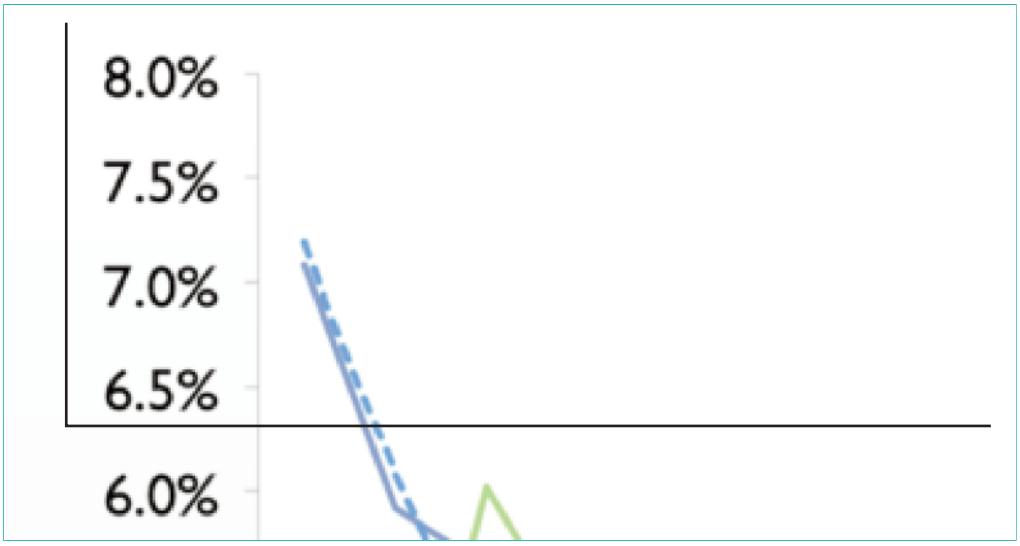

Fig. 2. Weekly percentage of dead embryos. The green curve is the flock with 1/5 sex ratio, blue is the one with 1/6 sex ratio and red is the one with 1/7 sex ratio. The dotted line is showing the tendency curve for each colour respectively.

Summary

From a technical point of view, adding clear eggs and early dead embryos rates, there is an advantage of 0.66% for the 1/5 male/female balance versus group six and 1.11% versus group seven.

As shown in Table 5, in this test, this technical advantage between group five and six ends up with a better productivity of 1.3 ducklings per female per laying period and 2.2 ducklings comparing group five versus seven. It is wise to consider as well that this test has certainly been conducted in real conditions but with no repetition.

On top of that, the testing farm was located in South Vietnam under a tropical climate; it is not certain that the conclusion would be similar if the test had been run under a continental climate.

As a conclusion, experimental evidence along with substantial commercial experience confirms sex ratio of one male for five females gives the best technical results.

However, sometimes, for any reason, males can face an issue during delivery or during the start up phase for example, modifying male and female balance.

Table 5 shows that if the sex ratio jumps from 1/5 to 1/6, even to 1/7, the situation does not become critical and stays under control. ■

Table 4. Average daily feed intake and feed cost comparison.

	Average daily feed intake (g)	Total feed during laying period (kg)	Estimated feed cost per female (€0.30/kg) (€)	Difference versus group 5 (%)
Group 5	197	57.9	17.37	
Group 6	189	55.7	16.71	-3.79
Group 7	186	54.8	16.44	-5.35

Table 5. Economical approach of each group based on group 5.

	Potential savings on breeder raising per female placed (€)	Average fertility clear eggs + dead embryos (%)	Impact of fertility on number of offspring per female placed, for the entire cycle
Group 5	0	7.54	0
Group 6	-0.98	8.20	-1.30
Group 7	-1.64	8.65	-2.30

Grimaud Vietnam GP farm.