

# Efficiency of feed utilization by different hybrids of broiler chicks

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## SUMMARY

The experiment investigated the efficiency of feed utilization by three broiler hybrids: Ross 308, Cobb 500 and Arbor Acres, using the feeding recommendations of the producers. The compound feed formulations were based on corn and soybean meal and they were calculated according to the chemical composition of the feed ingredients, by stage of growth. The experimental results show that the performance of all three hybrids was similar for all analyzed parameters.

Keywords: broilers, Ross 308, Cobb 500, Arbor Acres, performance indices, carcass quality

## INTRODUCTION

The nutrient requirement of the animals, in general, and of poultry, in particular, was determined after extensive research, which produced recommendations issued by the different international systems: National Research Council, from the USA (NRC), Rhône- Poulenc Animal Nutrition Recommendations, France (AEC), Agricultural Research Council, United Kingdom (ARC). These recommendations vary with the species, category of production, physiological state, age, sex, environmental temperature (for layers) and other factors, determining the nutrient content of the compound feeds, which are specific to each category of poultry.

The companies specialised in broiler production have organised their breeding programs for the production of fast-growing broilers, with maximal feed conversion, with specific proportion of the carcass parts and with increased resistance to the stress factors. These companies are selling their chick together with feeding recommendations which to support broiler performance. Such examples are the Scottish group Aviagen, selling Ross and Arbor Acres and the British company Cobb-

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Vantress, which includes as of 2007, Hendrix Genetics owner of the Hybro brand.

These birds, with improved genotypes are exploited for increasing performance, which require the formulation of adequate diets meeting the feeding requirements of the newly created hybrids, which need less feed for the same performance. Hence, the compound feed also needs to be of adequate quality in order to meet broiler requirements at their different developmental stages.

The purpose of our study was to test the performance of the most commonly used broiler hybrids under similar conditions of study.

#### MATERIAL AND METHODS

The study was conducted in the experimental farm of IBNA-Balotești on 900 one-day old Ross 308, Cobb 500 and Arbor Acres broilers, weighing 39, 43 and 42 g, respectively.

The broilers were assigned to three groups of 300 chicks each (3 groups  $\times$  2 replicates  $\times$  150 chicks).

The period of the study was 42 days, with three stages as follows:

- For Ross 308 hybrid: *start* (0 – 10 days), *growing-developing* (11 – 24 days) and *finishing* (25 – 42 days)
- For Cobb 500 hybrid: *start* (0 – 10 days), *growing-developing* (11 – 22 days) and *finishing* (23 – 42 days)
- For Arbor Acres hybrid: *start* (0 – 21 days), *growing-developing* (22 – 37 days) and *finishing* (38 – 42 days)

Tables 1, 2 and 3 show the compound feed formulations which were based on corn and soybean meal. The formulations were calculated according to the chemical analysis of the feed ingredients used according to producer's recommendations, Feeding handbooks: Cobb-Vantress, 2008 for Cobb 500 broiler and Aviagen, 2007 for Ross 308 and Arbor Acres broilers.

The chicks had free access to the feed and water. The broilers were housed in a room with microclimatic conditions similar to those from a farm with rearing on the floor, on permanent litter (wood shavings) and separate yards for each group and replicate with was continuous (24h) light regimen throughout the experimental period.

The chicks were vaccinated according to the sanitary-veterinary program specific to each category and treated with coccidiostatics in prevention dose.

#### *Monitored productive parameters:*

- Average daily feed intake (g);
- Body weight evolution, by developmental stage (g);

- Average daily weight gain, by age period (g);
- Feed conversion ratio (g feed/g gain);
- Liveable (%);
- Slaughter yield and proportion of carcass parts (%).

Table 1 Compound feed formulation for Ross 308 hybrid

| Structure/Ingredients                                     | Ross 308 hybrid          |                             |                               |
|---|--------------------------|-----------------------------|-------------------------------|
|   | Starter<br>(0 - 10 days) | Grower<br>(11 - 24<br>days) | Finisher<br>(25 - 42<br>days) |
| Corn (8%)   | 51.78                    | 54.33                       | 57.73                         |
| Soybean meal (46% CP)                                     | 36.55                    | 34.64                       | 32.55                         |
| Fish meal (65%)   | 4.00                     | 2.00                        | -                             |
| Oil   | 3.15                     | 4.70                        | 5.25                          |
| Monocalcium phosphate                                     | 1.45                     | 1.50                        | 1.56                          |
| Calcium carbonate   | 1.45                     | 1.28                        | 1.38                          |
| Salt  | 0.25                     | 0.25                        | 0.25                          |
| Vitamin-mineral premix<br>(starter + grower) <sup>1</sup> | 1.00                     | 1.00                        | -                             |
| Vitamin-mineral premix<br>(finisher) <sup>2</sup>         | -                        | -                           | 1.00                          |
| DL - methionine   | 0.28                     | 0.24                        | 0.22                          |
| L- lysine HCl   | 0.03                     | -                           | -                             |
| Choline HCl   | 0.06                     | 0.06                        | 0.06                          |
| TOTAL   | 100                      | 100                         | 100                           |
| <i>Calculated</i>   |                          |                             |                               |
| ME (MJ/kg feed)   | 12.65                    | 13.20                       | 13.40                         |
| Crude protein   | 24                       | 22                          | 20                            |
| Lysine, total   | 1.42                     | 1.25                        | 1.09                          |
| Lysine, available   | 1.25                     | 1.10                        | 0.96                          |
| Methionine + Cystine, total                               | 1.05                     | 0.95                        | 0.86                          |
| Methionine + Cystine, available                           | 0.95                     | 0.85                        | 0.78                          |
| Methionine, total   | 0.68                     | 0.60                        | 0.53                          |
| Methionine, available                                     | 0.65                     | 0.57                        | 0.51                          |
| Calcium   | 1.05                     | 0.90                        | 0.85                          |
| Phosphors, available                                      | 0.49                     | 0.45                        | 0.42                          |
| Fat, total  | 6.18                     | 7.59                        | 8.03                          |
| Crude fiber   | 2.88                     | 2.84                        | 2.80                          |

<sup>1</sup>The premix provided per 1 kg of starter + grower diet: 11,000 IU of vitamin A; 5,000 IU of vitamin D<sub>3</sub>; 75 mg of vitamin E; 3 mg of vitamin K<sub>3</sub>; 3 mg of vitamin B<sub>1</sub>; 8 mg of vitamin B<sub>2</sub>; 4 mg of vitamin B<sub>6</sub>; 0.016 mg of vitamin B<sub>12</sub>; 15 mg of Ca-panthotenate; 60 mg of niacin; 2 mg of folic acid; 400 mg of choline chloride; 120 mg of Mn; 100 mg of Zn; 40 mg of Fe; 16 mg of Cu; 1.25 mg of I; 0.30 mg of Se; 0.25 mg of Co.

<sup>2</sup>The premix provided per 1 kg of finisher diet: 9,000 IU of vitamin A; 4,000 IU of vitamin D<sub>3</sub>; 50 mg of vitamin E; 2 mg of vitamin K<sub>3</sub>; 2 mg of vitamin B<sub>1</sub>; 5 mg of vitamin B<sub>2</sub>; 2 mg of vitamin B<sub>6</sub>; 0.010 mg of vitamin B<sub>12</sub>; 15 mg of Ca-panthotenate; 40 mg of niacin; 1.5 mg of folic acid; 350 mg of choline chloride; 120 mg of Mn; 100 mg of Zn; 40 mg of Fe; 16 mg of Cu; 1.25 mg of I; 0.30 mg of Se; 0.25 mg of Co.

At the end of the experiment, 8 broilers (4 male and 4 female) per experimental variant were starved for 2 hours, weighed and slaughtered in order to determine the slaughter yield. The carcasses (including the head + neck, legs, abdominal fat + organs) were weighed individually.

Table 2 Compound feed formulation for Cobb 500 hybrid

| Structure/<br>Ingredients                                 | Cobb 500 hybrid          |                             |                               |
|---|--------------------------|-----------------------------|-------------------------------|
|   | Starter<br>(0 - 10 days) | Grower<br>(11 - 24<br>days) | Finisher<br>(25 - 42<br>days) |
| Corn (8%)   | 62.33                    | 64.66                       | 63.94                         |
| Soybean meal (46% CP)                                     | 28.30                    | 26.37                       | 27.13                         |
| Fish meal (65%)   | 4.00                     | 2.00                        | -                             |
| Oil   | 1.00                     | 2.30                        | 4.10                          |
| Monocalcium phosphate                                     | 1.50                     | 1.65                        | 1.70                          |
| Calcium carbonate   | 1.35                     | 1.43                        | 1.48                          |
| Salt  | 0.25                     | 0.25                        | 0.25                          |
| Vitamin-mineral premix<br>(starter + grower) <sup>1</sup> | 1.00                     | 1.00                        | -                             |
| Vitamin-mineral premix<br>(finisher) <sup>2</sup>         | -                        | -                           | 1.00                          |
| DL - methionine   | 0.19                     | 0.20                        | 0.22                          |
| L-lysine HCl  | 0.02                     | 0.08                        | 0.12                          |
| Choline HCl   | 0.06                     | 0.06                        | 0.06                          |
| TOTAL   | 100                      | 100                         | 100                           |
| <i>Calculated</i>   |                          |                             |                               |
| ME (MJ/kg feed)   | 12.50                    | 12.90                       | 13.29                         |
| Crude protein   | 21                       | 19                          | 18                            |
| Lysine, total   | 1.20                     | 1.10                        | 1.05                          |
| Lysine, available   | 1.05                     | 0.97                        | 0.93                          |
| Methionine + Cystine, total                               | 0.89                     | 0.84                        | 0.82                          |
| Methionine + Cystine,<br>available                        | 0.80                     | 0.75                        | 0.74                          |
| Methionine, total   | 0.56                     | 0.53                        | 0.51                          |
| Calcium   | 1.00                     | 0.96                        | 0.90                          |
| Phosphors, available                                      | 0.49                     | 0.48                        | 0.45                          |
| Fat, total  | 4.35                     | 5.50                        | 7.06                          |
| Crude fiber   | 2.68                     | 2.63                        | 2.66                          |

<sup>1</sup> The premix provided per 1 kg of starter + grower diet: 13,000 IU of vitamin A; 5,000 IU of vitamin D<sub>3</sub>; 80 mg of vitamin E; 4 mg of vitamin K<sub>3</sub>; 4 mg of vitamin B<sub>1</sub>; 9 mg of vitamin B<sub>2</sub>; 4 mg of vitamin B<sub>6</sub>; 0.020 mg of vitamin B<sub>12</sub>; 15 mg of Ca-panthotenate; 60 mg of niacin; 2 mg of folic acid; 400 mg of choline chloride; 100 mg of Mn; 100 mg of Zn; 40 mg of Fe; 15 mg of Cu; 1 mg of I; 0.30 mg of Se; 0.25 mg of Co.

<sup>2</sup> The premix provided per 1 kg of finisher diet: 10,000 IU of vitamin A; 5,000 IU of vitamin D<sub>3</sub>; 50 mg of vitamin E; 3 mg of vitamin K<sub>3</sub>; 2 mg of vitamin B<sub>1</sub>; 8 mg of vitamin B<sub>2</sub>; 3 mg of vitamin B<sub>6</sub>; 0.015 mg of vitamin B<sub>12</sub>; 12 mg of Ca-panthotenate; 50 mg of niacin; 1.5 mg of folic acid; 350 mg of choline chloride; 100 mg of Mn; 100 mg of Zn; 40 mg of Fe; 15 mg of Cu; 1 mg of I; 0.30 mg of Se; 0.25 mg of Co.

Table 3 Compound feed formulation for Arbor Acres hybrid

| Structure/<br>Ingredients                                 | Arbor Acres hybrid       |                          |                            |
|---|--------------------------|--------------------------|----------------------------|
|   | Starter<br>(0 - 10 days) | Grower<br>(11 - 24 days) | Finisher<br>(25 - 42 days) |
| Corn (8%)   | 63.57                    | 58.22                    | 62.25                      |
| Soybean meal (46% CP)                                     | 31.65                    | 31.11                    | 28.58                      |
| Fish meal (65%)   | -                        | 1.00                     | -                          |
| Oil   | -                        | 5.20                     | 4.70                       |
| Monocalcium phosphate                                     | 1.80                     | 1.62                     | 1.62                       |
| Calcium carbonate   | 1.55                     | 1.37                     | 1.38                       |
| Salt  | 0.25                     | 0.25                     | 0.25                       |
| Vitamin-mineral premix<br>(starter + grower) <sup>1</sup> | 1.00                     | 1.00                     | -                          |
| Vitamin-mineral premix<br>(finisher) <sup>2</sup>         | -                        | -                        | 1.00                       |
| DL - methionine   | 0.12                     | 0.17                     | 0.16                       |
| L- lysine HCl   | -                        | -                        | -                          |
| Choline HCl   | 0.06                     | 0.06                     | 0.06                       |
| TOTAL   | 100                      | 100                      | 100                        |
| <i>Calculated</i>   |                          |                          |                            |
| ME (MJ/kg feed)   | 12.10                    | 13.23                    | 13.40                      |
| Crude protein   | 20                       | 20                       | 18.5                       |
| Lysine, total   | 1.08                     | 1.09                     | 0.99                       |
| Lysine, available   | 0.95                     | 0.96                     | 0.87                       |
| Methionine + Cystine,<br>total                            | 0.78                     | 0.83                     | 0.77                       |
| Methionine + Cystine,<br>available                        | 0.69                     | 0.74                     | 0.69                       |
| Methionine, total   | 0.44                     | 0.50                     | 0.46                       |
| Calcium   | 0.95                     | 0.90                     | 0.85                       |
| Phosphors, available                                      | 0.47                     | 0.45                     | 0.43                       |
| Fat, total  | 3.06                     | 7.69                     | 7.61                       |
| Crude fiber   | 2.87                     | 2.81                     | 2.69                       |

<sup>1</sup>The premix provided per 1 kg of starter + grower diet: 9,000 IU of vitamin A; 3,300 IU of vitamin D<sub>3</sub>; 30 mg of vitamin E; 2.2 mg of vitamin K<sub>3</sub>; 2.2 mg of vitamin B<sub>1</sub>; 8 mg of vitamin B<sub>2</sub>; 4.4 mg of vitamin B<sub>6</sub>; 0.022 mg of vitamin B<sub>12</sub>; 12 mg of Ca-panthotenate; 66 mg of niacin; 1 mg of folic acid; 400 mg of choline chloride; 100 mg of Mn; 75 mg of Zn; 100 mg of Fe; 8 mg of Cu; 0.45 mg of I; 0.30 mg of Se; 0.25 mg of Co.

<sup>2</sup>The premix provided per 1 kg of finisher diet: 9,000 IU of vitamin A; 2,500 IU of vitamin D<sub>3</sub>; 30 mg of vitamin E; 1.65 mg of vitamin K<sub>3</sub>; 1.65 mg of vitamin B<sub>1</sub>; 6 mg of vitamin B<sub>2</sub>; 3 mg of vitamin B<sub>6</sub>; 0.015 mg of vitamin B<sub>12</sub>; 9 mg of Ca-panthotenate; 50 mg of niacin; 0.75 mg of folic acid; 400 mg of choline chloride; 100 mg of Mn; 75 mg of Zn; 100 mg of Fe; 8 mg of Cu; 0.45 mg of I; 0.30 mg of Se; 0.25 mg of Co.

### *Statistic calculation*

The data were processed for one-way variance analysis with the Fisher test and with the Student test to evaluate the significant differences between the experimental groups for P<0.05.

## RESULTS AND DISCUSSION

Table 4 shows the data on broiler performance.

Table 4 Broiler performance

| Variant/ Trait                        | Hybrid   |          |             |
|---------------------------------------|----------|----------|-------------|
|                                       | Ross 308 | Cobb 500 | Arbor Acres |
| Initial weight (g)                    | 39       | 43       | 42          |
| Final weight (g) <sup>1)</sup>        | 2477     | 2418     | 2456        |
| Total gain (g)                        | 2438     | 2375     | 2414        |
| Average daily weight gain (g)         | 58.05    | 56.55    | 57.48       |
| Total feed intake (g)                 | 4340     | 4388     | 4380        |
| Average daily feed intake (g)         | 103.33   | 104.48   | 104.29      |
| Feed conversion ratio (g feed/g gain) | 1.78     | 1.85     | 1.81        |
| Liveability (%)                       | 99.33    | 98.67    | 99.00       |
| Theoretic weight at 42 days           | 2652     | 2626     | 2637        |
| Theoretic total feed intake (g)       | 4644     | 4621     | 4655        |

<sup>1)</sup> Differences not significant ( $P > 0.05$ )

The body weight of Cobb 500 broilers were slightly lower, but the differences were not significant ( $P > 0.05$ ), compared to Ross 308 and Arbor Acres hybrids.

Figure 1 shows the weekly evolution of broiler body weight for the three surveyed hybrids.

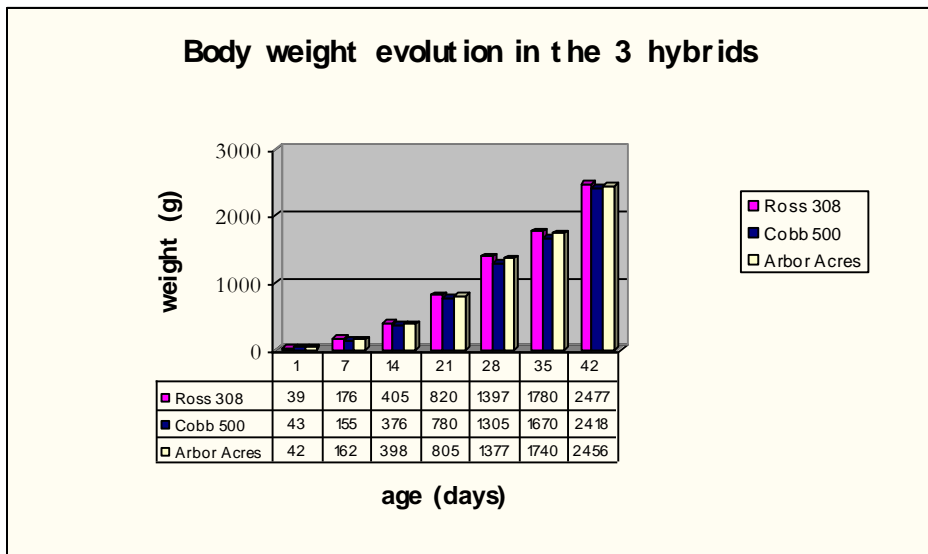


Figure 1 Body weight evolution of the three hybrids

Figure 2 shows the theoretical growth curve for the three hybrids according to: <Broiler Performance Objectives> (Cobb - 2008, Ross and Arbor Acres - 2007).

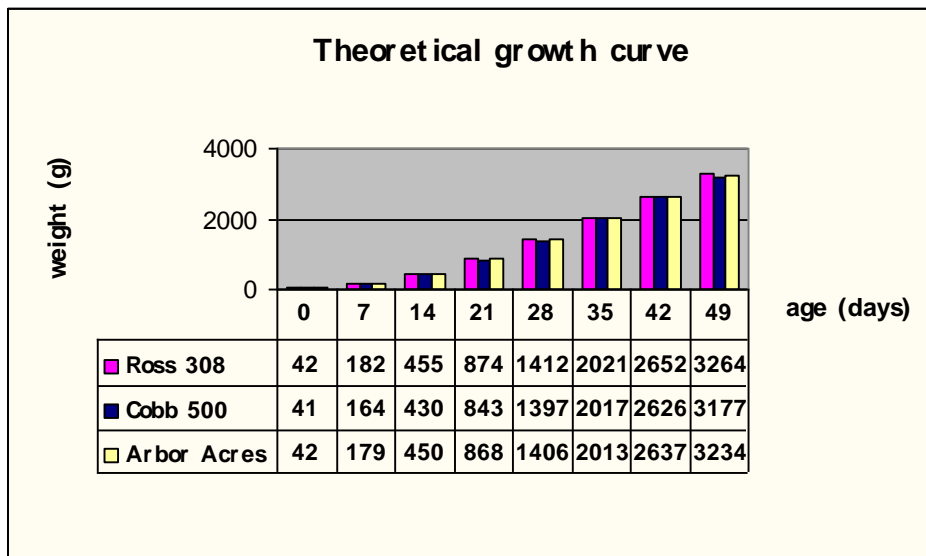


Figure 2 Theoretical growth curve for the three hybrids

Comparing the weekly weights with the theoretical growth curve, according to the performance recommended by the producing companies, we notice that up to 28 days the body weights were close to the targets recommended by the companies. Larger differences appeared after this age because of the different growth of the two sexes. Genetically speaking, the males have a higher capacity for protein synthesis than the females (Chamruspollert et al., 2002; Peisker, cited by Sundrum et al., 2005). This is mainly due to the different hormonal status of the two sexes. Compared to the females, the body weight of the males increased 15-19% more during the finishing period (Kirchgessner, cited by Sundrum et al., 2005). The higher protein synthesis in males is given by the higher feed intake (NRC, 1998).

Regarding feed conversion ratio there wasn't any changes between broilers hybrids studied.

Table 5 shows the slaughter yield and the proportion of carcass parts.

The average values of these data are close for all three surveyed hybrids.

This survey allows us to acquire a better knowledge on the efficiency of feed utilization by the three broiler hybrids traded in Romania: Ross 308, Cobb 500 and Arbor Acres.

Table 5. Slaughter yield and proportion of carcass parts (as % of live weight)

| Broiler strain | Live weight,<br>(g) | Slaughter yield | Breast | Thigh | Drum stick |
|----------------|---------------------|-----------------|--------|-------|------------|
| Ross 308       | 2370                | 71.82           | 18.91  | 12.79 | 10.17      |
| Cobb 500       | 2330                | 71.59           | 17.70  | 10.12 | 10.13      |
| Arbor Acres    | 2390                | 71.71           | 18.75  | 12.93 | 10.28      |

### CONCLUSIONS

The obtained data demonstrated that the performances of the all three analyzed hybrids were similar for all studied parameters.

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