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PRODUCTIVITY ANALYSIS OF GRANDPARENT STOCK IN 21 WEEK AGE GROWING PHASE

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Abstract
This research aims to compare the productivity of hens and roosters from GPS strains: (S1), (S2), (S3), and (S4), at 21 weeks of age. GPS performance records are important information needed by companies to see GPS productivity, which in turn will influence the productivity of their parent stock (PS) and final stock (FS). The research data was the audit results of each breeding companies, obtained from the Directorate General of Livestock and Animal Health, Ministry of Agriculture, from November 2022 to March 2023. Among the four strains, the highest body weight and uniformity were observed in the S4 strain hens, while the highest depletion rate was found in the S3 strain hens. The S4 strain roosters had the highest body weight, uniformity, and depletion rate compared to other strains. However, it must be noted that depletion rate does not reflect bad or good genetics, but only reflects a high selection rate.
Keywords: broiler GPS strain, depletion, uniformity, body weight

KAJIAN PRODUKTIVITAS GRAND PARENT STOCK AYAM RAS PEDAGING PADA FASE GROWING UMUR 21 MINGGU

Abstrak
Tujuan riset ini adalah untuk membandingkan produktivitas strain GPS, yaitu S1,S2, S3, dan S4 pada ayam betina dan jantan di umur 21 minggu. Data penelitian didapatkan dari hasil audit perusahaan pembibitan oleh Direktorat Jenderal Peternakan dan Kesehatan Hewan, Kementerian Pertanian dari November 2022 sampai dengan Maret 2023. Hasil penelitian menunjukkan bahwa perbandingan produktivitas ayam betina pada empat strai yaitu (1) strain S3 memiliki bobot badan yang tinggi dibandingkan strain lainnya, (2)strain S4 memiliki tingkat deplesi yang lebih tinggi dibandingkan strain lainnya, namun tingkat deplesi ini tidak mencerminkan jelek atau tidaknya genetik tetapi hal ini mencerminkan tingkat seleksi yang tinggi, dan (3) strain S3 memiliki tingkat uniformity lebih tinggi dibandingkan strain lainnya. Adapun produktivitas ayam jantan adalah (1) strain S3 memiliki bobot badan yang tinggi dibandingkan strain lainnya, (2) strain S3 memiliki tingkat deplesi yang lebih tinggi dibandingkan strain lainnya, namun tingkat deplesi ini tidak mencerminkan jelek atau tidaknya genetik tetapi hal ini mencerminkan tingkat seleksi yang tinggi, dan (3) strain S3 memiliki tingkat uniformity lebih tinggi dibandingkan strain lainnya.
Kata Kunci: strain GPS broiler, deplesi, uniformitas, bobot badan

INTRODUCTION

The broiler industry is a mega-industry with a fairly large capitalization, including in Indonesia. Multi-National Corporations (MNCs) or foreign companies control many of these industries. The poultry breeding industry, or better known as the Franchise Breeder Farm (Sarengat, 1999; Butland, 2004), develops chicken genetics starting from the pure line, great grandparent stock, grandparent stock (GPS), and parents stock (PS) (Dewi and Wahyuni, 2020). The genetic results of broiler chickens currently distributed in Indonesia are GPS, PS, and final stock (FS). Grandparent stock (GPS) produces parent stock (PS), and then the PS produces FS or commercial breed chickens (Sudaryani and Santoso, 2000). This commercial poultry is the final output of the broiler breeding industry, which is distributed to the public or companies for cultivation.

Companies that develop broiler GPS face high risk, especially in Indonesia, since they must import GPS with a relatively high price. GPS imports are also limited, so every breeding company must have strict breeding management through biosecurity, large capital,

and measurable business planning (Ditjen PKH, 2017). In 2022, there will be 19 GPS breeding companies and 45 PS breeding companies (Ditjen PKH, 2022). Since 2019, the government has required breeding companies to submit regular and online reports on population and production developments to the Directorate General of Livestock and Animal Health (Ditjen PKH), under the Ministry of Agriculture.

The Directorate General of Livestock and Animal Health published a cumulative report which revealed four GPS strains of broiler growing in breeding companies in Indonesia, namely S1, S2, S3, and S4. The four strains are developed by each breeding company in Indonesia, especially in genetic improvements for each strain. GPS maintenance records will be important information for companies to see GPS productivity in producing PS, which will then impact the provision of FS (Bell and Weaver, 2002). Progress notes of male and female GPS breeding are reported to the PKH Directorate General to see their productivity.

Research on the productivity of the four GPS strains hasn't been done in Indonesia or the world, and citations from several sources, such as international and domestic journals, do not reinforce the research results but only serve as comparisons. This research compared the productivity of the four GPS broiler strains developed in Indonesia. The aims of this study were (1) to analyze the productivity of four GPS strains, namely body weight, depletion, and uniformity in roosters at 21 weeks of age, and (2) to analyze the productivity of four GPS strains based on their body weight, depletion, and uniformity. The data were taken on hens at 21 weeks old because the mixing or mating between males and females takes place at that age. The results of this research are expected to be used as input material for the government to determine the technical policy on the number of GPS imports. In addition, the results of this study can contribute to the development of poultry science, especially in Indonesia.

MATERIALS AND METHODS

The research was carried out from November 2022 to March 2023 by collecting audit results from the Directorate General of Livestock and Animal Health, Ministry of Agriculture. Data were collected from three variables: body weight, depletion, and uniformity in GPS strains S1, S2, S3, and S4, both male and female at 21 weeks of age in 80 GPS broiler flocks. The definition of each variables is s as follows:

1) Body weight is obtained by weighing a random sample of 10% of the chicken population in each corner of the pen (screen) every week.
2) Uniformity is calculated by weighing the body of sample hens and males per pen of a flock, observed every week during the growing period.

$$\text{Uniformity} = \frac{a}{b} \times 100$$

Information:
a : The number of BW chickens is in the range (lower limit – high limit)
b : number of chicken samples weighed

The number of chickens with body weights in the range is the number of chickens with body weights that are 10% of the average body weight limit for the highest and lowest body weights.

3) Depletion is the death rate of chickens and the reduction of chickens selected due to defects, abnormal growth (culling) during the growing period (cumulative from 0-2 days to 1 week) expressed in % units.

Research Procedure

The procedures in collecting data on 4 GPS strains (S1, S2, S3, and S4) with the variables of body weight, cumulative depletion, and uniformity at 21 weeks of age were as follows:

1) Basic data from the audit results of broiler GPS productivity were sorted based on the Cobb, Indian River, Ross and Hubbard strains spread throughout Indonesia;
2) Data sorting was recapitulated and compiled containing information on the company name, province, district, flock identity, strain, age, chick-in date, male population, female population, depletion, feed consumption, body weight, and uniformity;
3) All data spanning from 0 to 21 weeks old, was inputted per-company and per-flock.
4) All collected data was confirmed to be sourced from closed-house breeding farms; and
5) All inputted data was then processed into tabular format, containing data on body weight, depletion and actual uniformity

from the age range of 0–21 weeks, for both males and females.

Analysis Method

Data from the recapitulation results were tested for normality to know whether the data were normally distributed (Siregar, 2015). If the data of confounding or residual variables are normally distributed, then the data can be continued for further analysis. The analytical method used to compare the productivity of the four GPS strains, namely S1, S2, S3, and S4, then uses analysis of variance (ANOVA). Analysis of variance is used to see the average comparison of a variable or more variables from two or more groups (Pratama and Permatasari, 2021), followed by Duncan's distance test of 5%. Data analysis using SAS 9.4 statistical software.

RESULTS AND DISCUSSION

The current poultry industry has been very developed. Even the genetic technology that has been developed has increased the harvest time of commercial broiler chickens faster than before. The selection of broiler strains is an option to increase productivity, especially for GPS strains (Bell and Weaver, 2002). There are only three GPS broiler manufacturer companies globally, namely Hubbard, Cobb-Vantress, and Aviagen (Hiemstra and Napel, 2013). These large breeding companies distribute broiler GPS breeds throughout the world. Because the three companies who produced the GPS strains never published their research results, the supporting citations for this article are very limited. The company provides the productivity results for each strain in the form of a company brochure related to the productivity of the principle.

Data obtained from the Directorate General of Animal Husbandry and Health (Dirjen PKH, 2022) regarding the audit results of GPS imports is presented in Figure 1. The S1 GPS strain had the highest import percentage (53% or 343,800 head), followed by the S4 strain, with 27% (175,143 heads), S2 (13%) and S3 (7%) as the strain with the least number of imports. The data shows that companies in Indonesia can compare the GPS strains based on their respective advantages. S1 strains are in great demand by breeding companies for several advantages over others. The results of research on the breeding company PT. Indah Pratiwi's work shows that the S1 308 strain has better production performance (Siagian et al., 2021).

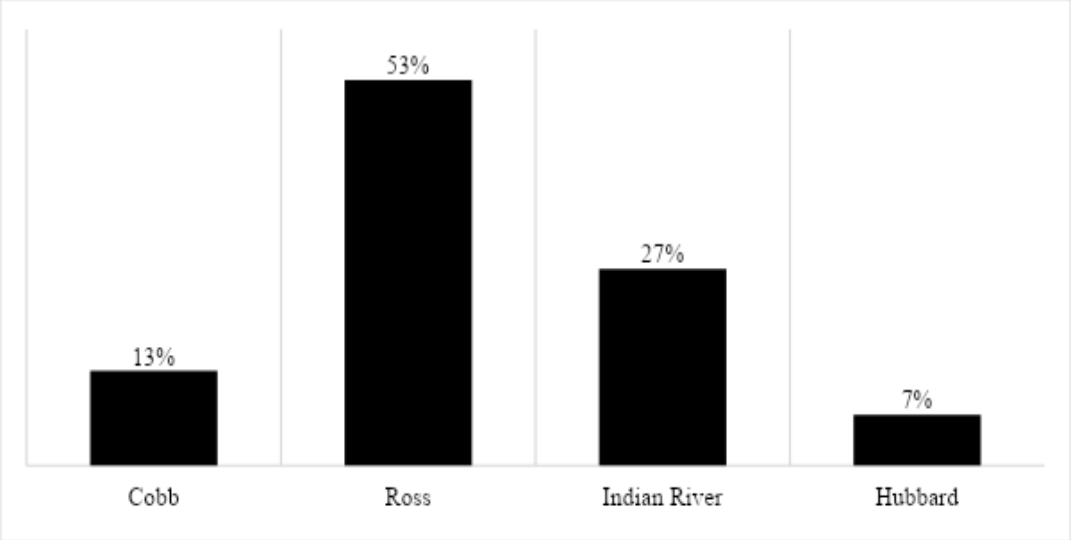

Figure 1
Number of GPS Imports in Four GPS Strains
(Source: Directorate General of PKH, 2018: N = 648,679 birds)

Comparison of Productivity Between Strains in Hens

Productivity comparison between GPS strains in hens at 21 weeks of age to determine which strain's productivity is the best in terms of body weight, depletion, and uniformity. Table 1 shows that each strain has its own advantages. Each strain has differences in body weight adjusted to the genetic characteristics of each strain, as proven by significant difference in hen productivity from each strain. The At 21 weeks of age, S4 strain has an average body weight of 2,598 grams, highest among the other three strains. These body weight results reflect the nature of the S4, which in 21 weeks reached this weight (Aviagen, 2011). The second highest body weight was observed in S2, with an average weight of 2,525 grams, followed by S3 and S1, respectively.

The depletion variable from the analysis showed that there was a significant difference between each strain. The S1 strain had a significantly lower depletion rate compared to the other three strains, with an average of 4.52%. The depletion rate reflects the company's ability to care and manage the farm (Permana, 2020). A high depletion value will cause losses for the company. The depletion from the S4 and S2 strain populations were almost similar at 21 weeks of age, and the S3 strain had a depletion value of 9% or a higher depletion value than the others (Hubbard Brochure, 2015). The depletion rate is closely related to the company's breeding management, especially in producing elite hens. Brood hen depletion was calculated from mortality, culling, and selection rates. Culling and selection contributed to the high depletion value. This was different from depletion in final stock chickens, where the maximum death rate is 5%, thus, it can be concluded that the company has good breeding management (Wiraman et al., 2018). Furthermore, cage cleanliness, equipment, environmental sanitation, culling, selection, and disease factors cause diverse depletion values (Wiraman et al., 2018).

The uniformity variable shows that there are differences between GPS strains. The S4 strain has higher uniformity than the other strains. This is because only one breeding company in Indonesia has developed the S4 strain so that its growth and performance are more controlled. According to Aviagen (2021), achieving the genetic potential of broiler breeders depends on management, especially providing an appropriate environment, nutrition, biosecurity, and disease control. If there is one of several factors that are not running optimally, it can have an impact on decreasing the performance of broiler breeders. As for the other three strains, their level of uniformity shows similarity and is lower than that of the S4.

Comparison of Productivity Between Strains in Roosters

The rooster plays a role in determining the embryo sexes in the produced eggs. The productivity of GPS roosters across four strains was assessed. Table 2 presents three variables measured in determining productivity: body weight. depletion, and uniformity.

Body weight (BW) variables showed a significant difference between each strain. The S4 strain has higher body weight than the other three strains at 21 weeks of age. It was possible that the S4 strain had genetically faster growth than the others. Body weight of the S3 and S1 strains had the same average body weight value, while the S2 strain showed the smallest body weight compared to the other strains at 21 weeks of age (Cobb Brochure, 2021). The difference in body weights between strains was due to different genetic potential, adaptability, feed consumption, environment, breeds and feed quality in each strain (Siagian, 2021).

Bird depletion reflects the management effectiveness in managing the GPS roosters, an especially important variable in producing high-productivity roosters. Depletion percentage in roosters consisted of death, culling and selection. High depletion in rooster does not always due to the mortality rate, but also culling and selection factors based on the company’s management decision in producing elite roosters. Table 2 shows significant difference in the depletion variable between each strain. The depletion rate in roosters was higher than that of hens. The breeding roosters underwent strict selection by the company, ensuring that those selected for further rearing exhibit superior genetic performance as determinant of their offspring. The S4 strain demonstrated higher depletion rate compared to other strains, however, this was not caused by its genetic factors but the farm’s breeding management.

Table 1. Hen Productivity in S1, S2, S3 and S4 GPS Strains

Variable	GPS strains			
	S1	S2	S3	S4
Body Weight (gr)	2.374 ^{d} ±43.24	2.525 ^{b} ±54.30	2.474 ^{c} ±17.52	2.598 ^{a} ±17.25
Depletion (%)	4.52^{c} ± 0.48	6^{b} ± 1.53	9^{a} ± 1.66	6^{b}±0.53
Uniformity (%)	82^{b} ± 4.61	84^{b} ± 8.17	86^{b} ± 3.05	91^{a} ± 4.10

Information: S1 = Ross, S4 = Cobb, S3 = Hubbard, S4= Indian River.
Different letters (^{a}, ^{b}, ^{c}, ^{d}) in front of each number refers to significant difference.

Table 2. Productivity of Roosters in S1, S2, S3 and S4 GPS Strains

Variable	GPS strains			
	S1	S2	S3	S4
Body Weight (gr)	3.131^{b} ± 44.35	2.920^{c} ± 39.09	3.149^{b} ± 31.22	3.170 a ±22.02
Depletion (%)	50^{b} ± 8.99	51^{b} ± 5.30	37^{c} ± 11.00	56 a ±7.71
Uniformity (%)	86^{b} ± 7.12	85^{b} ± 10.12	83^{b} ± 3.53	95a ± 4.68

Information: S1 = Ross, S2 = Cobb, S3 = Hubbard, S4 = Indian River.
Different letters (^{a}, ^{b}, ^{c}, ^{d}) in front of each number refers to significant difference.

The lowest depletion level was observed in the Hubbard strain. It is essential to note that the relatively low depletion level in the S3 strain does not necessarily imply superiority, rather, it aligns with the specific standards set by the company. Each strain exhibited significantly different rate of uniformity from each other. Table 2 shows that the uniformity rate of S4 strain chicken was better than the other three strains. The average uniformity value of the S4 strain was 95%, while the other three strains had the same average uniformity value, ranging from 83 to 86%. Uniformity is the level of body weight uniformity at the same age, which in this case, is at the age of 21 weeks. This result indicates that the 95% uniformity value implies only a 5% deviation in weight among roosters, which may fall below or exceed the standards set by the company.

CONCLUSION

The conclusions that can be drawn from the research results above are as follows:

1. A comparison of the productivity of the four hen strains shows that: (1) the S4 strain has a higher body weight compared to the other strains, (2) the S3 strain has a higher depletion rate than the other strains, but this depletion rate does not reflect its genetic quality, rather, it reflects a high degree of selection, and (3) the S4 strain has a higher degree of uniformity than the other strains.
2. Comparison of the productivity of the four strains of roosters shows that: (1) the S4 strain has a higher body weight compared to the other strains, (2) the S4 strain has a higher depletion rate than the other strains, but it does not reflect its genetic quality, rather, it reflects a high degree of selection, and (3) the S4 strain has a higher level of uniformity than the other strains

REFERENCES

Aviagen. (2011). *Indian River grand parent stock management manual.* US*:* Aviagen and the Aviagen.

Aviagen. (2021). *Ross Performance Objectives and Nutrition Specifications*. US: Aviagen and the Aviagen.

Bell, D. D., & W. D. Weaver. (2002). *Comercial Chicken Meat and Egg Production*. 5th Edit. New York (US): Springer Science and Business Medial Inc.

Cobb. (2021). Cobb500 Grandparent Management Supplement D Line To Produce Fast Feather Parentstock Females. Cobb-Vantress.

Hubbard. (2015). Performance Summary Broiler Panduan Manajemen Tambahan Cobb500 Breeder Fast Feather.

Butland G. 2004. World Poultry and Pork. (2004). Where are we?. Proceeding of Alltech's 18th Asia Pacific Lecture Tour. Alltech Co. KY.

Dewi, R. K., & Wahyuni. (2020). *Dasar pemuliaan ternak*. Jawa Timur: Litbang Pemas UNISLA.

Direktorat Jenderal Peternakan dan Kesehatan Hewan (Ditjen PKH). (2017). Direktorat Bina Produksi Peternakan. 2001.

Perkembangan Pembibitan Ayam Ras di Indonesia.

Direktorat Jenderal Peternakan dan Kesehatan Hewan (Ditjen PKH). (2018). *Perhitungan Rencana Pemasukan Bibit Ayam Ras dan Rencana Kebutuhan Bibit Doc Final Stock Tahun 2018*. Jakarta: Direktorat Jenderal Peternakan dan Kesehatan Hewan.

Direktorat Jenderal Peternakan dan Kesehatan Hewan (Ditjen PKH). (2022). *Statistik Peternakan dan Kesehatan Hewan*. Jakarta, Indonesia.

Direktorat Jenderal Peternakan dan Kesehatan Hewan (Ditjen PKH). (2022). *Hasil Audit GPS pada Beberapa Strain Ayam Ras Pedaging*. Jakarta, Indonesia: Peternakan dan Kesehatan Hewan.

Hiemstra, S. J. & J. T. Napel. (2013). *Study of the impact of genetic selection on the welfare of chickens bred and kept for meat production*. Belgium: Final report the project is implemented by IBF International consulting and Europe Union.

Permana, A. D. (2020). Dampak Kepadatan (Density) Kandang Terhadap Tingkat Deplesi pada Ayam Broiler Parent Stock Fase Grower. *Aras Journal*, 2(2): 1-10.

Pratama, S. A., & R. I. Permatasari. (2021). Pengaruh penerapan standar operasional prosedur dan kompetensi terhadap produktivitas kerja karyawan divisi ekspor PT. Dua Kuda Indonesia. *Jurnal Ilmiah M-Progress*, 11(1): 38-47.

Sarengat, W. (1999). *Perkandangan Ternak Unggas*. Semarang: Universitas Diponegoro.

Siagian, T. B., & N. K. Nugraheni. (2021). Broiler Breeder Performance in The Final Phase of Grower. *Jurnal Ternak*, 12 (2): 36 – 40.

Siregar, S. (2015). *Statistika Parametrik Untuk Penelitian Kuantitatif Dilengkapi Dengan Perhitungan Manual dan Aplikasi SPSS Versi 17*. Jakarta: Bumi Aksara.

Sudaryani & Santoso. (2000). *Pemeliharaan Ayam Ras Petelur di Kandang Baterai*. Jakarts: Penerbit PT. Penebar Swadaya.

Wirawan, I. M. W., I W. Sukanata & M. Wirapartha. (2018). Analisis performa produksi dan pendapatan usaha ternak ayam broiler pola mandiri dengan sistem kandang terbuka (*open house)* (studi kasus di UD. Merta Pura Desa Meliling, Kecamatan Kerambitan, Kabupaten Tabanan). *Journal of Tropical Animal Science*, 7(1): 32 – 50.