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PERFORMANCE OF FOUR STRAINS OF BROILER CHICKEN GRANDPARENT STOCK FLOCK IN INDONESIA

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Abstract
Every year, Indonesia imports Grand Parent Stock (GPS) broiler breeder chicken to meet parent stock needs and produce commercial broiler breeds (Final Stock). This study aims to determine the performance of Grand Parent Stock (GPS) flocks of four broiler chicken strains in Indonesia during the production (laying) across three age groupsyoung, medium, and old. The GPS's performance was measured by their hen day production (HDP), primary product (PP), hatching egg weight (EW), and chick hatch weight (HW). One-way ANOVA analysis was used to compare strains as a variable influencing performance, including three GPS strains with fast feather growth: Fast Feathering (FF), S1.1, S1.2, and S1.4. Slow Feathering (SF) S.1.3 strain performance across four provincial locations was also conducted. The results show that all S3 strain's average performances in three age groups (young, medium, adult), across four provincial locations. The highest average HDP was observed in the S1.1 strain. Primary product performance between strains at a young age was relatively in the medium and old age groups. The hatching egg weight between strains significantly differed in the three age groups, with the highest egg weight being found on S1.2 strain. Only the S1.1 strain had the hatching weight for all age groups, and no significant difference was observed among chicks from other strains. In conclusion, each strain has different characteristics and does not show perfect superiority in all observed indicators.
Keywords: Flock Performance, Grand Parent Stock, broiler breeder

PERFORMA FLOCK EMPAT STRAIN GRAND PARENT STOCK AYAM RAS PEDAGING DI INDONESIA

Abstrak
Indonesia setiap tahun melakukan impor bibit ayam ras pedaging dengan klasifikasi Grand Parent Stock (GPS) untuk memenuhi kebutuhan induk (Parent Stock) dan menghasilkan bibit niaga broiler (Final Stock). Penelitian ini bertujuan untuk mengetahui performa flock pemeliharaan Grand Parent Stock (GPS) ayam ras pedaging empat strain yang ada di Indonesia dibandingkan pada periode produksi (laying) untuk kelompok flock umur muda, medium, dan tua yang saat ini belum pernah ada penelitian sejenis. Metode analisis yang digunakan adalah analisis one way ANOVA untuk membandingkan strain sebagai satu variabel faktor performa meliputi tiga strain GPS memiliki satu kesamaan tipe pertumbuhan bulu cepat yaitu Fast Feathering (FF) yaitu strain S1.1, S1.2 dan S1.4. Analisis one way ANOVA juga dilakukan untuk membandingkan performa strain S.1.3 yang memiliki tipe pertumbuhan bulu lambat Slow Feathering (SF) ditinjau dari faktor empat lokasi provinsi.Perbandingan performa antar strain menunjukkan rataan HDP berbeda nyata dan HDP paling tinggi adalah strain S1.1 pada kelompok umur muda rata-rata sebesar 78,05±4,88 %, umur medium rata-rata 51,55±3,27% dan umur tua rata-rata 41,16±4,57%. Performa primary product antar strain pada umur muda relatif sama, pada umur medium dan tua berbeda nyata dan pada umur medium tertinggi adalah strain S1.1 sebanyak 40,41±4,67 ekor, pada umur tua tertinggi strain S1.1 kumulatif sebanyak 55,17±5,57 ekor. Performa berat telur tetas antar strain berbeda nyata pada ketiga kelompok umur, berat tertinggi strain S1.2 pada kelompok umur muda sebesar 62,11±2,64 g, umur medium sebesar 68,44±2,03 g dan umur tua sesebar 70,89±2,56 g. Hasil penelitian performa berat tetas antar strain berbeda nyata pada ketiga kelompok umur, hanya strain S1.1 yang memiliki berat tetas terendah untuk umur muda sebesar 39,34±1,56 g, umur medium sebesar 43,11±1,54 g dan umur tua sebesar 43,71±2,12 g. Berdasarkan hasil penelitian disimpulkan bahwa setiap strain memilki karakteristik berbeda dan tidak menunjukkan keunggulan yang benar-benar sempurna dari seluruh indikator pengamatan.
Kata Kunci: Kinerja Flock, Grand Parent Stock, pembibit ayam broiler

INTRODUCTION

Indonesia depends on imports of Grand Parent Stock (GPS) broiler breeds produce Parent Stock (PS) and Final Stock (FS) or commercial broiler Day Old Chick (DOC). Throughout 2018-2022, GPS imports have decreased by an average of 4.15% every year, rearing productivity and reduced and for broiler breeders (Directorate General of Animal Husbandry and Animal Health, 2022). The import of GPS broiler chickens is based on the technical calculation outlined in the national broiler chickens production plan, as an implementation of Minister of Agriculture Regulation No. 32 of 2017 regarding Provision, Distribution, and Supervision of Purebred Chickens and Eggs for Consumption, (Directorate General of Animal Husbandry and Animal Health,2020). The national production plan is realized through the National Stock Replacement (NSR), a yearly. plan for the needs of purebred chicken breeds with Grand Parent Stock (GPS) classification.The NSR details themonthly requirements, considering the need for parent stock (PS) to produce commercial or final stock chickens.The NSR is drafted based on the contributions in the previous year, as the GPS contribution income from purebred chickens was 19.8% in the first year of production, 75.9% in the second year, and 4.3% in the third year. Since the introduction of GPS in the early 1970s, no research has comprehensively presented the performance of GPS maintenance results from breeders.Good flock performance indicates uniformity, simultaneous sexual maturity, and persistent egg production, followed by high levels of fertility and hatchability (Aviagen, 2019). This research aims to fill this gap and appropriately evaluate the development and achievements of breeding productivity for all strains in Indonesia. This research limits its coverage to GPS of female broiler chickens from female line (D-line). The GPS management system is directed to produce optimal and high-quality descendants of DOC PS female. Success in GPS maintenance is measured through performance indicator during the growing phase,including depletion, weight body gain, and uniformity. These indicators are critical for determining success in the laying period (egg production). The government directs GPS breeders to maximize their efforts in achieving target production performance reference guidelines set by each strain principal.

The target from the growing phase is to obtain a parent stock chicken with uniform growth or and nearly identical body weight, (Kartasudjana and Suprijatna 2006). Good uniformity (80%) Weight structure, and sexual maturity within the same age group. The flock performance depend on various external and internal influences, such as stable team members' skills, extreme weather conditions, feed quality, and genetic quality, While some external factors (weather, temperature, humidity, speed wind) can be eliminated with technology arrangement in closed house pens. This research aims to compare the performance of breeding farms between strains, and compare each strain to the performance standards set by each strain's principal.

MATERIALS AND METHODS

This research was conducted from November 2022 to March 2023. The research used secondary data from the Directorate General of Livestock and Animal Health, Ministry of Agriculture. The data was a compilation of audit results from 12 broiler Grand Parent Stock (GPS) breeding companies selected during the egg-laying period. The recording was taken from young GPS, with the ages of 26-35 weeks for Cobb, Ross, Indian River, and Hubbard strains.

The leading indicators for flock performance as variables in this study were: (1) Hen Day Production (HDP), which represents the average daily egg production rate of the GPS prolific female population. HDP is a percentage measure of the daily average egg production rate at a certain age(2) Primary Products (PP), which refers to the number of hatched chicks derived from the total hatching eggs (HE) from GPS. These chicks are sexed selected female and chosen to become Day Old Chick (DOC) Parent Stock (PS) females in the egg-laying group at a young age; (3) Egg weight is obtained by weighing egg samples from each flock to calculate the average weight for each age group; and (4) Hatching Weight (HW) was obtained weighing the hatchedm egg samples to DOC PS and marked for each flock, and the average weight for each age group was determined.

Analysis Method

A comparative analysis of flock performance from GPS broilers (De Jong and van Emous. 2017) was conducted. For all strains,a one-way analysis of variance (ANOVA) was conducted, considering two factors strain and breeding company.Prior to the comparison test, normality and homogeneity of data variances were tested (Uyanto and Stanislaus 2006). The statistical analysis was performed using SPSS version 26. The hypothesis formulated aimed to determine significant difference in the young flock performances based on four variables across different strains andbreeding companie.

RESULTS AND DISCUSSION

Hen Day Production (HDP)

(HDP) was measured to evaluate the daily egg production levels at a certain age. The quantity of hatching egg (HE) obtained depends on the egg production level. According to Kartasudjana and Suprijatna (2006), performance hen day production is a percentage of egg production based on a group of chickens present at any time. Muharlien (2010) added that several factors that influence HDP include seeds, age, health condition of chickens, housing, lighting, feed, and environmental temperature. Optimal HDP performance can show that the number of eggs after grading is included in the hatching egg (HE) category.

HDP Performance Comparison Based on Strain Province S1.3

The observation on S1.3 strain was conducted on 19 sample flocks, spreading across East Java, West Java, Lampung, and South Sumatra provinces. The data was collected from maintenance periods in 2020, 2021, and 2022. A comparison of the HDP performance of the S1.3 strain according to provincial location is presented in Table 1.

The performance of Hen Day Production (HDP) in the S1.3 strain exhibited consistent results across various provinces and age groups, as evidenced by statistical analyses (Table 1). The uniformity in HDP performance aligns with the reports by the Directorate General of Animal Husbandry and Animal Health (2022), indicating that the hatching egg production level of the S1.3 strain remains optimal and stable. The reported deviation of 3.21% from the standard principle underscores the robustness of the S1.3 strain in achieving consistent production levels.

Breeders are effectively managing Strain S1.3 across all three age groups in four provinces. The good breeding practices, especially during the brooding and growing periods, plays a pivotal role in achieving this uniformity. According to Aviagen (2021), the success of maintenance, including body weight and uniformity factors, significantly influences hatching egg production performance during the growing period. The findings affirm the effectiveness of breeding practices and the strain's resilience across diverse environments and age groups.

The results showed that the average body weight of strain S1.3 at the end of the growing period (24 weeks of age) was 2,967 g, and uniformity was 90.27%. The body weight achieved at the end of the growing period was 5.67% more than Aviagen's standard body weight (2019), 2,800 g. Excess body weight in specific age periods, according to the report from the Directorate General of Animal Husbandry and Animal Health (2022), states that the average body weight of GPS maintained in Indonesia is 4% to 6% higher than the standard principle; this is used as an energy reserve in tropical environments in Indonesia.

Research results show that the S1.3 strain is maintained in the same well-controlled environment and management. The design and shape of the tunnel-shaped closed house enclosure are the same size: 120 m long, 12 m wide, and 2.6 m high. Tunnel-shaped cages are very suitable in tropical environments where the inlet area is on the right and left sides of the cage, and a separate outlet is at the back. The inlet section of the cage enters clean air that enters through the cooling pad and is sucked in by the exhaust fan at the outlet. This housing system regulates ventilation and air circulation well so that temperature, humidity, and oxygen availability are controlled according to the needs of chickens at different ages. The basic principle of implementing a controlled environment in tunnel type closed house cages, according to Aviagen (2021), is to provide sufficient oxygen supply and remove excess heat, water vapor, and dangerous gases such as ammonia from inside the cage so that chickens are comfortable and have optimal hatching egg production and persistent.

Comparison of HDP Performance between strains

The analysis result of daily egg production rate (HDP) among the three strains in all age groups are significantly different ($p < 0.05$). Strain S1.1 exhibited the highest HDP within the young age group, followed by strains S1.4 and S1.2, with the latter showing the lowest HDP. Similarly, in the medium age group, strain S1.1 displayed the highest average HDP, while strain S1.4 had the lowest. The cumulative average HDP in the old age group also showed significant differences between strains, with strain S1.1 demonstrating the highest performance, and strain S1.2 exhibiting the lowest. The detailed HDP performance of the four strains across three age groups is summarized in Table 2.

The daily egg production levels in the young age group are relatively higher compared to the medium group, aligning with the strain standards (Aviagen, 2021), which specify that peak egg production occurs between 30-45 weeks of age. In the older age group, a decline in production is observed starting at 60-65 weeks of age (Jaelani et al., 2016). This decline is attributed to suboptimal physiological conditions for egg production, increasing body weight, weakening physical condition of the broodstock, and a decline in reproductive organ function.

The research findings support the Directorate General of Animal Husbandry and Animal Health's (2021) study, indicating that egg production levels vary depending on strain types, with distinct age-related variations and specific standards for each strain. These differences in HDP performance between strain types align with Risnajati's assertion (2012) that genetic inheritance factors play a crucial role in the production capabilities of purebred chickens. Nurfirdausya et al. (2021) also support these findings, stating that genetics, environment, and their interaction significantly influence livestock performance. Strains S1.1 and S1.3 in the D line female line, as referenced by Aviagen (2019), possess genetic potential for high egg production, with estimates of 176 eggs and 178 eggs, respectively, during a single maintenance period (41 weeks of production).

Primary Product (PM)

Primary Product shows the average number of female day DOC PS produced from each GPS parent during one rearing cycle. According to the recording data from the Directorate General of Animal Husbandry and Animal Health (2021), approximately 47% of each flock in the female line (lines C and D) produces females as the Primary Product, while the remaining 48% are males (considered by-products), and 5% are deemed unfit or culled chicks.

Comparison of PP Performance Based on Province Strain S1.3

Primary Product (PP) performance serves as a key indicator of GPS productivity in producing female DOC PSThe comparison of PP strain S1.3 performance across provincial locations is detailed in Table 3. The performance of PP strain S1.3 in three age groups across provincial locations statistically showed no differences. The hypothesis (H0) was accepted with a p-value > α 0.05, indicating that PP strain S1.3 was similar across 19 flocks in four provinces.

The cumulative primary product for one period of the S1.3 hen house strain, as reported by the Directorate General of Animal Husbandry and Animal Health (2022), is noted as highly optimal and stable with a deviation of 9% from the standard principle. Aviagen (2019) stated that the productivity of GPS to produce DOC PS derivatives is greatly influenced by the performance level of hatching egg productivity, handling of hatching eggs from egg collecting at the farm, delivery, and handling at the hatchery. The hatchery unit is the final door to determine hatching performance, which depends on the egg production performance of the farm unit, especially fertility achievement.

Comparison of Primary Product Performance Between Strains

The average primary product for S1.3, S1.4, S1.1, and S1.2 strains in different age groups was compared to the Aviagen (2021) standard principle. The results, as presented in Table 4, demonstrated variations in primary product performance, likely attributed to differences in rearing management and environmental conditions among various flocks. The statistical analysis of the primary product variable for the young age group period for the four strains yielded a p-value of 0.12 > 0.05, indicating no significant differences in primary products in the young age group.

Contrary to the Directorate General of Animal Husbandry and Animal Health's statement (2021), which suggests that strain-specific productivity is different at various ages, this research's findings imply a similarity in GPS production performance for female DOC PS from all strains at a young age. This is attributed to factors related to hatching egg management, with eggs from young age group parents undergoing similar storage conditions

(7-22 days in the cooling room at 15-18 °C) (The Directorate General of Animal Husbandry dan Animal Health, 2021). The selection of all DOC to hatch into primary products is influenced by egg production per hen house, fertility, and hatchability factors across different strains (Vantress, 2021). The statistical analysis for primary product performance in the medium age group revealed a p-value of 0.00 < 0.05, indicating fundamental differences between strains. Strain S1.3 exhibited the highest primary product, while strain S1.2 displayed the lowest average primary product. These results align with the Directorate General of Animal Husbandry and Animal Health's report (2021) which states that GPS performance in producing average PS DOC during one maintenance period will vary across different strains. Differences in performance among strains in the medium and old age groups suggest variations in aging factors, declining egg productivity, and distinct inherited genetic characteristics. Hocking and Mc. Corquodale's (2008) also found significant improvement in the reproductive performance of GPS and purebred hens across different geographical environments. However, flock performance is able to remain relatively consistent in each continent (America, Europe, Asia, and Africa), as long as a diligent maintenance management is practiced.

Hatching Egg Weight

Hatching egg weight is measured to ensure that the eggs hatch into day-old chicks (DOC) with optimal weight to be raised as prospective parents (parent stock). According to data from the Directorate General of Animal Husbandry and Animal Health (2021), eggs produced from breeding farms are sent to the hatching unit and undergo a physical examination that includes assessing the age of both parents, the number of eggs to be hatched, flock origin, and the farm unit. The egg weight is determined by weighing a sample of approximately 3% to 5% of the total eggs received at the hatching unit. This weight is recorded based on the strain, parent's age, and flock origin. Heavy hatching eggs are identified by using the formula: egg weight (kg) divided by the number of eggs multiplied by 1000, and then the unit is expressed in grams per egg.

The weight of the hatching egg is an indicator of its quality, which is influenced by factors such as the parent's weight, nutrition, and feed consumption. Mahi et al. (2012) stated that other factors affecting egg weight include breed, age, nutrition, feed, temperature, environment, and sexual maturity. Horn (2005) added that genetic and nutrient interactions are essential to maximize efficiency and meet quality standards for poultry products.

Comparison of Actual Hatching Egg Weight Performance with standard

The study showed that the average egg weight for the S1.1 strain during the laying period was higher than the standard principle. The results showed that the average egg weight of the S1.1 strain during the laying period for the young age group was 60.59 g, the average for the medium age group was 66.59 g, and the average for the older age group was 68.72 g. According to the S1.1 strain standard (Aviagen, 2019), the average egg weight for the young, medium, and old age groups is 60.2 g, 64.7 g, and 66.2 g, respectively.

The average S1.2 strain's egg weight during the laying period was relatively similar to the standard principle. The average egg weight of the S1.2 strain in the egg-laying period of the young age group was 62.11 g, the average egg weight of the medium age group was 68.44 g and the average age group was 70.89 g. According to the S1.2 standard (Vantress, 2021), the average egg weight for the young, medium, and old age groups is 62.8 g, 69.1 g, and 71.5 g, respectively.

The S1.3 strain also showed egg weights similar to the standard during the laying period. The standard principle (Aviagen, 2021) states that the average egg weight for the young, medium, and old age groups should be 60.6 g, 65.1 g, and 66.6 g, respectively. The egg weight of the S1.3 strain during the laying period for the young age group averaged 58.59 g, the average for the medium age group was 64.95 g, and the average for the old age group was 67.43 g.

Lastly, for the S1.4 strain, the average egg weight during the laying period was 60.58 g for the young age group, 67.53 g for the medium age group, and 69.51 g for the old age group. These weights were relatively similar to the standard strain. According to the strain standard (Aviagen, 2021), the average egg weight for the young, medium, and old age groups should be 60.9 g, 65.4 g, and 66.9 g, respectively.

The research results indicate that egg weight increases as the age of the chicken increases. Elvira et al. (1994) and Mahi et al.

(2012) stated that egg weight is influenced by factors such as strain type, age, nutrition, feed, temperature, environment, and age at sexual maturity. The weight of the egg also affects the weight of the hatched chick. This is due to differences in the content of egg white and egg yolk (Suprijatna et al., 2008). The greater the egg's weight, the greater the egg white and yolk content, which serve as a food source for the developing embryo. The age of sexual maturity during the final enlargement phase also significantly impacts egg weight. Amrullah (2004) stated that chickens produce smaller eggs at the beginning of the egg-laying period, which gradually increases in size as the chicken ages, although this increase is not uniform.

Comparison of BTT Performance Based on Strain Province S1.3

Hatching Egg Weight (BTT) performance is the primary indicator of GPS productivity for producing female DOC PS. The Directorate General of Animal Husbandry and Animal Health (2022) emphasizes the importance of considering the weight aspect of hatching eggs to determine their suitability for quality. Breeders focus on maintaining uniformity in the chicken flock to obtain hatching eggs of consistent size and reduce floor eggs. Table 5 presents a comparison of the performance of BTT strain S1.3 across different provincial locations.

The performance of BTT strain S1.3 in terms of provincial location and age groups showed no significant differences. The hypothesis, H0, with $P > 0.05$, was accepted, indicating that the performance of BTT strain S1.3 was similar across the 19 flocks in four provinces. The Directorate General of Animal Husbandry and Animal Health (2022) report suggests that their handling and storage influence the weight of hatching eggs for strain S1.3 before hatching. It also states that the shelf life of hatching eggs in a large and diverse GPS flock population is 7-14 days from entering the incubator. Aviagen (2019) recommends a maximum shelf life of 21 days for hatching eggs to maintain their weight and hatchability percentage. The absence of significant differences in the weight of hatching eggs across the four provincial locations indicates that breeders follow strict standard maintenance procedures in each location.

Comparison of Hatching Egg Weight Performance between Strains

The comparison of egg weight variable during the young age group period showed significant differences among the four strains (P value <0.05). The one-way ANOVA test of egg weight variables, based on different strain factors in the three age groups, showed statistically significant differences, as presented in Table 6.

Table 6 demonstrates no difference in flock performance regarding egg weight indicators among the three strains in the young age group. However, statistically significant differences were observed in each strain's medium and old age groups. Campbell and Kenealy (2003) noted that as chickens age, there is a tendency for non-uniformity in egg size and weight, which affects egg production intensities. Larger eggs tend to have lower egg production intensity. The average weight of eggs breeding chickens produce varies depending on the strain type, parent age, body weight, and feed consumption (Petek and Dikmen, 2006). Similar findings were reported by Lapao et al. (1999) and Zahid and Hussain (2002), who stated that factors influencing egg weight include strain type, age, feed nutrition, environmental temperature, and age at sexual maturity.

The research findings indicate no uniformity in average egg weight among different chicken strains in the three age groups of the broodstock. Egg weight is relatively lower during the young period compared to the older period. According to Alsobayel et al. (2013), chickens produce smaller eggs at the beginning of the laying period, which gradually increase as they age. The egg's weight determines the weight of the day-old chick that hatches. Cobb-Vantress (2021) emphasizes the importance of achieving uniformity in egg size and weight, as it reflects the performance of the farm unit and facilitates shorter hatching times, or less than 30 hours, for pull chicks in the hatchery.

Hatching Weight

PS hatching weight indicates the weight of the female DOC PS after hatching. The results of GPS Female Line Female (FLF) offspring depend on the parent's age, the time they store hatching eggs, and management in the hatching unit (Directorate General of animal Husbandry and Animal Health, 2022). According to Septiwan (2007), hatching weight is the chick's weight immediately after hatching. According to Cobb-Vantress (2021), hatching weight is the weight of DOC that hatches at the time of the chick pull (harvest), and the end of hatching is generally known to be 36 hours after hatching.

Comparison of BT Performance based on S1.3 strain Province

Hatching weight (BT) performance is an indicator to assess the suitability of the quality of hatched DOC. The Directorate General of Animal Husbandry and Animal Health (2022) emphasized the importance of the hatching weight aspect, which must be considered to prepare prospective broiler parents (PS) to produce DOC FS offspring according to their genetic potential. The hatched DOC comes from a hen that has entered the productive period since 25 weeks. According to Aviagen (2019), DOC suitable to be kept as a primary product must have a minimum DOC hatching weight of 33-34 g. The weight of hatching eggs that are suitable for hatching, according to the Directorate General of Animal Husbandry and Animal Health (2021), is a minimum of 33 g for egg classification from GPS and 35 g for egg classification from PS. A comparison of the performance of BTT strain S1.3 according to provincial location is presented in Table 7.

The average hatching weight of DOC PS strain S1.3 in three age groups across provincial locations is statistically proven to have no differences.This result refers to the report from the Directorate General of Animal Husbandry and Animal Health (2022), whichstates that the hatching weight of the S1.3 strain is influenced by the weight of the hatching eggs and the length of hatching time. Directorate General of Animal Husbandry and Animal Health (2022) reports relatively similar hatching time, even though the hatching eggs come from various flocks at different GPS-rearing locations. Aviagen (2019) guides the length of hatching time depending on the uniformity of flock origin, egg shelf life, and hatchery machine performance.

Comparison of Hatching Weight Performance between Strains

In the medium age group, strain S1.2 had the highest average hatching weight, and the lowest hatching weight was S1.1. The oldest age group had the highest hatching weight in strains S1.2 and S1.4. The lowest was S1.1. Differences in hatching weight between *strains* based on research results are influenced by the average weight of eggs from each group during the production age period, as well as factors such as egg shelf life, hatch time, and the length of time for DOC to be weighed after hatching out of the shell. Based on Cobb-Vantress (2021), 24 hours of DOC after hatching (pull chick) can be estimated that the DOC will weigh 70% of the weight of the egg before incubation. The hatching weight performance of the three strains is presented in Table 8.

Table 8 shows the flock performance of the hatching weight variable in the analysis of variance, showing a significance value of 0.00 < 0.05. The average hatching weight based on the one-way ANOVA test in the three age groups was statistically significantly different regarding the strain type factor. Hatching weight in the young age group of strains S1.1, S1.2, and S1.4 was not statistically significantly different, as shown in Table 8. The hatching weight of all strains' average young age shows the same shelf life. According to the report from the Directorate General of Animal Husbandry and Animal Health (2022), the similarity in the shelf life of hatching eggs influences the relatively uniform weight of the hatched DOC. The comparison of hatching weights in the three strains in the medium age group and the old age group showed significant differences. The S1.1 strain is known to have a lower actual hatching weight than the S1.2 and S1.4 strains. This is in line with the lower hatching egg weight.

Chamsaz *et al.* (2011) stated that the quality of DOC differs from having optimal hatching weight. Apart from that, it also really depends on the performance of the farm unit, including the depth of the physiological conditions of the mother and male. The Directorate General of Animal Husbandry and Animal Health (2021) recorded that data recording measures of DOC weight conversion were an average of 66% of egg weight with a time interval of 36 hours from the time the chick was pulled until the DOC received feed and the weight would continue to decrease as the delivery time to the farm increased. The size and weight of hatching eggs strongly influence heavy DOC. According to

Cobb-Vantress (2021), closely hatched DOC is generally 66 % -68% of the egg weight.

An egg weighing 60 g tends to have a DOC weight of around 40 g. Data recorded by the Directorate General of Animal Husbandry and Animal Health (2020) noted that egg weight decreases due to water loss when the egg is incubated, thus contributing to variations in DOC weight. The length of time between hatching, pulling the chick, and sending the DOC simultaneously influences the final weight of the DOC before the chick is put in the cage.

Table 1. Average performance of hen day production strain S1.3

Province	***Hen Day Productions* for *Strain* S1.3 *(%)***		
Province 1	78.88±5.02	61.96 ± 2.44	41.39 ± 2.05
Province 2	82.26±2.61	67.17±0.69	44.58±4.59
Province 3	77.54±6.05	63.49±4.85	45.02 ± 0.32
Province 4	78.48±4.92	63.73±4.56	43.74 ± 2.28
Sig.	0.62	0.46	0.34

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 2. Mean hen day production variables according to strain

Province	***Hen Day Productions* in Each *Strains***		
	Young Age Group *(%)*	**Medium Age Group *(%)***	**Old Age Group *(%)***
S1.2	74.01±5.14 ^{b}	52.47±6.44 ^{c}	37.21±4.39 ^{b}
S1.4	75.85±5.52 ^{ab}	57.08±4.85 ^{b}	39.44±6.19 ^{ab}

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 3. Average Performance of Primary product strain S1.3 by province

Province	***Primary Products* of S1.3 *Strain***		
	Young Age Group	**Medium Age Group**	**Old Age Group**
		(tail)	
Province 1	15.51±2.3	39.93±5.16	59.88±1.48
Province 2	15.66 ± 2.12	40.94±6.06	59.65±2.74
Province 3	15.85±1.79	39.42±4.18	60.40±1.82
Province 4	15.06 ± 1.11	38.66 ± 2.81	57.69±3.13
Sig.	0.85	0.84	0.37

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 4. Average primary product performance according to strain

Province	***Primary Products***		
	Young Age Group	**Medium Age Group**	**Old Age Group**
		(tail)	
S1.1	15.19±2.11	40.41±4.67 ^{a}	54.94±6.09 ^{b}
S1.2	14.31 ± 2.15	33.48±6.19 ^{b}	43.18±7.99 ^{c}
S1.4	13.78 ± 2.6	36.12±4.28 ^{b}	43.55±3.39 ^{c}

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 5. Average performance of BTT strain S1.3 based on different provinces

Province	BTT		
	Young Age Group	**Medium Age Group**	**Old Age Group**
		(G)	
Province 1	58.64 ± 1.21	66.44 ± 0.44	67.55±1.21
Province 2	59.09 ± 1.61	65.21 ± 1.16	67.58±1.29
Province 3	58.41 ± 1.65	65.65±2.18	68.69 ± 0.34
Province 4	58.49±1.40	64.23 ± 1.85	66.97±2.02
Sig.	0.93	0.24	0.51

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 6. Average performance of hatching egg weight variables according to strain (g)

Province	Hatching Egg Weight		
	Young Age Group	**Medium Age Group**	**Old Age Group**
		(g)	
S1.1	60.59±2.46	66.59±2.48 [b]	68.72±2.98 [b]
S1.2	62.11 ± 2.64	68.44±2.03 [a]	70.89±2.56 [a]
S1.4	60.58±2.21	67.53±1.13 [ab]	69.51±1.56 [ab]

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 7. Average performance of BTT *strain* S1.3 by province

Province	Young Age Group	Medium Age Group	Old Age Group
Province 1	38.29 ± 0.79	43.17 ± 0.51	42.63 ± 0.79
Province 2	38.59 ± 1.05	42.26±1.24	42.53 ± 0.99
Province 3	38.14 ± 1.07	42.62±1.10	43.33 ± 0.35
Province 4	38.19 ± 0.91	41.51±1.34	42.08±1.36
Sig.	0.92	0.20	0.45

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

Table 8. Average *flock* performance with changes in hatching weight according to *strain*

Strains	Hatching Weight		
	Young Age Group	**Medium Age Group**	**Old Age Group**
		(g)	
S1.1	39.34 ± 1.56	43.11±1.54 [b]	43.71±2.12 [b]
S1.2	39.69 ± 2.01	44.23±1.43 [a]	45.46±2.07 [a]
S1.4	39.44 ± 1.50	43.92±0.85 [a]	45.37±1.54 [ab]

Description: Numbers with different superscript letters in the same column and different rows showed a significant difference (P<0.05).

CONCLUSION

Each strain has different characteristics and does not show perfect superiority in all observation indicators. The performance of HDP, PP, BTT, and BT Strain S1.3 in different provincial locations did not differ statistically. Strain S1.1. showed the highest primary product performance the lowest average hatching egg and DOC weight. Strain S1.2 and S1.4 have the lowest HDP and primary product performance but have the highest egg weight and DOC hatching weight. Judging from all performance measurement indicators, strain S1.1 has a more stable performance. Based on age group, HDP performance was highest in young flocks, and conversely, egg weight and DOC weight performance was highest in old flocks. Strains with high egg and primary product production tend to have relatively lower egg and DOC weight.

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