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GROWTH STUDY OF PANGASIUS CATFISH (*Pangasius* sp) BASED ON DIFFERENCES IN COMMERCIAL FEED TYPES

Studi Pembesaran Ikan Patin *(Pangasius* sp*)* Berdasarkan Perbedaan Jenis Pakan Komersial

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ABSTRACT

Catfish (*Pangasius* sp.) is one of the leading freshwater aquaculture commodities with high economic value and increasing market demand, both domestically and internationally. The success of catfish farming is influenced by the quality and quantity of feed, stocking density, and water quality. This study aims to determine the effect of two types of commercial feed (product A and product B) on the production performance and survival rate of catfish at Jombang. The research was conducted in six concrete ponds with a volume of 410 m³ using a descriptive-comparative method, applying a normality test followed by a paired sample t-test for production performance, as well as homogeneity and ANOVA tests for water quality. The results showed that feed type significantly affected fish growth. Feed product B resulted in the highest harvest (15.1 tons), but this was associated with larger initial seed size and higher stocking density. On the other hand, feed product A demonstrated better feed efficiency with lower FCR values (1.14–1.18) and higher survival rates (SR) ranging from 66.2% to 75%, compared to product B which showed higher FCR (up to 1.51) and lower SR (49.8%). Water quality measurements indicated that the temperature ranged between 29.8–30.3 °C, pH between 6.9–7.2, and DO between 3.7–7.6 ppm.

Keywords: Pangasius catfish (*Pangasius* sp); Feed; Growth; Water Quality

ABSTRAK

Ikan patin (*Pangasius* sp) adalah salah satu komoditas perikanan air tawar unggulan dengan nilai ekonomi tinggi dan permintaan pasar yang terus meningkat, baik di dalam maupun luar negeri. Keberhasilan budidaya ikan patin dipengaruhi oleh kualitas dan kuantitas pakan, padat tebar, serta kualitas air. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian dua jenis pakan komersial (produk A dan B) terhadap hasil produksi dan kelangsungan hidup ikan patin di Jombang. Penelitian dilakukan pada enam kolam beton berukuran 410 m³ dengan metode deskriptif komparatif, menggunakan uji normalitas, dilanjutkan dengan uji paired sample t-test untuk hasil produksi, serta uji homogenitas dan ANOVA untuk kualitas air. Hasil penelitian menunjukkan bahwa jenis pakan berpengaruh signifikan terhadap pertumbuhan ikan. Pakan produk B menghasilkan panen tertinggi (15,1 ton), tetapi disertai dengan bibit awal yang lebih besar dan padat tebar lebih tinggi. Sebaliknya, pakan produk A menunjukkan efisiensi pakan lebih baik dengan nilai FCR rendah (1,14–1,18) dan tingkat kelangsungan hidup (SR) lebih tinggi (66,2%–75%) dibandingkan produk B yang memiliki FCR tinggi (hingga 1,51) dan SR rendah (49,8%). Kualitas air yang diukur menunjukkan suhu berkisar antara 29,8 – 30,3 °C, pH antara 6,9 – 7,2, dan DO antara 3,7 – 7,6 ppm.

Kata Kunci: Ikan Patin (*Pangasius* sp), Pakan; Pertumbuhan, Kualitas Air

INTRODUCTION

Pangasius catfish is one of the leading commodities in freshwater aquaculture that has long been recognized by the community and has broad market prospects, both domestically and internationally. This species has a high level of productivity, as evidenced by production reaching 339,069 tons in 2015 and increasing in 2016 to 437,111 tons (DKP, 2016). Pangasius catfish grows rapidly, is tolerant to low oxygen conditions, and is highly favored by fish farmers (Iskandar, 2022).

Diharmi *et al*. (2019) stated that the abdominal fat of pangasius catfish contains 1.89% ω-3 and 21.84% ω-6. The composition of unsaturated fatty acids in the abdominal fat of pangasius catfish is dominated by oleic acid at 40.14%, while the saturated fatty acid component is palmitic acid at 26.22%. Because it is highly perishable, pangasius catfish is frozen for distribution, and all of its parts are processed into value-added products to increase business profitability.

Fish growth, in addition to being related to stocking density, is also closely associated with feed. Fish growth is determined by various factors, including feed quality and quantity, age, and water quality (Mulqan *et al*., 2017). Appropriate stocking density affects the absolute weight growth of fish. If the density is too high, competition for feed and space will occur, resulting in a decrease in growth rate (Hermawan, 2017).

Pangasius catfish (*Pangasius* sp.) is a freshwater fish with high potential for aquaculture development in Indonesia, with increased production depending on feed availability (Purnomo *et al*., 2015). Artificial feed is processed feed derived from natural ingredients and additives designed to meet the nutritional requirements of fish and to have forms and attractiveness that stimulate fish to consume it easily and eagerly (Agraeni & Abdulgani, 2019).

Fish growth rates vary due to differences in feed type and quantity, digestive capacity, nutrient absorption, and genetic factors, considering that each feed has different nutritional content (Saputra *et al*., 2020). Based on the description above, it is necessary to conduct research on the grow-out study of pangasius catfish (*Pangasius* sp.) based on differences in types of commercial feed.

METHODS

Time and Place of Research

This research was conducted from 01 August to 30 November 2024 and took place in Jombang.

Research Design

The research design used in this study was descriptive comparative, comparing the provision of different commercial feed products on the grow-out of pangasius catfish using six different ponds, consisting of three ponds for product A and three ponds for product B, based on differences in the types of commercial feed provided. This study used six ponds as experimental units, with treatment allocation of three ponds using commercial feed product A and three ponds using commercial feed product B. Each pond was stocked with pangasius fingerlings of relatively uniform number and size to maintain initial homogeneity. The observed parameters included fish weight and length growth, survival rate (SR), and feed efficiency measured through Feed Conversion Ratio (FCR) and Specific Growth Rate (SGR).

Data collection was carried out periodically by measuring fish weight and length every two weeks during the rearing period, and the data were then analyzed descriptively and compared among treatments to determine which feed provided the best growth performance. This research was supported by several relevant previous studies, including research by Yaqin *et al*. (2021) examining the effect of lysine amino acid addition to commercial feed on the growth of pangasius catfish (*World's Veterinary Journal*), Maryadi (2022) on feed management in pangasius catfish grow-out (Universitas Airlangga repository), Sedana *et al*. (2020) regarding the effect of probiotic addition to commercial feed on feed efficiency in pangasius catfish (*Jurnal Penyuluhan Perikanan*), Azhanifa (2024) who studied the growth of pangasius fingerlings fed diets supplemented with peat soil humic acid (*Jurnal Bioslogos*), as well as Agustina *et al*. (2024) who investigated growth response and feed utilization of pangasius catfish in relation to lactic acid bacteria levels in feed (*Bioflux Journal*). These five sources are available in PDF format and serve as a scientific basis supporting the selection of a descriptive comparative research design in comparing the effectiveness of two types of commercial feed on pangasius catfish grow-out.

Experimental Animals

The experimental animals used were pangasius catfish (*Pangasius* sp.) with an initial size of 4.5 g for ponds using product A (E1, E2, and E3) and an initial size of 6 g for ponds using product B (E9, E10, and E11) at the beginning of stocking. At harvest, the pangasius catfish were approximately 10 months old with body weights ranging from 300 to 800 g per individual. Qualitatively, the pangasius catfish used in this study exhibited healthy body organs and were ready for harvest.

Feed for Experimental Animals

The feed for the experimental fish consisted of pellet feed with different commercial feed products. Feed product A had characteristics of a fishy odor and light brown pellet color, whereas feed product B had characteristics of a less fishy odor and a darker brown pellet color. The nutritional content contained in the commercial feed products A and B provided to pangasius catfish is presented in:

Table 1. Fish Feed Composition

Content	Product Feed Type A	Product Feed Type B
Proteins	28.0 %	28.0 %
Water content	12.0 %	12.0 %
Fat	5.0 %	5.0 %
Ash	13.0 %	12.0 %
Fiber	8.0 %	8.0 %

Research Containers

The research containers used were 6 identical ponds. In the ponds using product A there were 3 ponds (E1, E2, and E3), and the ponds using product B also consisted of 3 ponds (E9, E10, and E11), with each pond having a length of 35 meters, a width of 7.81 meters, and a water depth of 1.5 meters, resulting in a total pond volume of 410 m^3 as presented in Appendix 1. The ponds were semi-permanent ponds with permanent embankment construction (concrete), and the pond bottom consisted of soil.

Research Tools and Materials

The materials used in the research consisted of: pellet feed product A, pellet feed product B, and freshwater. The tools used in the research consisted of: stationery, weighing scales, thermometer, pH meter, DO meter, basket tubs, nets (hauling nets), paddle wheel aerators, plastic drums, and water holding tanks.

Research Methods

The research method for the grow-out of pangasius fish included the measurement of Survival Rate (SR) and Feed Conversion Ratio (FCR) as the main indicators of aquaculture success. Survival Rate (SR) until the end of the study was compared with the initial number of fish stocked, calculated using the formula SR = (number of fish alive at the end of rearing / initial number of fish) × 100%. The SR value indicates the success level of rearing in maintaining environmental conditions and fish health, where a higher SR value reflects better culture conditions. Meanwhile, the Feed Conversion Ratio (FCR) describes the efficiency of feed utilization, calculated using the formula FCR = total feed given (grams) / total increase in fish biomass (grams). A low FCR value indicates high feed efficiency, meaning that fish are able to convert feed into flesh more effectively. These two parameters are important because they are directly related to production costs and fish growth performance. The explanation of the SR and FCR methods is in line with several recent studies, such as Yaqin *et al.* (2021) who examined the effect of lysine supplementation in commercial feed on the growth and FCR of pangasius fish (World's Veterinary Journal), Sedana *et al.* (2020) who evaluated feed efficiency through FCR and survival rate in pangasius fish fed probiotics (Jurnal Penyuluhan Perikanan), Agustina *et al.* (2024) who measured FCR and SR of pangasius fish fed diets supplemented with banana peel flour (Bioflux Journal), Maryadi (2022) who explained the application of FCR and SR as parameters in feed management for pangasius grow-out (Repository Universitas Airlangga), and Mukti (2020) who reviewed the rearing of pangasius fish with commercial and supplemented feeds in relation to growth and survival (Jurnal Logista).

Research Procedures

1. Pond Preparation

The research ponds had a volume of 410 m³ for each pond. Before use, the ponds were dried for 1–2 days. Subsequently, liming was carried out using 80 kg of dolomite lime, which was evenly spread over the surface and sides of the pond until uniform, then left for 2–3 days before filling with water. The ponds were then filled with water to a height of 1 meter and allowed to settle for 1–2 days. The water level was increased according to fish growth up to 150 cm. Paddle wheel aerators were installed when the fish reached a size of 200 g or more. To anticipate oxygen deficiency, the ponds were equipped with paddle wheel aerators.

2. Preparation of Test Feed

The commercial feeds used were from different producers. The feed was then stored in a safe and easily accessible place such as a warehouse, so that during the research period feed administration could be carried out more easily.

3. Weighing of Test Animals

Before the fish were introduced into the ponds, the next step was weighing the test animals. This weighing was intended to determine the amount of feed given to the fish during the study and to obtain initial weight data of the test animals. Mean Body Weight (MBW) in fish refers to the average weight of individual fish within a group or population over a certain period of time.

4. Stocking of Test Animals

The fingerlings were stocked in the morning to help reduce stress in the fish. Before stocking into the ponds, the fingerlings were treated by immersion using a PK (potassium permanganate) solution as shown in Appendix 3, prepared at a ratio of 5 grams of PK per 25 liters of clean water. The immersion process was carried out for 10 seconds in the transport container. The initial stocking density in this study consisted of 30,000 pangasius fish for three ponds (E1, E2, and E3) fed product A, with an average seed size of 4.5 grams per fish.

Meanwhile, for the treatment group using product B, the stocking density consisted of 42,000 fish in pond E9, 45,000 fish in pond E10, and 40,000 fish in pond E11, each with a seed size of 6 grams per fish.

5. Feeding

During the study, the test animals were fed according to the treatment. The amount of feed given was 3% of the biomass weight of the test animals. Feeding was carried out twice a day, at 07:00 and 15:00.

6. Water Exchange and Siphoning

Siphoning was conducted in the morning before feeding. Siphoning was carried out by opening the outlet until the discharged water became cleaner compared to before the outlet was opened, after which the outlet was closed again. Subsequently, water exchange was performed by opening the inlet until the water volume was increased to the initial pond volume (410 m^3) with a water depth of 150 cm. For fish weighing 200 g or more, the inlet was kept open continuously until the water overflowed through the outlet embankment boundary. This was done to maintain optimal water quality throughout the study.

7. Handling of Mortality and Disease in Fish

Handling of mortality and disease in pangasius fish was carried out when mortality exceeded normal limits, namely more than 20 fish per day consecutively for 2–3 days. The initial handling step was reducing feed provision to half of the initial amount; if mortality persisted, fasting was applied for a maximum of 2 days, with fasting considered complete when mortality decreased. In addition, the inlet was kept continuously open to balance water quality and remove waste. For disease management, molasses was evenly applied to each side of the pond at a dose of 8 liters per pond, with disease indicated when fish mortality exceeded normal limits or when fluctuations in water quality occurred outside the optimal range.

8. Fish Harvesting

Fish harvesting was carried out approximately 10 months after stocking, with fish considered ready for harvest when they reached a size of 300–800 g per fish or a Mean Body Weight (MBW) of 500–550 g. Prior to harvest, a sample of 10 fish was randomly taken, weighed, and the average weight was calculated. Preparation of equipment included nets, basket tubs, digital scales, and stationery. Harvesting was conducted in the morning to reduce fish stress, using nets that were spread and pulled slowly. Captured fish were weighed gradually, with the total weight recorded for productivity calculations. Consumption-sized fish weighing 300–800 g were collected, while those outside this size range were returned to the pond. After weighing, the fish were processed by bleeding and immersed in clean water to maintain quality. Harvesting was conducted partially over 2–3 days, with a maximum capacity of 5 tons per day, until the total production from each pond was achieved.

Data Analysis

This study used a normality test prior to applying the paired sample t-test to determine hypotheses regarding production quantity and survival after feeding with products A and B, while water quality was analyzed using homogeneity tests and ANOVA.

1. Normality Test

The researchers used the Shapiro–Wilk normality test because the sample size was small, with the analyzed data consisting of pre-test and post-test values. To test data normality, the Shapiro–Wilk test was applied. The testing criterion was that if the result of the normality test reached a significance value > 0.05, then the data were considered normally distributed, and vice versa. The hypotheses used were as follows:

a. H0 = Data are not normally distributed if Sig. (2-tailed) < 0.05
b. H1 = Data are normally distributed if Sig. (2-tailed) > 0.05

2. Paired Sample t-Test

The application of the paired t-test for before-and-after averages was based on initial stocking biomass and final production biomass, as well as initial survival at stocking and final survival at the end of rearing.

Hypothesis analysis was conducted using the Paired Sample t-Test with SPSS 20 for Windows at a 95% significance level. This test requires identical observation conditions for each data pair, with the differences between initial weight (pre-test) and final production (post-test) being normally distributed.

The hypotheses formulated in the paired t-test were as follows:

H0 : It is assumed that there is no difference between the initial total weight and thefinal total production after being fed product A and B feeds

H1 : It is assumed that there is a difference between the initial total weight and the final total production after being fed product A and B feeds.

The decision-making guideline in the paired t-test based on the significance value (Sig.) from the SPSS output was as follows:

If Sig. (2-tailed) < 0.05, then statistically H0 is rejected and H1 is accepted

If Sig. (2-tailed) > 0.05, then statistically H0 is accepted and H1 is rejected

RESULTS

Based on observations in 6 ponds, where 3 ponds, namely ponds E1, E2, and E3, used feed product A and 3 ponds, namely ponds E9, E10, and E11, used feed product B, the results are presented as shown in the table below.

Table 2. Research Results

No Pool	Pond Number Initial Stocking Number (Tails)	Mbw Early Spread (Gram)	Initial Stocking Biomass (Kg)	Final Production (Kg)	Total Feed (Kg)	Average final production (Kg)	Survival Rate (%)	FCR (Kg)
				FEED PRODUCTS A				
E1	30.000	4,5	135	12.549	14.230	11.927	75	1.14
E2	30.000	4,5	135	11.066	12.930		66,2	1.18
E3	30.000	4,5	135	12.166	14.030		72,9	1.16
				FEED PRODUCTS B				
E9	42.000	6	252	10.727	15.870	12.140	49,8	1.51
E10	45.000	6	270	15.109	20.040		65,9	1.35
E11	40.000	6	240	10.586	12.120		51,7	1.17

The normality test using the Shapiro-Wilk method was carried out because the sample size was small, to determine whether the initial weight data (pre-test) and final production (post-test) of fish fed with products A and B were normally distributed:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pre test	.317	6	.060	.766	6	.028
post test	.215	6	.200*	.854	6	.170

Based on the table above, the significance value for the pre-test (initial weight) was 0.028 and for the post-test (final production) was 0.170. These values are greater than the expected significance value (Sig (2-tailed) >0.05), so it can be concluded that the initial weight (pre-test) and final production (post-test) data after being fed products A and B are normally distributed.

Next, to determine whether there were differences between the two paired sample groups, a paired sample t-test was performed. This test only compares the differences between the two paired data groups, not the variances of the two different groups. Therefore, no homogeneity test was performed.

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 pre test - post test	-118.39333	16.90059	6.89964	-136.12941	-100.65725	-17.159	5	.000

DISCUSSION

The test results showed a sig. value of 0.000 < 0.05, therefore H0 was rejected and H1 was accepted, indicating a significant difference between the initial weight and final production of fish fed with product A and product B feeds.

The negative mean difference value indicates that the average production yield after being fed product B feed was higher compared to product A feed. However, there are several factors that could influence this outcome, such as the ash content of the feed, the initial stocking number of fish fed product B being higher than that of product A, the larger initial seed size of fish fed product B compared to product A, and the differences in odor and color characteristics between product A and product B feeds.

Differences in harvest yield are influenced by the type of feed provided. According to Muntafiah (2020), feed is the main source of energy for fish; therefore, the nutritional content of the feed must be maintained. Feed composition greatly affects the level of fish growth. Fish grow well when protein requirements are adequately fulfilled. Insufficient dietary protein can inhibit growth and result in lower body weight, because protein in body tissues is used to maintain vital functions, thereby causing suboptimal production outcomes. Exstrada *et al.* (2020) added that fish feed must contain complete nutrients such as protein, fat, carbohydrates, vitamins, and minerals in sufficient amounts so that optimal growth can be achieved and mortality of cultured fish can be prevented.

The final production results showed quite marked variations among ponds after being fed product A and product B feeds. Ponds with product A feed, pond (E1) obtained a final production yield of 12,549 kg, pond (E2) obtained a final production yield of 11,066 kg, and pond (E3) obtained a final production yield of 12,166 kg, with a total average production yield in product A ponds of 11,927 kg. Meanwhile, ponds with product B feed, pond (E9) obtained a final production yield of 10,727 kg, pond (E10) obtained a final production yield of 15,109 kg, and pond (E11) obtained a final production yield of 10,586 kg, with a total average production yield in product B ponds of 12,140 kg. Although the average production yield of product A ponds was lower than that of product B ponds, the survival rate and FCR results in each product A pond were superior compared to product B ponds.

Initial stocking density and initial stocking MBW in product A and B ponds also influenced final production. A larger initial stocking weight affects faster fish growth during the early rearing period because the body size is already larger and competitiveness for feed is stronger. Although the average production yield of product A ponds was lower, the advantages in survival rate and FCR indicate that fish in product A ponds were more efficient in converting feed into biomass. According to Prasetyo *et al.* (2019), an increase in stocking density (initial stocking weight) causes a decrease in specific growth rate, although total production increases. This means that even though the final weight per individual fish is lower, total biomass increases because the number of fish is higher.

The odor and color of commercial feed also influence fish feeding attractiveness. Product A feed has a more pungent odor and a light brown pellet color, whereas product B feed has a less pungent odor and a darker brown pellet color. Product A feed has a stronger odor, which can stimulate the olfactory senses of pangasius fish, thereby increasing their attraction to approach and consume the feed. Conversely, product B feed has a less pungent odor. A milder aroma is less attractive to pangasius fish and may reduce the frequency with which they approach the feed.

This is in accordance with the opinion of Utama *et al*. (2020) that light brown is a good pellet feed color for fish feed. In addition, according to Mudjiman (2008) in Yulianto (2018), there are various fish species that have selectivity toward the food provided, which is related to the attractiveness of the feed, including factors such as odor, taste, and color. Ideally, the feed odor should be close to the natural odor of the food normally consumed by fish, so that the pellets meet the criteria of good fish feed.

Feed Conversion Ratio (FCR) also affects fish production results. A low FCR contributes to feed efficiency, faster growth, cost reduction, and better fish health; all of these factors ultimately lead to higher and more profitable production outcomes in fish culture. A low FCR is a key indicator of aquaculture operations. It is also explained that FCR is not only about feed input efficiency, but also affects system load and oxygen demand within the culture system. A low FCR helps reduce environmental burden and production costs. According to an article by Council (2025), efforts to reduce FCR are very important because feed can account for up to 70% of total production costs. Even small improvements in feed efficiency can result in significant financial, environmental, and production performance benefits. The average FCR of intensively cultured fish ranges from 1.0 to 2.4, which is much lower than that of terrestrial livestock such as chickens or cattle. This fact emphasizes that improving FCR in fish culture not only benefits fish farmers but also strengthens aquaculture's position as a more efficient and environmentally friendly provider of animal protein.

The temperatures recorded in each pond produced average values ranging from 29.8 to 30.3 °C. According to Jirarattanarangsri (2022), the optimal temperature for fish ranges from 26 to 32 °C. The pH values recorded in each pond ranged from 6.9 to 7.2. According to Panjaitan *et al*. (2024), this is influenced by the decomposition of organic matter, which produces organic acid compounds that can lower water pH, thereby increasing water acidity and potentially harming cultured fish. Supriatna (2020) stated that pH concentration can affect the fertility level of waters. Kozlenko (2024) added that the optimal pH for fish growth ranges from 6.7 to 8.6.

The dissolved oxygen (DO) values recorded in each pond ranged from 3.7 to 7.6 ppm. Pangasius fish, which are classified as warm-water fish, will grow optimally and experience minimal stress when DO levels fall within this range. According to Putri *et al*. (2016), in line with the opinion of Ali (2025), the availability of dissolved oxygen as a water quality factor greatly determines the success of fish culture. According to general aquaculture standards, DO ≥ 5 mg/L is considered optimal to support growth, feed efficiency, and fish health. Under such conditions, fish metabolism proceeds normally, with more energy allocated to growth rather than to compensatory mechanisms due to oxygen deficiency. Conversely, DO levels decreasing to 2–4 mg/L can cause physiological stress in fish, characterized by increased respiration rate, reduced appetite, and increased susceptibility to disease. If DO levels drop below 2 mg/L, severe hypoxic conditions occur and can cause mass mortality, especially in intensively cultured species that require high oxygen supply. Widodo *et al*. (2017) added that pangasius culture in concrete ponds with intensive aeration and average DO levels of 5–6 mg/L showed higher daily weight gain and survival rates compared to systems without aeration.

CONCLUSION

Based on the results of the study on the Grow-Out Study of Pangasius Fish (*Pangasius* sp.) Based on Differences in Commercial Feed Types, the following conclusions can be drawn:

1. There is a difference between the initial total weight and the final total production after being fed product A and product B feeds, as indicated by significant t-test values and differences in harvest yields among ponds.
2. Brand A feed showed better feed efficiency with lower FCR values (1.14–1.18) and higher survival rates (SR) (66.2%–75%) compared to brand B feed, which had higher FCR values up to 1.51 and the lowest SR of 49.8%.
3. Brand B feed produced the highest harvest yield (15.1 tons in pond E10), but this was accompanied by higher stocking density and larger initial seed size. This indicates that high production yields are influenced not only by feed type but also by density management and initial fish size.
4. Excessively high stocking density, as observed in ponds E9 and E11, reduced SR and FCR efficiency, despite using the same type of feed.
5. Water quality conditions (temperature, pH, and dissolved oxygen) in all ponds were within the optimal range and did not have a significant effect on production results.

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