

## THE EFFECTIVENESS OF THE SUPER MEAT DUCK FARMING MODEL COMPARED TO VARIOUS OTHER FARMING METHODS IN PHU THO PROVINCE

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### Abstract

The 6550 meat ducklings were monitored and raised using three different methods in two cultivation cycles to evaluate several criteria regarding the efficiency of livestock farming, aiming at selecting a model for expanding meat duck farming and providing high economic efficiency in Phu Tho province. 550 ducklings were raised in the traditional household style combined with pond/field release; 1000 were raised in open-floor pens; 5000 were raised in enclosed industrial-style pens. The study results showed that the survival rate ranged from 91.5% to 96.5%, with the traditional style having the lowest survival rate (91.5% to 92.3%), and the enclosed pens having the highest (95% to 96.5%). The weight of the ducks for sale ranged from 3.2-3.5 kg/duck at 7-8 weeks of age, with the enclosed pens showing the most even growth, the best growth rate, and stability, and unaffected by seasonal changes in farming, especially in the first two weeks. The feed conversion ratio (FCR) of ducks raised in enclosed pens showed a better feed conversion rate in the spring-summer season, with FCR higher than open-floor pens and traditional farming, ranging from 7.7-14.5%. The economic efficiency per duck raised was highest in the 1000-bird scale and open-floor pen with 35,291 VND, followed by enclosed pens at 28,551 VND, and traditional farming at 19,275 VND.”

**Keywords:** *Meat duckling, traditional household, open-floor, enclosed industrial-style.*

### 1. Introduction

Poultry farming in 2023 has shown a continued growth in both total flock size and production output as both smallholders and enterprises experienced stable development, with disease control measures improved to ensure a stable supply for the market. By the end of December 2023, the estimated poultry population has been expected to increase by approximately 3.3% compared to December 2022, with estimated total slaughter output for the year reaching 2,308.7 thousand tons, marking a 6.0% increase [1]. The nationwide duck population in 2022 was 85.329 million, with 51.060 million being meat ducks; Phu Tho province alone accounted for 790 thousand ducks [2]. Meat duck farming is increasingly facilitated with favorable conditions and market opportunities. Currently, there are various modern meat duck farming models such as open-floor plastic pens, enclosed pens, and cold pens, replacing traditional

methods such as free-range or pond-based duck farming, etc.

Research aimed to evaluate and compare the efficiency indicators of super meat duck farming under different methods within various models in Phu Tho province.

### 2. Methods

#### 2.1. Materials and experimental design

- Materials: 6550 commercial broiler ducklings of the Mavin 536 breed, selectively bred from Cherry Valley ducks (UK) raised at three duck farms in Lam Thao, Phu Ninh, and Thanh Son districts of Phu Tho province.

- Experimental design: The study included four batches per farm over two rearing seasons, Spring-Summer and Autumn-Winter, with each season comprising two consecutive batches reared from March to June, and from August to November 2023. Ducks at each location were raised using different farming methods.

**Allocation of farms and duck farming methods**

	Lam Thao	Thanh Son	Phu Ninh
Number of ducks/ cycle	550	1000	5000
Farming method	Confined farming + pond release	Fully confined farming, open-floor, plastic flooring	Fully confined farming, enclosed cold
Feed	Complete mixed feed	Complete mixed feed	Complete mixed feed
Nurturing period	2 rearing cycles/season: rearing period of 56 days/cycle: Spring-Summer: rearing cycles 1 from March to April rearing cycles 2 from May to June Autumn-Winter: rearing cycles 1 from August to September rearing cycles 2 from October to November		

The ducks were fed with the Mavin Ausfeed 6101 complete mixed feed (1-21 days of age) and 6102 (from 22 days of age until sale) by the Mavin.

The mixed feed for ducks, from 1-21 days of age, Austfeed 6101, with registration number/Certificate number: 2654-3/18-CNVN-ĐT; applicable published standard number: TCCS 34:2012/AF.

The mixed feed for meat ducks, from 22 days of age until sale, Austfeed 6102, with registration number/Certificate number: 2655-3/18-CNVN-ĐT; applicable published standard number: TCCS 35:2012/AF.

### The nutritional composition of duck feed

Nutritional criteria	Austfeed 6101	Austfeed 6102
Moisture (%) - max	14.0	14.0
ME (Kcal/kg) - ME min	2800	2900
Crude protein (%) - min	19.0	16.0
Crude fiber (%) - max	7.0	7.0
Canxi (%) min-max	0.6-1.2	0.6-1.2
P total (%) min-max	0.5-1.0	0.5-1.0
Lysine total (%) - min	0.9	0.8
Methionine + Cystine total (%) - min	0.7	0.6
Chemicals and antibiotics (mg/kg)	Non	Non

## 2.2. Monitoring criteria and determination methods

Comparison among farming methods for the following criteria:

- Overall survival rate (%): Weekly and cumulative monitoring. Recording the number of deaths at each farm, the overall survival rate was the percentage ratio of the final number of ducks at the end of monitoring period to the initial number.

- Cumulative growth (W; kg, g/duck): Individuals in the flock were uniformly raised according to the procedure. Therefore, wing-tagging 30 individuals randomly from one day old/flock to monitor weight criteria. Weighing was done weekly using a 5 kg spring scale (with accuracy of 20g) at monitoring points from one to eight weeks old.

- Average daily weight gain (ADG; g/duck/day): Calculated based on weight gain during the monitoring period divided by the number of rearing days.

- Feed intake (FI; g/duck and g/duck/day): Monitoring feed intake and excess feed of the entire flock, recorded daily. Calculating the average feed intake per week and for the entire rearing period to assess feed utilization efficiency and economic efficiency.

- Feed conversion ratio (FCR; kg feed/kg weight gain): Ratio of feed intake to weight gain of ducks during the monitoring period.

- Economic efficiency (EEc) of different meat duck farming models using various methods. Financial income and expenditure were recorded and preliminarily assessed for economic efficiency.

Data processing was performed using the Minitab 16.2 software.

## 3. Results and discussion

### 3.1. Duck survival rate

The duck survival rate at the farming facilities varied between free-range pond-based farming (in Lam Thao), open-floor

confined farming (in Thanh Son), and enclosed confined farming (in Phu Ninh) (Table 1).

After eight weeks of rearing, the survival rate for free-range pond-based farming in Lam Thao was relatively high (91.5%), but lower by 3.6% compared to open-floor confined farming in Thanh Son (95.1%) and lower by 5% compared to enclosed confined farming in Phu Ninh (96.5%). Additionally, small-scale farming, combined within households, also had an impact of farming techniques on the survival rate. Therefore, the results were not as favorable

as intensive farming methods, as evidenced by the survival rate by week of age, with a higher mortality rate observed in the first and second weeks of age in Lam Thao due to poorer initial heat control (survival rate per week: 97-98%; after two weeks of rearing, the rate drops to only 95.3-95.9%). The duck survival rate when reared in confinement at the farms in Thanh Son and Phu Ninh was equivalent to the standard provided by the Mavin Company for breeding ducks. However, in farms employing traditional farming methods combined with free-range pond-based farming, the survival rate was lower in the early stages.

**Table 1. The survival rate of ducks across different farming facilities and rearing cycles**

Farm	WA1	WA2	WA3	WA4	WA5	WA6	WA7	WA8.sale
<i>The survival rate by week of age during the Spring-Summer rearing season (%)</i>								
Lam Thao	97.2	98.0	99.1	98.9	99.6	99.4	99.4	99.4
Phu Ninh	98.7	99.6	99.6	99.6	99.7	99.8	99.7	99.7
Thanh Son	99.0	99.3	99.3	99.4	99.5	99.4	99.5	99.6
<i>Cumulative survival rate for the Spring-Summer rearing season (%)</i>								
Lam Thao	97.2	95.3	94.5	93.5	93.1	92.5	92.0	91.5
Phu Ninh	98.7	98.3	97.9	97.6	97.3	97.0	96.7	96.5
Thanh Son	99.0	98.3	97.6	97.0	96.6	96.0	95.5	95.1
<i>The survival rate by week of age during the Autumn-Winter rearing season (%)</i>								
Lam Thao	97.5	98.3	98.8	99.4	99.4	99.3	99.2	100.0
Phu Ninh	98.9	99.3	69.1	178.6	99.7	99.8	99.7	99.7
Thanh Son	99.1	94.8	104.2	99.4	99.5	99.3	99.4	99.6
<i>Cumulative survival rate for the Autumn-Winter rearing season (%)</i>								
Lam Thao	97.5	95.9	94.7	94.2	93.6	93.0	92.3	92.3
Phu Ninh	98.9	98.2	67.9	97.6	97.3	97.1	96.8	96.5
Thanh Son	99.1	93.9	97.6	97.0	96.5	95.9	95.3	95.0

### 3.2. Growth of ducks

The duck weights at different ages varied depending on the farming methods employed,

particularly in terms of the weights at sale in the summer rearing season (Table 2 and Table 3).

**Table 2. Accumulated weights of ducks at various model farms with different farming methods and rearing cycles (Mean = g/duck; Cv = %)**

Farm	WA1		WA2		WA3		WA4		WA5		WA6		WA7		WA8.sale	
	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv
<i>The weight of ducks by week of age during the Spring-Summer rearing season (g/con)</i>																
Lam Thao	157	3.7	327	9.4	727	4.2	1327	2.3	2327	1.3	2740	0.7	3026	0.7	3293	0.9
Phu Ninh	170	0.6	420	4.8	820	2.4	1420	1.4	2533	1.2	3073	4.2	3458	2.3	3620	1.7
Thanh Son	167	3.5	380	10.5	780	5.1	1380	2.9	2407	1.3	2840	0.7	3240	1.1	3407	0.9
<i>The weight of ducks by week of age during the Autumn-Winter rearing season (g/con)</i>																
Lam Thao	153	3.8	333	6.9	733	3.2	1333	1.7	2387	0.5	2780	1.9	3186	1.9	3353	2.1
Phu Ninh	173	3.3	447	2.6	847	1.4	1447	0.8	2507	0.9	3100	3.6	3403	1.5	3527	0.9
Thanh Son	170	1.5	373	8.2	773	4.0	1373	2.2	2460	0.8	3033	4.8	3372	2.5	3513	1.8

The duck’s weight gain was uneven from 0-8 weeks of age, with rapid growth occurring from weeks 4 to 6. Growth slowed down gradually after six weeks of age. According to breed guidelines [3], ducks of breed 536 could be sold at 42-49 days of age (7 weeks of age), however the duck weights did not reach the standard weight at the traditional farming facility, so the evaluation period was extended by an additional week for comparison. From 7-8 weeks of age, ducks

raised in the traditional method in Lam Thao continued to gain over 200g/duck, while at industrial-style confined duck farms like Thanh Son and Phu Ninh, the weight only increased by around 100g/duck. Therefore, if the farming method is changed, the release time could be earlier to achieve sale weights of 3.2-3.4 kg/duck. The duck weights in Phu Tho showed better growth compared to Spot, TP, and PT, and were equivalent to T14 ducks at the same age [4].

**Table 3. Daily weight gain of ducks at various model farms with different farming methods and rearing cycles (g/duck/day)**

Farm	WA0-2		WA2-4		WA4-6		WA6-8		Average	
	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv	Mean	Cv
<i>Daily weight gain of ducks in Spring-Summer rearing season (gam/duck/day)</i>										
Lam Thao	19.76bz	11.0	65.00bz	2.2	100.95bz	3.0	39.52bz	4.2	57.92bz	3.9
Phu Ninh	26.43ax	5.4	71.67ax	3.0	118.10ax	2.3	39.05ax	2.9	63.75ax	1.7
Thanh Son	23.57ay	12.1	67.86ay	4.2	104.29ay	2.4	40.48ay	4.0	59.94ay	4.9
<i>Daily weight gain of ducks in Autumn-Winter rearing season (gam/duck/day)</i>										
Lam Thao	20.24az	8.2	63.10az	5.3	103.33az	6.9	40.95az	7.3	58.99az	2.1
Phu Ninh	28.33axy	2.9	71.10axy	2.3	118.10axy	2.2	30.48axy	3.6	62.08axy	0.9
Thanh Son	23.10ay	9.5	68.33ay	3.2	118.57ay	7.3	34.29ay	25.0	61.85ay	8.9

Note: The letters marked above the figures in each column: abc denote statistical significance regarding the rearing season ( $P < 0.05$ ); xyz denote statistical significance regarding the farming methods across farms ( $P < 0.05$ )

The growth of ducks showed no influence of the rearing season in confined duck farms ( $P > 0.05$ ), but it did have an impact on traditional free-range farms ( $P < 0.05$ ) (Table 3). The average daily growth weight at different monitoring stages presented no significant difference when evaluating the rearing season at Thanh Son and Phu Ninh, but there was a difference at Lam Thao. Regarding different farming methods, the growth weight of ducks at each age week differed significantly, with ducks achieving the best growth when raised in closed houses (Phu Ninh), lower in open-floor housing (Thanh Son), and lowest in traditional farming (Lâm Thao). In the winter season, the growth of ducks did not significantly differ between closed houses and open-floor housing

( $P > 0.05$ ), but in the summer season, there was a difference ( $P < 0.05$ ). The coefficient of variation (Cv) when evaluating the influence of the rearing season and farming methods was low in closed house farming and uniform in both rearing seasons, compared to the high level of this coefficient in open-floor housing or traditional farming, and the considerable difference between rearing seasons indicated that ducks raised under controlled environmental factors would have more uniformity in flock and better growth weight than other farming methods.

### 3.3. Feed utilization capacity of ducks

The efficiency of feed utilization of ducks in different rearing seasons and farming methods varied significantly (Table 4).

When monitoring the weight gain of ducks, there was not a significant difference between the breeding seasons. However, when evaluating the feed efficiency, differences were observed both in the breeding seasons and rearing methods. Compared to traditional free-range duck farming, confined and controlled environment duck farming reduced the Feed Conversion Ratio (FCR) by

10.9-14.5% in the summer season and 7.7-13.3% in the winter season. The difference between open-floor and controlled-environment duck farming also varied by 4% and 6.1% respectively in the two breeding seasons. Controlled-environment duck farming enhanced feed efficiency compared to other farming methods, contributing to economic efficiency.

**Table 4. Feed intake and conversion efficiency of ducks in different model farms with different farming methods and rearing seasons**

The feed utilization efficiency of ducks by rearing stage	Spring-Summer			Autumn-Winter		
	Lam Thao	Phu Ninh	Thanh Son	Lam Thao	Phu Ninh	Thanh Son
Growth weight 0-2WA (kg/head)	0.28	0.37	0.33	0.28	0.40	0.32
Total Feed 0-2WA (kg/head)	0.60	1.22	0.96	0.69	1.22	1.09
FCR 0-2WA (kgfeed/ weight gain)	2.19	3.30	2.95	2.42	3.07	3.41
Growth weight 2-4A (kg/head)	0.91	1.00	0.95	0.88	1.00	0.96
Total Feed 2-4WA (kg/head)	1.66	1.28	1.33	1.52	1.35	1.37
FCR 2-4WA (kgfeed/ weight gain)	1.82	1.28	1.40	1.72	1.36	1.43
Growth weight 4-6WA (kg/head)	1.41	1.65	1.46	1.45	1.65	1.66
Total Feed 4-6WA (kg/head)	2.71	2.33	2.38	2.80	2.25	2.57
FCR 4-6WA (kgfeed/ weight gain)	1.92	1.42	1.63	1.94	1.37	1.55
Growth weight 6-8WA (kg/head)	0.55	0.55	0.57	0.57	0.43	0.48
Total Feed 6-8WA (kg/head)	3.21	2.83	2.88	3.30	2.75	3.03
FCR 6-8WA (kgfeed/ weight gain)	5.80	5.23	5.08	5.78	6.69	6.61
Growth weight 0-8WA (kg/head)	3.29	3.62	3.41	3.35	3.53	3.51
Total Feed 0-8WA (kg/head)	8.17	7.67	7.54	8.30	7.57	8.06
FCR 0-8WA (kgfeed/ weight gain)	2.48ax	2.12cz	2.21by	2.48ax	2.15cz	2.29by

Note: The letters above the data in each column: abc differences have statistical significance regarding the breeding season ( $P < 0.05$ ); xyz differences have statistical significance regarding the rearing methods among farms ( $P < 0.05$ ).

Among the three mentioned duck farming methods, only controlled-environment farming achieved the FCR index comparable to the Mavin 536 duck breed standard (1.94-2.15 kg feed/kg weight gain) [3].

### 3.4. Economic efficiency of duck farming models

Economic efficiency varied significantly among different duck farming models when calculated based on the initial number of ducks (see Table 5).

While monitoring weight gain and feed efficiency indicated that controlled-environment farming yielded the best results, basic economic accounting involved various

influencing factors such as market prices for duck meat, investment in infrastructure, labor costs, and utilities. Consequently, the economic efficiency per duck was highest in open-floor duck farming (over 35 thousand VND per duck), followed by controlled-environment farming (over 28 thousand VND per duck), and traditional farming approached the yielding nearly 20 thousand VND per duck.

Despite the better feed efficiency in controlled-environment farming, the technical requirements, increased labor, and environmental management costs associated with it elevated the overall operating expenses.

**Table 5. Basic economic analysis of various duck farming methods (average per cycle)**

*Unit: 1,000 VND.*

Expense - Income	Lam Thao			Thanh Son			Phu Ninh		
	Amount	Cost	Into money	Amount	Cost	Into money	Amount	Cost	Into money
Expenses			63,991			112,585			514,463
Breeding ducks	550	18	9,900	1,000	18	18,000	5,000	17.5	87,500
Feed stage 1	1,132	11.2	12,678	1,949	10.2	19,880	9,525	10.2	97,155
Feed stage 2	3,397	10.8	36,688	5,848	9.8	57,310	28,574	9.8	280,025
Supplements, Veterinary medicine*	-	-	3,535	-	-	6,460	-	-	29,903
Other expense**	-	-	1,190	-	-	10,935	-	-	19,880
Income (duck sales)	1,663	45	74,840	3,439	43	147,877	16,431	40	657,220.56
Base profit		10,849			35,291.8			142,757.8	
Efficiency/perhead		19.725			35.291			28.551	

Note: \* Actual expenses include: vaccines, supplements, antibiotics for disease prevention and treatment.

\*\* Includes expenses for cage equipment, farming tools, livestock care labor (excluding Lâm Thao farm), electricity, water..

Unit of column amount include: breeding ducks = individual; feed stage = kg; duck sales = tons.

Unit of column cost and into money: 1000 VND (thousand Vietnamese dong)

For traditional farming, only small-scale operations were feasible, relying on labor force without technical labor cost, but feed costs, disease expenses, and survival rates have reduced profitability. Currently, in Phú Thọ, duck farming mainly operates at the household level, with relatively low farming techniques and investment challenges. The duck meat industry has not seen significant industrial investment, leading to price discrepancies compared to small-scale retail farming. Thus, confined open-air farming with a scale of fewer than 5000 ducks provides the best and most suitable economic efficiency.

## 4. Conclusions and recommendations

### 4.1. Conclusions

The survival rate of the Mavin 536 ducks in various farming methods in Phu Tho ranged from 91.5% to 96.5%. Traditional free-range farming showed lower survival rates ranging from 91.5% to 92.3%. Floor pens and closed pens ensured good survival rates from 95% to 96.5%. Duck weight for sale ranged from 3.2 to 3.5 kg/duck at 7-8 weeks, with closed pen farming providing the most consistent and stable growth, unaffected by seasonal variations, while traditional farming had an impact, especially in the first two weeks.

The ability to procure and efficiently utilize feed varied both the farming season and method. In summer season, closed pen

farming exhibited better feed conversion ratios compared to the winter season, with floor pen farming and traditional farming ranging from 7.7% to 14.5%. The highest average economic efficiency per head was for with a scale of 1000 ducks and floor pen farming.

### 4.2. Recommendations

In the context of duck meat farming in Phu Tho, the consumption of ducks on small and medium scales in households remains more favorable, thus yielding better economic efficiency. Although large-scale duck farming in enclosed houses is highly productive, it may not be the most suitable method at present. The seasonal factors in duck farming should be paid attention to improve the productivity.

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## HIỆU QUẢ MÔ HÌNH CHĂN NUÔI VỊT SIÊU THỊT THEO CÁC PHƯƠNG THỨC CHĂN NUÔI KHÁC NHAU TẠI PHÚ THỌ

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### Tóm tắt

6550 con vịt giống thịt được theo dõi nuôi với 3 phương thức khác nhau ở 2 vụ nuôi nhằm đánh giá một số chỉ tiêu về hiệu quả chăn nuôi để hướng tới lựa chọn mô hình chăn nuôi vịt thịt nhân rộng, đem lại hiệu quả kinh tế cao tại Phú Thọ. 550 con được nuôi kiểu nông hộ truyền thống kết hợp thả ao/ruộng; 1000 con được nuôi nhốt cạn trên chuồng sàn hở; 5000 con được nuôi nhốt theo kiểu công nghiệp trong chuồng kín. Kết quả nghiên cứu cho thấy tỷ lệ nuôi sống đạt từ 91,5-96,5%, trong đó nuôi vịt kiểu truyền thống thấp nhất (91,5% đến 92,3%); nuôi chuồng sàn hở, chuồng kín cao hơn (95% đến 96,5%). Khối lượng vịt xuất bán từ 3,2-3,5kg/con khi nuôi ở 7-8 tuần tuổi, trong đó nuôi chuồng kín cho sinh trưởng đồng đều, đạt khối lượng sinh trưởng tốt nhất, ổn định và không chịu ảnh hưởng của mùa vụ nuôi như chăn nuôi truyền thống, đặc biệt ở 2 tuần tuổi đầu tiên. Hiệu quả sử dụng thức ăn của vịt nuôi chuồng kín có hệ số chuyển hóa thức ăn tốt hơn vào vụ xuân hè, FCR cao hơn nuôi chuồng sàn hở và chăn nuôi truyền thống từ 7,7-14,5%. Hiệu quả kinh tế bình quân/đầu vịt nuôi cao nhất ở quy mô 1000 con và nuôi chuồng sàn với mức 35.291 đồng, chuồng kín là 28.551 đồng, nuôi truyền thống là 19.275 đồng.

**Từ khóa:** *Vịt giống thịt, chăn nuôi nông hộ truyền thống, chuồng sàn hở, chuồng kín.*