Current situation of beef cattle production on household farms in some districts of Lam Dong province

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ABSTRACT

The objective of this study was to assess the current situation of beef cattle production in households in some districts of Lam Dong province. Ninety household beef cattle farms (HBCFs) were chosen from Cat Tien, Don Duong and Duc Trong districts (10 households/commune and 3 communes/district) to perform the survey using pre-printed questionnaires and direct interviews on a cross-section study model and the Participatory Rural Appraisal method. Results showed that beef cattle husbandry householders have an extensive experience in beef farming with 36.7% having 11 - 15 years of experience ($P < 0.01$), although their educational levels were low, with 31.1% at the primary level ($P < 0.01$). There were 7.3 cattle/household in the total number of herd and and a beef cattle group of 4.7 cattle. Most households operated a husbandry scale from 1 - 5 cattle/household comprising 60.00% of the total herd ($P < 0.01$) and 69.32% of the beef cattle group ($P < 0.01$). High-yielding breeds dominated the current beef production systems in HBCFs, in which BBB cross-breeds accounted for 57.95% and 76.84% of households and total cattle, respectively; Charolais cross-breed accounted for 25.00 and 12.6%, respectively ($P < 0.01$). There was a high level (92.22%) of husbandry and management method as tied stall form ($P < 0.01$). Additionally, 76,14% of HBCFs applied fattening procedure for beef cattle before selling to abattoirs ($P < 0.01$), but artificial insemination application in HBCFs was just 48.86% ($P = 0.763$). The average daily gain of the beef herd for whole husbandry and fattening periods reached 580.3 and 696.4 g/day, respectively. Briefly, these results suggest that there are some limitations in beef cattle production on household farms for developing sustainably high-yielding beef cattle farming in Lam Dong. Therefore, there should be more application of scientific advancements to improve the present situation.

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1. Introduction

In Vietnam, beef cattle industry is developing strongly with a gradual decrease in the number of small-scale cattle farms for an increase in the intensive large scale, and the preference of raising high-yielding beef breeds (BBB, Charolais, DroughtMaster, etc) (Pham et al., 2018; Duong et al., 2019; Nguyen & Do, 2020) to get high economic efficiency. Small-scale production with 1 - 2 cattle/household has gradually changed to about 5 - 20 cattle/household (Nguyen et al., 2021a). In 2023, beef cattle industry developed steadily and increased by 2.4% of the nationwide total live beef output (Thuy, 2023). However, in the first 6 months of 2024, the number of beef cattle showed a downward trend could be due to the impact of the market economy, pandemic, increased feed cost, and low beef-product price (Hoang, 2024; La, 2024).

Lam Dong (LD) is one of the provinces with a developed beef cattle industry in Vietnam, applying the program of hybridizing cattle and upgrading high-yielding cross-breeds, thus having a central role in the overall development of national beef cattle industry. It possesses several advantages in natural conditions, grassland, feed ingredients, a variety of good beef cattle breeds and a favorable climate (Ngo et al., 2022) for developing the high yielding cross-bred beef breeds. However, a recent survey mentioned that beef cattle production was mainly focused on the small scale with various cross-breeds (Nguyen et al., 2021b). Therefore, evaluating the current situation of beef cattle production and identifying the reasons for limitation of the actual development potential of the high-yielding cross-bred cattle industry is essential.

Although there have been recent investigations evaluating the status of beef cattle production at both farm and household scales in many provinces of Vietnam, such as Dak Lak (Pham et al., 2021a; Ngo et al., 2022), Quang Binh (Hoang et al., 2009), Quang Ngai (Le et al., 2021), Tay Ninh (Pham et al., 2021b), Thua Thien Hue (Pham et al., 2022), Tien Giang (Nguyen et al., 2021c), Tra Vinh (Pham et al., 2021c), or Ho Chi Minh City (Pham et al., 2021d), no survey has yet been conducted in LD. Therefore, determining the current situation of beef cattle production in LD is necessary to find feasible technical solutions to improve the productivity, quality of beef cattle and beef production efficiency in LD sustainable development.

2. Materials and Methods

2.1. Location

This survey was carried out directly at household beef cattle farms (HBCFs) in 3 districts of Lam Dong (LD) from 06/2024 to 09/2024. The LD is in the south of the Central Highlands of Vietnam, which possesses good natural conditions, including large land, fertile soil, mild weather, and a favorable climate year-round.

2.2. Approach

Using retrospective data: From previous reports of the Department of Livestock, Veterinary and Fisheries of Lam Dong province on beef cattle production in three districts of LD to estimate the number of HBCFs (sample size).

Collecting raw data through direct interviews with pre-printed questionnaires at HBCFs as cross-

section study model by using the Participatory Rural Appraisal method in three districts.

2.3. Sampling method and survey implementation at HBCFs

The direct interviews were conducted at HBCFs using pre-printed questionnaires through sampling method of hierarchical nested sampling design with 3 levels (level 1 includes some districts in LD, level 2 includes some wards/communes in each district, and level 3 includes some households in each ward/commune). Specifically, a total of 90 HBCFs (N = 90) were randomly surveyed in 3 districts of LD (Cat Tien, CT; Duc Trong, DT; Don Duong, DD) with 3 wards/communes for each district and 10 HBCFs for each ward/commune. In fact, the CT, DT and DD are three typical districts in the beef cattle farming sector of the LD province. Therefore, these three districts and 3 wards (for each district) and 10 households (randomly for each ward) were chosen as the hierarchical sampling to ensure representativeness of the current status of beef cattle production in the LD province.

2.4. Survey measurements and parameters

General information of HBCFs: Experience and education level.

Important indicators associated with beef cattle production activities: Husbandry method, husbandry goal, origin of cattle of HBCFs, main income source of HBCFs, selling method of beef cattle, fattening application before selling for beef and culling breeding female cattle (BFC), and labor sources at HBCFs.

Parameters related to the beef cattle herd on farms: Herd scale, structure, and beef cattle breeds.

Indicators related to the growth and development of beef cattle: Live weight (LW), average daily gain (ADG, g/day) of beef cattle throughout the whole beef cattle production stage (WBPS) and fattening stage (FS).

Parameters associated with the breeding female cattle (BFC) group: Breeds and some critical indicators associated with artificial insemination (AI) (awareness, application, level and implementer).

2.5. Statistical analysis

Data from survey as cross-section study model were analysed by using Minitab 16.2. Quantitative values (Mean ± SD) were compared using ANOVA followed by Tukey test while qualitative values (%) were compared using $\chi 2$ test with significant differences at $P < 0.05$.

3. Results and Discussion

3.1. General information on HBCFs

The majority of experience distribution in beef cattle production among households in LD was in the range of 11 - 15 years (36.7%) and > 20 years (27.8%) with the minority in the range of < 1 year and 1 - 5 years (2.2% and 3.3%, respectively) ($P < 0.01$; Figure 1). Cattle production experience is a crucial factor in determining economic efficiency in agricultural production in general and livestock production in particular (Tran & Do, 2021). Therefore, LD is considered as a region with a long history of beef cattle production, and HBCFs have accumulated beef cattle experience in many years of practice.

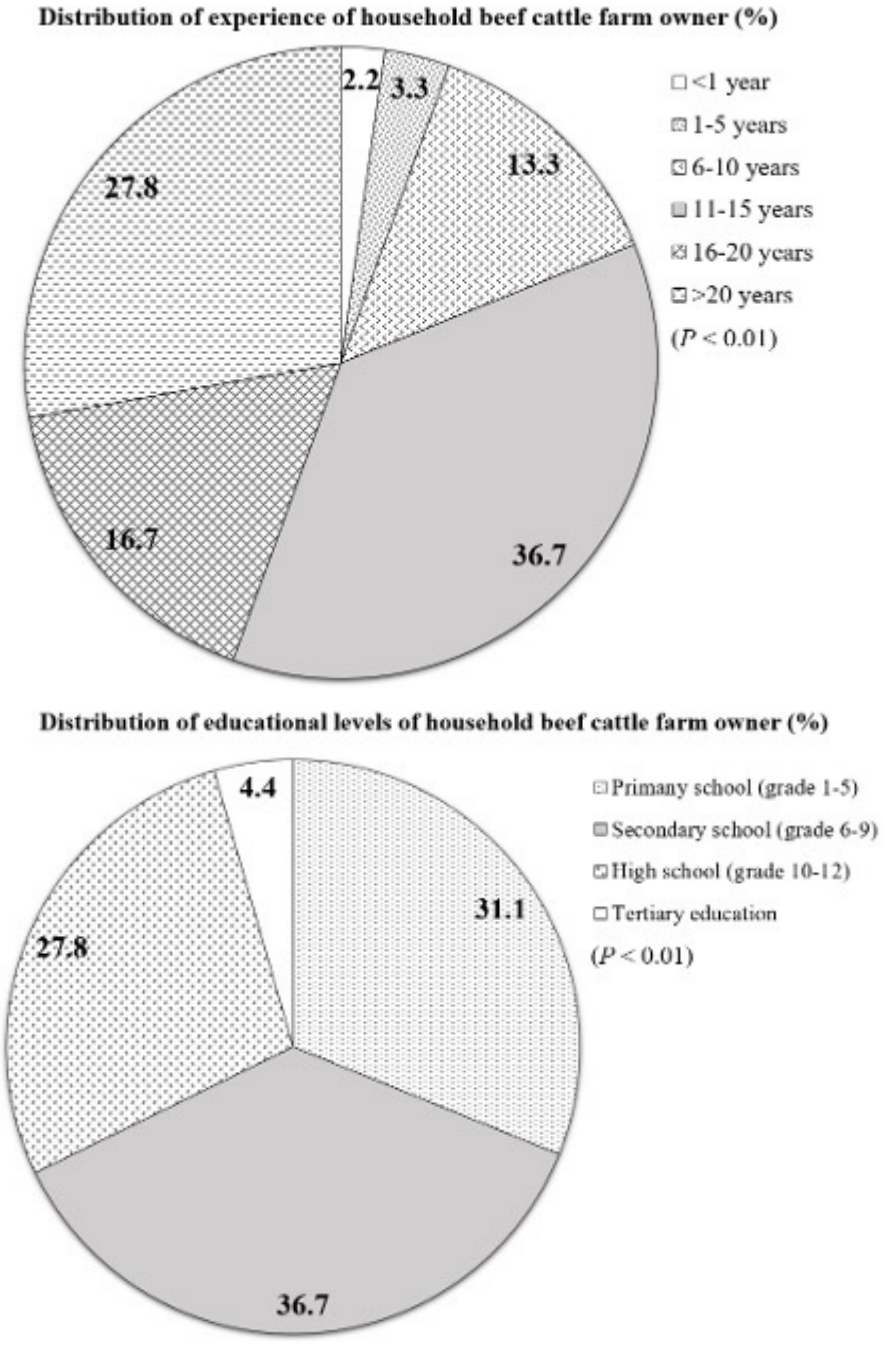

Figure 1. Experience and education level of household beef cattle farm owners (N = 90).

Furthermore, HBCFs owners in LD with tertiary education (college/university level) just accounted for 4.4%, significantly lower ($P < 0.01$) than those of secondary (36.7%), primary (31.1%) and high school level (27.8%). Therefore, improving education levels and participating in training workshops or practical field trips are necessary to effectively access, understand and apply scientific and technological models in livestock production (Kim, 2024).

3.2. Some important parameters related to beef cattle production activities

Table 1. Indicators associated with beef cattle production activities

Parameters	Classifications	Quantity	%	*P*
Beef cattle husbandry method (N = 90)	Full confinement	83	92.22[a]	< 0.001
	Semi-grazing	7	7.78[b]	
Beef cattle husbandry goal (N = 90)	Only beef cattle husbandry	2	2.22[b]	< 0.001
	Combination of beef cattle & BFC	86	95.56[a]	
	Only breeding female cattle (BFC) husbandry	2	2.22[b]	
Source of current beef cattle (N = 88)	Buying from outside for raising and fattening	2	2.27[c]	< 0.001
	Calves born from farm dams	34	38.64[b]	
	From both sources	52	59.09[a]	
Main income source (N = 90)	Beef cattle	16	17.78[b]	< 0.001
	BFC	74	82.22[a]	
Selling beef cattle (N = 88)	Through estimating live weight/appearance	88	100.00[a]	< 0.001
	Through estimating age	0	0.00[b]	
	Through weighing LW with market price	0	0.00[b]	
Fattening beef cattle before selling (N = 88)	Fattening application	67	76.14[a]	< 0.001
	No fattening	21	23.86[b]	
Fattening the culling breeding cattle (N = 88)	Fattening before selling	75	85.23[a]	< 0.001
	Selling immediately	13	14.77[b]	
Labor source for farming (N = 90)	Family labor	83	92.22[a]	< 0.001
	Outsource	1	1.11[b]	
	Both	6	6.67[b]	

[a-c] *Values within each parameter with different superscript letters differ (P < 0.01).*

Percentage of beef cattle husbandry method as the complete confinement (92.22%) was significantly higher than that of semi-grazing method (7.78%) ($P < 0.001$; Table 1). Previous surveys also indicated that confined farming and feeding at barn was predominant, and a common trend in beef cattle production in Dak Lak (95%) (Ngo et al., 2022) and Tra Vinh (86.67%) (Pham et al., 2019).

The proportion of combined husbandry of beef cattle and BFC was very popular (95.56%) and significantly higher than those of two other husbandry goals (only beef cattle, only BFC) ($P < 0.001$). The reason could be that this model produces high-yielding cross-bred calves with rapid growth suited for meat production (Lam, 2020) and enhance economic efficiency in beef cattle production (Thuy, 2020). The buying/importation of calves/cattle for raising/fattening occupied 2.27%, significantly lower than the source of beef cattle raised from calves born from farm dams (38.64%) and a combination of both methods (59.09%) ($P < 0.001$).

The percentage of HBCFs selling beef cattle through estimating the live weight/appearance of cattle was 100% ($P < 0.001$). Most HBCFs applied the fattening procedure for beef cattle and culling BFC before selling for slaughter (76.14% and 85.23%, respectively) ($P < 0.001$). The labor force in HBCFs was mainly from the family members (92.22%), and significantly higher ($P < 0.001$) than those of two other sources.

3.3. Parameters related to the beef cattle herd on farms

3.3.1. Herd scale and structure

The currently average total herd was 7.3 cattle/household, with the highest number in DD (9.1 cattle/household), followed by CT (7.9) and the lowest in DT (4.9) ($P < 0.05$; Table 2). The current herd size in LD was lower than that of the results in Dak Lak (8.06 cattle/household) (Pham et al., 2021a) and Ho Chi Minh City (11.19) (Pham et al., 2021d), but higher than that in Quang Ngai (4.8) (Le et al., 2021).

There was the majority of beef cattle (4.7 beef cattle/household at 57.4% of the total herd) in the general herd structure, with the highest proportion in DD (7.5 cattle/household at 78.4%) ($P < 0.05$; Table 2). The number of the BFC was significantly higher in CT (2.8 cattle/household at 43.4%) and DT (1.8 cattle/household at 35.4%) than that in DD ($P < 0.05$). The number of calves was highest in CT with an average of 1.0 calve/household ($P = 0.267$) and accounted for 17.7% of herd ($P < 0.05$). Currently, DD is promoting the development in agricultural sectors, especially livestock, leading to an annual increase in cattle herds and supporting farmers with more access to scientific advancements and quality breeds (Van, 2024). Meanwhile, CT is the area with its tradition of raising the BFC to supply calves to northern districts of Central Highland, so there was higher number of BFC and calves than those of DD and DT.

There currently was a vast percentage of beef cattle production scale by total herd and by beef cattle group of HBCFs in the range of 1 - 5 (60.00% and 69.32%, respectively) or 6 - 10 cattle/household (17.78% and 15.91%, respectively) compared with other scale groups ($P < 0.01$; Figure 2). It has been reported that beef cattle production in Central Highland was mostly small-scale with an average of 2.9 cattle/household, while large-scale farms only accounted for 32.94% with 9.19 cattle/household (Nguyen et al., 2021b). In LD, there has been a gradual change of scale from 1 - 2 to 5 - 20 cattle/household (Nguyen et al., 2021a) to achieve intensive cattle production with medium and large-scale in future.

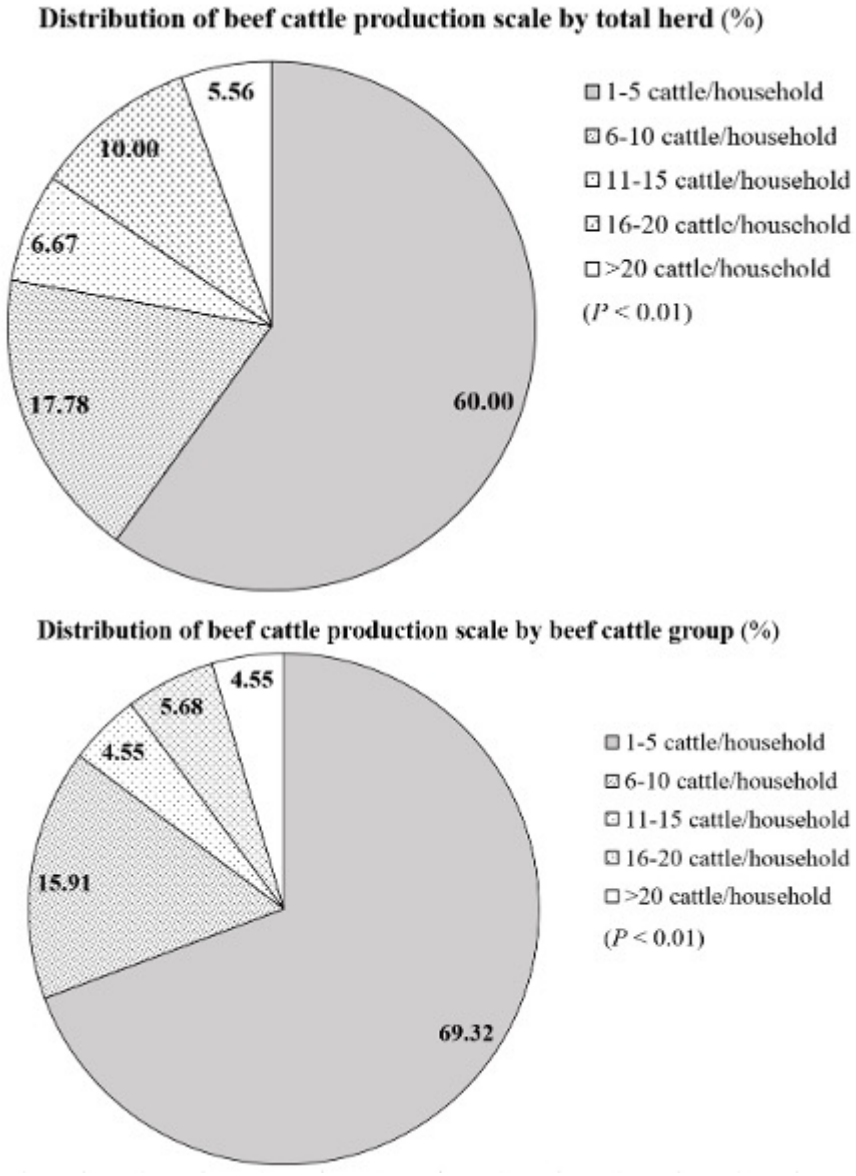

Figure 2. Beef cattle scale by total herd and by beef cattle group (N = 90).

Table 2. Structure of average cattle herd

Districts/ Parameters	N (households)	Average of total herd (cow/ household)	Beef cattle		Breeding female dams		Calves	
			Quantity (cow/ household)	%	Quantity (cow/ household)	%	Quantity (cow/ household)	%
Cat Tien	30	$7.9^{ab} \pm 6.1$	$4.1^{ab} \pm 5.6$	$38.8^{b} \pm 38.5$	$2.8^{a} \pm 2.4$	$43.4^{a} \pm 26.8$	1.0 ± 1.4	$17.7^{a} \pm 19.1$
Don Duong	30	$9.1^{a} \pm 8.6$	$7.5^{a} \pm 8.4$	$78.4^{a} \pm 38.4$	$1.1^{b} \pm 2.1$	$15.8^{b} \pm 28.8$	0.5 ± 0.9	$5.8^{b} \pm 12.6$
Du Trong	30	$4.9^{b} \pm 4.5$	$2.4^{b} \pm 2.3$	$55.4^{ab} \pm 41.7$	$1.8^{ab} \pm 2.3$	$35.4^{a} \pm 35.8$	0.7 ± 1.5	$9.2^{ab} \pm 13.8$
Average	90	7.3 ± 6.8	4.7 ± 6.3	57.6 ± 42.4	1.9 ± 2.3	31.6 ± 32.5	0.7 ± 1.3	10.9 ± 16.0
P		0.042	0.005	0.001	0.018	0.003	0.267	0.011

$^{a-b}$Values within column with different superscript letters differ ($P < 0.05$).

Table 3. Common beef cattle breeds

Districts/Breeds	BBB cross-breed		Charolais cross-breed		Sind cross-breed		Other breeds	
	% households	% cattle	% households	% cattle	% households	% cattle	% households	% cattle
Cat Tien (N = 28)	53.57	69.29^{b}	28.57	21.26^{a}	10.70	7.87^{ab}	7.14	1.57
Don duong (N = 30)	70.00	91.94^{a}	20.00	2.69^{b}	3.33	4.30^{b}	6.67	1.08
Duc Trong (N = 30)	50.00	49.25^{c}	26.67	23.88^{a}	16.70	20.90^{a}	6.67	5.97
Average (N = 88)	57.95	76.84	25	12.6	10.2	8.42	6.82	2.11
P	0.248	< 0.001	0.728	< 0.001	0.230	< 0.001	0.997	0.096

$^{a-b}$Values within column with different superscript letters differ ($P < 0.001$).

Table 4. Parameters associated with live weight (LW) and average daily gain (ADG) during the whole beef cattle production stage (WBPS) and fattening stage (FS)

Districts/Indicators	Starting age WBPS (month)	Starting LW of WBPS (kg)	Starting age of FS (month)	Starting LW of FS (kg)	Ending age of FS (month)	Ending LW of FS (kg)	ADG during WBPS (g/day)	ADG during FS (g/day)
Cat Tien (N = 28)	$8.0^{a} \pm 0.8$	139.3 ± 8.3	17.3 ± 0.5	301.8 ± 41.4	$22.8^{a} \pm 1.1$	413.0 ± 33.0	570.8 ± 124.0	685.0 ± 202.4
Don Duong (N = 30)	$7.7^{ab} \pm 0.4$	136.7 ± 3.8	17.5 ± 0.4	308.3 ± 34.9	$22.3^{b} \pm 0.6$	413.2 ± 29.6	573.5 ± 112.1	741.0 ± 192.6
Duc Trong (N = 30)	$7.6^{b} \pm 0.3$	136.3 ± 3.5	17.4 ± 0.3	311.7 ± 40.9	$22.7^{ab} \pm 0.5$	418.5 ± 39.9	595.9 ± 152.1	662.3 ± 119.1
Average (N = 88)	7.8 ± 0.6	137.4 ± 5.6	17.4 ± 0.4	307.4 ± 38.9	22.6 ± 0.8	414.9 ± 45.2	580.3 ± 129.6	696.4 ± 175.9
P	0.021	0.092	0.439	0.623	0.017	0.785	0.721	0.206

$^{a\text{-}b}$*Values within column with different superscript letters differ (P < 0.05).*

Table 5. Common beef female cattle breeds

Districts/Breeds	Sind cross-breed		Brahman cross-breed		Charolais cross-breed		Local Yellow cattle	
	% households	% cattle	% households	% cattle	% households	% cattle	% households	% cattle
Cat Tien (N = 28)	76.67	80.77^{a}	6.67	3.85^{b}	3.33	1.28	13.33	14.10
Don Duong (N = 30)	72.41	58.54^{b}	13.79	24.39^{a}	10.34	9.76	3.45	7.32
Duc Trong (N = 30)	58.62	56.14^{b}	24.14	22.81^{a}	10.34	8.77	6.90	12.28
Average (N = 88)	69.32	67.61	14.77	14.77	7.95	5.68	7.95	11.93
P	0.109	< 0.01	0.194	0.001	0.768	0.220	0.790	0.194

$^{a\text{-}b}$*Values within column with different superscript letters differ (P < 0.01).*

3.3.2. Breeds and genders

The BBB and Charolais cross-bred cattle are currently the two preferred breeds for raising. Percentage of BBB cross-bred cattle was 57.95% of households and 76.84% of the total herd, while the percentage of Charolais cross-breed was 25.00% of households and 12.60% of the herd (Table 3). In contrast, Sind cross-breed was only 10.2% of households and 8.42% of the herd. The proportion of BBB cross-breed was the highest in DD (91.94%), followed by CT (69.29%) and lowest in DT (49.25%) ($P < 0.001$). However, the proportion of Charolais cross-breed was the highest in DT (23.88%), followed by CT (21.26%), and lowest in DD (2.69%) ($P < 0.001$). A previous survey by Ngo et al. (2022) in Dak Lak showed that cross-breed occupied only 55.66% compared to 43.34% of local yellow cattle. In Ho Chi Minh City, cross-bred beef cattle accounted for 95.46% of the total herd, including 5.38% from BBB cross-breed, 6.47% from Charolais cross-breed and 77.15% from Zebu cross-breed (Pham et al., 2021a). Nguyen et al. (2021b) reported that the Central Highlands has a diversity of crossbred cattle with the popular breed from Sind and Brahman cross-breed. However, the current results confirmed that high-yielding beef breeds have been increasingly favored by HBCFs in LD due to their economic efficiency, productivity and good adaptation to local area.

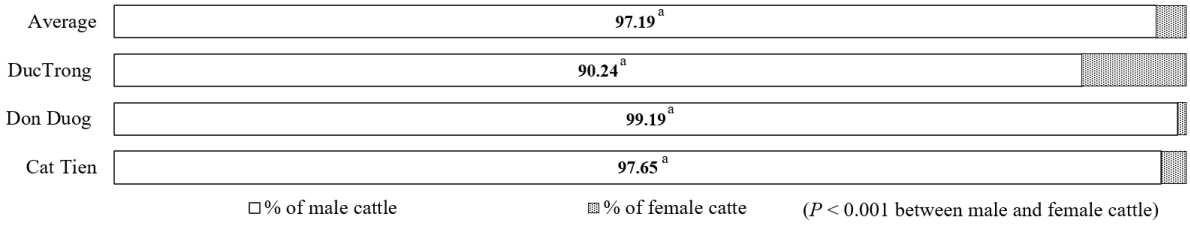

Figure 3. Gender distribution of beef cattle herd (%).

Male cattle seemed to be prioritizedly selected for animal husbandry of meat production (97.19%, from 90.24% - 99.19%) and was significantly higher than that of female cattle ($P < 0.001$; Figure 3). This difference could be due to faster growth, higher maximum LW at maturity and greater carcass yield in male cattle at the same age (Le, 2013), contributing to higher economic efficiency in beef industry.

The results from the survey and calculations in Table 4 revealed that ADG of beef cattle throughout WBPS and FS reached 580.3 g/day and 696.4 g/day, respectively. Moreover, it also indicated similar results in ADG of beef cattle throughout the WBPS and FS among three districts ($P > 0.05$). These results were similar to the previous findings of high-yielding cattle breeds raised in Ben Tre (Duong et al., 2019); however, it was lower than those of high-yielding cross-breeds raised in Ho Chi Minh City (Nguyen & Do, 2020).

3.4. Parameters related to the BFC

Sind cross-breed cattle were the most common breed of BFC in all three districts (69.32% of households and 67.61% of the total cattle) (Table 5). Specifically, the percentages of Sind cross-breed were highest in CT (76.67% of households and 80.77% of cattle), followed by DD (72.41 and 58.54%, respectively), and lowest in DT (58.62 and 56.14%, respectively) ($P < 0.01$; Table 5). Brahman cross-breed were mainly raised in DD and DT (24.39 and 22.81% of cattle, respectively), and lowest in CT (3.85%)

(P = 0.001). Sind or Brahman cross-bred female cattle were primarily chosen as the breeding females mainly due to their good adaptability to Vietnam's severe climate, good resilience, low disease incidence, relatively high meat yield and high reproductive efficiency (Bang, 2021). Therefore, this contributes to the creation of next generations of high-yielding cross-bred beef cattle to supply qualified calves (good adaptability and growth) for local farmers and to reduce the importation from other regions.

The majority of HBCFs were aware of AI methods (61.11%) (P < 0.001; Table 6), while the AI application on their farms was still limited (only 48.86%) (P = 0.763). At HBCFs using AI, it was primarily applied to cattle from the second parity (60.47%), significantly higher than that of all female cattle (16.28%) (P < 0.001). Moreover, AI manipulation in HBCFs was mostly done by outside hired technicians (74.42%) (P < 0.001), and most HBCFs owners using AI cared for the breeds of bull semen before implementing AI (86.04% of households) (P < 0.001). The current application of AI reached a relatively good conception rate with 81.13% at the frequency of services per conception in a range of 1 - 2 times (P < 0.001). The average cost per AI was 303,125 VND, and it took about 1.7 time of AI for pregnancy. This result was similar to the finding in Tra Vinh on BFC but higher than that of female heifers (Pham et al., 2021c), as well as significantly higher than in Ho Chi Minh City (Pham et al., 2021d).

Table 6. Other parameters associated with the breeding female cattle

Qualitative indicators	Classifications	Quantity	%	*P*
Knowing of artificial insemination (AI) (N = 90)	Know	55	61.11[a]	0.003
	Unknow	35	38.89[b]	
AI application in their beef farm (N = 88)	Apply	43	48.86	0.763
	Not apply	45	51.14	
Levels of AI application (N = 43)	All female cattle	7	16.28[b]	< 0.001
	Only cattle from 2nd parity	26	60.47[a]	
	Only cattle from 3rd parity	10	23.26[b]	
Who doing AI in farm (N = 43)	Outsource	32	74.42[a]	< 0.001
	Farm's worker	11	25.58[b]	
Pay attention to the breeds of semen when doing AI (N = 44)	Attention	37	86.04[a]	< 0.001
	Not attention	6	13.95[b]	
Frequency of service per conception (N = 43)	1-2 times	35	81.39[a]	< 0.001
	2-3 times	7	16.27[b]	
	3-4 times	1	2.33[c]	
Quantitative indicators		Mean ± SD	Min - max	
Cost for one services of AI (VND, N = 32)		303,125 ± 42,001	250,000 - 400,000	
Number of services per conception (time, N = 43)		1.70 ± 0.42	1.00 - 4.00	

[a-c]*Values within each parameter with different superscript letters differ (P < 0.01).*

4. Conclusions

The LD is a region with a long history of beef cattle production and HBCFs owners have many-year experience in, but the educational level is still relatively low. The most common husbandry method currently applied in HBCFs is complete confinement. The combined production of beef cattle and BFC is also the most popular. The labor force HBCFs mainly comes from family members, and the HBCFs apply the fattening procedure for both the beef and culling BFC rather than selling immediately. On average, there are 7.3 cattle/household in total herd and 4.7 cattle/household in beef cattle group. Most of the scale distribution of HBCFs is still small scale. The ADG throughout the WBPS and FS has only reached the modest level. Therefore, further investigations are urgently required to assess the other aspects (house conditions, cattle health, feed and daily diets) of HBCFs. In summary, these findings suggest that there are limitations of HBCFs for developing sustainably high-yielding beef cattle production in LD and there should be more applied new techniques to overcome the current situation.

Conflict of interest

No competing interest declared.

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