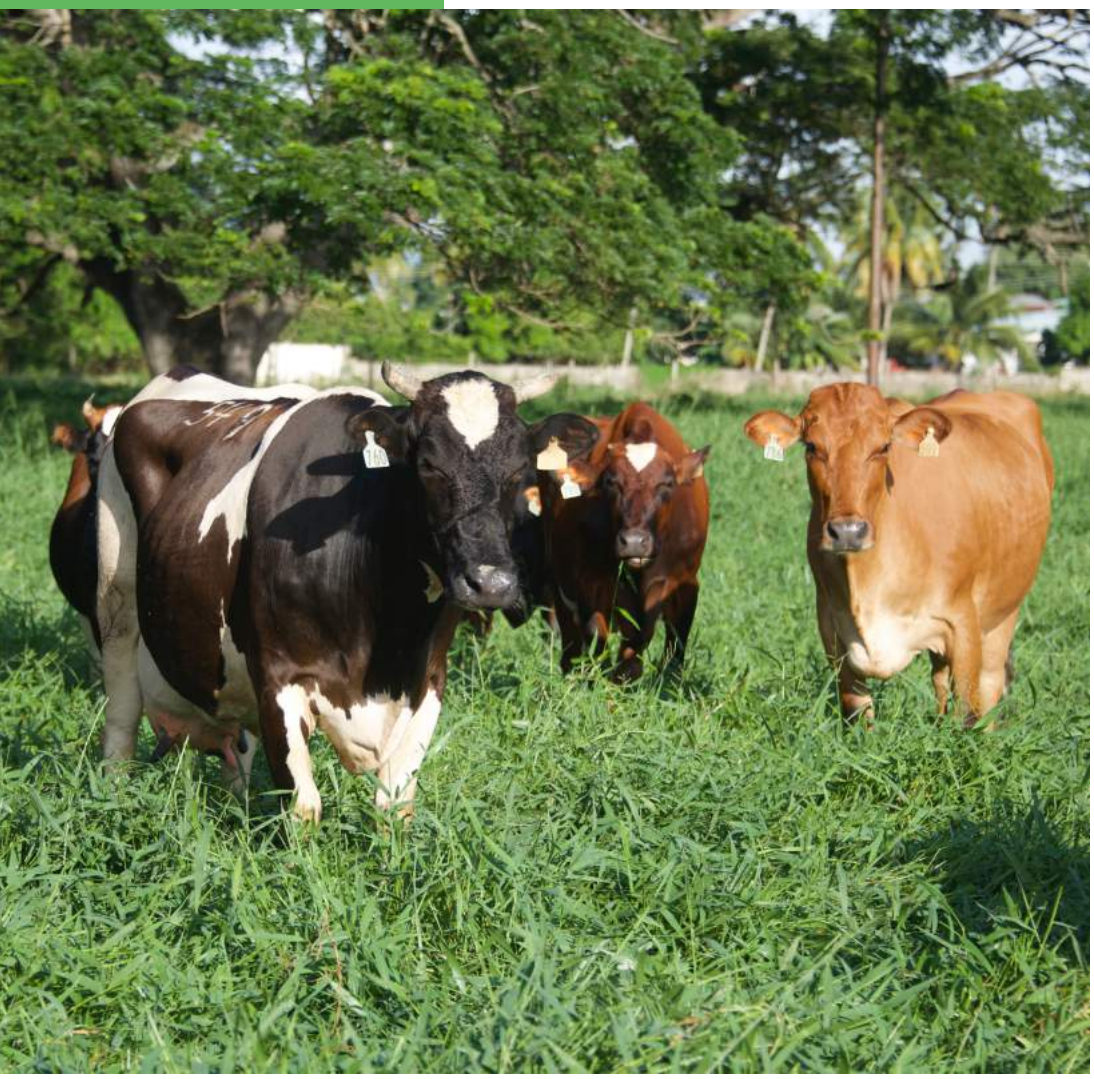
THE UNIVERSITY OF THE WEST INDIES ST AUGUSTINE

Status of Dairy Industry in Trinidad and Tobago

– Recommendations for improvement



- address pricing of milk
- use local forages and alternative feeds
- reduce praedial larceny
- adopt modern technologies
- dairy association reform
- farmers' capacity building

Report by the Faculty of Food and Agriculture, The University of the West Indies

Prepared by: Mr. H Ali, Dr. K. Gopalan, Dr. U. Krishnamoorthy, Dr. W. Harewood, Prof. W. Ganpat and Ms. S. Ragbir

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EXECUTIVE SUMMARY

The dairy industry of Trinidad and Tobago has suffered a decline in the production of cow's milk over the past few decades. At the same time, import data have shown an increased demand for cow's milk and milk products. Very few studies have been done that looked at the industry as a whole; as such it has become necessary to assess and report on the status of the dairy sector in Trinidad. An assessment conducted showed that most farmers (37.8%) fell within the age bracket of 51 – 60 years, which indicated an aging population with few (2.2%) young people involved in the industry. Record keeping was poor among the farmers. Only 29% of farmers kept any sort of physical record. The majority (62.2%) of farmers milked their cows by hand; an indication of low levels of technology use. The majority of animals kept in the farms were dairy cows with smaller numbers of breeding bulls. National daily production of raw milk was 9531.5 kg and was produced at a calculated cost of $5.22 per kg. Nestlé paid farmers $2.35 per kg of milk with incentives being offered to produce higher quality milk. The government paid farmers an additional $1.50 per kg of milk sold to Nestlé, totaling $3.85 per kg. The major production constraints included high feed costs, high cost of labour and issues related to land tenure. Marketing constraints included the unfavourable price presently received by farmers for milk and inadequate marketing facilities. Other constraints impacting on the industry were organizational and related to internal conflicts within dairy groups and a perceived lack of leadership. For extension support, farmers used private extension agents more than public extension agents. The major recommendation was for policy reform and implementation of strategies which would support revitalization of the local dairy industry. Decisive actions are needed to improve quality and quantity of forages, deal with praedial larceny, reform of the dairy association, training for leaders and farmers in all aspects of modern dairy production and increased technology use.

Introduction

Livestock production was relatively insignificant in the Caribbean prior to 1945. Milk and meat were not produced in a regulated manner as most livestock then were beasts of burden. Fresh milk was only available when there was an excess of milk from cows used for bullock production (CTA 1993). In 1938, the West India Royal Commission mandated that more emphasis be placed on milk, meat, egg and poultry production to develop the population. This resulted in the formation of Agricultural Policy committees in various countries of the Region and subsequently the formation of the Caribbean Research Council in 1946 by the Anglo-American Caribbean Commission. Many development programmes were started, with primary focus in Jamaica and Trinidad and Tobago to improve their local dairy industries (CTA 1993). Many Caribbean Community (CARICOM) countries began gaining independence in the 1960s and as a result, individual governments inherited the responsibility for livestock-related policy. The individual countries worked together to identify the constraints associated with establishing a sustainable dairy industry and began minimizing them through research and development.

Major opportunities identified at that time included the development of a suitable breed of cattle for a tropical environment with appropriate technology level, artificial insemination (AI) as a viable method of breeding and the improvement of tropical forages (CTA 1993). These opportunities were addressed by the commencement of AI services, forage development and breeding services.

Artificial Insemination services were subsequently started that complemented the breeding programmes in Jamaica and Trinidad and Tobago. Purebred bulls were imported from the United Kingdom or United States of America for natural service before an AI service was started in Jamaica and Trinidad and Tobago. The AI services provided quality semen and forages were improved to include the increased use of legumes. A vigorous breeding programme resulted in the development of the Jamaican Hope.

Through the 1950s – 1960s, although milk production increased in both Jamaica and Trinidad, it was also reported that governments imported large numbers of purebred Holstein cows to speed up the process of increasing milk production. Trinidad and Tobago imported around 7,500 cows; mainly of Holstein breed from the 1960s to the 1980s. As the importation of the Holstein cattle started to rise, many farmers sold their crossbred cows, which were well adapted to local climatic conditions and bought the Holstein cattle. However, instead of realizing an increase in their milk production, farmers ended up with an increase in problems. The imported cattle displayed high levels of intolerance to the climate and the associated heat (Samuel 2003), humidity and pests. The result was death, abortion and decreased milk production. There was also difficulty with re-breeding cows and extended calving intervals (CTA 1993). It was reported that Trinidad and Tobago's peak production was 11,578 tons (1 ton

=1,000kg or metric ton) in 1991; thereafter production declined steadily to 5,098 tons by 2013 (Pemberton et al. 2016). The decline in domestic production facilitated an increase in the importation of milk. It is assumed that much more milk, in its various forms is imported than is produced presently as supported by the data from the Food and Agriculture Organization (FAO) which reported that over 4000 tonnes of fresh milk and 10,000 tonnes of cheese were imported into Trinidad and Tobago in 2016 (FAOSTAT 2018). Figures 1 and 2 show the quantities of milk and milk products imported over the periods 1961 to 1989 and 1990 to 2016 respectively.

Imported dairy products from New Zealand and the European Union into CARICOM, as a result of trade liberalization, has caused changes in the structure, function and intensities of domestic milk production.

While importation can be regarded as a strategy to ensure food and nutrition security of the regional population, the increased dependence on importation can be risky in the context of instability in the global trading system, stymie the development of domestic production which limits employment opportunities and entrepreneurism in the dairy sector. Moreover, the ever-increasing threats of climate change will further exacerbate the unfavourable existing situation.

Milk and other dairy products are essential for meeting the dietary needs of key sectors of the population and thus is an important component of food and nutrition security.

The multinational company, Nestlé Caribbean Ltd, has a huge impact on the dynamics of the milk industry in Trinidad and Tobago. For example, Nestle purchased 3 million kg on an annual basis from approximately 150 dairy farmers in 2010 (Farmer, Singh and Maharaj 2015). The price paid for raw milk was $2.35 per kg with quality bonuses as incentives. The Government of Trinidad and Tobago pays farmers a further $1.50 per kg on milk that is sold to Nestlé. The other major buyer of raw milk is Medford Farms in Carlsen Field, which then distributes the raw milk to various processors, such as Ramsaran Dairies and various restaurants throughout the country (Farmer, Singh and Maharaj 2015). Farmers have claimed that the reduction in the number of milk collection stations has forced them out of business.

From the records, it appears that the last survey of the sector was conducted by Pemberton et al. in 1994. The present situation in the Trinidad and Tobago dairy industry begs for interventions at various levels; knowledge on its status could be beneficial towards understanding the constraints facing the industry and to better position stakeholders to firstly revitalize the industry and then put it on a sustainable development path.

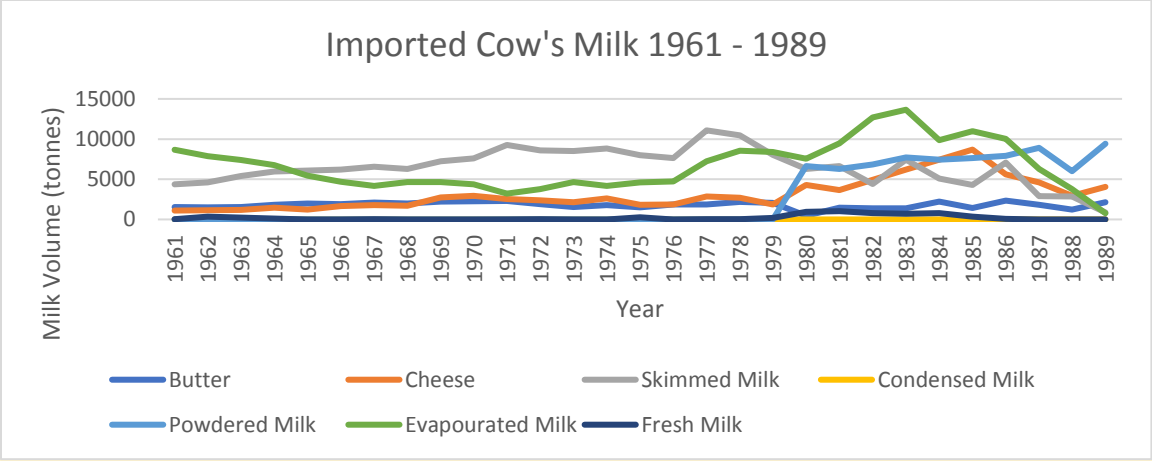

Figure 1: Quantity of Imported Cow's Milk and Milk Products from 1961-1989
Source: FAOSTAT 2018

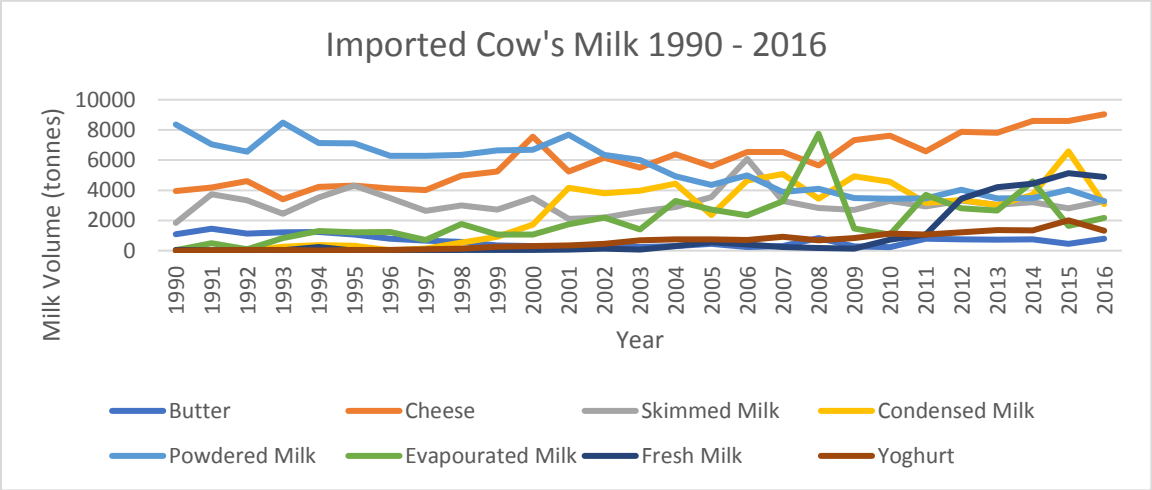

Figure 2: Quantity of Imported Cow's Milk and Milk Products from 1990 - 2016
Source: FAOSTAT 2018

This study investigated the status of the dairy industry in Trinidad, with special focus on the structure of the production system. The quantity of raw milk produced daily was determined, the cost of production of milk was calculated and the major constraints faced by dairy farmers were identified. Lastly, recommendations for the improvement of the industry are provided.

Methodology

The total number of dairy farmers in Trinidad is not accurately recorded. As such, the dairy farmers interviewed for this study were identified through lists provided by Nestlé, the Cattle Farmers' Association, farmers' knowledge and by references from farmers. One hundred and three dairy farmers were identified and information provided by 90 was used in the report. The dairy

farmers surveyed were located throughout the island, with core focus areas in Turure, Wallerfield, Charlieville, Carlsen Field and Woodland.

A survey instrument was developed to capture information on farmers' demographics, assets, inputs, costs incurred, outputs, perceptions of constraints and their suggestions on how to improve the industry, as well as data to assess the average herd body condition score. The instrument was developed and refined after consultation with the Cattle Farmers' Association, Dairy Focus Groups (established by the Faculty of Food and Agriculture, UWI) and selected farmers.

The data were tabulated and basic descriptive analyses were done. The cost of production of 1kg of milk was calculated as well as the daily milk production per cow.

Farmer and Farming Characteristics

Demographics

The dairy farmer demography (Table 1) revealed that dairy production in Trinidad is a male dominated production system, with 82% of the farmers being men and with a higher percentage of farmers clustered around the 40 to 60-year age range. Sixty-nine percent (69%) of the dairy industry is managed by Indo-Trinidadians, followed by Afro-Trinidadians (28%). Most of the dairy farmers surveyed belonged to the Hindu religion. A majority of the dairy farmers (64%) operated independently without being a part of any group or association; while the rest of the farmers belonged to the Dairy Farmers' Association.

Distribution of Dairies

Findings showed that dairy farmers were spread throughout the island, with 37.8% located in the central Carlsen Field area. This is in keeping with the traditional livestock development of the island, where State Lands were given for the development of the dairy industry. The second highest cluster of dairy farms were found in the North Eastern part of the island in the Turure Road area and environs (17.8% farmers being from that area) and 15.5% farmers were from the nearby Wallerfield area. The majority or 75.6% of the dairy farmers reported that they relied on dairy farming as their primary source of household income. Farmers were reluctant to give information on household demographics in terms of number of children and household income earners.

Table 1: Dairy Farmers' Demographics

Variables and Categories	N	%
Sex		
Male	74	82
Female	16	18
Age Group		
21-40	10	11.1
41-60	53	58.9
61+	26	28.9
other	1	1.1
Ethnic Group		
Indo-Trinidadian	62	68.9
Afro-Trinidadian	25	27.8
Other	3	3.3
Religion		
Hindu	43	47.8
Christian	24	26.7
Muslim	5	5.5
Other	18	20
Membership in Groups		
Cattle Farmer's Association	30	33.3
Other	2	2.2
None	58	64.5

Cattle Assets

The total number of cattle owned by the 90 farmers was 2752 animals; 2% of which were breeding bulls, 6% were fattening bulls, 62% were dairy cows, 16% were heifers and the remaining 14% were divided between male and female calves (Table 2).

Most farms (48) had no breeding bulls, while 30 farms had at least one breeding bull and 8 farms had two bulls. The majority of farms (81) had between 1-5 fattening bulls and there were only 5 farms with more than 40 cows (3 with more than 50 cows). Most farms (61) had less than 5 heifers, while 22 farms had between 6-10 heifers.

As for the milking cow herd composition, 70.7% of the cows were lactating, while 29.3% were dry.

Table 2: Overall Herd Composition

Type	**N**	**%**
Breeding Bulls	61	2
Fattening Bulls	162	6
Cows	1701	62
Heifers	444	16
Male Calves	145	5
Female Calves	239	9
Total	**2752**	**100**

Table 3: Milking Cow Herd Composition

Type	**N**	**%**
Cows (Lactating)	1202	70.7
Cows (Dry)	499	29.3
Total	**1701**	**100**

Herd Size and Land Holdings

The average herd size was 31. The largest herds (more than 50 animals) belonged to 15.6% of farmers, while the smallest herds (5 animals or less) belonged to 4.4% of farmers. Some 23% of the farmers had between 11-20 animals and 21% had between 21 – 30 animals.

With respect to farm size, most farmers (46.7%) had between 11-20 acres and 21% had between 21-30 acres of land for dairy farming (Table 4).

Management Systems

With respect to the housing of the animals, 86% of farmers had a basic shed or pen structure to house their cattle, while 11% had some lesser form of shade provided for animals. Extensive rearing systems (mostly free grazing) were used by 61.1% of farmers, semi-intensive used by 31.1% and a smaller amount (7.8%) used an intensive production system.

The majority (90%) of farmers utilized their family labour as their primary source of labour. In addition, some small amounts of casual labour (5.6%) and permanent

labour (8.9%) were hired.

Close to 47.8% of the farmers reported that they experienced incidents of praedial larceny on their farms.

Records of farm operations were kept in some form by 29% of the farmers, while 71% reported that they did not keep any physical records.

The majority of farmers (59%) milked their cows by hand, while a moderate percentage (29%) use milking machines (Table 4).

Table 4: Famer Characteristics and Management Systems

Categories	**N(90)**	**%**
Geographic Distribution		
Turure	16	17.8
Wallerfield	14	15.6
Charlieville/Cunupia	10	11.0
Carlsen Field	34	37.8
Woodland/ Caroni/Other	16	17.8
Primary Source of Income		
Dairy	68	75.6
Other	22	24.4
Herd Size		
0-5	4	4.4
6-10	9	10
11-20	21	23.3
21-30	19	21.1
31-40	15	16.7
41-50	8	8.9
>50	14	15.6
Mean	30.6	-
Median	24.5	-
Mode	14	-
Farm Size (Acres)		
0-5	16	19.0
6-10	7	7.8
11-20	42	46.7
21-30	19	21.1
>31	5	5.6
Type of housing		
Shade	10	11.1
Basic shed structure	80	89
Semi modern/ modern structure	0	0
System of Rearing		
Intensive	7	7.8
Semi-Intensive	28	31.1
Extensive	55	61.1

Table 4: (Continued)

Labour source		
Self/Family	81	90
Casual	5	5.6
Permanent	8	8.9
Incidence of Praedial Larceny (yes)	43	47.8
Record keeping		
Physical Records kept	26	29
Physical records not kept	64	71
Milking Technology		
Use of milking machine	37	41
By Hand	53	59
Breeding Technology		
Artificial Insemination	64	71
Natural	26	29

Figure 3: Basic Shed for Housing and Milking of Dairy Cattle
Photo: Hamza Ali

Figure 4: Animals under shade
Photo: Hamza Ali

Body Condition Scores

Body condition scoring has been used to determine the energy status or health of an animal as well as used to determine relationships between milk production, health and the amount of body fat used by lactating dairy animals (Waltner et al. 1993; Kellog 2010). It is done by visual assessment of the animal. In some cases, physical assessment is also done.

For the purpose of this study, the body condition score (BCS) was assessed across the herd as opposed to individual animal. To maintain accuracy, the same person was used to assess all the animals on the farms. The body condition score range for dairy cattle ranges from 1 to 5, with 1 being poor condition and 5 being overweight. The ideal body condition score for an animal is around 3. The photos below give a general indication of what each number on the scale would represent.

Body Condition Score 1

A cow with a body condition score of 1 has a very visible tailhead surrounded by a deep cavity. The surrounding bones and the short ribs are also prominent. Heavy depression of the loin area can also be observed (Kellog 2010).

Body Condition Score 2

A cow with body condition score of 2 has a shallow cavity around the tailhead with bones being visible but not prominent and the short ribs are slightly visible. There is notable depression of the loin area (Kellog 2010).

Body Condition Score 3

A cow with a body condition score of 3 has no visible cavity around the tailhead. The short ribs are not visible as they are covered by a layer of tissue. There is a very slight depression of the loin area (Kellog 2010).

Body Condition Score 4

A cow with a body condition score of 4 has lumps/folds of skin or fatty tissue surrounding the tailhead. There is no visible depression of the loin area (Kellog 2010).

Body Condition Score 5

A cow with a body condition score of 5 has a layer of fatty tissue covering the tailhead. There is no depression of the loin area (Kellog 2010).

(Photos Credit Craig Johnson)

Of the 90 farms surveyed in the study, herds from 33 farms were assessed. The results indicated a mean BCS of 2.32. Herds on 18 % of the farms had a BCS of 3.6–3, indicating good condition. Herds on 72.7% of the farms had a BCS of 2.1–2.5, suggesting a fair condition, while 9% of herds had a poor BCS of 1-2.

Milking and Breeding

The majority (71.1%) of farmers used Artificial Insemination (AI) for their cows, while the rest reported using natural service of a breeding bull. Hand milking was done by the majority (62.2%) of farmers, and 37.8% reported using milking machines to milk their cows (Table 4).

Milk Production and Marketing

The majority of raw milk (79.7%) produced was sold directly to milk processors on a daily basis (Table 5). Raw milk sold directly to consumers accounted for 9.4% of the total milk produced, however only 2.3% of the raw milk produced was converted into milk products while the remaining 8.7% of milk produced was kept for home consumption or fed to calves. The majority (69.5%) of revenue from milk sales was obtained from the milk sold directly to processors. However, it can be noted that even though only 2.3% of milk was processed and sold as milk products, it accounted for 7.9% of the revenue from milk sales. Using the calculated dollar per kg, it was estimated that the revenue generated from the sale of milk products ($15.8 per kg) was almost 4 times the revenue from the sale of raw milk to processors ($3.9 per kg) on a per kg basis. It can be concluded that more efforts should be focused into value addition of raw milk.

Table 5: Daily Milk Volume and Revenue Generated ($TT)

Variables and Categories	**N (kg)**	**% of Total Raw Milk**	**Value ($)**	**%**	**Return per unit ($/kg)**
Milk Volume					
Quantity of Raw Milk Sold to Processors	7595	79.7	29804.4	69.5	3.9
Quantity of Raw Milk Sold to Consumers	892.5	9.4	6509.5	15.2	7.3
Quantity of Raw Milk Converted and Sold as Products	216	2.3	3406	7.9	15.8
Quantity of Raw Milk Consumed at Home/Used for Calves	828	8.7	3187.8	7.4	3.9
Total	**9532**	**100**	**42908**	**100**	**-**

*Value of milk fed to calves/consumed calculated based on minimum price received for raw milk at $3.9

Cost of Milk Production

Information was collected on a number of parameters to calculate the cost of milk products and this is summarized in Table 6.

It should be noted that this calculation did not take into account the variance between farmers nor the farmers who did not provide information on feed costs due to lack of records (supported by Table 5). The cost was spread evenly among the farmers surveyed and as a result, reflected a number that is assumed to be significantly lower than the actual cost of production.

From the data provided, it costed the industry $5.2 to produce 1 kg of milk for a total volume of 9531.5kg per day (Table 5) using the formula "Total Expenses/Total Volume Milk Produced or 49754.61/9531.53".

Farmers who supplied milk to Nestlé were paid $2.35 per kg of raw milk and the government paid a further $1.50 in subsidy per kg of milk sold to Nestlé. This totaled $3.85. The calculated cost would suggest therefore, that the farmers would have been producing at a loss.

Table 6: Daily Production Cost

Item	**Value (TTD) $**	**% of $**
Expenses		
Feed Cost	15518.5	31.19
Labour Cost	33900.0	68.13
Other expenses (Vet. services, AI, medicine, misc)	336.1	0.68
Total Expenses	**49754.6**	**100.00**
Revenue from Milk		
Raw Milk Sold to Processors	29804.4	69.46
Raw Milk Sold to Consumers	6509.5	15.17
Raw Milk Converted to Product	3406.0	7.94
Raw Milk Fed to Calves/Consumed at Home	3187.8	7.43
Total Revenue from Milk	**42907.7**	**100.00**
Cost of Production/Litre = Total Expenses (Table 6)/ Total Volume Milk Produced (Table 5)	**$ 5.2 / L**	
Milk Production / Cow = Total Raw Milk Produced / Number of Cows Lactating	**7.93 L/Cow**	

Figure 5: Farmer delivering milk to a Milk Depot (Carlsen Field)
Photo: Hamza Ali

Constraints to Dairy Farming

Constraints to Dairy Production

The major constraints outlined (Table 7) indicated that 83.9% of farmers considered the high cost of feed to be the most significant production constraint. The issue of land tenure was also a constraint as reported by 55.9%. High cost of hired labour and difficulty with obtaining credit were also reported as significant constraints (47% and 39.7% respectively).

Table 7: Constraints to Dairy Production (n = 68)

Constraints to Farming	**Most Important**	**Somewhat Important**	**Important**	**Little Important**	**Not Important**
	%	%	%	%	%
Cost of feed	57.4	26.5	11.8	1.5	2.9
Land Tenure	41.2	14.7	10.3	7.4	26.5
Diseases	14.7	33.8	26.5	13.2	11.8
Labour Cost	23.5	23.5	11.8	13.2	27.9
Difficulty in obtaining credit	26.5	13.2	10.3	17.7	32.4
Distance from Lending Institution	13.2	22.1	4.4	20.6	39.7
Lack of Knowledge	2.9	17.7	33.8	11.8	33.8
Lack of Time	13.2	5.9	17.7	16.2	47.1
Low Productivity	0.00	10.3	23.5	29.4	36.8

Issues with Marketing

The major constraint to marketing of dairy and dairy products (Table 8) was the price farmers received for their milk; with 64% suggesting that it was most important and somewhat important. This was followed by infrastructure (38.7%). However the majority of farmers indicated that irregularity of payment for their milk and infrastructure at the chilling facility were not major concerns.

Issues with Dairy Groups

Within dairy groups (Table 9), various issues are reported. The majority (57.4%) of farmers indicated issues with the lack of leadership, 39.7% indicated problems with conflicts within the group and 35.2% indicated the presence of subgroups. Interestingly farmers did not report “training” as being important, nor lack of scientific knowledge as a constraint (33.8%).

Table 8: Major Constraints with Marketing of Milk (n = 62)

Constraints to Marketing	**Most Important**	**Somewhat Important**	**Important**	**Least/Not Important**
	%	%	%	%
Price received for milk	41.94	22.58	25.81	9.68
Lack of Information	3.23	16.13	33.87	46.78
Road infrastructure	17.74	20.97	27.42	33.87
Infrastructure in Chilling plant	1.61	11.29	14.52	72.58
Transport distance	6.45	20.97	24.19	48.38
Marketing facilities	11.29	9.68	14.52	64.52
Irregular payment	1.61	0.00	0.00	98.39

Table 9: Major Constraints within Dairy Groups (n=26)

Constraints within Dairy Group	**Most Important**	**Somewhat Important**	**Important**	**Least/Not Important**
	%	%	%	%
Age of people in the group	11.3	9.7	14.5	64.5
Lack of Education	1.6	0.0	0.0	98.4
Conflicts in the Group	26.5	13.2	10.3	50
Presence of Subgroups	13.2	22.1	4.4	60.3
Lack of Leadership	57.4	26.5	11.8	4.4
Absence of Risk Taking Ability	14.7	33.8	26.5	25
Difficulty in availing Credit	0.0	10.3	23.5	66.2
Scientific Knowledge in Rearing Dairy	2.9	17.7	33.8	45.5
Lack of Training	13.2	5.9	17.7	63.2
Lack of Exposure to Mass Media/info	23.5	23.5	11.8	41.2

Table 10: Frequency of Use of Extension Services (n = 69)

Service	**Always**	**Sometimes**	**Never**
	%	%	%
Private Extension	21.7	37.7	40.6
Public Extension	0.0	30.4	69.5
Print Media	0.0	27.9	72.1
Radio Programme	2.9	7.3	89.9
Television Programme	2.9	7.3	89.9
Mobile Apps	0.0	0.0	100.0
Social Media	0.0	0.0	100.0
Text Messaging	0.0	0.0	100.0
Other Farmers	8.9	44.8	46.3
Members of the Dairy Association	1.5	8.7	89.9
Research Organizations	0.0	13.0	86.9

Losses

Fifty farmers reported losing animals within the last five years, due to diseases, estimated at about TT$1.03M. Forty-three farmers reported losses by theft of 165 animals within the last five years estimated to be TT$651,000.

Issues with Extension Services and Media

Dairy farmers did not appear to place great emphasis on the use of extension services for assistance (Table 10). Some 69.6% of farmers indicated that they never use the Ministry of Agriculture's Extension Services. 21.7% indicated that they used the Extension Services from Nestlé and from other private organisations. There was little use of traditional media (radio, television, newspaper) and no use of modern media (social media tools).

Discussion of Key Findings

Farm and Farmers' Characteristics

The age of the farmers was of concern since the majority of farmers fell within the 41 to 60 age group. This has implications for the continuity and sustainability of the sector, as well as the willingness for the adoption of modern technologies

Since 90% used family labour on the farm, the industry offers good self-employment and this is positive for the industry.

The energy status or health of an animal and the relationship between milk production, health and the amount of body fat used by lactating dairy animals can be determined by the body condition score (BCS). Of the herds assessed in the study, a mean BCS of 2.32 was found, with only 18 % of the herds having a BCS of 3.6-3, indicating good condition, since the ideal BCS is 3. There is need therefore to improve the BCS of the herds, which could be attained by better nutrition, improved forage use and better management practices.

It was found that the majority of farmers still milked cows by hand (59%). This implies that the majority of farmers use low technology on their farms.

The majority of farmers (71%) did not keep physical records. This would affect their capability to access credit as well as to ascertain if their farms are making a profit.

Praedial larceny was a concern to the farmers, since 48% of them were affected. There is need therefore to implement policy which would strengthen the national praedial larceny squad to deal with this constraint.

The majority of farmers (89%) had basic shed structures and the majority (61%) practiced extensive grazing. There is a need therefore to move to more semi-intensive and intensive systems, which could utilize better forages and lead to increased milk production.

Dairy Issues

The price offered for raw milk by the main milk processor, Nestlé was $2.35 and a $1.50 subsidy was paid by the Government of Trinidad and Tobago to give a total price of $3.85 per kilogramme of raw milk. Raw milk was brought to four milk collection depots owned by Nestlé. The milk was tested daily. Farmers had the opportunity to receive a bonus based on the quality of milk they produced, which acted as an incentive. This process begs for revision towards simplification and a

timely, singular payment entity.

Another buyer of raw milk was Medford Farms, which also purchased milk from dairy farmers, in a smaller quantity. Medford Farms paid farmers $5.00 per kilogramme of raw milk. The milk was collected at the farm or brought to a specified location.

It was found that the cost of production per kilogramme of milk was $5.22. The revenue obtained per kilogramme of milk was $3.85 (from Nestlé plus subsidy) and $5.00 (from Medford Farms). The cost of production was higher than the revenue received from the milk processors. Consultations among all parties involved, with the outcome of a favourable price for all, must be done urgently to arrest the further decline of the industry.

Constraints

The major constraint reported to dairy production was the cost of feed. Hence the majority of farmers tended to practice extensive grazing which resulted in poor nutrition of the animals, as evidence by the low BCS of the cows. The use of poor forages and deficient management practices must be addressed if milk production is to be improved.

An improvement of the cow's nutrition, management and ultimately milk production could increase family income and by extension, the number of cows. Research and development and promotion of improved forages are essential. Training for on-farm management practices could be a complementary activity.

Land tenure was also reported as a major constraint by a high number of farmers (41%). Security of tenure assists with access to financial support from lending institutions, which was reported as a challenge. Another constraint mentioned was labour costs. All these constraints impact negatively on the survival of the industry.

Price received by the farmers was reported as an important constraint by 91% of the farmers.

Farmers belonged to various dairy groups, however they cited lack of leadership within these groups as a major constraint. There were conflicts within the groups and even the presence of sub-groups within the main groups. These conflicts could undermine the proper functioning of these groups and affect the sustainability of the industry.

Animal losses due to diseases and praedial larceny were also of importance, indicating that there was a need for better animal health care and security of animals. General management training is underscored once again.

Conclusion

Based on the results obtained, it was concluded that the dairy industry of Trinidad is in need of revised policies, directed programming efforts and increased stakeholder involvement that would serve to empower dairy farmers to produce in a more economically feasible manner, as well as promote the industry.

Recommendations to improve the dairy industry of Trinidad and Tobago

* Further investigation into the efficiency of milk production in Trinidad and Tobago.

* Concerted efforts to support value addition to increase incomes of farmers.

* Policy reform to address the many constraints of the industry.

* Efforts to further reduce praedial larceny must be put in place.

* Further research into and use of improved forages, local forages (Tanner Grass and Elephant Grass depending on the type of production system) and alternative feed resources is necessary. This could reduce the cost of production for farmers.

* Forage banks need to be strategically established to ensure availability of forages to all farmers throughout prolonged periods of dry weather.

* Training in management and advocacy for the Dairy Association. It is an important asset to dairy farmers, one which can be used to influence policy and decision making within the sector.

* Improved and dedicated extension services by Government to assist farmers.

* Utilization of social media and other forms of mass media for the delivery of extension services to the dairy community.

* Herd composition should be improved so that the number of heifers and female calves are approximately 40% of the total number of dairy cows to ensure herd sustainability and production levels.

* Improved estrus synchronization and on-time insemination via Artificial Insemination services. Sexed semen can be used to ensure the production of heifer calves.

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