A REPORT
AFTER EXAMINATION
OF "DAIRY FARMING" METHODS AND SYSTEMS
AS PRACTISED IN TRINIDAD.

by

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<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Agricultural history of Trinidad</td>
<td>1</td>
</tr>
<tr>
<td>East Indian peasants</td>
<td>2</td>
</tr>
<tr>
<td>Review of literature</td>
<td>2</td>
</tr>
<tr>
<td>Stock improvement in the Tropics</td>
<td>2</td>
</tr>
<tr>
<td>Methods of establishing dairy cattle strains</td>
<td>2</td>
</tr>
<tr>
<td>Origins of Shorthorn and Ayrshire cattle</td>
<td>4</td>
</tr>
<tr>
<td>Previous methods of type fixation</td>
<td>4</td>
</tr>
<tr>
<td>Cattle</td>
<td></td>
</tr>
<tr>
<td>origin</td>
<td>4</td>
</tr>
<tr>
<td>distribution</td>
<td>5</td>
</tr>
<tr>
<td>introduction to West Indies</td>
<td>5</td>
</tr>
<tr>
<td>Reasons for milk demand</td>
<td>5</td>
</tr>
<tr>
<td>Disease amongst cattle in Trinidad</td>
<td>6</td>
</tr>
<tr>
<td>Writer’s outlook</td>
<td>6</td>
</tr>
<tr>
<td>Stock improvement in Trinidad</td>
<td>6</td>
</tr>
<tr>
<td>Lines of enquiry</td>
<td>7</td>
</tr>
<tr>
<td>Difficulties due to the present war</td>
<td>7</td>
</tr>
<tr>
<td>Smallholder cow keepers</td>
<td></td>
</tr>
<tr>
<td>general</td>
<td>8</td>
</tr>
<tr>
<td>fodders</td>
<td>9</td>
</tr>
<tr>
<td>feeding</td>
<td>10</td>
</tr>
<tr>
<td>cattle</td>
<td>11</td>
</tr>
<tr>
<td>management</td>
<td>12</td>
</tr>
<tr>
<td>examples</td>
<td>12</td>
</tr>
<tr>
<td>Medium sized dairies</td>
<td></td>
</tr>
<tr>
<td>general</td>
<td>14</td>
</tr>
<tr>
<td>visits</td>
<td>14</td>
</tr>
<tr>
<td>feeding</td>
<td>15</td>
</tr>
<tr>
<td>Large dairies</td>
<td></td>
</tr>
<tr>
<td>visits</td>
<td>16</td>
</tr>
<tr>
<td>feeding</td>
<td>17</td>
</tr>
<tr>
<td>stock</td>
<td>17</td>
</tr>
<tr>
<td>Discussion</td>
<td></td>
</tr>
<tr>
<td>general</td>
<td>19</td>
</tr>
<tr>
<td>pasteurising</td>
<td>20</td>
</tr>
<tr>
<td>fodders</td>
<td>20</td>
</tr>
<tr>
<td>stock</td>
<td>20</td>
</tr>
<tr>
<td>constitution</td>
<td>21</td>
</tr>
<tr>
<td>Recommendations</td>
<td>23</td>
</tr>
<tr>
<td>References</td>
<td>26</td>
</tr>
<tr>
<td>Bibliography</td>
<td>26</td>
</tr>
<tr>
<td>Photographs</td>
<td>27-30</td>
</tr>
</tbody>
</table>
This report is a survey of milk production from cattle, and its various aspects in Trinidad. It was allocated to the writer, to form part of his course as a refresher student at the Imperial College of Tropical Agriculture, and carried out under the guidance of Professor Harrison, who suggested methods for obtaining information. The object is to obtain information regarding the present position of dairying in Trinidad, with especial attention given to breeding.

The investigation, though it entailed visits and enquiries over the western half of the island, was mainly confined to districts within ten miles of Port of Spain, where, some two hundred visits were paid in approximately one hundred and seventy hours, and about five hundred miles travelled by car. Visiting commenced in November 1939, and continued at intervals till June 1940.

Dairying, especially in Trinidad, presents an infinite variety of interesting problems, facts and conjectures for study, and is an industry to which much attention should be paid, especially when it is learnt that well over £100,000 worth of condensed milk is imported annually. This report will be confined mainly to breeding, feeding and management, with particular attention to stocks used. These three points go hand in hand, and, though management and feeding are extremely important, without the animal they are useless.

Trinidad.

Trinidad lies ten degrees north of the equator, and is therefore tropical; it has a fairly even temperature varying around eighty degrees Fahrenheit throughout the year. There is a wet and a dry season, the latter normally extending from February till May, though for the last few years these have not been so definite as might appear from their names.

The island is mainly agricultural, consisting of estates which were originally from six hundred to eight hundred acres each in extent; now some have combined either privately or by companies to form estates of several thousands of acres, while others have been subdivided to give the small peasant holdings; this accounts for the smallest units dealt with being grouped in different areas. The small size of these holdings is due to the estate owners, when the slaves were freed, putting up the price of land and limiting the amount bought to less than could give a livelihood, so that the estates were assured of labour. However at present most estates are making increased use of mechanical appliances, and so reducing the need for labour, thus not only will land settlement be more favourably regarded, but there will be an increasing demand for such schemes.
East Indians, who originally came to Trinidad as indentured labourers, usually are the owners of peasant stock, as other types are said to be generally too lazy to give the constant attention which all livestock require. These people number one third of the total population of the island.

Review of literature.

Few direct references to the dairying industry in Trinidad were found apart from two addresses by Capt. H.V. Metivier (1, 2), two publications by Dr. Shannon, one of his assistants (3, 4), part of a report by Professor Hammond (5), and Professor Wood’s book on cattle in the tropics (6).

Reports and reviews of the various agricultural and veterinary departments of India, Africa, the Phillipines and the United States, were read as well as a miscellany of articles in the different dairying and genetics publications, hoping to find that a certain method of breeding was being successful in different tropical countries. However, it appeared that in Texas the Zebu was being used to improve European blood, in Nigeria grading with European stock had so far failed, in South Africa the Cape cow had been evolved from the Dutch Friesian and the Afrikander, although good herds of pure European stock were doing very well there. The Military Dairies in India have not been too successful with the Zebu-Ayrshire crosses they were using; but the milk strain selected from the Sahiwal is making a name for itself. These were used as foundation stock, not because they were any better than others, but because they were on the spot and not too expensive—no reference can be found to substantiate this.

There are three schools of thought as to the best method of establishing a tropical dairy strain. Professor Hammond recommends grading up local stock with European bulls; others with experience in India believe that grading up will only lead to failure and that selection should be purely within the local foundation stock, as has been done with the Sahiwal. A third group believe that the milk strains of the Murrah water buffalo should be intensified, as these animals are already acclimatised and show a capacity for producing milk. Here in Trinidad, there are herds of water buffalo, Friesians, Zebus, various other European crosses and the heterogenous mixture of the peasants, so that information regarding these in the island is increasing, though not recorded.

There is no reason why every one of these methods should not be successful, but unless one method is strictly adhered to, no result of any value will be obtained.

It should be remembered that there is an urgent demand for milk now, and not about to be in a number of years, also that as much use as possible should be made of existing stocks with as great economy as possible, without harming any scheme.
Sir Arthur Olver writes:—"Approximately the same average yields are obtained by the Military Dairies from their herds all over the country, though they are necessarily maintained under entirely different conditions of climate and soil. It is clear in fact that unscientific feeding and management are the main causes of degeneration, not climate, and it is essential that the ryot should be brought to understand that it is economically unsound to feed his cattle mainly on such inadequate foodstuffs as rice straw and overripe grass, and that it pays much better to introduce good fodder crops, particularly legumes, into his rotation, than to devote the whole of his land to the production of grain crops. The most feasible way of effecting this seems to be to assist suitable ryots to obtain good cows of the same breed, in areas where pedigree bulls are available, and to give them every possible assistance in breeding and rearing good stock from them, which if properly developed could be registered and marked as pedigree animals. From such cows, properly fed and managed, he would learn that besides obtaining more milk, better progeny and better manure for his land, he could feed his family better; and our experience has been, for example at the Amand Creamery in Gujarat, that wherever a steady market is provided for milk or other dairy produce the ryots in the vicinity soon become anxious to secure good cows. That being so it should not be difficult where suitable bulls are available to arrange for the breeding of acclimatised pedigree stock by ryots throughout the greater part of India, and I suggest that a system of issuing pedigree cows on part payment would be the most suitable way of effecting this.

For the proper care and feeding of such cows and their progeny, control by an expert department would be required, and systematic investigation of the foodstuffs locally available and of stock diseases."

It is hardly necessary to comment on the above statement, except to point out that under tropical conditions a suitable cow must first be obtained, which is then not only maintained at the height of its capabilities by suitable feeding and management, but with time improved still farther. One must remember when discussing breeds of livestock, that strain is as important as breed, since the difference between strains may be as great or greater than between breeds. Thus, there have been dairy herds of Herefords and beef herds of Friesians. The work carried out by some of the experimental stations and private enterprises may therefore have been pronounced good or bad without due regard to strain or to the individual animals. Where the areas paying for experimental work are small with a still smaller cattle population, available
money, time and space are all restricted. This may partly explain why different places find different crosses or pure breeds satisfactory.

The Friesian, a Dutch breed, was introduced to the subtropics by the earliest Dutch colonists in South Africa and found to be satisfactory, before attempts were made with British breeds.

Britain is recognised as having produced some of the finest strains of cattle both for milk and for beef in the world.

The Shorthorn breed was improved and standardised by the Collings, Booths, Bates and Cruickshanks. The three former selected a type and inbred continuously, achieving fine results, whereas Cruickshanks, not liking this type, selected good animals of varied points and breeding, founded a herd from the mixture to produce the forerunners of the Scottish Shorthorn which is now world wide.

The Ayrshire was produced at the end of the eighteenth century and had Shorthorn, Channel Island and Dutch blood in it.

The origin of these three breeds is mentioned to give some idea of methods previously used and the results obtained. The value being in the fact that no matter how the breed started, either from a single type or from a wide selection of types, a distinctive final type was obtained and fixed. This could not have been achieved unless the type had first been visualised and severe culling practised, combined with breeding records, herd books, and milk recording for dairy cattle.

The final results of much work show the cream, the very best, but it must never be forgotten that there would be seventy to eighty per cent at least of quite useless discards, and so long as no selection and no breed recording lasts, this seventy to eighty per cent continues to exert the major influence at an ever increasing rate. This is an extremely important point which cannot be over emphasised. One may say that in the wild state, the bad will increase over the good. Normally this is impossible since nature is the selecting hand and she is severe so that none but the fittest survive; this is especially true of tropical types which are the fittest survivors of recurrent waves of disease and periodic drought through the centuries. Now, with domestication and unnatural forcing of one aspect as in the milk animal, man has taken the selection out of nature's hands, and must, if he would continue to have stock, exercise as rigid if not more rigid control.

CATTLE.

Origin and Distribution.

The genus Bos is believed to have originated in the area where the Himalayas now are, and by Miocene times to have become
differentiated into an Aurochs or Northern type, known as Bos taurus, and the Zebu or Bos indicus type found in Southern Asia and the shores of the Mediterranean. These two indigenous types may roughly be differentiated by the following characteristics: the taurus type is long haired, short horned with thick unpigmented skin, while indicus is short haired, long horned with pigmented skin, and very often a hump on the shoulder while the former has a straight back line. Thus the Zebu may be associated with the dark skinned native races of mankind and low latitudes. Natural selection amongst the Zebu type took place in India, Africa and the East Indies where breeds suitable to tropical conditions were evolved.

Introduction to the West Indies.

The Spaniards first brought cattle in 1494, to the islands of Puerto Rico, Jamaica and Hispaniola (Haiti and the Republic of San Domingo), leaving them behind when they departed to exploit the mainland (8). These would be of the Bos indicus type. No date of their first appearance in Trinidad can be found, but buccaneers are spoken of hunting Wild cattle for their hides in the latter half of the sixteenth century. The name buccaneer is derived from the boucan where meat was preserved by smoking. Later, Indian Zebu cattle of the Mysore, Gujerat, Nellore and Hissar breeds were introduced purely for work purposes, with no milking tendency apart from rearing a calf; later still European breeds were obtained to improve beef, milk and dual purpose qualities. Thus the Jersey, Guernsey, Red Poll, Devon, Ayrshire, Shorthorn and Friesian were all imported intermittently. These have impressed certain characteristics on the common stock of the island so that when travelling round they are quite noticeable. Probably imported bulls being valuable and scarce would be inbred.

Originally, in Trinidad all the towns and villages had a number of public savannahs on which cattle were kept for a dollar per head per month. Pure bred Friesian bulls were maintained there free of charge by the government. Gradually with increased population these savannahs have become "enclosed" and changed to recreation grounds. Thus there are increased numbers of people, requiring more milk for health, and fewer central grazing grounds, which also provided the easiest method of reaching the peasant with the most suitable bulls.

Dr. Shannon calls attention to the shortage of dairy cattle in Trinidad and to the increased demand for milk caused by the desire for better living by some, and by the decision of the government to supply milk to all school children after hearing the report of the Nutrition committee, to the effect that all health and disease, subsequent to malnutrition, is widespread in the island and that the main cause is a lack of fresh milk, milk products, animal proteins and fats; another reason is the present
success of modern commercial dairies and milk bars. These facts indicate that the breeding of dairy cattle and the production of milk should prove a most profitable form of animal husbandry.

**Disease.**

Disease amongst stock here does not appear to be great. All dairy cattle are tested annually, by government, for tuberculosis but few reactors are found. Mastitis and bovine abortion has appeared mildly once or twice, but has been quickly eradicated. Bat rabies, carried by Desmodus rufus, until recently was serious but is now under control. The greatest losses are caused by intestinal worm parasites.

Imported stock were liable to contract redwater, etc., but are now all treated before importation, while local stock become immunised at birth.

Animals with unpigmented skins and long hair, though this can hardly be called a disease, suffer much from exhaustion, of which the pigmented, fine haired animals do not show signs; again the dense, tough skins of the Zebu type are said to be more impenetrable to ticks, than the less dense of the European animal.

The evolution of a suitable dairy type in Trinidad is of interest to an infinite variety of people though many of them are not aware of it. The government administrative, agricultural, veterinary, medical, and public health departments, consumers, producers, retailers and geneticists are all concerned or should be.

**Personal.**

The writer feels that some indication of his outlook might be of value to the reader of this report. Though, until the present time he has neither lived in the tropics nor studied any tropical problem and should therefore not be biased regarding any particular point of view here in Trinidad, he may be biased, having been brought up in Scotland and having spent a number of years both in Denmark and in Scotland in close touch with dairying, especially with the Ayrshire breed and in conjunction taking the various established methods of stock improvement in temperate countries as applicable to the tropics.

**Stock Improvement.**

Shortly after the war of 1914-18 interest was taken here in obtaining some satisfactory dairy animal. Capt. Metivier, chief veterinary officer, and in 1923 also in charge of the Government Stock Farm, St. Joseph, gathered together a number of Zebus to form a herd. A bull and a few cows, intended to be from the famous Sahiwal dairy strain, were shipped from India to aid in this project, unfortunately these animals were found to come from the common stock from which the improved strain was selected, and have been of very little value. However, about the same time
various strains of Canadian Friesians were imported, and these both crossed and pure are giving satisfaction. Capt. Metivier is working more or less on the lines suggested by Professor Hammond whose figures from Hope Farm, Jamaica were worked out by Edwards showing that for milk inheritance and constitution 1/4 to 1/32 Zebu to Friesian blood would prove satisfactory.

It soon became evident that with the "enclosing" of the public savannahs some other way of giving people with cows the service of good bulls was necessary, so Breeding Units were started and now number five. These consist of good males of every stock type, standing at stud in advertised districts for four months at a time, so that now in one year they cover fifteen different areas. At the same time additional Friesian bulls are kept in districts with a heavy cattle population.

The Lines of Enquiry.

The milk producing people here for the purposes of this report fall into three fairly well defined units.

1. The smallholder cowkeepers with generally from one to six cows, mostly producing milk for their own consumption and retailing any surplus to a very limited local area. They are practically all East Indians with a low standard of living, and are purely milk producers, as apart from one or two they have not enough cows to form a herd. They will be referred to in future in this report as "holders".

2. The medium sized dairies which are under the immediate supervision of the owner or manager, consisting of from ten to thirty good graded European stock. The milk from these is distributed widely over local areas.

3. The large dairies of which there are three, are all run in conjunction with large sugar estates, by a manager; the milk is retailed widely.

Naturally, between the first and second classes no hard and fast line can be drawn, however, those in the second class are intelligent men who try to keep up to date with dairying by reading.

There are hundreds of holders compared with ten or so medium sized and three of the large dairies.

Apart from two, all places visited lay within fifteen miles of Port of Spain.

The British Empire, and therefore Trinidad, has been at war during the whole of this survey, consequently, imports of milk, milk products, and all types of cattle foods have been greatly restricted, so that milk producers have been feeding what they could get and not always what they wanted, quite apart from many other difficulties.
I. SMALLHOLDER COWKEEPERS.

These holders are dealt with in general, apart from giving
the various localities in which they may be found, for two
reasons: a) It is difficult to be sure of finding any particular
holder.
b) They are in general very alike in each district.

When visiting, the writer often travelled by car in a
selected district until cows were noticed. The car was then
parked by the roadside, and anyone seen was questioned till
the owners of the cows were found. Generally they were very
helpful, answering most questions, though not necessarily
truly, and directing one to the nearest neighbour with more cows,
who was generally not more than a few yards away. Therefore
once in any district one can generally dispense with a car.

One had to depend greatly on what was seen, since no records
of any sort were kept amongst the holders, nor were memories
all they might have been. They had difficulty in understanding
what the writer was saying, while he had similar difficulty in
making sense from what they said as they spoke a mixture of
English and Hindustani and in some cases only the latter,
however one could generally get hold of small boys as interpreters.
The holders had a habit of breaking up a conversation to ask
for things, at the same time saying how poor and ill they were
and how much better off their neighbours were; certainly many
did look poor and weedy. Occasionally, if they thought one was
a government official they would act unnaturally, becoming silent
or abusive, complain about fines, water supplies, rents, etc., or
whisper confidentially derogatory information about a neighbour.
They did not appear to have had an upbringing or training
suiting them to care for stock and this lack of education and
training may be more difficult to overcome than stock or feeding.

Visits to holders commenced in company with Dr. Lumsden,
an assistant to Capt. Metivier, and Mr. Carr of the Public
Health department, who were performing the annual tubercle
inspection of all dairy cattle in Trinidad; with them and later
approximately two hundred holdings were visited in the districts
of: Warren village, St. Augustine; Curepe; St. Joseph; San Juan and
Santa Cruz; El Soccorro and Aranguez (Jogi road); 6th Avenue,
Barataria; Dibe; La Ceiba road; Diego Martin; Crystal Stream area;
Rich plain area, and Petit Valley St. Lucian road area. These
groups all lie within ten miles of Port of Spain, and can be
found on the ordinance survey map, sheet B, county St. George.

No instance was found where a holder was solely dependant
on producing milk for a living, though several said they were
even after questioning which showed this to be untrue. While
doing other work, their wives looked after the stock and holding.
These are mostly contiguous, forming blocks, due to the way in which they were originally bought. Many people live in their midst, who are purely householders, generally occupying the best land next the roads as convenient for transport to and from town. Some of the holders complain that they are being pushed out of their holdings, because of the demand for building sites, and that land is becoming scarcer than ever. Many have gardens and rice patches in the Caroni swamp several miles away, while those nearer the hills as in Diego Martin have patches on them to supplement the holdings.

Often when enquiring for the owner of a cow, the reply would be that he was away at his garden or cutting grass, which might take all day; after a time it was found that this was a stock answer, as very often the man was round the corner of the house and just did not want to see anyone or was afraid that his cow was going to be handled. Many of them hate the tuberculin test, and blame it for every ailment the cow or its calf will ever have. There may be some truth in this, as in Britain many believe that a cow may abort from excitement or is upset and falls off in milk yield; as the Zebu cows are very nervous there may be after effects. It was in such cases that the women showed that they had a good bit to do with the running of things, for, though the men might hang back, the women spoke their minds, and after that discussed all sorts of things fairly reasonably and intelligently, then the men would join in and the difficulty was to get away without being rude.

**Fodders.**

The holdings are mostly from half to one acre in size, though some are as much as six or seven acres, about half of which is in sugar cane and the rest planted with maize, millet, cowpea, yam, rice, sweet potato, bananas, coconuts, oranges, etc., and, although there are the vines and straws from them as well as cane tops, there is not nearly sufficient green fodder to supply the wants of a year, so the stock owners cut grass from the bunds of the rice fields, traces in plantations, roadsides, and from under citrus, cocoa, coffee, and coconut trees. They pay about a dollar a month for the feed for two cows, amounting to two or three tons of greenstuff, but which seem cheap, but including time, work and transport, is dear.

Good grass could not be grown on their plots as they said that there was not room, or if they grew it, it was stolen at night, or if para grass, which is considered one of the more valuable fodders, were grown, it made the ground dirty just as couch grass in Britain. If prices for plantation crops were better, many of the plantation owners would prefer to leave the grass under the trees uncut.
The grasses fed varied enormously, both in kind and quality, though para grass was preferred. Some fodders were dusty and half withered, while others were green and rank; some holders fed rice straw indiscriminately whenever they had not time or were too lazy to cut grass.

Feeding.

The amounts of grass fed by different holders varied from sixty to one hundred and forty pounds per cow per day, and was measured by the armful. This, plus four pounds of linseed meal locally known as "oilmeal", formed the maintenance ration. Three-quarters of those visited had the idea of feeding more meal to a cow giving more milk, the others gave the same amount all the time. After much questioning it appeared that the above was the desired feeding and in many cases not what they got. A few used coconut meal, but as it goes rancid, it is not much favoured, though war restrictions are forcing it into more general use, which should be a good thing, as it is a locally produced concentrate. Rice water and any rice left over from the house is always used. Some used to feed two pounds of rice in place of the "oilmeal", as they said it stimulated the milk yield. Since the outbreak of war rice has become too expensive for this purpose. A few used soya bean meal, coconut meal and linseed meal mixed, while others used stuff bought from the local shop which might contain anything. The concentrate in all cases was fed in the form of a very liquid swill, with salt and molasses added—about two pounds of meal, half a pound of molasses, and a small handful of fine salt in four to five gallons of water. This was given twice a day and occasionally thrice. Many holders firmly believed that cows would not take water in any other way. In no case was a mineral mixture fed or even lime itself to supplement the lime and phosphates deficiency which is shown in these districts by soil samples, crop tests and the general condition of the stock. Some are getting waste citrus skins from the citrus packing factory, which according to Professor Hardy contain a certain amount of lime and essential oils, both of which appear to be beneficial to the cows. It is surprising that more trouble is not experienced from rats and the concentrated foods, as the latter are mostly left in the open bags open to water both from above and below.

Cattle.

Their cattle were mostly Zebu graded with Friesian from the Government Stock Farm. The greater the interest taken in the cattle the greater the amount of Friesian blood in the stock, except on one or two of the more distant holdings, where the bull was said to be too far away; some said that the only reason they used the Friesian bull was because they were told to do so,
though by whom they would not say. Approximately half the cattle were of a reddish dun self colour, looking more Zebu than Friesian and showing signs of short horn and Guernsey blood.

The extreme docility of the Zebu bulls and the nervousness of the cows was very apparent, though neither required much tethering in the byres, where a piece of light string round the horns was sufficient to hold them. Accidents have occurred since the introduction of European stocks, as these bulls are always treacherous and those accustomed to handling Zebus occasionally forget this. In many cases however, constant underfeeding and exposure had reduced the bulls to a state of apathy. Though the East Indians all liked their cattle this did not help them to understand that stock have feelings will starve and stop milking if unfed. There was a lot of callousness, mixed with obea in their handling of stock; coloured rags were tied round animals’ necks to make them well, when they were often only suffering from starvation and worms.

A fairly general loss of bone and constitution was apparent. Milk yield is reckoned in bottles of which six go to make the imperial gallon, and cows are bought and sold mostly on the number of bottles they give per day on calving. Little attention is paid to length of lactation. A fifteen bottle cow is considered reasonable, a twenty bottle one good, but there are many eight and ten bottle cows. The lactation period of a holder’s cow corresponds to the time required to suckle offspring, though quite a few now milk up to six months; so that a holder says his cow gives twenty bottles, leaving one to understand that that is the peak of the yield which lasts from three to six months. These cows when bought by better dairymen, properly fed and handled will increase one to one and a half gallons in daily yield, and often milk for ten to twelve months—very definitely showing the effects of feeding and management. The Indian does not appreciate that with a little more expense in the feeding he could make a good profit.

The owners, in a few cases, knew the breeding of their cows for two generations on the dam’s side, but the bull was just whatever was in the district or “up the road.”. They were very vague as to the kind of cow, it was black or brown, or it once gave twenty bottles, or was a cull from a larger herd, where it was next a good cow and must therefore be good. It is quite understandable that they do not know pedigrees, as there are none yet, nor any way of identifying cows and their qualities to the casual observer. However it was found that few people knew anything about the district or the people in which they lived. There was a complete lack of interest, which may have been shyness.
Difficulty was often found in getting a cow in calf, if the first heat period was missed, they might even become sterile.

For various reasons, religious and otherwise, there is a preponderance of uncut calves. The Hindu's religion is against this, while others say the heavy forequarters needed in a draught animal will not develop if emasculated. Again the Hindu objects to killing cattle, but not to selling to a middleman whom they know is buying for a butcher and taking the profit which would make a great difference to them.

As a matter of interest and to show how the imagination must be used, the Indian refers to in heat and castrated, as calling and altered, while plant nutrients are called by some "grease" as they consider that the more grease in their own food the better it is.

Management.

The byres are flimsily built of poles wired together, with a roof of thatch, corrugated iron, or a variety of scraps. The public health authorities are insisting on concrete floors, previously they were of beaten dirt which absorbed all sorts of micro-organisms, even with the concrete floors they are not kept clean. There is a cambre to assist the run off, of liquid manure which is caught in pools over which flies swarm. Some places are kept scrupulously tidy and clean with a liquid clay wash which unfortunately, probably only conceals more bacteria. Many of the holders boasted of how cleanly they did everything at milking time, washing parts of the cow including its vessel; however, they did not wash their own hands, used a dirty cloth, doubtful water, and milking with wet hands would scratch their bodies and feet, pick their nose and teeth. It is illegal to water milk, and though it was never seen, several who had been fined for this were spoken with, nor were they in the least upset, some believed it was necessary to make the cow milk, while others looked on it as a game in which it was bad luck to be caught. Probably neither is the real reason, which may be psychological.

Most are now realising the value of the manure on crops.

Many keep their animals out in the sun all day with no shade, lack of which appears to drain the vitality of the stock. They are tethered and shifted without any system, often amongst scrub which reduces the amount of grazing available.

Examples.

One man kept a bakery, while his mother living with him, had six cows; his father's other widow kept hens. He had one wife at home to help him and another in a shop about two miles away. He had seven children and was about twenty six years old, looked wealthier and healthier than many of the other small
producers. Sanitary conditions here were neither good nor bad, but he wanted to get rid of the cows, because of the flies and the smell. His mother said she did not need to keep cows to live but only because she liked them.

A man in Diego Martin in November had two nice cows but said he was losing money and could not go on with them; visited again in April he had eight good cows and is still losing money though he is getting another eight very shortly. He boards out all his heifer calves with neighbours, who, in payment receive the first calf and the first year's milk, so he gets his animal back just as she is ready to drop her second calf. He tried using a scrub bull, but got weakly calves so is going back to the stud centre which he forsook because of the distance to travel.

An old negro on a savannah near Port of Spain, looking after his two cows and a stirk, said he paid fifty cents per head per month for grazing. One cow and the stirk were about seven eights Friesian, while the other, though half Friesian looked Zebu. The former were in good condition and he said the cow milked well giving ten bottles, had given fifteen and would go dry after milking for three months. He sold his milk to parlours in Port of Spain. He had a shed and a house but no land, would like to have gone further away to get some but felt too old and looked it. He answered enquiries about feeding swill saying: "one man wears shoes all time, he do not go without, other man never wear shoes, do not like wear them." He believed in using the government pure bred stud bull, because he got a better price for the calf as he had a certificate of service, with the bull's name on it and the date, also he believed that the cow herself gave more milk if put to a good bull.

Just before leaving him, two young men came up and led the cattle away wishing us good morning as they did so, to which the old man politely replied. On being asked if they were his sons, it turned that they were plain clothes policemen, taking the cows off the savannah, where grazing was forbidden, to the police station where they would be held till a fine of a dollar an animal was paid. From the way in which this took place it might have been an every day occurrence, and partly shows the carelessness and casualness which is evident amongst these people, and also that it is not always the truth one is told. The beginning of answers to questions having been shown to be faulty, how much of the rest was true?
Medium Sized Dairies.

Passing from the smallholder cowkeeper to the medium sized dairyman, may be described also as passing from the non-commercial to the commercial dairy; both the medium and the large dairies are more truly commercial than most of those in Britain, as here, they are treated as an investment by business men.

The dairies visited lay with one exception in or around Port of Spain, where their customers were.

None of the owners or managers were brought up to handle stock; their previous experience shows the variety of people engaged—one was a sailor, another an estate manager, a third a retired race horse owner and trainer, a fourth the wife of a retired ship's doctor, while a fifth left an agricultural college to build up a herd of his own.

Three-quarters of them had no other means of livelihood and the most efficient and promising were run by them. The more efficient they were, the higher the infusion of European blood in the stock, mainly Friesian, though in the dairy which appeared the best (A), the manager has introduced a lot of Ayrshire blood and is trying, in spite of the war, to keep on using Ayrshire bulls. All his animals have good bone and milk well, nor do they show any signs of degeneration. He has retained the pigmented skin of the Friesian and Zebu, and possibly the fine dense skin of the latter. He may obtain a sound udder which will not break down, good butter fat and general thriftiness from the Ayrshire, but it must not be forgotten what Professor Crew says:—"Ayrshires will continue to remain Ayrshires only so long as they live in an Ayrshire, which is not a county of Scotland, but is a peculiar combination of human stock, social organisation, husbandry and climate. Transplant the Ayrshire and it will become more or less, different, better or worse." As this man keeps very complete records it should be worth while watching his results.

A relation (B) of (A) is following his methods but sticking to the Friesian-Zebu cross and getting some very nice calves.

The people running these dairies are intelligent and can decide their own line of procedure after making enquiries regarding feeding and breeding, though some require a number of things brought to their notice especially sanitation. None of them are making proper use of byre washings or manure, even in the dry season when grass is scarce.

Two dairies in San Fernando (C), (D), though not visited for this report might be worth calling on.

Visits.

(A) has two acres of steeply sloping land, with a thin top layer of humus overlying sandstone, giving poor grazing, and more for exercise.
The herd consists of eighteen milking and three dry cows, one bull, five heifers and seven heifer calves; of these, ten are half Ayrshire, half Friesian-Zebu, one Ayrshire and the rest high grade Friesian. The average milk yield per day over a number of years has been twenty seven pounds, but is steadily increasing and is at present thirty two pounds per cow per day. The average age of the herd is five and a half years, with ten to eleven months lactation, calving every twelve months.

Each day forty five gallons of milk are retailed at twenty cents per quart, in three deliveries, covering fifty two miles. There are occasionally extra deliveries.

Feeding.

The concentrated mixture consists of 200 lb. soya bean meal, 125 lb. linseed meal, 150 lb. coconut meal, 60 lb. bran, 2% minerals, 1% salt. This is fed at the rate of four pounds for every gallon of milk, and works out at 1:4 2 of protein to starch equivalent; it costs 2,15 dollars per 100 lb. At times he also used Purino a proprietary food from Canada, 34% mixed protein plus half coconut meal, costing 2,50 dollars per 100 lb.

The heifers are fed a mixture of 200 lb. coconut meal, 100 lb. oats, and 60 lb. linseed meal, at the rate of three to four pounds a head.

Each month thirty thousand gallons of water are used for all purposes. Each cow drinks about eighteen gallons a day.

He values his stock at 4,500 dollars, though bought originally for eighty to one hundred and fifty dollars apiece, the latter price was for good calving heifers or cows. He has complete breeding records, is a member of the National Institute of Dairying, Reading, and would like more land to carry two cows per acre at about six dollars per annum.

His labour and costs per day are:—two milkers at 72 cents, one boy at 40 cents, one maid at 40 cents, and one van driver at 86 cents, totalling 3,10 dollars. He does not want to go beyond thirty milking cows because he finds that dependable labour is the limiting factor.

(E) who is in charge for his mother, has eighty two head, consisting of 34 milking and 6 dry cows, 2 bulls (1 Friesian, 1 Guernsey), 20 heifers, 8 stirks and twelve calves. They graze six acres and average fifty gallons daily. He has fourteen acres altogether giving grass for eight months; during the other four months he cuts grass from estates as far off as fourteen miles. His land also is on a steep slope with a stream running through it. The dung is put on the grass and the liquid manure run into the stream, though the public health authorities are now requiring him to find some other method of disposal. Eleven thousand gallons of water are used daily for all purposes.
He is trying to get a Friesian-Guernsey cross with as little Zebu blood as possible.

His staff consists of five men who milk, wash and feed the animals, three men and a lorry driver to cut and cart grass, one boy who delivers milk and helps in the dairy, plus a clerk. This labour costs him on an average 4.50 dollars per week per man.

Each cow for maintainance receives 70 lb. grass plus 4 lb. of concentrates, and 4 lb. concentrates for each successive gallon. The concentrate consists of: 3 parts coconut meal, 1 part soya bean meal, plus certain wastes from bakeries, fine salt and citrus skins.

The cows are out at night and brought in for milking twice daily, except heavy milkers which remain inside till milked an extra time at noon.

(F) has a very modern and well equipped dairy, though just recently started. He buys an excess of useful looking cows of all kinds of breeding, picks the best thirty for milking and runs the rest in paddocks with a bull, to sell on calving. He attends to the managing and retail side himself, keeping a man to attend to the feeding. As the whole concern is still in its infancy he did not want to say much about things, till he had proved certain ideas of his own.

(G), in Tobago, was visited during one of the college tours. He is grading local stock with Friesian blood, which he got from Lord Rayleigh in England. The stud bulls are the four year old, Terling Glorious, and a son out of a pedigree Ceres cow. These strains proved themselves in South Africa, and were reimported to Britain. This is the only case which could be found in the West Indies where a tried strain is being used. Good results should be expected, but the bulls are still too young to be proven sires.

These medium sized dairies are therefore, of a convenient size to be under thorough supervision, and, as in most cases they are the sole livelihood of the person concerned, everything will be done to meet whatever regulations are in force, regarding clean milk production.

Large Dairies.

These are not so much large dairies, as dairies attached to large sugar estates. There are three (K), (L), (M), all well equipped, with good housing and sanitation. The two latter are medium in size, supply milk and manure, and if possible though not necessarily show a profit, the third is large and definitely commercial, with two hundred and fifty head of cattle. It lies some fifteen miles from Port of Spain, and has a modern distributing centre run in conjunction with it there.
The pasture and buildings occupy some fifty acres, and in future a further twenty to thirty acres will be cultivated for fodder.

There are one hundred odd milking, and fifty dry, cows plus followers which here amount to one hundred. Bull calves are sold within ten days of birth. The average milk of the herd per day is two and a half gallons.

**Feeding.**

Sugar cane tops or Uba cane are fed during ten months of the year, and Uganda and Elephant grass during the other two months. The animals get fifty pounds of chopped cane tops, or eighty pounds of grass, plus 1 1/2 lb. molasses, 5 lb. of concentrates for maintenance, and 4 lb. for every gallon of milk. The mixture for milking cows is: 250 lb. coconut meal, 125 lb. linseed meal, 99 lb. wheat bran, 30 lb. soya bean meal; for calving cows and heifers: 200 lb. coconut meal, 245 lb. linseed meal, 69 lb. wheat bran, 15 lb. salt; dry cows: 400 lb. coconut meal, 50 lb. linseed meal, 33 lb. wheat bran, 15 lb. salt.

The salt is supposed to be a lime-salt-mineral mixture. They also have used Purine, and for calves another proprietary food called Calf Manna.

Twenty five or thirty men are required to run the dairy, one man can completely attend to ten milking cows, or eighteen others, two do nothing else but whitewashing, while two look after the manure which is made in two ways. One, in an open midden with concrete walls, over the contents liquid manure is poured by men lifting it from an open drain leading from the byre. The other method is to make diminutive batteries, which are turned till cured in a week or two. Direct applications of both solid and liquid manure are now being tried on Uganda grass. The latter it is hoped is a strain of Elephant grass resistant to fungal attack. This fungus has at intervals killed off a large percentage of the stools of the common elephant grass in Trinidad.

**Stock.**

The stock consists mainly of grade cows containing 2% to 3% Friesian blood. The owners are doubtful about having more than 2% Friesian blood in case they lose stamina, so they are using for a stock bull, a 3/4 bred son out of Jewel—a 3/4 bred Friesian—by Rutgers King Sadie Vale De Kol, a well bred imported Friesian. This grade bull's name is "Judge", and his dam, the half-bred cow, has averaged over a thousand gallons per year for twelve years.

The dairy was started about 1926 with pure bred, imported, in-calf, Ayrshire and Friesian heifers from Canada, later one Ayrshire and two Friesian bulls were imported. The former was sold in 1934 and the latter died; then the pure bred imported...
Friesian bull "Rutgears" was bought. Again in 1936 they obtained "Carnation Inka Wayne Colantha" from the Carnation farm in the United States, and in 1937 "Autocrat" to put to the daughters of the 1936 bull. Now they are using "Judge". Even with so many importations the basis of the herd is local stock.

Sterility and difficulty in holding a service is experienced, but this has partly overcome by using wheat germ oil, a proprietary medicine, and a Zebu bull. These bulls have much longer penes than the European sires, and so make a service more certain.

The dairy and paddocks occupy fifty acres, while twenty acres of peas are also grown as fodder. The cows each receive 30-40 lb. of cane tops or para grass per day plus half a gallon of molasses and three pounds of concentrates per gallon of milk. The concentrate consists of: 8 parts coconut meal, 3 parts cottonseed meal, 2 parts linseed meal, 6 parts bran, 3 parts soya meal.

There are approximately thirty-six cows excluding followers, descendants of local stock plus ten pure bred imported Canadian Friesian cows and a bull. Progeny have been used for grading till at present with 2% Friesian blood, they are undecided whether or not to raise it still higher. If the war had not intervened, they had intended to import good quality Ayrshire stock, to form a pure bred herd, as they were of the opinion that no really good Ayrshires had been as yet tried.

All the large dairies have well built byres, giving plenty of room for freely moving air, open sides and the cows facing outwards. Abundance of light reaches the floors, and the stalls are cement faced concrete, with roomy curved troughs, which are level with the beds at the bottom of the curve. The tethers and stall divisions are of galvanized iron tubing and easily kept clean. All this reduces the chances of bacteria or moulds remaining in the air or collecting in the concrete and equipment of the buildings.

Thus the large dairies have every opportunity of producing clean milk under sanitary conditions. Their difficulties are the same as those of the other types i.e. feeding, breeding and management though in a different manner. They would never be left quite unstaffed normally, as they could draw on the other estate workers, but greater supervision is necessary. There is an ample supply of good fodder and concentrates, but they still are not sure if it is the best food, grown in the best way, and fed in the correct proportions for cattle under tropical conditions. While with breeding, they can afford to import the best stock, but are doubtful as to the best way of using it.
Discussion.

The large dairies therefore can be considered as definite assets to Trinidad. They help to maintain the fertility of the estates on which they are; they produce a pure clean food, which is as well handled as is known both before and after production; they act as experimental stations, using their own money to work them, and giving strangers the benefit of their work.

At the present time when plantation crops show doubtful promise of profit, and milk imports are in the region of seven or eight hundred thousand dollars per annum, and liquid milk of the best quality is being retailed at eighty cents a gallon—the highest price in Britain, apart from London—is forty-eight cents, and land is dearer—there is no reason why this type, attached to large estates should not be extended, as dairy cattle might be run on some of the waste land, coconut groves and pastures, housed in sheds in the same way as the draught oxen, where they could make dung at night and in the heat of the day, and receive any maintenance ration necessary.

The installation of one or more permanent milking bails of the Gascoigne type, would allow a thorough washing, milking, any extra concentrated food consumption, and if required the automatic milk recording attachment. The estates could easily ensile sugar cane tops in quantity to carry the stock through the dry season. In this way good sized herds might be established with the minimum of cost, something after the style of the Hosier system.

The medium sized dairies produce both the best quality milk and some of very moderate cleanliness. Some are scrupulous in their attention to every detail while others are extremely slipshod. Strictly enforced legal standards for clean milk production would greatly improve them. Some understand feeds and feeding while others have not the slightest idea of them. Some breed with no system or are merely milk producers, buying cows to give milk, while a few have a definite object in their mind's eye.

The large group of smallholder cowkeepers improve their land with the manure and should improve their health with the milk, unfortunately many of them, because of the high price for milk and the fact that they are in debt sell all they can get. Many of them are dangers to the community, because of the filthy way in which the cows are kept and milked, and because the milk so produced is sold and often bulked with good milk. The advisability of keeping goats rather than cows should be advocated, as the former are cheaper, and hardier; cost less to feed, and give milk suitable for a family.
The value of pasteurising milk in Britain and other temperate climates, to avoid the dangers of bovine tuberculosis, is still open to discussion; but as a remedy against the wholesale spoiling of large quantities of bulked milk due to the prevalence of mastitis in the country, it is invaluable. Here, where the temperature is extremely suitable for the rapid growth of bacteria, especially in such a favourable medium as milk, it should be compulsory along with the cooling of milk, which being at one and the same time an excellent medium for carrying all types of infectious diseases, etc., and an invaluable food, should be given the fullest protection possible.

**Fodders.** Mr. Paterson has been carrying out a number of experiments over a period of years to determine the most suitable fodders for Trinidad, their values and the best stage to cut them at; all results are purely on laboratory analyses, assuming that the American and European feeding standards hold good for cattle here in Trinidad, and without being substantiated by feeding trials. Some time ago digestibility trials were carried out by J. Maule, while this year Capstick worked on the digestibility of certain grasses at the Imperial College of Tropical Agriculture. It appears that no result of definite value has been reached as the trials were neither of long enough duration nor carried out on a sufficient number of animals. It does show however that there is a lot of work still to be carried out in this direction, therefore it cannot be sound policy to push cows to give large yields at the present time, while a suitable strain or strains are being sought after and correct feeding is not yet known. It tends to be too much of a strain on the cow on what may very possibly be a quite unsuitable ration, to give large yields, and at the same time remain healthy and fertile, and the mother of strong sound calves, for the future herd. Forced yields would tend to aggravate weaknesses rather than allow for them. It may be argued, that the sooner such weaknesses are found out the better, but they may be brought on by malnutrition, just as is the trouble with the human stock here.

**Stock.** Until the last few years, very little has been done regarding the selection of dairy stock in Trinidad and practically none at all regarding the use of scrub bulls, and unless strict control measures are taken quickly, the remaining stock will not only degenerate in respect of their milking qualities, but also in their desired stamina which has been maintained by their use for draught and may now disappear with the...
Forcing for milk and stopping work. Milk stock require greater attention than working animals, as they become more delicate and refined, and the more milk they give the better the feeding and management they require.

Professor Hammond considered that the degenerative changes he saw in the European breeds were associated with feeding conditions. The better the feeding and management, the less the type was disturbed. He states that the causes of the degenerative changes within the tropics probably consist of a number of factors, among which are the following in order of importance:

1) Sub-lethal infections of tick fever.
2) Lack of concentrated feeds and too much roughage, combined with lack of protein.
3) Selection for size of frame only.
4) Inbreeding.
5) Hair character, with most change in longest haired.
6) Unpigmented skins.

The assumption is that, as Professor Hammond would appear to regard an animal which showed no degenerative changes as having a "tropical constitution", the converse of his causes for degeneration can be taken as his reasons for constitution.

Colonel Matson says that it is the extractive property of the Zebu animal's stomach which confers the constitution which the European types appear to lack.

From the above it would appear that feeding and management are of equal importance to breeding, but it still seems to the writer that though first rate stock by bad feeding and management will become third rate; third rate stock with good feeding and management will improve but never be first rate, and also that the previous quotation from Sir Arthur Olver (7) applies equally well here in Trinidad especially with regard to the holder. The breeding of a suitable type of animal is a direct problem for the government and will take many years whereas feeding and management are more the concern of the holders who can be trained and which could be applied immediately to all types of stock.

As already mentioned there are a number of breeding units throughout the island, plus a number of single bulls. These have been steadily increasing, but as yet, they are not proven, nor is there a proper record of mating results. It seems to the writer that as soon as possible, each of these bulls should have allotted to him a number of cows, which would be cared for by the government. Each bull would move to a different lot of cows each time the unit moved, all the progeny being kept. A rough count in each district travelled would give some idea of the bull's capabilities. This plus the calves produced and grown under controlled con-
ditions would allow of selection of grade sires, which could be proven before being used for travelling, and so allow a start to be made at fixing a type. A number of the dairies have reached $\%$ Friesian blood and apart from one case are not attempting to fix any type.

No reference can be found for the following statement, but it should be borne in mind. Bulls are believed to transmit milk capacity and cows butter fat potentialities; here the high yielding Friesian bulls have been used with Zebu cows known to have high butter fat content, that is very good, but might it not be that it is the Zebu bull that carries the important factors connected with constitution. It is being generally assumed that the male is going to give the valuable characters of the European breed while the cow is rather neglected. The Arabs when breeding their famous horses pay more attention to the dam, and her pedigree than the sire and they are breeding for stamina and constitution all the time. Therefore at the same time the other cross might be attempted for this reason as well as the fact that the Zebu bull and the European cow are both known to be of a much more placid temperament, than their opposite numbers.

Some of the smallholders are passing into the medium sized dairy type, they are the more intelligent, but none of them large or small, apart from one, the manager of which was brought up to dairying in Britain, appear to understand that cows can only be run as businesses and factories to a limited extent.

Dairies all over are on the increase and extra accommodation is being built, yet most say they are just making a living; but if they can make that living in European style on ten to twenty milking cows, then dairying is paying well. This increase will reach a limit when prices will drop, and then will be the time to get the proper selection which is necessary.

As long ago as 1907, Mr. C.W. Meaden, a former manager of the Government Stock Farm, read a paper to the Agricultural society, of Trinidad and Tobago, advocating the formation of a herd book for pure bred Zebus. It is time that a register of some sort should be in existence for dairy cattle. A number of the better dairy men are trying to form a society for their mutual benefit, but it appears that unless government takes an interest in it, it will be useless as a feeling of mutual distrust seems to exist.

People of all types were asked where they got their milk, and why they went there. Every one—policemen, taxidrivers, shopkeepers, city residents, and peasants—said that they made enquiries about cleanliness of handling from neighbours first, and then bought, but did not go to see the premises; the post-
graduate students, newly out from Britain, only thought of the skin on the milk due to boiling.

**RECOMMENDATION**

A number of steps could be taken to improve the quality of milk and the standard of the industry such as:

1. The compulsory castration of all male animals if not considered fit for breeding.

2. Registration of all stock suitable for dairying purposes, and/or the start of a herd book in which animals reaching a certain standard, could be entered and permanently marked. The standard could be decided by a meeting of competent and representative people.

3. An increase in land settlement.

4. Small cooperative creameries, in conjunction with these schemes, which would pasteurise, refrigerate and bulk the milk, prior to organised transport and delivery. The creamery would be held responsible for the quality of the milk.

5. A further increase of classes in schools, as in Tobago, to encourage the keeping of useful pets, such as poultry, rabbits and goats. A table show might be held each term, and occasional talks given by the officers of the various departments.

6. A small bonus to be paid to the cleanest milk producers, and a cup to have the name of the best holder in each district every six months, engraved on it; a cup to each district.

The agricultural shows, both large and small, should be given all the support possible, as they are appreciated greatly. This is shown by the enthusiasm of the exhibitors, and the attendance of large numbers of interested spectators.

7. More work on the digestibility of foodstuffs and fodders singly and in combination should be carried out, on pure bred Zebus, pure bred European and graded stock, over a considerable period. The concentrates and fodders used should be mostly those produced locally, and special attention should be paid to the amount of fodder grown per acre, the number of stock this would feed, and the amount of dung available from them, which would be the basis of the manuring program.

The possibilities of ensiling various fodders, especially sugar cane tops should be investigated.

8. The method mentioned for proving sires and fixing types should be more thoroughly examined.

9. A comprehensive survey of the cattle of the island to be carried out with especial attention to dairying types.

10. A section of the Department devoted to livestock, which could carry out some definite policy.

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SUMMARY.

The report deals with a matter into which the writer was asked to enquire, while a refresher student at the Imperial College of Tropical Agriculture, Trinidad.

The introduction describes in general the area in which enquiries were made, the time spent there and the reasons for the report.

A very brief history of agriculture is given, followed by a review of literature.

The origin of cattle is indicated as in Miocene times, and the differentiation into Bos indicus and Bos taurus types with their respective characteristics, leading on to the first appearance of cattle in the West Indies and the later infiltration of many breeds.

The widespread malnutrition found in the people of the island and the dearth of cattle and cattle products is correlated.

Brief reference is made to cattle diseases in Trinidad, and the reasons why Zebu and European stock are differently affected.

The outlook of the writer is given as it must influence the report as a whole.

Methods of stock improvement up to date are discussed.

The milk producers are divided into three classes, to facilitate this report—smallholder cow keepers, medium sized dairies, and large dairies. These are discussed under the headings of fodders, feeding, cattle, management and examples.

Various ways for increasing the number of dairies, improving the quality of milk and cattle are discussed, as well as the work already carried out on fodders and stock in Trinidad, combined with the opinions of people in other countries bearing on the subject.

The writer recommends that castration, registration, and marking along with an effort to fix a definite type of animal by using proven crossbred sires should be attempted.

Several much more comprehensive digestion trials, on a variety of stock with a variety of feeds, both individually and in combination, should be carried out, and at the same time...
the possibilities of silage investigated.

Support should be given to stock instruction in schools as well as agricultural shows.

The extension of land settlement schemes, and the fostering of a cooperative spirit amongst them if possible.

Finally, a thorough census of cattle with especial attention to dairy stock, should be carried out, and a section of the Department of Agriculture, devoted to a definite policy with regard to livestock.

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"Terling Glorious" 4 years old.
By "Terling Marthus" out of "Gilston.Ymeskje Madrigal 2nd"
Bred by Lord Rayleighs Farms Ltd.
Owned by Mr. Alefunder, Studley Park, Tobago.

"Judge" ¾ bred Friesian by Rutgers
Sadie Val De Kol out of Jewel.
Bred and owned by Trinidad Dairies Ltd.

Zebu cattle grazing. Seen at Govt.
Stock Farm, St. Joseph.

Common type of black cattle seen
with owner. Note general weakness.

Two animals of common stock seen
at Studley Park. Note better
condition due to care. The cow was
giving 700 gallons per annum.
Animals seen at Mr. De Norbrige's in Tobago. Foreground shows a Shorthorn grade, right a Zebu, left Zebu cross.

Peasant's cow and calf, showing the effect of the Government bulls.

The effect of worms.

Individual pail feeding of calves. Note zebu calves, which are never allowed to suck the dams, and so letting a better and longer milk flow.

Boy wiping milk off calf's muzzle. Stops flies laying eggs there, etc. Also at Govt. Stock Farm.
Two photographs of shade trees which should be wherever the tender skinned crossed stock are grazed.

Part of the byres at Jerningham. Note prevailing dark colour of stock, well ventilated, cool sheds, good mangers and tethers, and cows all facing outwards.

Byre at Waterloo, with wide central walk, also well ventilated. Note amount of light entering from sides and yet the cows are shaded.

Peasant byre, quite clean. Animals in good condition.
Peasant cow, stalled facing wall of house, while family sit about and watch it eat.

Peasant cows, underfed, and in poor condition, animal in foreground is the type which should be culled.

Good example of bad sanitation, housing and feeding. Animal starved, roof made of all sorts of litter, standing of mud held together with bamboo and stones, filth on the bed and liquid manure collected just in foreground, and smell strongly.

Black and white calf in foreground is 1 year 4 months old and out of same cow-background-by same bull as 4 months old calf on right. Shows great difference in progeny. Elder calf is uncut bull, younger is a heifer.