

A PLAN FOR THE IMPROVEMENT OF THE  
DAIRY INDUSTRY IN PUERTO RICO

by

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## INTRODUCTION

Dairy cattle have existed in Puerto Rico for the last 454 years when they were first brought in according to Bague (2) by Don Juan Ponce de Leon . Since then, first under the spanish rule up to 1898, and from then on as an American possession, Puerto Rico has seen its dairy industry develop slowly and quite unsteadily until the last 16 years which have been marked by a very noticeable progress.

There are no data recorded which can demonstrate with complete certainty that the first imported cattle belonged to any one definite breed, but Bague (3) suggested the possibility of their being of the same Longhorn cattle introduced to Mexico and from there to the southern part of the U. S.

In the early years of colonisation the main and almost only source of income of the island was agriculture; the standards of living were very low, the agricultural salaries were accordingly very low, land was very cheap and abundant and so milk could be produced, as a general rule, with little regard to costs. In those days, as was happening probably the world over, all the milk produced in the farm was for home consumption and the commercial dairy was a thing unknown.

Even some years after becoming a U.S. possession, the conditions were basically the same except for a great increase in population which had a reducing effect upon the amount of land available and thus on its price.

As the volume of importations from the mainland to the island increased, the production and sale of foods became increasingly competitive. Today, this fact coupled with a large overpopulation, a growing industrialis-

ation which is attracting agricultural workers away from the countryside and a large increase in the salaries for the working class, have put the milk producers on the island in a situation which is starting to become untenable, to a point which for a good number of them, milk production is a losing proposition.

As the reader will readily notice, the conditions in which the dairy industry is today are far from acceptable if they are compared to the standards set by the American dairyman, but there is something that gives the author some hope; they have been worse.

During the last sixteen years there has been a marked improvement. According to Gastambide (15) there was an increase in production per cow of 20 percent from 1940 to 1950, from 1950 to 1955 the increase was 30 percent and the increase in total production from 1940 to 1955 was 40 percent.

The Puertorrican dairyman has to produce more milk for two reasons; first to serve that ever expanding population which is increasing at one of the fastest rates in the world, and second to utilize large tracts of land which are either lying idle or being misused. But to produce and produce efficiently, the farmer has to avail himself of the best that science and experience can offer; otherwise the dairy industry is doomed and the dairyman is on the way out.

This work has been undertaken with the purpose of bringing out the present condition of the dairy industry in Puerto Rico, and of offering ideas for the correction of its deficiencies with the sincere desire that the opinions hereby expressed may be of some benefit in the future.

## CATTLE IMPROVEMENT

As was previously stated in the introduction of this work, cattle have existed in Puerto Rico for the last 454 years. They were first brought to the island by the Spaniards and it has been asserted by Bague (4) that most of them were possibly related to the Longhorns found in other parts of America. After the original importation, a large number of cattle of different breeds had been brought in, to the extent that actually most of the dairy cattle were a combination of Holstein, Guernsey, Jersey, Brown Swiss, Brahma, Milking Shorthorn, and some Ayrshire blood. Although the dairy industry on the island has been what could be termed a melting pot of the seven breeds above mentioned, the great majority of the animals exhibit more characteristics of the Holstein-Friesian than of any other breed.

All along the life of the industry on the island there has gone on an indiscriminate type of outcrossing and crossbreeding with rather poor results production-wise. Lately, with the advent of the organized artificial insemination, the policy has been changed to a grading-up system and this predominantly to Holsteins.

It is the author's opinion that this practice, under actual circumstances is the best possible means to improve the existing stock. Rice and Andrews (10), were of opinion that through this technique a nearly purebred level could be obtained in five or six generations. It is only obvious to add that a strict system of culling would increase the opportunities for improvement. This implies that the agencies in charge of the agricultural education should stress the point of record keeping and selection, having uppermost in mind the production angle.

Another idea voiced by the past State Secretary of Agriculture, Colon-Torres (14), for an even faster improvement of the industry was the importation by the government of one thousand purebred females per year to be later resold to the farmers at the same price they were originally obtained plus the costs of transportation, immunisation, etc. This method undoubtedly would have represented a marked increase in the average production, and would have offered a greater opportunity to the bulls being used by the Artificial Insemination stud because of the undisputable superior qualities of the imported females. This plan was not carried on by the government, so the only action being taken now toward improvement is the use of the imported purebred bulls.

Organized artificial insemination was established on the island in 1953. It was started and is still run by the State Department of Agriculture, but several cooperatives have been organized across the country in such a way that in the future they can be federated and eventually will buy the stud from the Government. The insemination is performed by employees of the cooperatives, which visit daily each dairy. The results achieved so far, have been very good. The average 90 days non returns is a steady 75 percent and the numbers of cows inseminated artificially, according to Gastambide (16) have been growing from 1,150 in 1953 to 2,420 in 1954 to 5,176 in 1955. It was expected that in 1956 there would be an increase of about 20 percent, but in the first five months of the year, the correspondent increase has been surpassed.

If there is any fault in the program it has been the approach taken by those persons organizing it, the author included, toward the farmers. Too much emphasis was put on the breeding phase in order to sell the idea, in

contrast to the small amount of information offered in relation to feeding and management. This fact alone could defeat the purposes of the work done and this situation calls for a vigorous campaign for better raising methods for calves and better feeding and management practices for lactating and dry cows.

It would not be sensible to advise on the advantage of using European breeds of dairy cattle on the island for the improvement of the industry if previous experience had not been had with these animals in the Puertorrican environment.

All five major dairy breeds, namely the Holsteins, Ayrshires, Guernseys, Jerseys and Brown Swiss have been tried on the island. Most of them have been introduced from the continental U.S. by either the Government or by individual breeders. A good other number, especially of Holsteins, were brought from Canada.

#### Ayrshires

The Ayrshires were imported to the island due to their well known adaptation to rugged climate and topography. They were mostly taken to the hilly mountain farms of the west where they would most probably thrive. According to Basherov (5), the first shipment consisted of twenty females and a bull, which came in the mid 1930's. After that, several small groups of this breed were imported, but today very seldom can an animal be found possessing Ayrshire characteristics, a fact which implies the lack of popularity that undoubtedly stems from a very poor adaptation of the breed to the environment.



### Brown Swiss

Phillips (37), asserted that the Brown Swiss breed is the most tolerant to heat of all dairy breeds. That was the reason the breeders had particular interest in the performance of this breed in the tropics.

Unfortunately, there were no existing records to prove either the adaptability or the inadaptability of the Brown Swiss in the Island. Lately, the Government, through one of its agricultural agencies, introduced a large number of these animals and they will probably provide the answer when their records are compiled.

### Jerseys

The Jerseys were introduced to the island for the same reason as the Brown Swiss. Phillips (38) also pointed out the great heat tolerance of Jerseys. The College of Agriculture of the University of Puerto Rico once owned a herd of them and according to Basharov (6), records up to 8000 pounds of milk were obtained from them. All the indications are that Jerseys can be easily adapted to the conditions on the island, but for some reason they do not appeal to the dairyman as the breed to choose and very few of them are found in breeder's herds at present. In recent years, the Government imported a very large number of them and they will probably confirm the previous experience.

### Guernseys

It could be said that Guernseys stand second in number and in importance among the dairy breeds on the Island. There are several herds in the western part of the country where they are more popular. Most of the inform-

ation recorded about them has been published by Basherov while working with the herd of the College of Agriculture of the University of Puerto Rico at Mayaguez. He has demonstrated, through 21 years of record keeping in that herd, that when fed and managed appropriately, Guernseys produce at a similar level to those in most of the U.S. herds.

It has also been pointed out by Basherov (7) (9), that purebred animals born and raised on the Island surpass in production their ancestors that were imported when already mature. Most of the animals of this herd compare favorably with their counterparts in U.S. herds in both size and weight.

This example offers a sound conclusion that there are no detrimental factors that enhance the production of high milk yields provided the animals are bred, fed and managed correctly.

#### Holsteins

According to Phillips (39), Holsteins are the least tolerant to heat of all the major dairy breeds. If the breeders would have reacted according to this opinion there would be no Holstein-Friesians in Puerto Rico, but the reality has been much to the contrary. It can be said that Holsteins and Holstein-crosses actually make up about 90 percent of the total dairy cattle population on the Island. In spite of the difficulty these animals have with the heat, some of them have yielded very high amounts of milk. Huyke (22), reporting on a study made on sixty herds making up part of the milk shed of the capital city, found one case of 60 head with an average annual yield of 11,296 pounds of milk, having two among them which gave over

13,000 pounds and one over 14,000 pounds of milk. One detail that should not be omitted is that these cows made these records on rations far from what is thought as adequate. This is further proof of the potentialities for correctly bred, fed, and managed cows in the Puertorrican environment.

### Selection

One of the most important reasons for the past failures of the Puertorrican dairy industry has been the inability of the breeders to choose the best replacements for their cows. It has been common practice for the farmer breeders to raise whatever number of females were born, completely disregarding their ancestor's records or type. In other words, the process of selection used, when any process was used at all, was based on such things as color markings and in some instances for purely sentimental reasons.

It is only logical to advise that it is of utmost importance to instill in the mind of the farmers the acute necessity of the best possible training for them on the matter of selection. Extension workers should be thoroughly trained in selection methods so they will transmit their knowledge to the breeders. The farmers should have a clear picture of what a good milk cow looks like, a thing which has not been part of their current knowhow.

To stimulate a true interest in the development of superior cattle, local and state fairs and shows should be promoted. The very few fairs which have been celebrated in Puerto Rico have had a tremendous impact upon both the farmers and the general public but it seems that the cost of

annual fairs of this sort and size was too large and therefore, they are held only occasionally. The author cannot overemphasize the great usefulness and promotional value for the industry of such activities as this.

#### Development of a Native Breed

For several years, the Agricultural Experiment Station of Puerto Rico has been working on the idea of developing a so called "native breed." In a very enlightening article by Labadie (33), he explains the procedure used as the crossing of native stock with imported Brown Swiss cattle. The author looks upon the experiment with great respect, but at the same time there are two facts concerning it that makes it look unfeasible. If the information given on the adaptation of Brown Swiss cattle on the island is read, it will be found that their performances were not the best and if to this fact is added that native cows have never been known to be great milkers, it could be concluded that the outlook of these crosses is not very promising. The question has been raised that if there were already breeds that could produce abundantly, why go into such a difficult and improbable task.

#### IMPROVEMENT OF FEEDING AND MANAGEMENT PRACTICES

Time and again it has been proven that the principal direct cause for the low production average of the Island cattle is deficient feeding and management practices. Basherov (8) demonstrated it with the College of Agriculture herd of Guernseys. For a long time, low yields have been taken for granted and not until the last few years, when the milk imported from the U.S. started making competition very stiff to the local producers, had there been a noticeable reaction from both the Government and the dairy

farmers towards a more economical way to produce milk.

Although a pasture improvement program was started by the Government in 1954, it was thought that it lacked something really basic and that concerns the farmers themselves more than the pastures. It is of paramount importance that the breeders have a working knowledge of what feeding is and a clear idea of the hows and whys of feeding.

Still at present times the idea prevails that a cow with a full stomach, regardless with what, is a cow well fed. Hodgson and Reed (21) in a study of dairying in tropical America comment on Puerto Rico that in spite of Government efforts to improve conditions and aside from very few progressive breeders, the yields of dairy cattle are very low. They give as a reason, besides the poor inherited characteristics for production, the poor feeding and management systems for young and adult cattle.

Examples of the above statement can be seen anywhere in Puerto Rico. On the southern semi arid part of the island where the drought season is most severe, farmers have started building silos to be filled with either sorghum or corn, but nowhere can they be seen. It is well known that row crop silage alone is far from being a complete ration for dairy cattle because of its low content of protein, P., Ca., T.D.N. and high water content. But still much worse off are those cattle whose owners do not have silos and which have to subsist on rations of scanty dry mature grass, cane tops which are always mature or fields of corn stalks. On the rainy portion of the Island there is the advantage of shorter dry periods and most of the time green grass is available. In spite of this, when the drought comes, the food becomes very scarce and farmers have to feed cane tops to their cattle because there is nothing else to do. In this area, silos are very seldom found and hay is unknown.

The industry should strive toward improved pastures, if possible, combinations of grasses and legumes. For the dry season in the semi-arid zone legume hay, if possible alfalfa. For the rainy zone, grasses and legume silages would more readily correct the deficiencies.

According to Vicente, et al. (54), the Soil Conservation Service introduced a legume in 1940, namely Tropical Kudzu (*Pueraria phaseoloides*). This legume has adapted very well to those areas with a precipitation of more than 60 inches of rain annually, but singularly very few of the farmers have plained it, the major objection being the fact that it grows slowly and does not adapt well to harvesting by cutting. This legume represents perhaps the only way to improve the ration for the dairy cattle but so far it has gained very little popularity.

It is obvious that the phase of feeding dairy cattle has been largely abandoned and that there is an immediate and acute need for improvement. The problem should be attacked at its roots; that is, college students of agriculture should be given a rigorous training in this phase because they will be the future county agents and vocational agriculture teachers, who will be responsible for teaching farmers better methods. The need to make dairymen conscious of the importance of feeding cannot be overemphasized, and this coupled with economic aid from the Government in the forms of seeds, fertilizers and information on the matter in general will improve the existing conditions.

The item of concentrates is the largest the dairyman has in his business in Puerto Rico. This fact is true, not because farmers use it in excess, but because the Island is a very poor producer of grains and thus, almost all of

it has to be imported principally from the U.S., this making the prevailing prices considerably higher than those on the continent.

Grain feeding of cattle has been a standard procedure on the Island for a long time but the methods used are definitely faulty. There exists no correlation between the quality of roughages and amount of grains fed or the content of protein. Sometimes, the only judgement used is the amount of milk given by the animal and this can be misleading and uneconomical when the ratios used are too wide.

The ratio generally used is one of one pound of grain for every 4.5 or 5 pounds of milk. Miller (34) after exhaustive study of the general conditions recommended an increased amount of grain feeding with perhaps a lower content of protein for milking cows and heifers. As the quality of the cattle improves, so will the ability and know-how of the farmers have to increase to extract from their animals the largest possible production.

#### Feeding of Molasses

Puerto Rico, being a large producer of cane or blackstrap molasses, it is only obvious to say that this material is used to a great extent as part of the common dairy ration. Molasses has a definite place, no doubt, in the feeding of cattle but Puertorrican dairyman are falling in the custom of giving it in much larger amounts than it is proper. This practice may bring undesirable results by reducing the digestibility of higher carbohydrates and increasing the incidence of scours by loosening the bowels in excess and eventually causing an irritation of the mucosa of the intestine.

Farmers should be advised on the proper use of this valuable feedstuff so that they can derive the best results from its use. Amounts of two pounds

per animal per day will not only increase the palatability of poor roughages but will also provide minerals and a good amount of energy without the undesirable reactions.

### Minerals

As Puerto Rico is a tropical country with a high annual rainfall in most of its area, it is obvious that there must have been a serious loss of minerals in its soils throughout the years.

This deficiency has reflected in the size and productivity of the cattle which are noticeably low when compared to U.S. standards.

Reports of an investigation by Miller (35) proves this statement right when he makes recommendations concerning the urgent need to feed mineral supplements. Among the deficient minerals, calcium, phosphorous and the minor elements were mentioned outstandingly.

It is important to make the farmers, particularly those in the wet mountainous area, conscious of the need to include supplements rich in these minerals. This practice should be heartily recommended as a standard procedure, without which it is barely possible to produce milk economically. The same endorsement should be given to the continuous use of salt which is commonly missing in a large number of the dairies.

Vitamins are a detail about which Puerterrican dairy farmers do not have to worry much about. This is so on account of the abundance of green forage that are available most of the year, thus providing all the needed vitamin A and the fact that the sunlight is present always, taking care of the vitamin D requirements.



### Galf Raising

This is another of the notably weak points of the Island dairy industry. The deficient development of the young stock has its roots when the embryo is still unborn. There are very few men that recognize the importance of feeding well a dry cow and therefore the birth weights of most calves leave much to be desired. Basherov (9) observed that after the calves are born they are started on milk which is given for a short period of time, average two or three weeks, and immediately after this they are given either green cut grass, or pasture, or sorge silage, depending on the season of the year. Grains are very seldom fed to dairy animals at this stage of their lives. This system naturally produces thin, unthrifty calves which grow and gain weight very slowly, due both to their inability to handle so much fiber and also to the infestation of parasites which are invariably obtained from the green forages.

This phase of dairying needs a total revamping of its methods and procedures. The feeding of the dry cow must be improved not only for a better development of her calf, but also to replenish her Ca and P reserves to be used in the subsequent lactation. It should be fully recognized that calves up to four months old are not ruminants and therefore can handle only small amounts of roughage. The feeding of milk or milk substitutes is essential for the growth and development of the calf until it is ready to eat fully as a ruminant and grain can be fed together with the roughage.

The feeding of good legume hay is very beneficial for young calves. In Puerto Rico very little or no hay is available at present, and dairymen should make it a primary objective for the improvement of their calf raising program and the dairying progress in general.

## CATTLE HEALTH

Puertorrican farmers have been extremely lucky throughout the years in various respects in relation to cattle health. The fact that Puerto Rico is an Island, has aided greatly in isolating the cattle living there from diseases that in other countries are casually introduced by trespassing or smuggled animals. The Government has also provided an adequate system of inspection of imported animals. Thus, the Island dairymen can be thankful for a total absence of Vibriosis and Hoof-and-Mouth Disease. Clavell (10), discussing cattle health, informs of the almost total eradication of tuberculosis, which actually has been lowered to 0.4 percent of the total population. The cattle fever tick (*Boophilus annulatus*) and thus Piroplasmosis and Anaplasmosis were banished from the Island since 1953. No new cases of those two diseases have appeared since that date.

The above statement comprises those diseases which are nonexistent on the Island or that have ceased being major problems, but still the industry has to fight against several others which cause tremendous losses annually to the dairymen.

### Brucellosis or Contagious Abortion

The disease is actually considered the principal health problem among the cattle of Puerto Rico. According to Rivera (11), the Brucellosis infection was first brought into Puerto Rico by a group of cattle imported from the U.S. about 1923. It possibly went unrecognized for several years because it was not until 1934 that the Federal Bureau of Animal Industry together with the State Department of Agriculture started a campaign for its eradication.

In the years prior to its recognition and perhaps even after the eradication campaign started, the disease had the opportunity to spread considerably through the herds on the Island first due to the ignorance of the farmers and the Government, and later due to the apathy and lack of cooperation on the part of the dairymen. As time passed, the breeders became conscious of the threat and the anti-Brucellosis program has been running more effectively. Up to 1950, a total of 19,806 calves had been immunised with the Strain 19 vaccine and had thus acquired a certain degree of immunity which enabled them to substitute discarded cows far more efficiently.

Records up to 1950 show a variable percentage of infection among the cattle population in different parts of the Island ranging from 1.5 percent in the southeast to 10 percent in the southwest. The overall average for the whole Island, Clavell (11) states, only amounts to 4.9 percent.

The fight against contagious abortion is not over and it is indispensable to be on the alert to avoid as much as possible the introduction of infected animals or a flare-up among the existing stock.

Constant information to the dairymen is mandatory so as to make them fully conscious of the responsibility and make them watchful without the need to be watched themselves.

#### Mastitis

As happens in most of the milk producing countries the world over, mastitis is one of the main draw-backs against better production of milk in Puerto Rico. There is one obvious advantage in the tropic and that is the even temperature that prevails throughout the year. The temperature factor is an important one concerning the incidence of mastitis in the countries with cold climates. On the other hand, there are two things which worsens

the state of things even more; one is the complete disregard that most farmers have for the comfort and cleanliness of their animals, and secondly, the total lack of knowledge of the disease in itself and of the proper control measures. It is a common sight even in the best dairies to see infected animals put together with the non-infected ones and consequently, the infection spreads even more.

As is so common, the farmers have taken the responsibility of diagnosing and treating mastitis without the proper advice of a good veterinarian. The one and only treatment used is the administration of antibiotics which has resulted in a remarkable number of cows developing resistance to the action of a number of these drugs making them of no practical value for further treatments.

Orlandi and Rivera Anaya (36), after studying the problem for four years, recommended the following practices for the reduction of the incidence of the disease and enumerated them as follows: (1) obtain frequent samples of milk from lactating cows, (2) make laboratory tests of these samples, (3) treat infected cases as promptly as possible with the best suited drug for the organism causing the disease, (4) establish a management program based on sanitary practices and procedures to avoid cuts and bruises which tend to provide ideal conditions for the development of the infection.

The employment of these practices besides the improvement of the milking procedures actually used will no doubt cut down the incidence of these infections.

#### Sterility

Sterility has no doubt been a factor in keeping the Puertorrican dairy industry from advancing normally. The apparent causes for this deficiency

are several but, in the author's point of view, four of them should be classified as primordial.

Perhaps the greatest failure in the whole industry is the lack of a good system of records. Clavell (12) asserted that records were kept only by a handful of the more progressive breeders and even at the present, no one knows how many of them avail themselves of their usefulness. This situation causes several troubles, such as heifers being bred too young, cows going on several months' before they are bred, and others which are dried up while being unbred.

It is indispensable that farmers be taught and encouraged to keep a system of records to avoid all these difficulties that their absence brings forth, but it is also important that this system be simple enough to be understandable or else no one will be willing to work with them.

The common feeding practices used by the dairymen on the Island have already been discussed earlier in this work and from the details offered, it can be seen why this constitutes another factor of importance in sterility. An appropriate standard of feeding is needed for the best functioning of any animal's reproductive system and this is very far from the reality at present.

Diseases no doubt play an important role in this phase of dairying. Brucellosis has long been blamed for the largest percentage of the cases of sterility, but there is a possibility that other complications have a part in the problem. This uncertainty originates from the fact that adequately trained veterinary personnel is badly missing and many of the opinions on this matter have been offered by laymen who are not properly authorized to do so.

There is such an acute need for veterinarians on the Island that the southwestern part with a cattle population of over 6000 head only has available the services of two, both of which have private interests, and dedicate only a small part of their time to actual practice.

If the dairy industry is to flourish in Puerto Rico, there has to be a large increase in the number of practicing veterinarians. Up to the present, the Government has been granting scholarships to students who are able to get a place in the U.S. veterinary colleges, but on account of the unavailability of space for out-of-the-country students, a very limited number of them have taken advantage of this facility. A more vigorous effort on the part of the Government should be made to secure places for veterinary medicine students. This seems to be the only possible solution to this situation.

#### Parasites

Included among the factors responsible for the state of health of the Puertorrican cattle, parasites occupy an outstanding place. This is so, particularly because of the large amount of stomach and intestinal parasites. Clavell (13) reported the intestinal parasites as the greatest killers of young stock on the Island.

In contrast to this, there are no external parasites of any economic importance, since the cattle fever tick was eradicated finally.

Alvarez (1) singled out the four most important internal parasites and listed them as follows: 1. Lungworm or *Dyctiocaulus viviparus*, 2. the Stomach worm or *Haemonchus contortus*, 3. the Hookworm or *Bunostomum phlebotomum*, and 4. the Liver fluke or *Hasciola hepatica*. The first three,

Schwartz (48) reports, are the most common and damaging to calves under a year old. All three are quite easily controlled by the administration of phenothiazine but preventive measures are more effective. To avoid the infection, green grass cannot be fed to young calves and they should not be allowed to run on wet ground where infected animals have previously been. The easiest way to achieve this is by keeping the calves on cemented or paved floors while dry roughages are fed. Very fine examples of the results of these methods can be found in several places on the Island which could serve as demonstrations for tours of visiting farmers.

The liver fluke problem is of another kind. Fasciola infections are most abundant in adult cattle that are put to graze in the wet plains of the west and north-east zone. Its control would be rather difficult because the fact that they are wet is what makes these pastures valuable, keeping them green the year round. It is possible that very few owners would accept the idea of draining these pastures to avoid the infection, if the roughage production were to be decreased greatly. The treatment recommended for the control of the liver fluke by Sullivan (53) is the drenching of hexachloroethane in the form of a wettable powder in different doses according to the age of the animal, but the system seems to be impractical when there are large numbers of animals and the farmers make little or no use of it.

Great care should be taken to protect cattle from these parasites, more so, animals imported from cold climates where internal parasites do not have the high incidence they have in the tropics.

#### IMPROVEMENT OF PASTURES

One of the great and most promising potentials for increased production

in Puerto Rico lies in the improvement of grasslands to produce pasture, silage and green crops for cattle feeding. More and better grass can be grown on the Island and ample land suited for this purpose is available. Improved pastures and forage crops on this land would provide the means for a considerable expansion of the dairy industry and thus produce for greater economic returns than are now obtained.

Much of the land now in use for pastures in Puerto Rico is considered to be low in productivity. Actually, this includes a great amount of land which had been previously cropped in such a way that erosion has almost made it worthless.

According to Koenig (23), there are about 730,000 acres of strictly pasture land in Puerto Rico much of which is still unimproved pasture but possesses a considerable productive potential. The productivity of much of this grassland could be doubled or tripled simply by the use of such pasture improvement practices as liming, fertilizing, reseeding, and the adoption of better grazing systems and more efficient management of the improved grasses and legumes. With good pastures and the use of silage and other forage crops for feeding dairy cattle, milk production could be increased substantially and made far more economical.

Koenig (24) also states that although about 730,000 acres are now regarded as being grassland because of their present use, this does not mean that all these acres are being employed for the purpose to which they may be best suited.

Undoubtedly, some of this land with very steep slopes would be far better utilized if planted to forest or some tree crop. On the other hand, there is no doubt that much of the land of the Island is being used for clean crops



when it might be used more advantageously if devoted to improved pastures.

Most of these acres of land, Vicente (55) points out, are very low producers and therefore more acres are required to maintain an animal and fewer animals can be kept because of the limited amount of land. Thus, this implies that imports of larger amounts of feedstuffs which are far more costly for feeding than locally produced supplies are necessary.

The key to increasing the production of feed nutrients from grassland is in the use of legumes, and their proper use along with other necessary improvements will increase livestock feeding values of the present grass pastures in Puerto Rico two or three times. Rivera-Brenes (42) concluded that grasses and legumes will produce on much of the croplands now in use, more T.D.N. per acre at lower costs and with greater returns per man-hour of labor than will corn or the other feed grains.

Experimenting with a combination of Tropical Kudzu (*Pueraria phaseoloides*), is the best legume pasture found so far for the Island, and two or three different kinds of grasses, Vicente, et al. (56) found that a herd of Guernseys produced an average of 2.5 pounds of milk per day more than on good barn feeding alone while the percentage of protein in the concentrates was lowered from 20 to 14. This experiment was repeated two years in a row with the same results. The value of the increase represents about 40 dollars profit per cow per year.

In the pastures of Puerto Rico there can be found a considerable number of native species of legumes, but their productivity is very low due to the competition with existing vegetation and the effect of continuous overgrazing. Garcia-Molinari (18) told of their existence in the wild stage because there was no available data about them under cultivation.

There are several promising grasses established on the Island which have been introduced from various parts of the world. Among them, Pangola grass, brought in from Florida, is by far the better adapted. It has been planted in several kinds of soils and at different altitudes and, in most of the cases, very good results have been obtained. In order to obtain the best results with it, liming and heavy fertilizing with nitrogen compounds is indispensable. It is specially well adapted for grazing, having a great power of recovery. Attempts to harvest it by cutting have proven unsuccessful.

Also prominent among the grasses is the St. Augustine Rose lawn (*Stenotaphrum secundatum*). It is very similar in appearance to the Pangola grass but its establishment is very costly and it demands calcareous soils for best results.

Both of these grasses, Vicente (57) comments, can reach to very high protein contents when heavily fertilized with nitrogen and have proven to be excellent for hay making purposes.

To conclude, it can be stated that no matter how well grasses do, they have never compared favorably with the combination of grasses and Tropical Kudzu, which has given always a larger tonnage, more palatability and better erosion control. Whenever possible, mixtures of grasses and legumes should be preferably recommended to farmers instead of grasses alone. Besides the advantages already stated, this legume also possesses the ability to improve the physical condition of the soil by adding annually large amounts of organic matter in the form of leaves and vines.

### Silos and Silages

As stated previously, the high cost of producing milk on the Island is principally due to the deficient way in which forages are used and therefore to the increased amounts of concentrates which have to be imported to compensate for the lack of feed produced locally. If Puerto Rico wishes to increase the size and the efficiency of its milk industry, a better use of the lands in pasture must be made.

It is a sad truth that almost anywhere on the Island, either in the rainy or in the dry zone, forages are not being put to the best use. In the wet zone all the forage cannot be cut at the optimum time and so a good part of it is lost. In the dry zone the case is similar, but with the difference that the periods of drought are longer and the need for roughages is far more acute. As a solution for this problem, Rivera-Brenes (43), experimenting with the ensiling of grasses, recommends this practice so as to have roughages available for consumption all throughout the year.

When speaking of silages on the Island it is nearly always understood that reference is being made to row crop silages. The only two crops actually ensiled are Indian corn (*Zea Mays*) and Sorgo (*Holeus sorghum*). It is indispensable that the practice of ensiling be enlarged and diversified. Rivera-Brenes, et al. (44) conducted successful experiments in the ensiling of grasses and legumes such as Merker Grass (*Pennisetum purpureum*), Tropical Kudzu, Sugar cane tops and Para Grass (*Panicum purpurascens*). The ensiling of these grasses would mean the usage of a vast amount of feeds which are currently lost and which could save a considerable amount of money to the farmers. It is a must for the industry that these experiments be publicized and adapted to farm conditions as promptly as possible.

Presently, there are very few silos in Puerto Rico but through inducement payments by the State Department of Agriculture and the Production Marketing Administration, a good number of them are being constructed. The southern dry zone is where most of the silos have been built. According to Hernandez (19) the two most common types are the upright and the trench silo. These have appealed more to the farmers on account of their relatively low initial cost and their economic operation. Only very few silos can be found and the above bunker and the stack are totally unknown.

Although haying is one of the commonest practices among dairymen the world over, it is, with very rare exceptions, almost unknown in Puerto Rico. This is so because in a large part of the Island green forages are available most of the year. Even in spite of this, hay could be a most important factor in the dry zone of the Island by providing good quality roughage during the drought, and in the wet zone, it could increase the actual carrying capacity of that land planted to grasses suitable for hay making.

Hernandez (20) asserts, after visiting countries in the Caribbean area, that there is not a reasonable explanation to account for the obstinacy of Puertorrican farmers in not using this practice. In several of the countries he visited, production of hay has so exceeded its local demand that the excess is sold to neighboring areas where haying is made difficult by weather conditions.

Koenig (25) states, that alfalfa (*Medicago sativa*), possibly the best of legumes, has been grown experimentally in Puerto Rico both in the dry southern coast and in the semi-dry northwest. Nine cuttings yielded nine tons of dry hay per acre per year. It may be worthwhile to continue testing adapted varieties of alfalfa for haymaking.

Several different types of grasses and legumes have been made into hay with varying degrees of success besides alfalfa. Among the legumes are Tropical Kudzu, Trailing Indigo (*Indigophera endecaphylla*), Pidgeon Peas, and Blackeyed Peas. The grasses so tested are Pangola grass, Guinea grass (*Panicum maximum*), St. Augustine Roselawn, and Coastal Bermuda grass (*Cynodon dactylon*).

It is largely debatable whether alfalfa should be favored instead of the above mentioned grasses and legumes.

The most exhaustive study possible is recommended for a definite conclusion on this matter and the development of standard procedures for the different sets of existing conditions on the Island.

#### Irrigation

Irrigation has been used in Puerto Rico since the time of the Spanish domination (1492-1898) in several parts of the Island, particularly the dry southern part and the northwest. Koenig (26) reported that actually there were about 100,000 acres of land under irrigation, 90 percent of which was dedicated to sugar cane. This did not include the 26,000 acres to be irrigated in the near future in the Lajas valley, located in the southwestern part of the Island.

Besides the irrigation systems covering the above mentioned 100,000 acres of land, there were a few small systems privately owned by farmers.

Very few dairy farmers were using irrigation as a method to improve the productivity of their land. Production of roughage could be doubled or perhaps tripled if, Koenig (27) asserted, more use was made of irrigation not only in the coastal plains but also in the mountainous region. He con-

cluded by stating that irrigation could do away with the need of haying or ensiling roughages with added economic returns.

The drilling of more deep wells should be encouraged among the farmers in order to increase the output of available water in those areas not covered by Government irrigation systems. To this end, the State Department of Agriculture is granting inducement payments which may cover in some cases up to 50 percent of the total cost of the operations. The principal cause for the slow development of irrigation in the Island apparently stems more from the lack of interest of the farmers than from the cost of the water that would be used.

Once the advantages of surface irrigation and the greater advantages of overhead irrigation are more widely known throughout the Island, it should be possible to overcome the apathy toward irrigation that exists among many farmers. This would perhaps lead many farmers to organize cooperative or Government sponsored portable sprinkling systems.

The need to educate farmers to the value of irrigation and the methods to be employed for effective results is not confined to any one area. Most of the farmers of Puerto Rico think of irrigation in terms of sugar cane only. The general tendency is to overlook the possibilities of irrigating other crops profitably.

#### CONCENTRATES

The production and manufacture of concentrates on a commercial scale on the Island for the dairy cattle would constitute one of the most important steps in the industrial as well as the agricultural progress of the country.

The great majority of the concentrates for dairy cattle consumption is

imported from the U.S. and a small part from other countries. According to Koenig (28) importations for the year 1950-51 amounted to 59,486 tons with a value of 4,970,850 dollars.

The value of these annual imports gives a clear idea of the importance it would have for the dairy industry if at least part of it could be produced and elaborated locally.

Serrano (49) reports that it has been calculated that the item of concentrates represents 45 percent of the total cost of the production of milk.

With the coming of irrigation for around 26,000 acres of land in the fertile Lajas valley, Puertorricans would be able to produce a substantial part of the grains for cattle consumption, provided that production costs were lower than those of the articles imported. Although it is not sound to produce when imports are cheaper, it is also true that Puerto Rico must produce all that is economically feasible so as to even up the balance of trade so unfavorable at present.

Several grains and other feedstuffs have been tried under Puertorrican climatological conditions and have proven to be adequate for production.

Alfalfa, which is at times used as a part of concentrate mixtures, has been grown successfully on several occasions. Yields of up to ten tons of hay per acre have been obtained, a production which compares favorably with those in the U.S.

Soybeans have been known to prosper for a long time in Puerto Rico but up to the present they have been planted only in experimental plots. Two crops of soybeans can be harvested in a seven-month period; making possible one crop of corn in the remaining five months of the year. Besides the added help this would mean for the dairy industry, the planting of soybeans

would theoretically bring more profits to the farmer than sugar cane would and the excess of stored sugar would be thus diminished.

Peanuts is another of the grains that could be possibly produced to be used as a constituent for cattle feeds. Its planting would be restricted to loose sandy soils along the coastline but nevertheless, it would provide a rich source of proteins and fats which are badly needed. Crops of 1000 to 1200 pounds of grain per acre have been obtained, but improved systems of fertilising and new varieties should increase the production average.

Corn is planted in several parts of the Island and almost all through the year. Serrano (50) reported the total production for the country in 1947-48 as 184,000 hundred weights. It is very correctly assumed that under modern methods of irrigation, fertilisation, insect control, etc., the yields could be greatly increased.

Sorghums are planted in Puerto Rico almost for the sole purpose of ensiling for the consumption of dairy cattle. The grain is never used as such to be fed to cattle. Experimentally, crops of grain of 35 hundred weight per acre have been obtained in three crops. Sorghums together with corn could become one of the mainstays of the dairy industry such as is the case in the U.S.

Yucca (*Manihot utilissima*) is a root crop very common on the Island as food for human consumption. Not until recently was it found out that it could contribute a very valuable by-product for the feeding of cattle. Serrano (51) reported that yucca leaves, after being dehydrated and made into a meal, have proven to contain as much protein as alfalfa meal and twice the content of carotene, besides having a lower content of fiber. Further



investigation on the possibilities of this product for its future use in concentrate mixtures is strongly recommended.

Blackstrap molasses is one of the feedstuffs which is always abundant and cheap on the Island. The average production is about 50 million gallons annually of which a small portion is used in the manufacture of alcohol, another small part is used as feed for cattle and the remainder is exported to the U.S. If Puerto Rico is to manufacture concentrates, a considerable increase in the amount of molasses will be used.

Even though the planting of cotton has been decreasing sharply in the last decade, the crop of 1951 reached a total of 459,000 pounds of which 344,000 were seed. Cotton seed meal could certainly be used as a source, but the possibility of increased production of cotton is very poor.

Koenig (29) states that 27,000 tons of pineapples were produced in Puerto Rico in 1950-51. A part of this is exported in its fresh state to the U.S. market and the remainder is canned. The canning of pineapples utilizes approximately 55 percent of the fruit leaving off 45 percent of residues composed mostly of the skin and the core. According to Serrano (52), these residues can be dehydrated and made into a meal which contains 19 percent of soluble carbohydrates other than sugar, 20 percent of sugar, 25 percent of higher carbohydrates, 3.6 percent of protein, and 1 percent of fat. The ash is said to be rich in calcium and iron. A similar product is used extensively for cattle feeding in Hawaii. The outlook for the availability of this product is tremendous as the growing of pineapples is scheduled to continue increasing very sharply.

Another industrial by-product which could be used for the manufacture of concentrates is brewer's grains. This foodstuff is already being used by

one of the feed manufacturing concerns on the Island. Because of the variability of beer consumption in the Country, this product cannot be counted as a reliable source of food.

#### MECHANIZATION

The hoe and the machete have long been characteristics of agriculture in Puerto Rico. These two hand tools stand out as symbols of a system of farming that is still primitive in many respects. Mechanisation has been slow in all farming enterprises except in the production of sugar cane, and even in this industry the percentage of work done by machines could be increased considerably.

Keenig (30) reported that of the 53,515 farms shown by the 1950 census, 423 farms reported 619 wheel tractors and 604 farms reported 1007 crawler tractors. Figures also showed 7,268 farms with 35,420 oxen, however, this compares favorable with reports of the 1940 census of 8,356 farms with 67,652 oxen.

Mechanigation on dairy farms has advanced at the same pace of the other agricultural enterprises and the further development of the dairy industry has been detained largely by this fact. The industry is only slightly mechanized and as a result, Keenig (31) asserts, the man-hours needed to produce 100 pounds of milk is from three to four times as great as the number required on the mainland.

Only a few dairies on the Island use milking machines, few use power mowers or cutters, and still fewer have silos. This is more noticeable in the dairies of the mountainous region, where the topography restricts the use of machinery, and as a general rule the returns are lower.

There can be little doubt as to the important role that mechanization and related techniques could play in the improvement of the dairying on the Island, so their use should be recommended and credit should be provided to farmers by the credit agencies, to enable them to make the purchase.

#### MILK MARKETING

Dairying in Puerto Rico has gradually developed into one of the major enterprises and plays a very important role in the economy of the Island. The production of milk accounts for more than 10 percent of the gross value of the agricultural output and yet the supply of milk produced is far short of the demand. To cover up this deficit, Gastambide (17) states, in 1955 imports of canned milk amounted to 17,844,000 dollars.

Most of the improvements in the production and distribution of milk have been made during the last ten years, but the improvements in the distribution phase have been much less.

According to Koenig (32), only about one fourth of the total amount of milk produced is handled by relatively modern marketing enterprises.

As the milk marketing system now functions in Puerto Rico, producers are unable to sell all the milk they produce, but strangely enough, consumers are frequently unable to obtain all the milk they desire. Rosenbaum (46) observed that this may be due to the flat price system that prevails on the Island. He insists that a classified price plan would enable the dealers to pay producers a fluid milk price for all milk sold in fluid form and to utilize surplus milk in other ways at a price that prevents the loss of money in its sale.

The flush season extends usually from four to six weeks between the months of April and May. It is at this time that the variable price plan would be especially helpful in milk marketing and beneficial throughout the rest of the year.

If a variable price plan is to help, the milk dealers must know how to utilize any supplies of milk in excess of their normal sales. They also must have the necessary equipment for handling surplus milk.

Trained personnel are needed for the adequate production of several kinds of dairy products that enable the dealers to get rid of their surplus milk. The common practice, observes Rosebaum (47) is to convert surplus milk into a white pressed cheese which has a limited demand and very poor holding qualities.

Another correction that needs to be enforced is the payment of a premium for milk having butterfat in excess of a certain predetermined percentage. This would encourage the farmers to produce higher quality milk and enable the dealers to establish a difference in price for inferior milk.

Another glaring disadvantage which if amended would bring very beneficial results is that of advertising. Actually, the only dairy products which are advertised continuously are those imported from the mainland and subsequently their selling is correspondingly made easier. A combined effort of all the dealers to sell the idea of buying locally produced fresh milk should be vigorously encouraged.

Still another measure that would benefit greatly the condition of the producers would be the organization of cooperatives to market their own products which according to Rivera (45) would help break to some extent the monopolistic tendencies of a good number of the dealers handling large amounts of the product.

## SUMMARY

This report is an itemized discussion of a plan for the improvement of the dairy industry of Puerto Rico.

The author has divided up the material in the seven phases of the industry which, in his opinion, are the final determining factors of failure or success of such an enterprise.

One of the primary objectives of the Puertorrican dairyman should be to improve his cattle genetically so as to insure a positive response from them when all the other factors of production are also improved. The Holstein-Friesian is offered in this work as the breed most likely to succeed under the prevailing climatological conditions based on authorized opinions and previous experiences.

It would not be logical to expect any great improvement in the dairy business if the feeding phase is not adequately tended. The great failure of Puertorrican farmers in this phase is essentially the lack of the production of roughages to be consumed during the dry spells, such as good legume hays and silages.

Because the soils have low contents of calcium and phosphorous, the addition of such minerals to the ration are recommended here.

Well fed, good quality cattle can scarcely be productive if their health is not up to par. The incidence of several diseases and parasites have had a detrimental effect on the effective improvement of the dairy industry in general. Both the Federal and the State Government have recognized the need for a better health of dairy animals and are actively aiding to solve the disease and parasite problem. Farmers need to be taught the

best methods for prevention and eradication of these maladies in order to get a concerted effort for the best obtainable results in this matter.

Several species of good legumes and grasses have been introduced to the Island by the agricultural agencies serving the country. It is greatly important that the idea of improved pastures be sold to the farmers with all the energy and insistence that this matter demands. No progress can be made on the kind and quality of roughages that are presently used.

Puerto Rico imports the immense majority of the concentrates fed to dairy cattle. Most of it is brought from the mainland and usually these feeds are readily available in the local market, but in the event of any disruption of the transportation facilities the dairy industry would find itself in distress in a matter of days.

To avoid the possibility of such a blow, several grains and foodstuffs which could substitute the imported mixtures and which are commonly produced in Puerto Rico are discussed here.

One of the causes for the slow progress of the industry is the high cost of production of this article. Even though all the measures already proposed would tend to cut down costs, the author believes that mechanization of the dairy enterprise would have the most dramatic effect.

It is indispensable that the man-hours actually used to produce a hundred weight of milk be cut down at least by 50 percent. This goal could only be achieved through the intelligent use of machinery in the barn and on the fields.

The marketing of the product has been so deficient that it has prevented the sale of a large amount of milk already produced and badly needed by the consumers.

Several corrective measures are imperative if a continuous flow of the needed amount of milk is to be had.

The change of a flat price program is heartily endorsed and the organization of farmers' cooperatives to market their own product should also be encouraged if the final goal is to be achieved.

The forgone work has been written trying to bring to the surface all those phases of the Puertorrican dairy industry which are deficient and which if not corrected in the near future might mean the end to an enterprise that otherwise could become a rich source of food, of work, of agricultural and therefore of economic stability to the country, but it is the author's opinion that this list of purposes would not be complete without perhaps the most important detail of all: the men.

The average Puertorrican dairy farmer is what can be termed a gentleman farmer, whose main function is that of an overseer when at all. This situation in itself is increasing the cost of milk production in two ways; first, the work done by the owner has to be done by somebody else who is no doubt receiving a salary and second that usually the employees are persons without the slightest notion of how to operate a business of this nature, or the desire to improve the condition of either the animals in their charge or of their employer.

This great endeavor of improvement calls for a new kind of farmer; one whose education is enough to enable him to understand and put into practice new scientific methods, whose youth and strength permits him to take an active part in his business, whose devotion to his animals makes him more than merely a producer of milk, and whose sense of responsibility toward his community and his country urges him to make a better part.

The description of this individual might sound too idealistic, but of what value would all these changes be if the man to produce them is not there?



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A PLAN FOR THE IMPROVEMENT OF THE  
DAIRY INDUSTRY IN PUERTO RICO

by

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The purpose of this report has been to compile information leading to the formulation of a plan for the advancement of the dairy industry in Puerto Rico.

In order to get the best possible information, the author made use mostly of the two top publications written on the matter; Revista Agrícola de Puerto Rico, published by the Puerto Rico State Department of Agriculture which was written by the leading authorities on dairying in the Island and A Comprehensive Agricultural Program for Puerto Rico written by Nathan Koenig, assistant to the Secretary of Agriculture, U.S. Department of Agriculture. Besides this, several research bulletins of the Experiment Station of the University of Puerto Rico and personal communications from prominent dairy authorities were also used.

The plan includes all the possible phases of the dairy industry which in the author's opinion have a direct bearing on the development of this enterprise in Puerto Rico.

The five major dairy breeds have been tried on the Island with varying degrees of success. The Holstein-Friesian breed has apparently given the best results if its great popularity among the majority of the dairymen is taken as a measure. Well fed and managed cattle belonging to this breed have made records seven times as large as the average production of cows in the Island.

The system now being used for the improvement of the present cattle population is that of grading up with purebred Holstein-Friesian bulls through artificial insemination.

It seems that the main cause for the low productivity of the cows is

the deficient ways in which they are fed and managed. The inclusion of legumes and superior grasses in the ration as well as high quality silage is heartily endorsed. Another recommended practice is the addition of minerals to the ration, especially calcium, phosphorous, and sodium and chlorine in the form of common salt. The improvement of the actual calf raising programs is pointed out as one of the first objectives that should be planted in the minds of dairymen.

There are two main diseases which have prevented the dairy industry from progressing as it should have; Brucellosis or Contagious Abortion and Mastitis. The control of Brucellosis has been in charge of the Federal Bureau of Animal Husbandry through a campaign using vaccination with Strain 19 to calves 4 to 8 months old. Mastitis has been a perennial problem and can be only controlled by the farmers themselves. A program for its control is suggested.

There is a great need for veterinarians in the Island. This is one of the great drawbacks in relation to cattle health.

Several new grasses and legumes have been introduced to the Island by different agricultural agencies. Their planting for the improvement of the quality of the pastures is essential. There are large tracts of land, mostly in the mountainous area in which most of these grasses and legumes have been proven to thrive. Such practice as liming, fertilizing and re-seeding are very important for the complete adaptation of these forages.

The building of silos should be encouraged among farmers for the best utilization of the above mentioned forages.

Puerto Rico imports the great majority of grains fed to dairy cattle. There are some grains and other feedstuffs which have been grown success-



fully on the Island and that could substitute at least part of the total of imported concentrate mixtures. Among them pineapple canning residue, brewer's grains, blackstrap molasses, yucca leaves, corn sorghum, soybeans and cotton. Their cultivation in a commercial scale is encouraged, provided the cost of production is comparable to the price of the imported mixtures.

One of the factors which have been responsible for the high cost of producing milk in Puerto Rico has been the limited use of mechanization.

The intelligent use of machinery is a must of the industry and its need can not be overemphasized. Credit should be made available to farmers to enable them to purchase machinery.

A good part of the total milk produced on the farm does not reach the consumers on account of poor marketing prevailing systems. A classified price plan for milk purchases is advised. Facilities for the industrialization of milk is essential to open new outlets for surplus production during flush time. Farmer's marketing cooperatives could play an important role in the improvement of the marketing of milk.

The summary of this work is a resums of the above stated facts. It has been proven several times that milk can be produced in Puerto Rico on a sound economical basis; the practices used in those cases should be publicised to extend their use more generally.

The last recommendation calls for a new type of dairy farmer whose qualifications enable him to put into work the practices hereby suggested.