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PRESS BULLETIN NO. 26.

The Algaroba in Hawaii.

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INTRODUCTION OF THE ALGAROBA.

The algaroba, or keawe (*Prosopis juliflora*), is commonly recognized as the most valuable tree which has thus far been introduced into the Territory of Hawaii. The accounts of its first introduction into the Territory are somewhat at variance. At the corner lot belonging to the Catholic Cathedral of Honolulu stands an algaroba tree which is supposed to be the first one introduced, and which bears a tablet stating that it was planted by Father Bachelot in 1837. In support of this tablet we find the following statement in an article on the "History of the Hawaiian Missions,"[1] referring to the second visit of Father Bachelot to Honolulu: "On his return from California he had planted in the Mission grounds four shoots of the algaroba tree, until then unknown in the Islands. Only one of these had taken root and was now growing fast. As the worn-down missionary left his mission house, never again to return to it, he looked upon the plant with moistened eyes and said as though prophetically: 'Even as this young tree by Divine Providence will thrive and cover the whole of the island with its shade,' " etc. Essentially

1 Damien Institute, Vol. 12, 1903, No. 12, pages 190 and 191.

the same statement was translated into French and subsequently published.[2] In the "Pacific Commercial Advertiser" for January 1, 1900, in an article by H. M. Whitney, we find the following statement placing the same date upon the first introduction, but attributing it to another man: "The algaroba—by far the most valuable tree on the Islands—was introduced by seeds brought from Chile by Bishop Maigret, and the first tree started by him is now growing in the north corner of the Catholic Church yard." A drawing of the Catholic Cathedral at Honolulu was made in 1842 and was subsequently published in Paris with certain notations. In this drawing the original algaroba tree is shown standing considerably higher than the Cathedral. This would obviously have been impossible if the tree had been only five years old at the time the drawing was made. Below the drawing of the Cathedral is a printed statement in French, which, translated, reads as follows: "Tree planted by Mr. Bachelot in 1828. It is a magnificent Acacia. The seed was brought from the Jardin du Roi de Paris." Father Reginald, Librarian of the Catholic Cathedral, has looked up all of the records relating to the introduction of the algaroba and considers 1828 as undoubtedly the correct date. He states in a recent letter to Father Valentin that in 1837 there were already several algaroba trees from the seed of the first one. Moreover, the statement in the previous quotation, that the original tree came from a shoot imported from California, may be considered as somewhat doubtful on account of the difficulty of propagating the tree from shoots, except under favorable conditions. Shoots brought by sailing vessel from California would, ordinarily, not be in good condition for planting upon their arrival.

BOTANY AND HABITAT.

There are eighteen or more species of *Prosopis,* the natural habitat of which is in tropical and semi-tropical America. The algaroba occurs from Texas to Chile and in the West Indies.

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2 Ann. Sacres Coeurs, 1896, pages 288-290.

Another species (*Prosopis glandulosa*), known also as the Texas mesquite, is found alongside of the algaroba in Texas, and there are a few trees of this species on Molokai. Seeds from these trees have also been planted in other localities. If we accept as true the statement that the original seeds were brought from Paris by Father Bachelot on his first trip to the Islands, it is impossible to determine their exact origin. The tree is, of course, not native in France and the seeds must have been brought there from some other locality.

The distribution of algaroba in Hawaii is largely determined by the rainfall conditions. The tree thrives best in dry localities, and is somewhat sensitive to salt air. Nevertheless, on the windward side of Lanai there is a fine belt of algaroba which extends to within a few hundred feet of the seashore. The trees which grow nearest the water on the leeward side of the Islands, sometimes have the leaves destroyed by salt spray during Kona storms, but recover later, showing little effects from the salt water. Algaroba thrives best at low altitudes, but is everywhere gradually extending to higher levels, and it is found in some localities at altitudes as high as two thousand feet. Apparently, it is gradually becoming acclimated to the higher altitudes, but it bears most abundantly at lower levels. Considerable attention has been given to the distribution of this tree in carrying it from one island or locality to another, but, on the whole, its distribution has been largely accomplished by stock. Practically all of the islands have enormous belts of algaroba forest, extending from the sea-shore, on the leeward side, up to an altitude of 800 or 1,000 feet.

USES OF ALGAROBA.

There are few trees which are distinctly useful for more purposes than is true for the algaroba. Its flowers furnish the most important source of pure honey known in the Territory. The bee-raisers of the Territory have shown an active interest in securing the rights of placing apiaries so as to utilize to the full-

est extent the algaroba forests. The yield of honey is recognized as large and important, and occurs at two seasons, there being two crops of flowers and pods annually.

As a forage crop algaroba is of far greater financial value. The pods are everywhere recognized as one of the most important grain feeds of the islands and are greatly relished by all kinds of live stock, including chickens. The quantities of pods produced by the algaroba forests cannot be estimated, even approximately, for a large proportion of the pods are allowed to fall on the ground and are eaten by cattle, hogs and horses, without being previously picked up. It has been estimated that approximately 500,000 bags of the beans are annually picked up and stored, particularly for feeding horses and cattle. On two or three estates at least 15,000 bags of beans are annually stored for this purpose.

Algaroba wood also constitutes one of the best and chief sources of fuel in the Territory. Its growth is comparatively rapid and the larger trees can be removed for fuel, thus making room for the growth of another generation of trees. In addition to these uses of the algaroba, it might also be stated that the bark contains tannin, and the gum is suitable for use in varnish. Being a legume, and of remarkable penetrating power in the soils, it is also a soil-maker of some importance. As a shade and ornamental tree it is highly appreciated. The form of the tree is graceful and spreading. The small branches furnish excellent material for making charcoal. Piles made from algaroba are relatively free from the attack of the Toredo. Moreover, since the pods contain a high percentage of sugar, they may be used in the manufacture of denatured alcohol and vinegar.

ALGAROBA BEANS AS STOCK FEED.

The algaroba is chiefly interesting on account of the enormous quantity of forage which the beans furnish. As already stated, all kinds of farm stock are very fond of them, and their feeding value has long been recognized from the practical results ob-

tained. As a feeding material there seems to be only one objection to them, and that is, a slight flavor given to milk when the beans are fed in excess to the dairy cows. This objection, however, could be overcome by feeding the beans after milking, rather than before milking. The whole pods of the algaroba show the following percentage composition: Water 15.26, protein 8.89, fat .58, nitrogen free extract 47.27, crude fibre 24.75, ash 3.25. The seeds alone, however, have the following percentage composition: Water 14.38, protein 33.62, fat 3.94, nitrogen free extract 36.78, crude fibre 6.84, ash 4.44. It has long been known that on account of the hard case, like that of a shark's egg, surrounding each seed, the seeds themselves are not digested by live stock. On this account, if the pods are fed whole, the protein content is largely lost and the pods do not furnish a ration so well balanced as would be the case if the seeds were rendered digestible.

Realizing the great importance of algaroba beans as a forage, a number of persons made attempts to grind the pods, in order to crack the beans, and thus render them available as food. Mr. Paul Isenberg spent a great deal of time and money in this experiment, during which confident promises of success were made by mainland millers, without ultimate success. Similarly, Mr. F. G. Krauss of this Station, while connected with the Kamehameha Schools, had experiments made by six or more mainland concerns who at first believed that some of their mills, designed for grinding drugs and miscellaneous materials, would successfully meet the problem of grinding algaroba beans. All their tests, however, proved that the machinery then in use was not adapted to grinding the algaroba. The difficulty in the way of grinding the beans is furnished by the large amount of sugar in the pulp of the pods. This sugar is in essentially the condition of molasses and gradually accumulates on the milling machinery, forming a layer resembling vulcanized rubber in consistency, and ultimately causing a heating of the machinery so that it has to be stopped. The cleaning of mill machinery which has once

been coated with this layer is a very tedious and difficult operation.

Two years ago this Station began experiments in grinding algaroba beans and soon came to the conclusion that special machinery was needed for this purpose. It was found that various milling machines would successfully do the work for a few minutes, or perhaps for half an hour, but that ultimately the coating of moistened sugar on the machinery rendered further operation impossible. It was found, however, that the addition of a very small quantity of water to the cracked pods was sufficient to render the sugar in the pods no longer sticky. The extraction of a portion of the sugar, by means of water, makes it possible to dry the cracked pods in a condition in which any feed-grinder will successfully crack the seeds. The removal of a portion of the sugar, however, takes away some of the feeding value of the beans and renders an alcohol or vinegar plant necessary in order to utilize the sugar thus extracted. The desirability of special machinery, which would successfully crack the beans in fresh, untreated pods, became therefore more and more apparent. Finally the interest of a trained mechanic and inventor, Mr. C. W. Renear, was enlisted, and after several months of experimenting, he succeeded in devising a machine which would grind the fresh beans, cracking all of the seeds, and thus rendering them available for stock. The feeding test made by this Station showed that the seeds thus cracked are completely digested by horses, mules and cattle.

In repeated tests with the algaroba bean meal, just referred to, it was found desirable to adopt the suggestion made by this Station as to the advantage of a minute spray of water to prevent the sugary material from adhering to the roller of the mill. After this device was adopted, no tendency was shown for the sugar to adhere, and the roller remained perfectly clean. The amount of water added in this process is altogether too small to endanger the keeping qualities of the meal. The sugar in the pods does not ferment unless considerable water is added. The

keeping quality of the meal is quite sufficient for the ordinary demands of the trade. When kept in sacks or open containers it retains its original odor and flavor, without change, for six or eight months, and the meal is no more subject to the attacks of insects than is any other grain feed.

On account of the prevalence of weevils, which attack and destroy the seeds on the tree, or after the pods have fallen off, or have been stored in bins, it was thought desirable to attempt the introduction of parasites to control these weevils. The Bureau of Entomology of the United States Department of Agriculture very kindly consented to cooperate with this Station, and Dr. W. D. Hunter made several shipments of mesquite beans containing parasitized weevils from Texas. The parasites were bred from this material in large numbers by Mr. D. T. Fullaway of this Station, and were subsequently liberated on Maui and in several localities near Honolulu. It is too soon yet to speak of the success of this introduction, but if subsequent investigation shows that the parasites have not become established, further introductions from Texas will be made during the coming season.

When it is considered that women and children pick up the beans and sell them for from $7.50 to $10.00 a ton, it is apparent that this feed has a much higher feeding value than its actual market price, particularly when compared with the high price which must be paid for imported feeds. The dairymen and ranchmen recognize the importance of feeding large quantities of the beans picked up for storage, in order to prevent the great loss which would occur if they were all left upon the ground. Wherever the belts of algaroba timber are large it has been found possible to maintain stock for a month or two of each season without any other forage than algaroba beans. Some of these belts, however, have been allowed to grow up much too dense. Under such conditions the individual trees remain too small and the yield of beans is less than would be the case if the trees were thinned out, so as to give a chance for each tree to spread to its

full limit. The thinning process would nearly, if not quite, pay for itself in most localities in the fuel which would thereby be obtained. With the successful mill, which is now available for grinding algaroba, the feeding value of this already important natural forage asset of the Territory will be greatly increased.