

Prosopis juliflora as an Alternative Source of Food in the World's Semiarid Areas

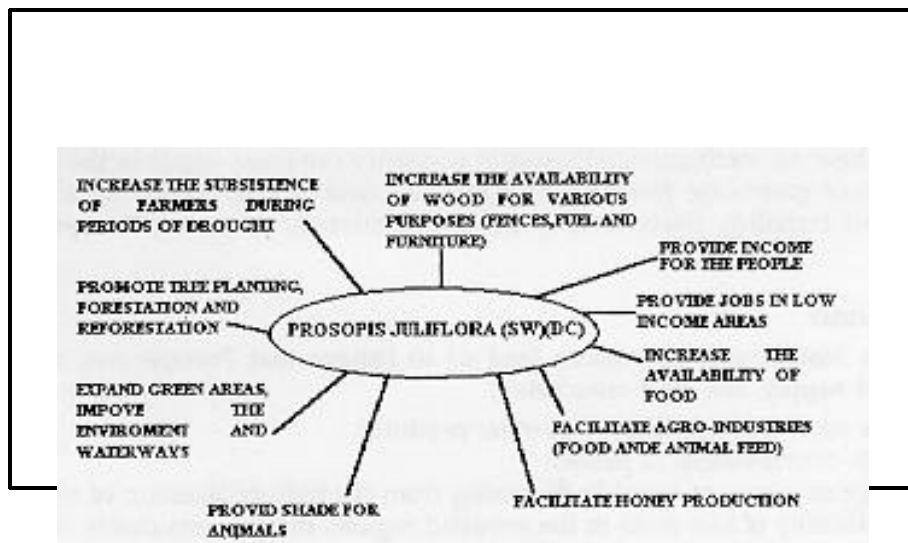
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We are gathered here to treat of a subject of utmost importance to all humanity and especially to people who live in the world's semiarid areas. In speaking of *Prosopis juliflora* we are, at the same time, addressing the problem of how to develop the semiarid impoverished areas in dire need of improving the living standards of their people.

Many people see algaroba (*Prosopis juliflora*) as an alternative foodstuff for animals. However, it is the perspective of this presentation that it can also be widely used for human food, being especially useful in providing more protein for human consumption. To sustain and increase the provision of food for people is of the utmost importance, assuming that the world population will double within the next 40 years.

The world's forests are now decreasing at a rate of almost 1% per annum, bringing serious problems to millions of people. This is where algaroba has a significant contribution to make because it helps augment the amount of green matter available, thus improves the environment in critical areas.

In arid northeastern Brazil, where drought conjoined with poverty afflicts the population and the environment, *Prosopis juliflora* (algaroba) can contribute to the development of a region of over 1,000,000 square kilometers with rainfall varying between 300 and 600 mm per annum, with a population of more than 16 million, 60% of whom live below the poverty line (Figure 1).



As a politician, one devoted to public affairs, and a rural businessman, I have struggled and striven to have *Prosopis* exploited fully and sensibly. I cannot say I have witnessed great advances: *Prosopis* still remains classified with weeds and useless vegetation. The challenge of the present time is to discover and implement means to make the rural areas viable with the aid of plants and vegetable growth to support industry and protect the environment.

The semiarid world is aware of the potentialities, virtues, and drawbacks of *Prosopis*. These drawbacks will continue unless we are determined to modernize its cultivation and production. We are gathered here to find solutions, which will not be found unless we control and plan the cultivation of algaroba as a basis for industrial agriculture. If industrial agriculture does not develop, there is little advantage in talking about algaroba. In fact, we may even be promoting unplanned and disorderly invasion of land by algaroba seeds and seedlings.

Special attention must be given to spacing with due regard for the fertility of the areas in question and the purpose of cultivation, whether for foodstuffs, timber, or reforestation. No matter what spacing is adopted, seeds and fruits will be produced, making harvesting imperative to avoid disorderly growth and undesirable propagation. Where undesirable crops invade areas, recourse must be had to weeding and thinning to improve productivity.

Therefore, it is critical that the stands be managed. On our *Prosopis* plantation of about 4,000 ha, we intensively manage the trees. The trees are staked and pruned to allow a single stem to 1.8 m height that will produce good lumber. The trees are also pruned to enlarge the foliage crown to stimulate increased fruit production. The trees are initially planted at 10 m by 10 m spacing. With regular cultivation between the trees, no invasion of young trees occurs. When the trees become larger, they are thinned to a 20 m by 20 m spacing by harvesting alternate rows. The harvested trees are used for timber, stakes, and fuel. With this spacing and periodic pruning, the growth of the plants at the 20 m by 20 m spacing will improve and produce up to 300 kg of pods per tree.

By crowding small trees together on a close spacing (i.e., 4 m by 4 m) and pruning all side branches, it is possible to obtain single stems 7 m long that would be very useful for timber.

Without careful management, *Prosopis* can invade open areas, resulting in very high densities of small trees. As both horses and cattle have great fondness for the high-sugar-content pods, and as their chewing mechanism only serves to scarify the many seeds in the pods, hundreds of seedlings may germinate from a single pile of horse or cow dung. As a result, without cultivation and thinning, pastures may develop thousands of young *Prosopis* seedlings per hectare.

Animal Foodstuff

As previously stated, various reasons lead us to believe that *Prosopis* can contribute to an increased food supply, the chief ones being:

- Low cost in comparison with other products
- High concentration of protein
- Large numbers of byproducts arising from the industrialization of algaroba
- Availability of idle areas in the semiarid regions that are unsuitable for cultivation of products of a short growth cycle but are suitable for the cultivation of *Prosopis*
- The ease with which the plant adapts to semiarid conditions, making increased herds possible in these areas

Prosopis can be a useful source of animal feed, substituting or reducing, at much lower costs, the use of maize, soybeans, and wheat, all of which can be produced on only a very limited scale in the semiarid areas. A comparison of the protein content of mesquite leaves and mesquite pods with other common feeds from the arid regions of Brazil is in Table 1, which illustrates the fact that mesquite has higher protein content than all common feeds from arid regions (alfalfa has to be irrigated).

Table 1. Comparison of Protein Content of Mesquite Products in Comparison to Other Products Common in Brazil

Description	Protein
Mesquite pods (<i>Prosopis juliflora</i>)	12.9
Mesquite leaves (<i>Prosopis juliflora</i>)	13.6
Manioc (<i>Manihot esculenta</i>)	1.6
Maize (<i>Zea mays</i>)	6.0
Alfalfa (<i>Medicago sativa</i>)	14.1
Guinea grass (<i>Panicum maximum</i>)	2.6
Spineless cactus (<i>Opuntia ficus-indica</i>)	0.4

Source: ITAL -1987

In Brazil, 1 kg of food made from algaroba sells for \$US0.18, wheat bran (of much less nutritive quality) sells for \$US0.20, and maize (of equal nutritive quality) sells for \$US0.24. In the case of large and medium-sized animals, the addition of 1 kg of algaroba bran per animal to the roughage feeding (grass, hay, and chicken feces) acts as a complement to the feeding and stimulates roughage consumption.

Thirty percent of concentrated feeds can be replaced by algaroba bran without lessening productivity and at considerably reduced costs. Research by the Federal University of Pernambuco recently has shown that the introduction of up to 10% of bran from algaroba pods can substitute other normal food without affecting productivity of chickens and other birds raised for meat. The research has also shown that up 30% of the food of cattle, horses, goats, sheep, and pigs can be furnished by algaroba bran.

These statistics show the existence of a huge store of algaroba foodstuffs, calculated at between 300,000 and 400,000 tons annually, in northeastern Brazil alone.

In considering the value of *Prosopis* pods for feed, we must realize that the pods have three main components: the seeds in the very interior which contain about 43% protein (Table 2), a high-sugar-content pulp near the outside of the pods, and a leathery capsule that separates the high sugar pulp from the seeds. The pulp which is about 55% of the weight of the pods, is the only part that can be digested by animals without processing. Due to the hard seed coat the animals are unable to digest the seeds unless the pods are ground. Thus, if the pods are not ground, there will be a loss of 45% by weight of potential feed that includes the 43%-protein-content seeds. In addition, if cattle are fed unground pods, when they return to the fields these animals will spread the seeds through their dung.

It is also necessary to process algaroba pods because their unprocessed consumption has proved harmful to the organs of animals. Consumption of unprocessed pods has lead to diseases such as "Lingua de Pau" (Timber Tongue) "Cara de Torta" (Crooked Face) and also the puncturing of stomach and cud. Death has occurred in some cases, especially with cattle and horses.

On our ranch we pay workers to collect pods by the weight of pods they collect. It is important to verify the daily production of each worker by measuring the weights of the pods they collect.

Table 2. Proximate Analyses of Dried, Ground Mesquite Seeds and Refined Flour from Mesquite Pods

Characteristic	Dried Ground Mesquite Seeds (%)	Refined Mesquite Flour from Pods (%)
Moisture content	N.D.	2.3
Ash	N.D.	3.8
Fiber	9.6	8.0
Protein	43.5	8.3
Lipids	9.0	8.7
Total carbohydrates	N.D.	73.8

The analyses were performed by the Nutrition Department, Federal University of Pernambuco, Recife, Brazil. Mesquite seed analyses were conducted by Maria Olivia Cutrim Tavares and pod flour by Vera Lucia Viera.

The high sugar content of the pods has a very great affinity for water in the atmosphere. If this water is not removed by a drying process before grinding, the partially ground flour will adhere to itself and all machinery components, resulting in clogged machinery. Before grinding, but before drying, the pods are chopped into segments several centimeters long. The chopped pods are dried in rotary driers adopted from the coffee-drying process. The driers are heated with wood-fired furnaces. We have used industrial hammermills for grinding the pods after they have been dried. The output of the grinders feeds directly into bags, which are then sewn shut and transported to the warehouse. This product can be refined further for human use.

In view of all this, I would like to stress how vital it is for the production and cultivation of *Prosopis* that all those concerned should be fully aware of the need for processing the algaroba pods.

Food for People

While algaroba is useful mainly for animal feed, I should like to point out and stress its possibilities for use as human food. Historical studies show that algaroba was used in various Latin American countries as human food by the indigenous people, not the least in northeastern Brazil where significant traces of its use as human food can be found. The composition of the mesquite-pod flour in Table 2 shows that while it is moderate in protein (about 8.3%), it has a very high level of carbohydrates (73%). The amino-acid profile of the mesquite pods presented in Table 3 shows that it is above the FAO requirements for children for every essential amino acid. This is rather unusual since most legume-seed proteins are deficient in the sulfur amino acids and in tryptophan.

Algaroba pods can be processed to produce honey, flour, coffee, alcoholic drinks, ice cream, gums of the galactomannan type (similar to the widely used carob gums in the food industry). Some of these products, especially ice cream and biscuits, have had a very good reception because of the delicious taste and agreeable texture that is gratifying to the palate.

In 1984, as a special secretary for Northeastern Brazil to the Minister of Agriculture, I took part in the first International Conference on *Prosopis*, in Arica in the Atacama Desert of Chile. On that occasion, the International Prosopis Association (IPA) was established, and I was chosen President, a distinction I proudly continue to hold to this day. During that meeting, I vigorously proposed the need to process *Prosopis* pods, giving some suggestions and indications of how processing might be

done. In 1986, as Pernambuco state Secretary of Agriculture and President of IPA, I presided over the Second International Meeting of the *Prosopis* Association held in that state. At that stage, the factory showed clear signs of improvement and evolution. I am proud to say that I surmounted many barriers and obstacles so that now a well-setup industry exists, culminating in production of 20 tons/day of human and animal foodstuff derived from *Prosopis*.

Table 3. Average Amino-Acid Content of *Prosopis juliflora* Pods in Comparison with Nutritional Requirements for Children and Adults as Indicated by FAO

Component	Mesquite Pods (g/16 g N)	FAO Food Values (1973)	
		Children (g/16 g N)	Adults (g/16 g N)
Isoleucine	3.56	4.0	2.0
Leucine	7.86	7.0	2.8
Lysine	5.04	5.5	2.4
Total sulphur amino acids	4.73	3.5	2.6
Total aromatic amino acids	7.21	6.0	2.8
Threonine	3.03	4.0	1.4
Tryptophan	2.23	1.0	2.0
Valine	5.85	5.0	2.0

Source: ITAL/SAO PAULO (1987)

Needless to say, I am fully convinced of the importance of algaroba in contributing to the food supply of the world, chiefly in the arid and semiarid areas, and also of its role in developing a sustainable growth rate in these areas.

In this gathering, we bear a serious responsibility. Let us share experiences and develop projects and plans with suggestions for the ruling authorities in the semiarid areas to reflect upon, especially the possibility of improving cultivation and the fullest possible exploitation of algaroba. Postponing decisions will mean missed opportunities for investments capable of producing important economic returns with social benefits for people in the lowest income brackets (Figure 2).

Relying on my life-long experience devoted to the study of algaroba and its products and being fully aware of the difficulties presented by rural areas for industry, I appeal to all present, researchers, technicians, rural producers, government representatives, and business people, to ensure that this meeting produces a document assuming responsibility for the exploitation and processing of algaroba.

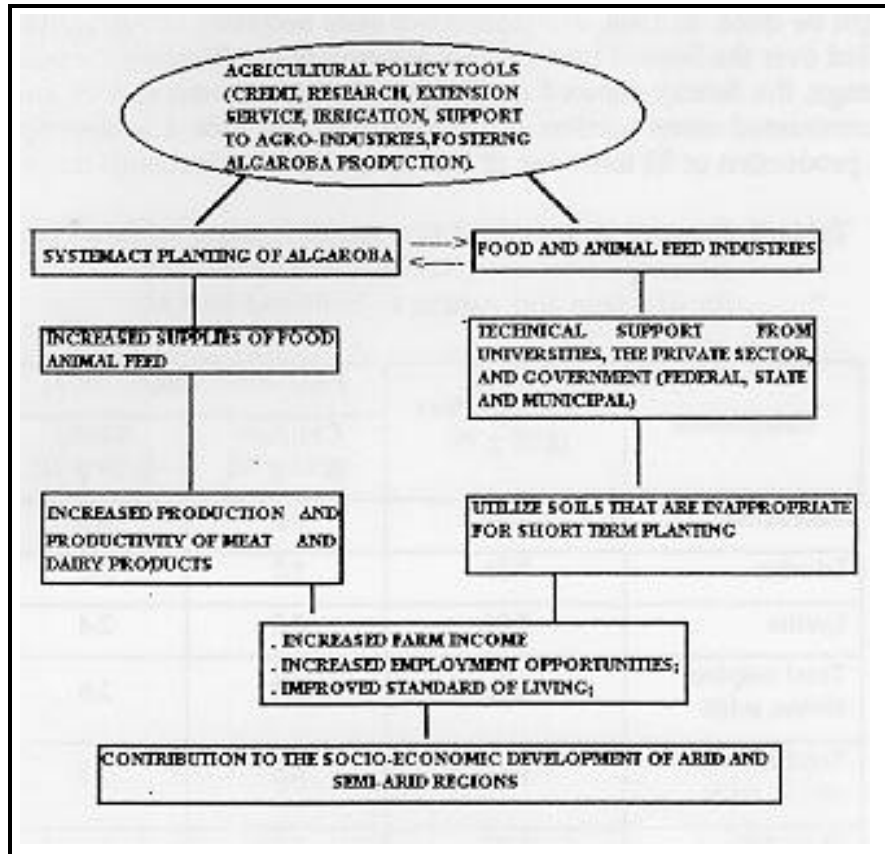


Figure 2. Development Strategy for the Semi-arid Region Making Use of *Prosopis*