The Morama Bean of the Kalahari Desert as a Potential Food Crop, With a Summary of Current Research in Texas

Joseph Bousquet
Department of Sociology and Anthropology
Southwestern Texas State University
San Marcos, Texas

Ethnobotany, the hybrid of anthropology and plant science, offers to enrich human life by bringing the knowledge of plants and their uses from one human group to another. Cooperative research on the morama bean (*Tylosema esculentum*, syn. *Bauhinia esculenta*) by anthropologists, plant scientists, and nutritionists is helping to bring this wild Kalahari Desert legume into cultivation by arid lands agriculturists.

Morama is a viney plant that produces a bean with unusually high levels of protein and oil (Figure 1), and a tasty tuber which is used as a failsafe for thirst by Kalahari foragers (Vierich, personal communication). Although it is presently known only in a wild state, morama is a prime candidate for expanded food use and cultivation. This plant attracted worldwide interest when the National Research Council of the National Academy of Sciences called for greater research attention to this "neglected legume of great potential" (National Academy of Sciences, 1979).

The specific name *esculentum* (= "edible") is well chosen, according to Codd (1952), because "...not only is this plant sought out by browsing stock and game, but the tubers and seeds were a staple food for the indigenous people (of the Transvaal) and are even today relished by the farming communities in areas where plants grow."

The beans are never eaten raw, but nearly always roasted, which gives them a rich, nutty flavor (Adlung, 1913; Wehmeyer et al., 1969; SIDA, 1972; Lee, 1979). There are also reports of San (Bushmen) who boil the beans (Ebert, personal communication). The plant's desirability as a food can be estimated from reports that foragers in the Kalahari will walk 40 kilometers to collect morama, and that some groups live on little else for several months of the year (Tanaka, 1976; Wilmsen, personal communication).

Morama is called *tsin* by the !Kung. For groups in the Dobe area studied by Richard Lee, it is second only to the mongongo nut in dietary importance (Lee, 1979). Lee describes the way *tsin* are cooked and used:

Unripe beans may be sun-dried before further processing. A batch of 50 or so beans is roasted in the shell for a few minutes in the hot ashes and sand of the cooking fire. Slight bursts of steam from the roasting beans indicate that they are ready for eating. Occasionally, a bean explodes, but without much damage. The beans are removed from the ashes, placed on an anvil stone, and opened with a single light tap of a rock or stick. Each bean comes apart easily into halves. Eaten whole, the beans have a rich, strong, nutty flavor. Alternately, the shelled beans may be pounded in the mortar and then mixed with hot water and eaten as soup or porridge. (Lee, 1979: 487).

The NAS report mentions the young tubers as a valuable food source. The proper term for the tubers is *sekophane* in Tswana, or *n//n* in !Kung, but for convenience we have been calling them morama tubers. Kalahari foragers dig them up when they weigh about one kilogram and bake, boil or roast them. The tubers have a "sweet pleasant flavor and make a good vegetable dish" (National Academy of Sciences, 1979: 70). To the southeast of the Central Kalahari Game Reserve, Vierich notes that "morama is more important as a tuber than as a nut, becoming one of the staples in the dry season for many peoples..."(personal communication).

Not only is morama a nutritious and tasty wild bean and tuber, but the morama plant has the advantage that it survives and produces in an arid and semi-arid climate with

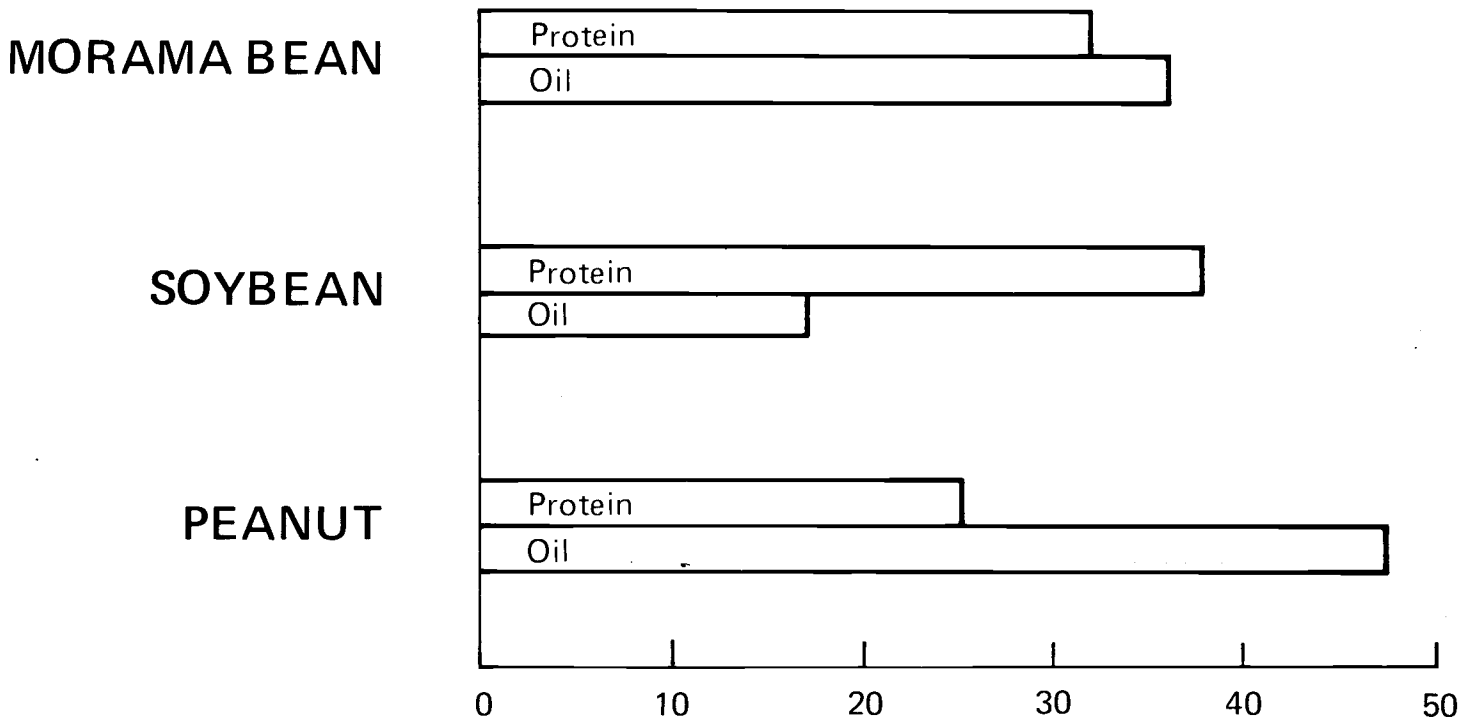

Figure 1: *Comparison of percentages of protein and edible oils in morama beans, peanuts and soybeans. Source: NAS, 1979.*

highly unpredictable rainfall. In one year out of four, a severe drought can be expected in the Kalahari; in other years, rainfall may exceed 600 mm., placing the area just inside the semi-arid category (Lee, 1979). A morama plant, once established, will survive a year of no rain by drawing on deep soil moisture and the stored moisture in the tuber (National Academy of Sciences, 1979). Surprisingly, the plant also seems to thrive under conditions of excessive moisture. In 1974 a record-breaking 1184 mm. of rainfall was recorded at Maun, Botswana; although the rain destroyed the mongongo nut crop, Dobe area gatherers discovered a bumper crop of morama (Lee, 1979).

Enjoyment of morama is not confined to a small minority of foragers. The first Boers to trek from northern Cape Province to the Ghanzi region of Bechuanaland (now the nation of Botswana) relied heavily for the subsistence on morama beans supplied by their San trading partners (Guenther, 1976; Russell and Russell, 1979). As late as 1952, Codd reported that in Namibia, European farmers roasted and ground the beans to garnish their salads.

Current Experiments with Morama

Despite the popularity of this plant in the Kalahari region, and its potential value for people in other arid and semi-arid parts of the world, morama is not cultivated by any of its traditional users. As a result, we do not know the range of soil and moisture conditions that it tolerates or prefers for highest yield. We do know that in the Kalahari region it does not grow everywhere, but confines itself to isolated patches of sandy soil. We also know that in any given year, not all the plants produce beans (Wilmsen, personal communication). Efforts to grow morama a few kilometers south of its present range have resulted thus far in failure (Clauss and Clauss, 1979).

Field observers in Botswana have discovered a number of valuable points about morama beans. Regarding soil preference, Thoma reports that morama grows in deep sand and also in sandy areas with limestone outcroppings, but not on basalt or granite soils (personal communication). Vierich notes that morama and its related species *Bauhinia macrantha* grow mainly in open grassland. In Botswana, such places are either fossil river valleys or the edges of pans (fossil lakes), but it is difficult to know whether the plant grows there primarily because of the type of soil or because of the lack of competition from tall shrubs and trees (Vierich, personal communication). Thoma discovered by experiment that the plant does not flower before the third year. The bean pods begin to appear in December in the eastern Kalahari (Vierich personal communication), and in the northern Kalahari the gathering season ranges from February to May (Wilmsen, personal communication).

In contrast to several published reports that the maximum length of the morama runners reaches 6 meters (National Academy of Sciences, 1979; Codd, 1952), Vierich reports seeing very old plants whose runners cover half an acre. The radius of a circle of this size is over 25 meters. Earlier sources have given maximum size for the tubers as ten to twelve kilograms, but Hitchcock, Thoma, and the Eberts reportedly dug up a root weighing over 80 kg., and an old tuber weighing

250 kg. was brought to the National Museum by a worker from the Botswana Ministry of Agriculture (Hitchcock, personal communication).

Vierich suggests that the distribution of morama plants in Botswana may depend not on soil and moisture alone, but also or even more importantly on the location of other species such as shade trees. Animals and humans also affect the distribution of the plant. Grazing animals, especially cattle, eat the stems and leaves, possibly limiting the occurance of the plant around waterholes (see Martin, 1979). Because of the extensive human exploitation of the tubers for moisture in areas near villages, only old plants with inedible tubers are to be found today; and these plants probably matured before the nearby human occupation began (Vierich, personal communication).

. Vierich also notes the effect of burning on morama seed production. The road to her base camp passes through many large stands of morama. In the spring she noted that five large stands had been burned on one side of the road, but not on the other side. Later, when the beans were ripening, she stopped and counted the number of pods per plant on all the plants within a radius of 100 meters from the point where she parked her vehicle. The plants that had been burned produced twice as many pods as the plants on the side of the road that had been missed by fire (personal communication).

Beginning in the fall of 1980, propagation experiments began at three institutions in Texas, with funding from the U.S. Department of Energy, to determine environmental tolerance and potential productivity of morama. The Chihuahuan Desert Research Institute established field test sites near Ft. Davis, Monahans, El Paso, Terlingua, and Alpine. At Texas Tech University in Lubbock, J.R. Goodin began germination experiments and greenhouse planting. At Greenhills Agricultural Experiment Station near Dallas, Geoffrey Stanford began outdoor propagation in prairie soils. These sites provide a variety of temperature and rainfall conditions, as well as wide-ranging expertise in plant science (Bousquet, 1979).

Although the final reports are not all in as of this writing, some remarkable results have come of the morama experiments in Texas. CDRI researchers found that scarification aided germination of the seeds. Less than ten percent of unscarified seeds planted in fall 1980 germinated, where up to 50% of seeds scarified with a three-cornered file came up (Miller, 1981). Goodin found the scarification with industrial-strength H_2SO_4 was more effective (Reeder, 1981), and CDRI used this method when replanting in the spring of 1981. The vegetative growth from all the fall plantings reached a maximum length of 10 cm. before dying back. Although this may be a response to frost, the greenhouse plants responded in the same way (Goodin, personal communication). None of the fall-sown plants reappeared in the spring. Acid-scarified seeds were planted at all the CDRI sites in the spring, resulting in up to 82% germination rates. Without supplemental watering, vegetative growth reached a maximum of 20 cm.; and rodents devoured much of what did appear at the unfenced sites (Miller 1981).

The most spectacular results were met in the water-enriched plots. Miller reports that seeds planted in a test plot containing 60 cm. of rich alluvial topsoil and given 4 liters of water daily through a drip irrigation system showed the most growth. All ten scarified seeds in this plot germinated within two weeks. Vegetative growth continued through the summer without any dormancy periods. By mid-September, multiple vines were present in at least half the plants, and these vines averaged approximately 180 cm. in length (Miller, 1981). A tuber that was uprooted for nutritional analysis at the end of September weighed just over 2 kg.

Miller's conclusions sum up the state of the art of morama cultivation as of March 1982: "...the key to the success of morama as an energy efficient arid-land crop rests with the survivability of tubers during winter dormancy" (p. 13). Irrigation may be necessary for getting the tubers well-established, as indeed, heavier-than-average rainfall may be the prerequisite for the plant's establishment in the Kalahari.

Conclusions

Research on morama beans exemplifies the potential for application of ethnobotany to the satisfaction of human material and psychological needs. As we publicize the skills and knowledge of the San and other Kalahari foragers, these people and their sedentary relatives, will to some degree escape the onus of being considered "primitive". As we discover techniques for controlling and enhancing the productivity of morama, we will provide the growing numbers of inhabitants of the world's arid regions, including the Kalahari Desert, with a tasty and nutritious cultivar.

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