

## NOTES ON ECONOMIC PLANTS

**The jujube (*Ziziphus jujuba* Mill.), a multipurpose plant.**—Although it is unknown to most westerners, the jujube is one of the world's major fruit crops and is cultivated in India, Russia, the Middle East, southern Europe, and especially China. This remarkable plant merits even wider cultivation (6, 10, 14, 17). A small, graceful tree, the jujube produces strong wood, has medicinal properties, and yields honey, in addition to fruit. This note will briefly describe the plant, summarize information previously available only in Chinese, and provide new information about it in the southeastern United States.

**Nomenclature.** Synonyms for this plant are *Ziziphus vulgaris* Lam., *Rhamnus ziziphus* L., *Ziziphus sativa* Gaertn., and *Ziziphus zzyphus* (L.) Karsten. Several varieties (*lageniformis*, *inermis*, *jujuba*, *spinosa*) are differentiated. *Ziziphus jujuba* Lam. is the same plant as *Ziziphus mauritiana*.

Other common names are anab, bedara, ber (usually applied to *Ziziphus mauritiana*), beri, bidara, bor, Chinese date, Chinese jujube, French jujube, kankole, ilantai, ma-tan, masan, onab, taotau, tsao, and zao.

**Natural History, History, and Cultivation.** The jujube is one of many species of *Ziziphus* (Rhamnaceae) that produce edible fruit (16), but only one other species of *Ziziphus*, the cold-sensitive Indian jujube (*Ziziphus mauritiana*), is widely cultivated for its fruit (see 12). The present natural distribution of the jujube is from southeastern Europe to China (1), and it has become infrequently naturalized in the southeastern United States (5). Accounts of its original range vary, but humans moved it from the Middle East to Rome, where it was known by Pliny (2). It has been cultivated for 4000 years in China, as inferred by its association with rice culture in the *Book of Songs*, the famous poem of the 10th century B.C. (15). Today, approximately 40 cultivars (4, 9) are grown in Beijing and in the Hebei, Shandong, Shanxi, and Henan provinces of China (Jane Zhang pers. comm.). Annual fruit production in China is 450 000 long tons produced on 290 000 hectares (6). To give perspec-

tive, jujube hectareage in China is equivalent to citrus hectareage in Florida.

**Jujubes in the United States.** In 1908, Frank Meyer, a USDA plant explorer, introduced the first cultivars into the U.S. Recently, Roger Meyer (no relation) has introduced several Chinese and Russian cultivars. In addition, some cultivars have been selected locally from seedlings (Travis Callahan pers. comm.).

In the U.S., the jujube is primarily a dooryard fruit tree (see back cover), but a few small-hectareage commercial plantings primarily serve ethnic niche markets in California. Many attributes of the jujube favor its wider adoption. In general, the plant has few pests. Although it is better adapted to arid regions, it will tolerate a range of climatic conditions (see 11), including the humid Gulf Coast region (8; Travis Callahan pers. comm.). The jujube will grow in different soils and is resistant to alkalinity and salinity. It has a low chill requirement, yet it is cold hardy. The bloom period allows it to escape late-spring frosts and the long blooming period (4) is a decided advantage to beekeepers. Fruiting is usually precocious and regular; some cultivars consistently bear heavily. On the other hand, jujube culture is not entirely carefree. First, the tree is potentially weedy because it forms root sprouts. Second, under some climatic conditions, some fruits split, and in addition, a portion of the fruit spoils before maturity. Finally, the jujube fruit is a host of the Caribbean fruit fly (*Anastrepha suspensa*) (Wayne Sherman pers. comm.), which is present in restricted areas of the U.S. In summary, the jujube is not immune to all problems, but it is a plant that withstands neglect and requires few inputs.

In the southeastern U.S., long-time favorite cultivars are 'Tigertooth' (synonym, 'Silverhill') and 'Li' (synonyms? 'Geant', 'Leon Burk', 'Swoboda'), but many other cultivars also fruit here (Travis Callahan pers. comm.). Because of its status as a minor fruit, only one university, Alabama A&M, has an on-going study of the adaptation of jujube in this region, where the tree usually only achieves the size of a dogwood. Two adapted cultivars double as unique



**Fig. 1.** Examples of products produced from jujube: **A.** Rolling pin and comb made from the wood; **B.** Herbal tea, advertised to have healthful benefits, made from jujube and other fruits; **C.** Medicinal tea made from powdered jujube kernel. Below the Chinese characters, the Chinese words are transliterated into the Latin alphabet, where “zao ren” is translated as “jujube kernel”; **D.** Jujube flower, ca. 7 mm in diameter, showing nectar glistening on the floral disc; and, **E.** Honey produced from the jujube flower. Below the Chinese characters, the Chinese words are transliterated: “zao hua feng mi” is translated as “jujube-flower honey.”

ornamentals: ‘Sherwood’ is a columnar tree and ‘So’ is a contorted dwarfish bush.

**Many Uses.** Few plants are as versatile as the jujube. First, the wood itself is valuable. Strong, durable, and smooth, it is used for the manufacture of musical instruments, artwork, carts, ships (4), and miscellaneous items (Fig. 1A–1C). It has also been crafted into gears and caskets,

which bring honor to the deceased (Zhirong Du pers. comm.). Second, it is a source of fodder for cattle, camels, and goats. Third, it has been used medicinally for 3000 years (7). All parts of the plant—kernel, flower, fruit, leaves, bark, wood, and root—have been used medicinally (4). As an example, Fig. 1C shows a preparation of powdered kernel (*Z. jujuba* var. *spinosa*).

Modern scientific methods show that spinosin, a flavonoid glycoside, is partially responsible for the sedative and hypnotic effects of this type of preparation (7). Fourth, the fruit has been used for every imaginable edible purpose—fresh, dried, candied, in teas (Fig. 1B), in myriad recipes, and for the production of wine and vinegar (4). Last, the jujube is a major honey source in China (3) and elsewhere, but varietal honey production records are not maintained by the Chinese (Jane Zhang pers. comm.). Undoubtedly, this honey plays a role in the 22 million kilograms of honey that China exports annually to the U.S. Jujube honey (Fig. 1E) is considered to be of good table quality (4). Wang et al. (18) ranked its quality above tallow honey, below orange honey, and equivalent to sunflower honey. Jujube honey is slow to granulate (3), as predicted by the low glucose content of the nectar (Fig. 1D; 13).

**Plants.** Plants can be obtained from Roger Meyer (16531 Mt. Shelly Circle, Fountain Valley, CA 92708, exoticfruit@95net.com) or from Just Fruits, 30 St. Frances Street, Crawfordville, FL 32327.

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**Literature Cited.** (1) Bailey, L. H., and E. Z. Bailey. 1976. *Hortus Third*. Macmillan Publishing, New York, NY. (2) Brizicky, G. K. 1964. The genera of Rhamnaceae in the southeastern United States. *Journal of the Arnold Arboretum Harvard University* 45:439–463. (3) Crane, E., P. Walker, and R. Day. 1984. *Directory of important world honey sources*. International Bee Research Association, London. (4) Gao, X. Y., Y. Z. Ma, and S. L. Li. 1999. Jujube. New technology for high yields [in Chinese]. Jing Dun Publishing, Beijing. (5) Godfrey, R. K. 1988. *Trees, shrubs, and woody vines of northern Florida and adjacent Georgia and Alabama*. University of Georgia Press, Athens, GA. (6) Hache, V., and L. P. Xu. 1995. The jujube, a fruit of high potential not only in China [in German]. *Flüssiges Obst* 62:35–36. (7) Leung, A. Y. 1990. Chinese medicinals. Pages 499–510 in J. Janick and J. E. Simon, eds., *Advances in new crops*. Timber Press, Portland, OR. (8) Lyrene, P. M. 1983. Flowering and fruiting of Chinese jujubes in Flor-

ida. *HortScience* 18:208–209. (9) Mao, Y. M. 1997. Illustrations of high-yield jujubes [in Chinese]. China Forestry Publishing, Beijing. (10) Meyer R. 1995. Three new crops with proven market potential. The Sixth Conference of the Australasian Council on Tree and Nut Crops Inc, Lismore, NSW <http://www.newcrops.uq.edu.au/acotanc/papers/meyer.htm>. (11) Meyer, R., and R. R. Chambers. 1998. *Jujube. Primer & source book*. California Rare Fruit Growers, Inc., The Fullerton Arboretum, California State University, Fullerton, CA.; (12) Morton, J. F. 1987. *Fruits of warm climates*. Julia F. Morton, Miami, FL. (13) Outlaw, W. H., Jr., S. Zhang, W. R. Tschinkel, B. G. Smith, E. C. Outlaw, and N. N. Outlaw 2001. Chemical and biological attributes of the nectar of the jujube (*Ziziphus jujuba* Mill.). *American Bee Journal* 141:61–62. (14) Reich, L. 1991. Uncommon fruits worthy of attention. *A gardener's guide*. Addison-Wesley, Reading, MA. (15) Qu, Z. Z. 1983. Jujubes in ancient China [in Chinese]. In *Collection of Papers from the Jujube Institute*. Jujube Group, Department of Horticulture, Hebei Agricultural University. (16) Sturtevant, E. L. 1919. Sturtevant's notes on edible plants. Pages 620–623 in U. O. Hedrick, ed., *Report of the New York Agricultural Experiment Station. 27th Annual Report, Vol. 2, Part 2*. (17) Sweet, C. 1985. Large market potential seen for the Chinese date (jujube). *California Grower* 9:41–43. (18) Wang, Z. S., J. Y. Xu, and S. L. Yun. 1996. *Guide to honey production* [in Chinese]. China Agricultural Science and Technology Publishing Co., Beijing.

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