Simmondsiaceae—Jojoba family

*Simmondsia chinensis* (Link) Schneid.

**Jojoba**

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Other common names. goatnut.

Growth habit, occurrence, and use. The Simmondsiaceae (jojoba family), has only 1 genus, *Simmondsia*, which consists of only 1 species, jojoba—*S. chinensis* (Link) Schneid. Once considered an isolated member of the box family (Buxaceae), jojoba is now regarded as sufficiently distinct to be placed in its own family. Jojoba is found from coastal and cis-montane southern California east to central Arizona and south to Sonora and Baja California (Munz 1974; Yermanos 1974). It is a characteristic plant of upland shrub communities in the Sonoran and Colorado Deserts and is also quite common as a component of chaparral.

Jojoba is a sparsely branched, decumbent to erect shrub that grows to 2 or rarely 3 m in height. Its large (2- to 4-cm-long), opposite, entire leaves are evergreen, leathery, and dull gray. Plants are extremely tolerant of drought (Al-Ani and others 1972) and their foliage is a source of nutritious forage for sheep, goats, and cattle, as well as for wild ungulates and smaller browsers such as rabbits. The large seeds have been used locally as a food source by indigenous people (Brooks 1978).

The most noteworthy feature of jojoba from a human perspective is the unusual liquid wax that makes up the storage reserve of its seeds. This substance, a fatty acid ester of a long-chain alcohol, is unique in the plant kingdom. It has chemical and rheological properties similar to those of sperm whale oil, which make it useful in a host of applications (Brooks 1978). Interest in commercial production of jojoba seed was greatly increased in the mid-1970s, when import of sperm whale oil into the United States was banned. First efforts were focused on harvesting seeds from wildland stands, but it was soon realized that for cost-effective production, cultivation in an agronomic setting would be necessary (Foster 1980; Yermanos 1974). Since that time, jojoba has been successfully cultivated in many semi-arid regions of the world (Ismail 1988; Kumari and others 1991; Milthorpe 1989; Mathana 1981; Nimir and Ali-Dinar 1991), where it has the advantage of low water requirements and the ability to grow on agriculturally marginal land. Selection on natural variability and breeding have given rise to improved cultivars (Dunstone 1990; 1991; Palzkill and others 1989).

Flowering and fruiting. Jojoba is dioecious and relies on wind for successful pollination (Niklas and Buchmann 1985). The flowers, which are greenish yellow, inconspicuous, and without petals, are borne in the axils of the leaves. The male flowers are clustered at the nodes, and the female flowers are usually borne singly. Flowering occurs in March through May in response to winter rains. Plants of most populations appear to have a short (2-week) vernalization requirement for induction of flowering (Nord and Kadiş 1974). Under plantation conditions, jojoba usually begins producing seeds the second or third year after planting (Nord and Kadiş 1974; Yermanos 1974). Seeds ripen during the summer. The endosperm is absent (figure 1), and the cotyledons (which function as the storage organs) contain about half of their weight as wax (Brooks 1978). Good seed crops are produced at intervals of 2 to several years (Brooks 1978; Castellanos and Molina 1990). Some individuals appear to be genetically predisposed to be more productive than others, making selection for higher yield possible (Nord and Kadiş 1974; Yermanos 1974). The 1 to 3 large seeds are borne in a capsule that superficially resembles an acorn. This splits open apically and down the sides to release the seeds. As is the case with many large-seeded North American desert species, jojoba seeds are dispersed by scatter-hoarding rodents that are also their principal consumers (Castellanos and Molina 1990). Sherbrooke (1976) reported that only 1 heteromordy species in southern Arizona—Bailey’s pocket mouse (*Perognathus baileyi*)—was able to utilize jojoba seeds. The seeds contain a unique toxic cyanogenic glucoside (simmondsin). He concluded that Bailey’s pocket mouse had evolved a detoxifica-
Figure 1—Simmondsia chinensis, jojoba: longitudinal section through a seed (top) and exterior view of a seed (bottom).

Germination. Jojoba seeds require no pretreatment and are usually readily germinable immediately after harvest (Nord and Kadiš 1974; Rao and Iyengar 1982). They are protected from premature summer germination by a requirement for relatively cool temperatures—an optimum 15 to 23 °C (Nord and Kadiš 1974), with no germination at 30/40 °C (Ismail 1988)—and slow germination rates. It takes 3 days for the first emergence of the radicle at 20/30 °C and 7 days at 10/20 °C (Ismail 1988). Seedlots of large seeds germinated more quickly and to higher percentages than did lots of small seeds, suggesting that seed size is associated with germination polymorphism (Ismail 1988). This may function to reduce germination risk under field conditions by spreading out germination across rain events.
Dormancy could be removed in most seeds by breaking the testa at the radicular end. Nord and Kadish (1974) reported that jojoba seeds could germinate at 5 to 10°C but only after an 8-hour pre-treatment at 20°C. Germination is hypogeal (figure 2).

Nursery practice and field seeding. Jojoba may be direct-seeded if the plots are protected from seed predation and seedling grazing by rodents. The seeds should be planted in spring, when daytime soil temperatures are above 60°C, at a depth of 2.5 to 5 cm (1 to 2 in) (Nord and Kadish 1974). Although mature plants can tolerate some freezing, the seedlings do not, perishing at temperatures below –2°C.

Seedlings may also be readily be produced as container stock (Yermanos 1974). Seedlings emerge in 7 to 12 days at 60 to 75°C. The plants may be held in 3.8-liter (1-gal) pots outdoors for 8 to 24 months. With the longer period, flowering takes place in the pots, making it possible to optimize sex ratios in plantation plantings. Another alternative is to establish plants from cuttings of known sex. Jojoba can be propagated from softwood stem cuttings taken in the spring or summer (Nord and Kadish 1974).

References


Figure 2—Simmondsia chinensis, jojoba: seedling development at 3, 7, and 14 days after germination.