Erythrina edulis Triana ex Micheli

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FABACEAE (BEAN FAMILY)

Erythrina edulis Triana ex Micheli (Jour de Bot. 6:145.1892); *Erythrina edulis* Posada-Arango; *Erythrina esculenta* Spague; *Erythrina lorenoi* F. Macbride; *Erythrina megistophylla* Diels (Secretaria Ejecutiva del Convenio Andrés Bello 1992)

Ante-poroto, balú, baluy, basul, bean tree, bucare, camentsa, Chachafruto, Chachapurutu, frijol de pobre, frijol nopás, frisol, frisol de monte, hijuela, ingano, Juatsembese, nopas, nupo, pajuro, pajurro, pashigua, pashuello, pisonay, poroto, poroton, poruto, sachafruto, sacha-poroto, sachaporuto, sachapuroto, sachapurutu, uswal, zapote de cerro (Acero and Barrera 1996; Barrera 1994a, 1994b; Secretaria Ejecutiva del Convenio Andrés Bello 1992)

Erythrina edulis is one of the 117 species of the genus *Erythrina* reported in the world (Neill 1993). In Colombia, it is one of the 13 species currently reported. *Erythrina edulis* is native to the Andean region and is found in the spur of the Andes mountain range; it is distributed in the sub-Andean forests [according to Cuatrecasas (1958)] or in humid subtropical forests (bh-ST) (Holdridge 1978) from Mexico, across Panama, to Venezuela, Bolivia, Colombia, Ecuador, and Peru.

Erythrina edulis is a leafy bean tree that reaches up to 14 m in height with a crown diameter of up to 7 m when allowed to grow freely. Its main stem is ligneous, and it can reach up to 47 cm d.b.h. (40-year-old trees). The tree grows at free exposure, accepts shade, and has a high demand for water in the first stages of its development. *Erythrina edulis* grows well in association with other trees, in soils with loose sandy texture or in heavy soils with adequate drainage. It does not grow well in acid soils with a pH less than 4.5. Although it is found between 1000 and 3000 m above sea level, the optimal elevation range for its growth is 1600 to 2200 m, with annual rainfall between 1800 and 2200 mm and temperatures between 15 and 24 °C.

Erythrina edulis is considered a multipurpose tree, ideal for agroalimentary programs, for the management of soils and watersheds, and for the stable increase of agroforestry and agropastoral systems. The beauty of the flowers promotes its use as an ornamental tree. Its flowers can also be used in salads and sweets and in infusions taken for anxiety and urinary problems. Its dried flowers can be used in floral arrangements.

Erythrina edulis is used in agroalimentary programs because the flour from the seed has a high protein content. At 23 percent dry basis it has a protein efficiency ratio (PER) of 1.15, which is higher than that of the kidney bean (0.88) or the lentil (0.91). The flour also has an index of essential amino acids (IEA) of 90, which is higher than that of the kidney bean (64) or the vetch (59) (DeSilvestre and Surco 1996). However, because the content of methionine and tryptophan is low, *E. edulis* becomes a complete food only when it is complemented with flours rich in methionine and a tryptophan such as corn, *Zea mays*, and dividivi (sesame seed). The resulting flour is used in cakes, sweets, soups, compotes, fritters, and creams. It also serves as a protein supplement for animals. The leaves, which contain more than 20 percent protein and have an acceptable digestibility of 59 percent that can be improved by combining it with other forages, are used as a protein supplement for ruminants. The complete, cooked fruit is used as pig and bird feed; the cooked seeds as bird feed. The raw seeds are fed to monogastric animals because they contain lectins.

In agroforestry programs, *E. edulis* is planted in rows 5 or 6 m apart to obtain a productivity of up to 170 k of fruits per tree per year in trees over 7 years old (Barrera 1992), in

rows alternating with other crops, or as shade for crops. Its leaves decompose easily and serve as green manure. In silvopastoral programs, the species is planted in rows 2.5 or 3 m apart. It also serves as a protein bank when planted in rows at 1.5 by 1.5 m in a homogeneous crop or associated with other species. In Colombia, production of up to 80 tons of edible forage per ha per year has been reported.

The crimson red flowers are grouped in inflorescences defined as phylum racemes. If the soil provides adequate levels of potassium, the tree will flower and fruit at 3 years. An inflorescence has from 180 to 200 complete zygomorphic flowers with short pedicels grouped in triads around the floral axis. Only 15 to 20 percent of the flowers produce fruits, about 8 to 18 legumes per raceme. Legumes are hairless and cylindrical. Those with a diameter of 3 to 3.5 cm and a length of 15 cm will have 2 seeds; with a length of 36 cm, 6 seeds; and up to 55 cm, 9 to 11 seeds.

The greenish-white seed is a huge bean 3 to 7 cm long and 2.0 to 2.5 cm in diameter. It has a concave-convex configuration, made up of two cotyledons united by the flat part. The color of the testa varies with the state of ripeness and the morphotype, from chestnut to a dark-coffee color or from pink to dark red; lighter yellowish and black morphotypes have been observed (Acero and Barrera 1996). The seeds also vary by size. The dimensions are related to the food reserve stored in the cotyledons. A large seed averages a maximum diameter of 2.65 cm, a minimum diameter of 2.02, and a total weight of 26.28 g. A medium seed averages a maximum diameter of 2.03 cm, a minimum diameter of 1.55 cm, a length of 3.98 cm, and a total weight of 11.88 g. A small seed averages a maximum diameter of 1.68 cm, minimum diameter of 1.41 cm, a length of 3 cm, and a total weight of 6.03 g.

Reproduction by sexual seed is successful if seeds are planted promptly after harvest, even with no pregermination treatment. Tests showed 89 percent of emergence in seeds planted 10 days after harvest, 65 percent at 20 days, and 51 percent at 30 days (Mejía and others 1996). Vegetative reproduction of *E. edulis* is also successful by shoot, at 85 percent, and by stem cuttings of 3 to 5 cm in diameter, at 90 percent.

The seeds may be planted in 1 kg bags or can be sown directly if kept clean and protected with a good water supply. The rainy season is the best time for sowing. The seed is placed with the hilum facing down, allowing the back to be protected by a 1 mm layer of soil. The bud emerges in 9 to 15 days. If planted in a bag, the plantule is ready for outplanting in 20 to 40 days.

Lack of water during the first year limits plant growth. With enough water, a plantule 8 months old can reach a height of 2 m. To maintain a protein bank, the seedling should not be pruned until 15 months after the plantule is established.

ADDITIONAL INFORMATION

The cylindrical stem possesses trichomes shaped as thorns and has a shiny green color, starting at the insertion of the roots. At the apex of the main stem of the plantule, the arrangement of the branches from the third knot up changes in 20 to 30 days (Mejía 1993). The leaves are either simple or composite; they are inserted in the knots of the stem or in the lateral branches through petioles. The primary simple leaves appear in the second knot of the main stem; they develop in the seed during embryogenesis. They are opposite, simple, acuminate, and have a shiny green color. The first trifoliolate leaves appear after the knot of the primary leaves. From the third knot onward, trifoliolate leaves are formed to elongate the stem; it can be observed that in the stem there are, at the level of each knot, other organs such as stipules and branches.

The seed is made up of the testa and the embryo, which consists of the plumule, the two primary leaves, the hypocotyl, the two cotyledons, and the radicle. The plumule-radicle complex is located between the cotyledons; it occupies only a very small part of the empty space between the cotyledons.

After the radicle emerges, the epicotyl lengthens, forming an arc; the cotyledons remain covered (hypogeous germination), and finally the bud emerges above the ground with the two real leaves. The leaves develop in the plumule, continuing the growth of the terminal bud.

Nematodes limit the growth and productivity of *E. edulis*. Plantules with nematodes show dwarfism, yellowing, and low production of foliage. In Colombia, the following nematodes have been identified: *Longidorus* sp. (Orjuela and others 1996) and *Helicotylenchus* sp., *Hoplotylus* sp., and *Meloidogyne* sp. (Barrera 1994a, 1994b).

Most of the insects associated with *E. edulis* are found in the foliage and belong to 29 families of 7 orders of insects and 4 acari, establishing diverse types of relationships: Order Lepidopterous, family Tortricidea (borer of the fruit and seed); family Pyralidae (borer of the fruit and seed); possibly *Terestia meticulosalis*; another Pyralidae (borer of the stem of plantules in a tree nursery setting and in the field); an insect of the order Hymenoptera, family Tenthredinidae (skeletonizer of leaves); and one Hemipteran from the family Miridae (sucker of foliage) (Palacios and others 1997).


2cm
2cm