

---

# Lagos Spinach

Larry Yarger

---

## INTRODUCTION

Lagos spinach (*Celosia argentea*; a.k.a. quail grass, soko, celosia, feather cockscomb) is a low-maintenance broadleaf annual crop that will grow with minimal effort and resources. This underexploited leafy vegetable is easy to plant, grows in most climates and soils, withstands drought and heat, has few problems with pests and disease, is easy to prepare, highly nutritious and tastes good, and produces large quantities of seed. One might wonder why such a plant is so little known!

## DESCRIPTION

*Celosia argentea* belongs to the Amaranth family (Amaranthaceae). It grows widespread in the tropics. In East and Southeast Asia it grows as a native or naturalized wildflower, and is cultivated as a nutritious leafy green vegetable. It is traditional fare in countries of Central and West Africa, and is one of the leading leafy green vegetables in Nigeria, where it is known as 'soko yokoto', meaning 'make husbands fat and happy.'

*C. argentea* grows rapidly from seed. Depending upon the variety and soil fertility, it can reach a height of 2 m (6.5 ft). When days become shorter, this attractive plant is covered with silvery-pink to purple blossoms. Each inflorescence is an indeterminate feathery spike; as it elongates, the basal end of the inflorescence dies, producing large numbers of small, black, edible seeds, while the tip continues to bloom, attracting bees and other insects. At ECHO we have noticed a number of predatory insects frequenting the flowers, particularly wasps and hornets.

In West African nations where *C. argentea* is produced commercially, there are three distinct types: a green, broad-leaved type, a broad-leaved type with red pigmentation in the leaves and stems, and a type with narrow, deep green leaves with a hard texture. There is also a wild type that can be a nuisance, especially on clay soils that are relatively fertile.

A cultivar in Thailand has leaves with dark purple coloration and a red stem. This particular accession was found to have very high anti-oxidant activity with high ascorbic acid (vitamin C) content.

A collection of *Celosia* germplasm is maintained at the National Horticultural Research Institute (NIHORT), in Ibadan, Nigeria. Limited breeding has been done on *C. argentea*, and selections have been made based on leaf size and shape, time of flower initiation and leaf coloration. Completely green cultivars have been selected and are now generally the ones utilized.

## USES

Leaves, shoots and tender stems of *C. argentea* are eaten as a potherb in sauces or soups, cooked with other vegetables, with a main dish or by itself. The leaves break down easily, even when cooked only briefly. The seeds are also edible. Chopped plants have been used as forage for poultry and other livestock. The flowers make nice ornamentals, fresh or dried.

Medicinal uses of *C. argentea* have been reported where its use as a leafy vegetable has been adapted into the culture.

## COOKING

Like its cousins the amaranths, the leaves of *C. argentea* are high in protein and vitamins A and C, and are good sources of calcium and iron. The flavor is pleasant, spinach-like and mild, with no trace of the bitterness sometimes found in amaranth. Young shoots and older leaves are cooked by boiling for about five minutes to soften the tissue and remove oxalic acid and nitrates, potentially toxic anti-nutrients. The water becomes dark due to red and yellow plant pigments. These are harmless, but the water should be discarded because of the dissolved oxalates and nitrates. The leaves themselves will not discolor during the cooking process. In fact, they become an attractive green color looking much like cooked spinach. Lengthy cooking will reduce the vitamin content.

We do not recommend that these greens be cooked in a steamer. When staff at ECHO prepared the greens this way, the leaves became black and had an unpleasant taste. It actually irritated the tongue. Apparently the pigments and oxalates normally removed by discarding the cooking water were left in the steamed leaves.

*C. argentea* is best eaten as a vegetable before it begins flowering. Most sources recommend harvesting five to seven weeks after sowing for optimal nutritional value. The highest total marketable and edible yields and total crude protein yield, however, occurs at 15 weeks after sowing. After flowering, the new leaves are too small and unappealing to be worth eating.

## NUTRITION

The nutrient content in *C. argentea* varies between cultivated varieties, and apparently with time of harvest. Green-leaved varieties generally are more palatable and have higher protein and ascorbic acid (vitamin C) content than red varieties.

Name	Moisture (g)	Dry Matter (g)	Protein (g fresh wt)	Protein (% dry wt)	Energy (kcal)	Vitamin C (mg)	Iron (mg)
<i>C. argentea</i>	85	15	1.2	8.0	23	59	28.3
<i>Amaranthus viridis</i>	91	9	2.0	22.2	24	17	18.2
<i>A. spinosus</i>	84	16	3.6	22.5	62	33	13.1
<i>Alternanthera sessilis</i>	84	16	3.6	22.5	35	14	14.1
<i>Basella alba</i>	93	7	3.3	47.1	31	15	5.5
<i>Sauropus androgynus</i>	88	12	3.4	28.3	28	22	10.1

Table 1: Nutritional values of selected underutilized green leafy vegetables. Source: Sheela, K., G. Kamal, G. Nath, D Vijayalakshmi, G.M. Yankanchi, R.B. Patil. 2004. Proximate Composition of Underutilized Green Leafy Vegetables in Southern Karnataka. Journal of Human Ecology 15(3):227-229. Other sources listed the protein content as more comparable to the plants in this table

A 2004 study in Karnataka, India compared the nutrient qualities of 38 underutilized green leafy vegetables. Partial results of this study are in Table 1. *C. argentea* is an outstanding source of iron and a very good source for protein and vitamin C. (The USDA recommends 60 mg

vitamin C, 1000 mg calcium and 18 mg iron per adult per day.) The data in Table 1 are from samples weighing 100 g fresh weight. The evaluation of all the compounds was found to vary with the position of the leaves and their age.

An AVRDC (Asian Vegetable Research & Development Center) study showed *C. argentea* to be high in antioxidant content. Antioxidants bind free radicals (cellular by-products known to cause cancer, heart disease and a weak immune system, among others) in the bloodstream and render them harmless. Principle antioxidants include vitamins C, E and carotenoids (beta-carotene). Out of 20 indigenous leafy vegetable species tested for antioxidant content, *C. argentea* placed second only to [leaves of] *Cleome gynandra* (spider flower), *Moringa oleifera* (horseradish tree) and *Toona sinensis* (Chinese mahogany).

Peace Corps volunteer Jessica Jacklet tested *C. argentea* at her site in Panama, where few vegetables grew well. The foliage of *C. argentea* was rich and dark with lovely purple flowers. Those who started growing *C. argentea* were very proud of its exceptional growth. She introduced the plant as "purple spinach" to the villagers, who were learning ways to incorporate the leaves into their recipes. This very productive plant is hardy and attractive, and it merits trial in more areas.

## CULTIVATION

SEEDING. *C. argentea* may be seeded directly into the soil at a depth of 0.75 cm (0.25 in) or started in a seedbed. Germination can be expected at five to seven days. Thin seedlings to 15-30 cm (6-12 in) apart, or transplant them into the field when 10-15 cm (4-6 in) tall, at two to three weeks, using the same spacing. For a once-over harvest (uprooting the whole plant), seed may be mixed with sand or loose soil

at a ratio of 1:20 (to obtain a more even distribution) and broadcast onto the prepared soil. The seeding rate is 6-9 g per 10 m<sup>2</sup>, whether broadcast or seeded directly into rows. *C. argentea* germinates very readily.

**FERTILIZATION.** *C. argentea* responds well to fertilizer application. Organic manures, supplied at a rate of 24-40 T/ha, may substitute for or augment inorganic fertilizers.

**ENVIRONMENTAL & CULTURAL CONDITIONS.** Minimizing weed competition shortly after seeding is important because the *C. argentea* seeds and resulting seedlings are so small. A rich organic soil is the best for growing *C. argentea*. It tolerates full sun, but will produce best under partial shade. *C. argentea* is killed by standing water or freezing temperatures. Although temperatures below 20°C (68°F) will severely restrict growth, it withstands high temperatures well. Optimal daytime temperatures range between 30 and 35°C (86-95°F) with optimal nighttime temperatures between 23 and 28°C (73-82°F). *C. argentea* has produced well at altitudes as high as 1700 m (5400 ft).

*C. argentea* and other members of the amaranth family tend to reseed themselves abundantly. In places where few plants will grow without special care, that might be an advantage. However, caution should be taken that it does not become a new weed.

## HARVESTING AND SEED PRODUCTION

**ONCE-OVER HARVEST.** This method of harvesting refers to uprooting the whole plant. At four to five weeks after sowing, thin out the tallest plants (20-30 cm or 8-12 in). The whole of each uprooted plant can be eaten, or the roots may be cut off, bundles made and prepared for market. Harvest continues in this manner until any remaining plants are 40-50 cm (16-20 in) tall. At this point, you may see the onset of flowers and/or lateral branches. Either way, at this stage newly emerging leaves will be small and unfit for harvest.

**SUSTAINED HARVEST.** This method involves periodic cutting and regrowth. The first harvest is made after about four to five weeks. Tops are cut, leaving a stem 15-20 cm (6-8 in) from the ground, allowing side shoots to grow. A second harvest is taken 15-20 cm from the stem, again leaving a sufficient number of buds for regrowth. Cuttings may be made in this manner at two to three week intervals. This method allows for four to five harvests to be made before the onset of flowering at which time leaf size and quality begin to decline.

Most farmers prefer the once-over harvest method to the sustained method, though the former yields slightly less overall. Some farmers will combine the two techniques, first harvesting the entire plant as a thinning operation, then ratooning the remaining crop.

**SEED PRODUCTION.** For seed production, select several healthy, vigorous plants and mark them. After the first harvest, cut these plants 15-20 cm from the ground, and allow for regrowth. Pruning will stimulate multiple lateral branch production and, therefore, multiple flower heads. If planting specifically for seed production, transplant seedlings into rows 70 cm apart with 40-45 cm between each plant in the row.

Seed harvests in tropical environments may be expected to begin 10 weeks after sowing and to continue up to another 10 weeks. Seed is ready to be harvested when flowers begin to turn silvery in color and the leaves turn yellow. To harvest the seed, cut the whole flower spike and place in a bag that allows air to circulate. Store in the shade until dry, and then thresh. Alternatively, you can collect seed weekly because seed is formed starting at the base while the flower keeps growing longer. Hold a container under the seed head and rub or tap it gently. Seed yield is 200-700 kg/ha. One thousand (1000) seeds weigh 1.0-1.5 g.

## PESTS & DISEASES

Although relatively pest-free in temperate regions and at ECHO's subtropical location in Florida, *C. argentea* sustains damage from a number of diseases and pests in the tropics. Spider mites and nematodes tend to be the biggest pest problems. Also reported in Nigeria are the variegated locust and a beetle, *Baris planetes*, which attack and feed on immature seed capsules causing seed loss. Sometimes caterpillars feed on the foliage, and grasshoppers and aphids can cause minor damage. Nut grass (*Cyperus spp.*) is a serious weed problem.

*C. argentea* is reported to be quite susceptible to root-knot nematode (*Meloidogyne spp.*) infection causing the formation of galls on the roots, stunted growth, small brown-colored leaves and reductions in yield of up to 40% (however, at ECHO, where root knot nematode problems are severe in general, we have no difficulty whatsoever growing *C. argentea*).

White rust (*Albugo blitii*) and crown blight (*Choanephora cucurbitarum*) are considered the most serious fungal diseases affecting *C. argentea*, and are most problematic during the rainy season and when there is high humidity. Appropriately spaced plant stands, clean fields (free of diseased and dead plants) and resistant varieties can help to significantly reduce fungal disease damage to your crop.

Other diseases include damping-off, collar rot and leaf spots.

Use appropriate measures to control diseases and pests without endangering your household or the environment. If you must utilize commercial chemicals, remember to read the label and understand how to safely apply the chemical, how to clean yourself and your equipment afterwards and how to safely dispose of the empty container.

ECHO has seeds of Lagos Spinach. We have 'Green' and 'Mixed' (mixture of red and green) types. Those serving small-scale farmers overseas may request a free trial packet. Each packet contains half a teaspoon of seeds. We have just obtained seed for several new varieties and will announce their availability in future EDN issues after we have increased the seed supply.

*A list of references and useful resources is found in the Technical Note. Request a copy, or check our website.*