Crotalaria[1]

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CROTALARIA JUNCEA

Scientific Name: *Crotalaria juncea* L.

Family: pea family (Fabaceae).

Common Name: Sunn hemp, Indian hemp, Madras hemp, brown hemp, and sann hemp

Common Variety: 'Tropic Sun,' jointly released in 1982 by the University of Hawaii and the Soil Conservation Service, USDA

Origin and Distribution: Sunn hemp is native to India and Pakistan. In Southeast Asia, sunn hemp has been grown as a green manure crop for centuries and now is cultivated in many tropical and sub-tropical regions worldwide. Sunn hemp seeds are mainly produced in India, Hawaii, Colombia, and South Africa. In the U.S., this plant has been grown as a summer cover crop in the southern, Mid-Atlantic, Pacific and northern Great Plains states. Flowering is triggered by short days with a long season required for full seed set. Therefore, sunn hemp will not produce seed in most U.S. states.

Description of Plant: Sunn hemp is a short-day, herbaceous annual, with erect fibrous ridged stems. The leaves are simple, up to 5 inches long and up to 1.4 inches wide, oblong lance-like in shape, covered with short, downy hairs, and arranged spirally along the stem. The plant has a strong taproot with well-developed lateral roots. It forms lobed nitrogen-fixing nodules that are colonized by cowpea-type rhizobia form on the roots. The plants branch at approximately 20 inches above the ground when not crowded, but branching is suppressed in dense stands. When grown under short day lengths, flowering occurs about eight weeks after seeding. In Homestead, Florida, when sunn hemp has been seeded in May, the plant's showy bright yellow flowers bloom profusely beginning in early September.

Uses: Sunn hemp is well suited for use by vegetable producers in Florida as green manure/cover crop to provide both organic matter and nitrogen during the period between summer and the winter cash crop. Since sunn hemp can produce significant quantities of biomass and nitrogen in as little as 6 weeks after seeding, it can readily fit into short-rotation sustainable production systems in Florida. When seeded in spring or early summer in Homestead, Florida, sunn hemp grows to a height of 7 feet and covers the land completely (canopy closure) in about ten weeks. No other cover crop is known to grow so rapidly in this region. However, when seeded during short-day lengths, the plant may grow only 3 to 4 feet tall. To obtain high yields of biomass in Florida, sunn hemp should be seeded in April through June and not later than mid-July. Since this plant is a legume, sunn hemp supplies its own nitrogen, and provides residual nitrogen to the subsequent

crop. Furthermore, sunn hemp can be grown as high-quality forage. Since livestock do not eat sunn hemp plants when green, sunn hemp should be cut for hay. In India clothing, twine and rope are made from the fiber of older, densely grown plants. In some areas, seeds are fed to pigs and horses without adverse effects. However, since some sunn hemp varieties contain moderately toxic levels of pyrrolizidine alkaloids, sunn hemp fodder and seeds are usually provided as no more than 45% of the feed ration of ruminants, swine, and horses.

Via atmospheric nitrogen fixation, sunn hemp may accumulate as much as 180 pounds of nitrogen per acre. This crop also adds 2.5 to 11 tons of organic matter when incorporated into the soil. When environmental conditions are optimal, as much as 16 tons of aboveground fresh biomass and 700 pounds of nitrogen can be accumulated in subtropical regions, such as south Florida (Fig. 1). To grow sunn hemp in subtropical regions, seeds should be sown at a soil depth of 1 inch or less in June through July. At greater seeding depths, emergence is poor. Seeds should be sown in soil temperatures greater than 68°F for successful germination. Seeds usually germinate readily within 3 days, and seedlings rapidly develop a dense ground cover. To establish as a cover crop, sunn hemp should be sown at a rate of 10 to 40 pounds of seed per acre. Lower seeding rates can promote lateral branching. Seeds can be inoculated with cowpea inoculant to improve nitrogen fixation.

Figure 1.

Sunn hemp growing in southern Florida.

In field trials at Homestead, in which sunn hemp was seeded together with velvetbean (3 pounds per acre of sunn hemp and 30 pounds per acre of velvetbean), sunn hemp served as a trellis to support the velvetbean and to strongly shade weeds. Velvetbean in combination with sunn hemp produced more than twice the amount of biomass compared to pure velvetbean stands. In addition, when used as a trellis, sunn hemp performed better than corn, which had to be sprayed repeatedly to protect it from insects and diseases.

Production and Harvest: Sunn hemp grows well at mean annual air temperatures from 70 to more than 100°F. High temperature with moderate humidity is preferable for sunn hemp growth and development. Growth may be slowed by cool weather, and the plant is susceptible to freezing injuries when the temperature is less than 28°F. Although sunn

hemp tolerates poor fertility soils and no fertilizer is necessary, its productivity is enhanced on fertile soils. Sunn hemp can grow well in soils with pH ranging from 5.0 to 8.4. This plant is adapted to well-drained calcareous soils and acidic sandy soils, but not to waterlogged or saline/sodic soils. Sunn hemp is drought tolerant and, generally, no irrigation is necessary during the summer in south Florida. Nevertheless, in Miami-Dade County, studies have shown that irrigation just before and after seeding may improve germination and productivity.

Sunn hemp plants need not be mowed during the middle of summer. However, mowing to remove the very top of the plant can be beneficial. For example, in an experiment at Homestead, Florida, in which 5-foot-tall plants were mowed at 1 foot, 2 feet, and 3 feet above the ground and then allowed to grow 70 more days, the total yields of dry biomass were 8.3, 11.0, and 13.8 tons per acre, respectively, compared to 11.4 tons per acre in the uncut control. The corresponding numbers of pounds of nitrogen in the biomass were 259, 255, 277, respectively, compared to 238 pounds of nitrogen in the uncut control. Mowing cuts the main stem and thereby destroys the dominance of the apical bud. Thus, mowing induces profuse branching and the production of additional leaves and flowers. Sunn hemp roots, stems, and branches are fibrous with high cellulose and low nitrogen content, whereas leaves and flowers are rich in nitrogen. When the leaves and flowers are incorporated into the soil, they are readily mineralized. The combined dry weights of leaves and flowers in the above experiment were 2.7, 2.0, and 1.7 tons per acre in plants cut at 1 foot, 2 feet, and 3 feet above the ground , respectively, compared to the 1.7 tons per acre in the uncut control. Further, the amounts of nitrogen in the leaves and flowers were 192, 147, and 132 pounds per acre in plants cut at 1 foot, 2 feet, and 3 feet above the ground, respectively, compared to the 122 pounds per acre in the uncut control.

In the above experiment, the greatest amount of biomass and nitrogen was obtained by cutting the main sunn hemp stems at 3 feet above the ground, whereas the greatest amounts of leaves and flowers were produced when the stems were cut at 1 foot above the ground. Therefore, mowing at 1 foot above the ground would be beneficial if high quality biomass is desired for production of a vegetable crop or for use as hay.

Mowing sunn hemp plants at less than 1 foot may result in plant mortality. Regrowth of mowed plants requires that at least 10 leaves remain on each plant. Since the lower leaves tend to become senescent and drop off as the plant matures, the cutting height should be higher in more mature stands than in young stands. With long day lengths, relatively early cutting facilitates regrowth and high yields. However, with short day lengths, the time of cutting has little effect on yield. In addition, the use of circular mowers with dull blades or poorly adjusted flail mowers are likely to kill many sunn hemp plants. A dull blade or flail knife will cause the stem fibers to tear down to the base of the plant, usually resulting in loss of that plant.

The plant should be plowed down when flower buds have formed or during the early flowering stage (Fig. 2). Mowing and disking are common practices to incorporate the plant residues into the soil (Fig. 3). For example, to follow sunn hemp with vegetables and to take advantage of the nitrogen present in the sunn hemp biomass, the plant should be

incorporated into the soil within 60 days of planting a vegetable crop. This practice ensures sufficient sunn hemp decomposition to supply nitrogen to the following crop.


Figure 2

Sunn hemp being turned under using a roto-tiller.


Figure 3

Sunn hemp flowering with one strip mowed in preparation for cultivation into the soil.

Several insect species may attack sunn hemp, but usually they do not cause substantial economic losses that justify chemical treatment. However, sunn hemp grown in wet soil is susceptible to *Pythium* spp. and *Fusarium* spp., which may cause significant yield losses. Therefore, good soil drainage is necessary to obtain adequate biomass production. In addition, since sunn hemp is resistant to soil root-knot and soybean cyst nematodes, adding sunn hemp to the crop rotation with nematode-susceptible cash crops may substantially benefit these cash crops by lowering nematode pressure (carryover effect). Another benefit of sunn hemp in subtropical areas is its rapid growth. Therefore, sunn hemp can effectively control weeds during the summer months. This crop also supplies the added benefits of soil erosion prevention and windbreaks for vegetable and tropical fruit crops due to its denseness and height. The sensitivity of sunn hemp plants to herbicides has yet to be studied.

Seed Production: Shortages of seed from local suppliers have limited the use of sunn hemp. Currently, cost of seed ranges from $1.50 to $4.00 per pound. Seed is mainly imported from tropical countries and limited amounts are supplied from Hawaii. Seed production is more difficult in the subtropics than in the tropics. Long day lengths and cool temperatures are the major factors limiting local seed production in Florida. In the tropics,

flowering can begin at six weeks after planting, and seed maturity is reached at four months or more. Worldwide, seed yields range from 400 to 900 lb per acre. It should be possible to increase yields by cutting the main stem at 3 feet above the ground or higher. There are approximately 15,000 seeds per pound. Seeds remain viable for years if properly stored at low-temperatures. Currently a study is underway to evaluate sunn hemp seed production potential in South Florida. We expect that seed production can be improved in this subtropical region to supply local seed demands in the future.

FOOT NOTES_____

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CROTALARIA: WARM SEASON LEGUME. MORE INFORMATION

- Fast growing cover crop
- Suppresses nematodes n
- Significant N in 60 days
- Fast biomass production
- Suppresses weeds
- Builds soil heath
- Helps conserve soil moisture
- Tolerant of dry conditions
- Up to 2.5 tons biomass per acre

- Large roots, strong taproot

VEGETABLES

Crotalaria suppresses nematodes like few other cover crops. Outstanding nitrogen and biomass production in a short growing window makes Crotalaria a valuable addition to rotations.

SMALL GRAINS

Crotalaria is ideal for planting after small grain harvest. The soil cover and shade in warm weather helps reduce soil and moisture loss while adding large amounts of nitrogen and biomass.

SUGAR CANE

Crotalaria is ideal for planting after sugar cane harvest to revitalize soil, add nitrogen, and help suppress weeds.

CORN SILAGE

Following corn silage harvest, especially in southern regions, Crotalaria competes with pigweed with its rapid growth and dense shading foliage.

USES

Vegetable growers appreciate the natural nematode suppression and warm weather nitrogen production of Crotalaria. The short 8-week growth window fits into many crop rotations, depending on the individual grower program.

Crotalaria adds up to 2.5 tons per acre of biomass, which is especially helpful in sandy soils.

Sugar cane growers can rejuvenate soil following sugar cane harvest by planting Crotalaria in the spring to early summer.

Small grain growers can restore N following harvest by planting Crotalaria. The warm season legume produces nitrogen in the root zone.

Crotalaria grows quickly and achieves peak benefit potential after 8 weeks growth in warm weather, based on conditions.

Corn silage growers in warmer growing zones fight pigweed, a challenging weed and prolific seed producer that is hard to control.

Crotalaria planted as a cover crop immediately following corn silage harvest grows fast and can help suppress pigweed by shading it out with its tall growth habit and dense foliage.

An annual program based on planting Crotalaria immediately following corn silage harvest can help reduce pigweed over time while adding nitrogen, large amounts of biomass, and good soil cover on an annual basis.

Other uses benefit from Crotalaria based on its rapid growth, large biomass, warm weather nitrogen production, nematode suppression, and effectiveness as a ground cover when rolled down. Crotalaria is killed with the first killing frost.

KEY FACTS AND CULTIVATION TIPS

- Crotalaria is proven to suppress nematodes.
- Crotalaria requires an inoculant; a cowpea type is recommended.
- Control (terminate) at first flower for maximum benefit, and before it becomes fibrous and difficult to manage.
- Produces significant amounts of nitrogen within 60 days, depending on conditions.

PLANTING TIPS

PLANTING WINDOW

Plant any time after last threat of spring frost.
For maximum benefit, plant a minimum of 8 weeks before average first frost in the fall.

PLANTING DEPTH, pH

Plant from 1/2 inch to 1 inch deep as required for good seed-to-soil contact with adequate moisture present on a weed-free seed bed. Soil pH 5.5 to 7.5

SEEDING RATES

Drill (7.5” rows) 15 lbs/acre Broadcast /Aerial Not recommended Precision (15” rows) 9 lbs/acre
Precision (4” in-row spacing)
Using a 60-cell small sugar beet plate:
15” rows 9 lbs/acre
30” rows 5 lbs/acre