GLIRICIDIA SEPIUM FACTSHEET

Establishment, management and benefits

What is *Gliricidia sepium*?

Gliricidia sepium, commonly known as 'gliricidia', is a fast-growing, nitrogen-fixing shrub, exotic to Kenya but native to El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama and the United States of America.

Figure 1. *Gliricidia sepium* seedling (left) and flower (right). Photo: World Agroforestry

Gliricidia as an agroforestry species

1. It is a fast-growing shrub and establishes well on acidic, degraded and infertile soils.
2. Gliricidia is an excellent biomass producer (both wood and leaf). Thus, it provides households with both firewood (including charcoal) and fodder for livestock and poultry. The fodder is rich in nitrogen.
3. It is an excellent soil improver, being both a nitrogen fixer and an excellent recycler of nutrients. Thus, it causes increase in soil fertility and crop yields by almost 2 to 3 times without any fertilizer application.

Figure 2. Gliricidia and maize intercrop. Cosmas farm, Siaya County, Kenya. Photo: World Agroforestry

4. Gliricidia stabilizes soils against acidification. Application of 1.6 to 4.0 tonnes of fresh mulch of gliricidia per acre (0.4 hectare) increases soil pH, nutrient content and crop yields.
5. Gliricidia is a deep-rooted agroforestry tree with limited lateral root growth (except in areas with hard pan where lateral root is more pronounced). This lessens competition with food crops for water and nutrients.
6. Its ability to pull up nutrients from far beneath the ground into a crop's root zone makes it one of the best agroforestry trees for intercropping.
7. Gliricidia can tolerate repeated cuttings and has high shoot regrowth. It can be managed in this way in crop fields for at least two decades before replanting is needed.

Figure 3. Coppiced gliricidia. Photo: World Agroforestry

Other benefits

For farmers:

- Enhances soil productivity.
- Produces high-quality green manure and may contain as much as 4% nitrogen (N) in its leaves.
- Increases crop yields.
- Improves nutrition for cattle. It contains more than 20% crude protein. It is readily palatable by cattle upon wilting the leaf.
- Good source of bee forage for honey production.
- Controls striga weed.

For the environment:

- Increases organic matter in the soil.
- Improves soils' physical properties.
- Restores and improves soil fertility through adding valuable nutrients, such as N, phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg).
- Improves water infiltration, reducing run off and soil erosion.
- Reduces pollution because the use of chemical fertilizers and sprays can be minimized.

For national and county economies:

- Sustains agricultural productivity
- Reduces reliance on fossil fuels for producing fertilizers
- Increases carbon sequestration

Table 1. Time before benefits come from gliricidia

Benefit	Expected time from planting
Firewood	12 months. Then every 4 months following the first cutting
Fodder	12 months. Then every 4 months following the first cutting
Improved soil fertility	2 years. (Better soil fertility with higher leafy biomass returned to the soil and sound soil management)
Striga weed controlled	1 year. (Better weed control with higher density of fertilizer shrubs)
Improved crop yields	2 years
Increased household income (from sales of products)	12 months (Feedstock for livestock fodder or energy). After 2–3 years additional crop yields and savings from chemical inputs such as lime and fertilizer

Where will gliricidia grow?

1. **Soil requirement**: Gliricidia does well in a wide range of soil types but particularly flourishes on fertile soils. It tolerates acidic soils (pH 4.5–6.2), high clay content soils and poor, degraded, infertile soils under rainfed conditions.
2. **Temperature/rainfall requirement:** temperature range of 15–30 ^{0}C and rainfall range of 600–3500 mm: from the semi-arid subtropics to the wet tropics.
3. **Altitude requirement:** 0–1600 m above sea level.

How to propagate gliricidia in a nursery

- Gliricidia is best propagated from seed. Stem cuttings can also be used but do not give very good establishment rates.
- Gliricidia seeds can be directly[1] planted in well-prepared cropland or raised in a nursery for 6–8 weeks before transplanting.
- For uniform germination;
  - Soak gliricidia seeds in hot water (80^{0}C)[2] for 12 hours and sow in the bed or directly sow into the field (at the on-set of rainy seasons). Otherwise, there is no need of pretreatment for fresh gliricidia seeds (i.e. seeds stored for less than 1 year).
  - Ensure you cover the seeds with light or thin soil and dry mulch.
  - Water regularly. The seeds will germinate within 7-14 days of sowing.
- Once germinated, seedlings can be raised bare rooted or in containers (*see the figure below*) but regular watering is necessary for good survival.

Figure 4. Bare-root (left) and container systems (right). Photo: World Agroforestry

How to plant gliricidia on a farm

- Transplant seedlings at the start of the rainy season.
- The planting density or spacing varies with the farmer's objective (that is, the purpose of planting) and the agroecological conditions of the place.
- For intercropping and management of soil fertility, a spacing that allows good crop establishment between gliricidia rows is recommended. A spacing of 3–4 m between gliricidia rows and 0.5–1 m within rows can be considered.

[1] Direct sowing of gliricidia seeds is possible with 2-3 seeds per hole at a depth of 1-2 cm.

[2] Soaking in hot water at 80 degrees Celsius (^{0}C). Water at this temperature forms large bubbles at the bottom of the container. Another way is to bring a known quantity of water to boiling, normally 100 degrees Celsius, then add a known quantity of cold water, normally 20 degrees Celsius. For example, 1000ml boiled water at 100 degrees Celsius would require mixing with 330ml cold water to bring the mixture to 80 degrees Celsius. The seed is then soaked in this water for 12 hours. Of course the water cools with the seed.

Figure 5. Gliricidia and maize intercrop. Photo: World Agroforestry

- If a farmer wants to establish a field of only gliricidia (also called a 'woodlot'), a spacing of 1 x 1 m or less is recommended.
- For establishing a gliricidia hedge or stabilizing and protecting soil, a spacing of 0.5 x 0.5 m is recommended.

How to manage gliricidia on a farm

- Gliricidia is managed by cutting, that is, by pollarding or coppicing.
- Pollarding (cutting off the top crown) is done at 1.5–2 m above ground 18–24 months from planting.
- Pollarding is most appropriate when gliricidia is intercropped with perennial crops, such as coffee and tea, as a shade tree or when planted along boundaries or on soil-protection structures, such as terraces.
- Pollarding is also recommended for use in monocropping systems.

Figure 6. Pollarded gliricidia. Photo: World Agroforestry

- Coppicing (cutting back) is done at 0.3–0.50 m above ground 9–12 months from planting. Coppicing is recommended when intercropping gliricidia with annual crops.

Figure 7. Coppiced gliricidia in cropland

- To improve soil fertility, the cuttings from coppicing or pollarding should be left in the field for two weeks to allow the leaves to completely detach from the branches.
- Alternatively, the leaves can be removed from the branches by chopping and incorporating them into the soil as green manure.
- The farmer can use the branches for firewood.
- Green manure from gliricidia is best applied in a tied-ridge farming system in which existing ridges are first split for leaf and twig application then the biomass is covered by building ridges over it.

Figure 8. Green manure from gliricidia leaves and twigs being applied. Photo: World Agroforestry

- Alternatively, gliricidia leaves and twigs can be evenly spread and lightly covered with soil or slowly decomposing organic matter, such as crop residues, to prevent loss of nitrogen from exposure to direct sunlight.
- In subsequent growing seasons, the gliricidia trees can be pruned every 2–3 months from the first pruning. The procedure is then repeated regularly.
- After the harvest of seasonal crops, the gliricidia trees are left to grow as fallow when crops are not being grown.

Figure 9. Gliricidia on a farm during the non-crop season. Photo: Dennis Garrity

- The system can be managed for 10–20 years before a new plantation of gliricidia needs to be established.

Potential crop yields with gliricidia

Crop yields, particularly maize, can increase 150–300% per hectare per year in good years without needing to apply chemical fertilizers, especially in impoverished soils where yields are very low. In soils where yields have been good, the increase rarely exceeds 50% per hectare per year. The increase in yield varies with the amount of gliricidia leaves and twigs returned to the soil and how the soil is managed.

Potential yield of wood

One gliricidia tree can produce 1.2–4.0 kg of dry wood per year, depending on the planting density, coppicing height and agroecological conditions. Note that the average total wood yield of gliricidia ranges 21–28 tonnes per hectare per year at 1.0 m coppicing height and 1 x 1 m spacing, especially where producing wood for power generation is the main purpose of planting.

Potential seed production

Gliricidia produces abundant seeds: with seven seeds per pod, this equates to 75–180 kilogram per hectare per year, depending on the quality of the tree and how it is managed. A kilogram of gliricidia contains about 8000 seeds. It is important to encourage farmers to leave some trees uncut so that they can produce enough seeds to increase the density of trees on their farms and for income from the sale of seeds or seedlings to other farmers. Depending on the stocking of the farm, a minimum of 30 trees can be left uncut for seed production. Neighbouring farmers can be encouraged to exchange their seeds to maintain genetic diversity.

Further reading

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