



THE INDIGOFERA (INDIGOFERA TINCTORIA L.) PLANT: ITS ORIGINS, SIGNIFICANCE, AND ADAPTABILITY TO SALINE SOIL CONDITIONS

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Abstract: This article highlights the significance of Indigofera (*Indigofera tinctoria* L.)—a non-traditional legume crop cultivated in the saline soil conditions of the Jizzakh region—and examines the role of biostimulants in grain formation and yield. It is scientifically demonstrated that sowing 3 kg per hectare during the third ten-day period of April results in a grain yield of 20.9 t/ha (an increase of 7.2 t/ha compared to the control), a 1,000-grain weight of 0.5 g, and a seedling count of 107 during the germination and flowering stages.

Keywords: *Indigofera tinctoria* L., Uzgumi, Fertilite, Geogumat, legumes, grain crops.

There are many beautiful plants, but some—such as *Indigofera tinctoria*—are particularly fascinating. Under favorable climatic conditions, it develops into a magnificent low-growing shrub that blooms profusely during the season; throughout the rest of the year, it remains a fast-growing plant that adds an elegant touch to the landscape.

Best of all, like many members of the legume family, its roots fix nitrogen, thereby improving the soil.

Scientifically known as *Indigofera tinctoria*, it is commonly referred to as indigo or indigo plant. Its exact origin is unknown, but it has become naturalized across tropical and temperate Asia, as well as in parts of Africa. It grows to a height of 1 to 2 meters and features green, pinnate leaves.

The flowers are arranged in pink clusters, and following pollination, they produce seed-filled pods.

There are the following methods for caring for the *Indigofera tinctoria* plant.

- Location: It must be outdoors, exposed to the sun.
- Earth
- Pot: Universal growing substrate mixed with 30% perlite
- Garden: grows in all types of soil, but performs better in fertile, well-drained soil.
- Watering: three times a week in summer, and every 4–5 days during the rest of the time.
- Propagation: by seeds in the spring.
- Pruning: at the end of winter, you can remove dry, diseased, weak, or broken branches.

Hardiness: it is sensitive to cold. Ideally, temperatures should not drop below 0°C. If you live in an area with cold winters, keep it in a greenhouse or indoors until spring returns.



Indigofera tinctoria L. is a species of plant belonging to the legume family. These herbs or shrubs typically feature odd-pinnate leaves. Their flowers, which range in color from pink and dark red to white, are arranged in racemes located in the leaf axils. The fruit is a legume (pod). There are over 700 species, widely distributed across tropical and subtropical regions; three species are found in CIS countries (*I. gerardiana*, *I. potaninii*, *I. kirilowii*), and ornamental varieties are cultivated in Crimea, the Southern Caucasus, and Central Asia. *Indigofera* plants are known for their beautiful blossoms and propagate via seeds; many species rely on ants for seed dispersal. Numerous *Indigofera* species—such as *Indigofera tinctoria* and *Indigofera anil*—yield the blue dye known as indigo. Basma (a black hair dye) is produced from the leaves of *Indigofera tinctoria*. Many *Indigofera* species contain the glycoside indican, which produces the blue indigo pigment. *Indigofera tinctoria* is a species within the *Indigofera* genus and belongs to the legume family; it originated in India and is cultivated in many tropical countries for the production of blue dye.

We previously presented our initial findings [1] regarding the adaptability of the *Indigofera australis* plant to our climatic conditions. Continuing our research, we examined the benefits of localizing *Indigofera australis* and the yield of indigo dye extracted from it. Beyond serving as a valuable natural pigment for cotton, silk, and wool fabrics in the Asian and European textile industries, the localization of this plant offers several advantages for the environment and human lifestyles. For example:

- its attractive flowers and adaptability to various growing conditions make it suitable for use as an ornamental plant;
- it is an excellent plant for wildlife; its flowers provide a source of pollen and nectar for many native insects, including bees;
- the plant also serves as a beneficial food source for butterfly larvae;
- ecological benefit: it restores the fertility of degraded (saline or unproductive) lands. Because symbiotic bacteria exist in its root nodules, *Indigofera australis*—like other legumes—fixes atmospheric nitrogen and incorporates it into the soil, thereby enriching and improving soil quality [2];
- *Indigofera* can also be cultivated to strengthen the soil;
- agricultural use: it helps increase the productivity of degraded croplands; specifically, the residual biomass remaining after indigo extraction is used as "green manure" for vegetables and fruit trees. This residual biomass can also serve as nutritious livestock feed;
- the plant has long been used in the traditional medicine of Tibet and Indochina. It is also known that in the Indochinese pharmaceutical industry, the plant has been used to produce



antibacterial and antifungal medications, treatments for dog and snake bites, and remedies for epilepsy, liver toxicity, skin diseases, and certain types of cancer.

The yield of *Indigofera* biomass depends largely on soil conditions, agricultural practices, and timely harvesting.

Plant biomass yields reached 65% on loamy soils and 80% per sotikh (100 m²) on slightly saline sandy soils. This translates to an average yield of 35–40 tons of green biomass per hectare. After drying the plant in a cool place, 4–6 tons of dry matter remain. From this dry matter, it is possible to obtain between 0.8 and 1 ton of pigment.

CONCLUSION

Cultivating *Indigofera* offers several advantages: the plant can grow in sandy, loamy, clay, rocky, and slightly saline soils, and it requires minimal fertilizer. These characteristics of **Indigofera australis** make it suitable for cultivation in our local climate. The natural dye pigment can be extracted using a simple, low-cost process. Seeding requires 6–7 kg of seeds per hectare, at a cost of 500,000 UZS. During the season, an average of 30–35 tons of green biomass can be harvested per hectare. This biomass yields an average of 100–130 kg of valuable pigment; given that the price of Indigo on the European market ranges from 150 to 300 euros per kilogram (depending on quality), this represents a lucrative opportunity for farmers. On the domestic market, the extracted pigment sells for 600,000–800,000 UZS per kilogram, meaning that selling the pigment locally generates revenue exceeding 70 million UZS per hectare for farmers.

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