# NoduMax Legume Inoculant for Soybeans

Solution Holder is **Nodumax Factory, IITA Business Incubation Platform** and can be contacted through **f.scheurs@cgiar.org**

**Summary**

NoduMax is a peat based inoculant ensuring that soybean’s symbiotic rhizobium bacteria are present, resulting in improved root nodulation and high rates of biological nitrogen fixation (BNF). Nitrogen fixation eliminates the need for costly nitrogen fertilizers. NoduMax contains the industry-standard strain USDA 110 and includes a gum Arabic adhesive and user instructions, It is packed in 100 g packets sufficient for 10 to 15 kg soybean seed. Seeds are inoculated at a cost of about $18 per ha and result in yield increase of about 350 kg per ha worth $175. NoduMax is produced by the IITA Business Incubation Platform (BIP) in Ibadan, Nigeria and its distribution area includes Benin, Ghana, Nigeria and Togo. Manufacturers may apply to license NoduMax from the BIP. Distributor are eligible for quantity discounts.

**Technical Description**

NoduMax for Soybean is a solid inoculant product containing Bradyrhizobium japonicum strain USDA 110 "Tiny" originally obtained from BioNext of Wichita, Kansas, USA. The carrier is APT peat that is gamma irradiated. It is packed with finely ground gum arabic and user instructions in four languages (English, Hausa, Ibo and Yourba). Each unit of 100 g is sold for about $3.20 depending upon the quantity and current exchange rate. It is then assembled, stored and marketed in labeled cardboard boxes containing 25 units. Product descriptions are also available in French. The carrier material used in NoduMax is finely-ground peat obtained from American Peat Technologies (APT) of Minnesota, USA. It is purchased in one-ton super-sacks, repackaged into 50 g units, sterilized through gamma-irradiation by the commercial facility in Accra, Ghana and packed into 2.5 kg quantities (25 units) for distribution to agrodealers and farm cooperatives. This process removes all contaminants and allows for the production of a world-class, pure inoculant product.

**Uses**

Soybean is increasingly produced across Africa (about 1.3 million ha) and offers huge benefits in terms of protein sufficiency and value addition including animal feeds and processed and protein-enriched foods. Investing in soybean production, including inoculants, generates income for farmers, strengthens import substitution, contributes positively to the health and nutritional status of farming families, and improve soil fertility through the crop's large capacity for biological nitrogen fixation. Indeed, Africa is

now poised for a soybean revolution and inoculation plays an important role in this growth.. For the first time, accompanying production technologies are now in place including high-yielding and disease-tolerant crop varieties, specially-blended fertilizers and weed management strategies that when employed in combination close yield gaps, taking yields to 2.5 + ton per ha.

### Composition

NoduMax contains Bradyrhizobium japonicum strain USDA 110 at a density of at least 1 billion live cells per gram of inoculant. The quality is tested using drop plate counts on Congo Red Yeast Extract Mannitol agar. This is a pure product, but is also tested for microbial contaminants using Glucose-Peptone agar.

### Means of application

NoduMax is applied to soybean seed just before planting. First the gum arabic adhesive is dissolved in clean, hot water, applied to 10 to 15 kg of soybean seed, mixed to coat the seed exterior, the inoculant added, and the seeds mixed again until the inoculant appears as a fine brown powder uniformly distributed upon the seeds. Seeds should be planted shortly after application and protected from direct sunlight. This is referred to as the two-step method and results in the most uniform distribution on the seeds. An alternative, simpler method involves mixing the inoculant to the adhesive solution, and then applying them to the seeds but this technique tends to clump.

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| **Agroecologies** | All Agroecologies. |
| **Regions** | Africa South of Sahara. |
| **Developed in Countries** | Nigeria. |
| **Available in** | Benin, Ghana, Mozambique, Nigeria, Togo. |
| **Solution Forms** | Input Supply. |
| **Solution Applications** | Soil fertility management. |
| **Agricultural Commodities** | Soybean. |
| **Target Beneficiaries** | All farmers. |

## Commercialization

### Commercialization Category

Commercially available

## Startup Requirements

Inoculant production requires industrial microbiology facilities. Mother cultures are stored under refrigeration and their viability and purity tested. Cultures are raised in Yeast Extract Mannitol broth in aerated fermenters. Carrier is placed into a thin plastic bag and sterilized. Mixing mature broth and carrier material requires sterile conditions. Product is cured under low humidity conditions to improve its hardiness. Inner packages are then combined with adhesive and instructions in an outer labelled alumino-laminate package to protect the product during shipping and storage. Skilled microbiologists are required to produce the product.

## Production Costs

The NoduMax factory at the IITA BIP cost about $150,000 to build, and another $120,000 to equip. The factory has the capacity to produce 16 tons of product per year worth over $500,000. Each 100 g packet is produced for less than $2.20 each and sold for over $1 profit.

## Customer Segmentation

NoduMax is intended for use by soybean producers. It is distributed through agrodealers and farmer cooperatives. There are some licensed distributors in Nigeria.

## Potential Profitability

Wholesale manufacture and sales of NoduMax provides profits of about $0.75 per unit. Resale at the retail level provides about $1 per unit. Product remains viable for one year after manufacture.

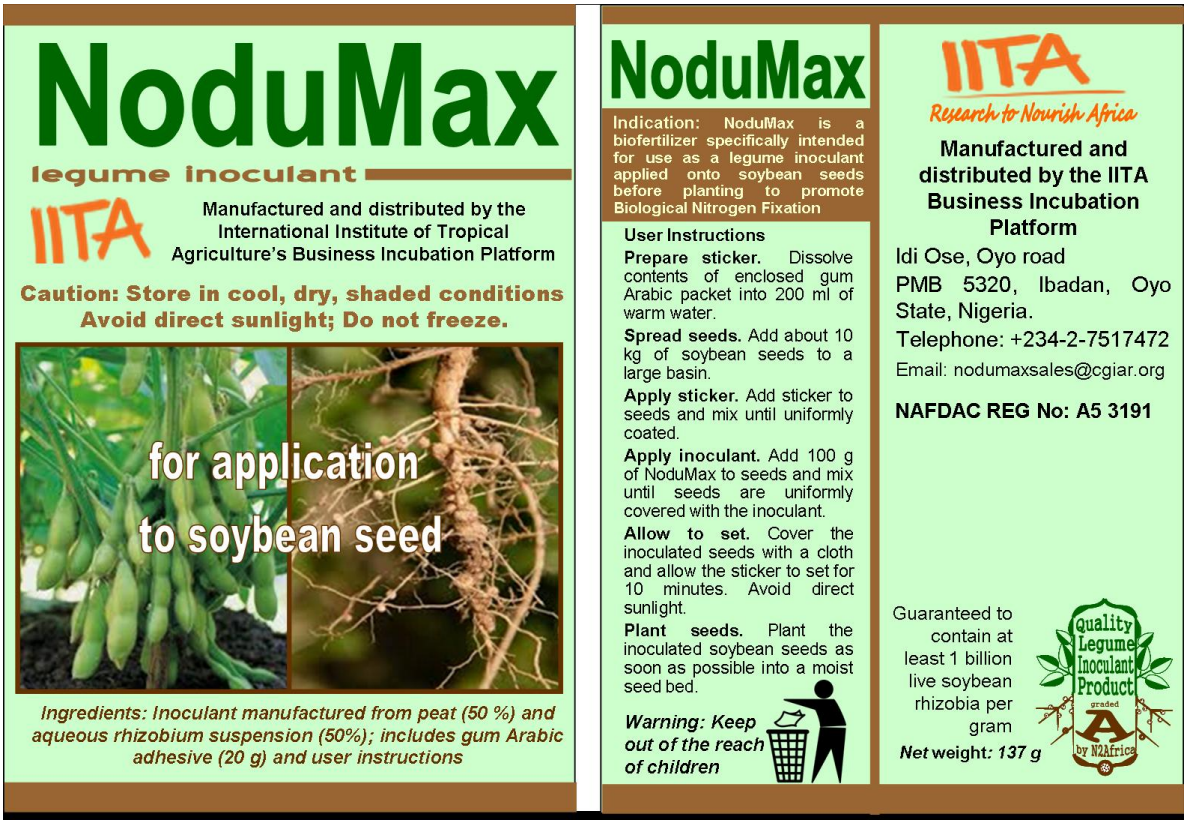
## Licensing Requirements

NoduMax production is not patented but is rather protected through several trade secrets. IT can be franchized for manufacture through the IITA Business Incubation Platform. The product is registered with Nigerian regulators as NAFDAC REG No A5 3191.

## Innovation as Public Good

NoduMax was initially developed through a grant from the Bill and Melinda Gates Foundation (the N2Africa Project, 2010 to 2019) and as such is a public good. The Business Incubation Platform holds considerable expertise in its production and subsequently developed some trade secrets to stream;line and economize its manufacture.

## Solution Images






## Institutions

## Accompanying Solutions

For inoculation of Nodumax to be successful, nitrogen availability and not another growth constraint must be limiting. For this reason it is important that the soybean varieties produced be tolerant of pests and diseases, especially Asian Rust. Also, basal fertilization of nutrients other than mineral nitrogen is important, particularly phosphate (e.g. Super Phosphate) or fertilizer blends specifically recommended for grain legumes

(e.g. Sympal, NPK 0-23-16 +). Commercial farmers also rely upon pre-emergent herbicides to reduce field weeding operations.