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## Mothbean (*Vigna aconitifolia* L.): A comprehensive review

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### Abstract

Mothbean (*Vigna aconitifolia* L.) is a significant legume crop grown extensively in India. It is a drought-tolerant crop that can thrive in poor soil conditions, making it an ideal crop for resource-poor farmers. This review paper aims to provide an overview of mothbean's cultivation, nutritional value, and uses. We also discuss the crop's potential to contribute to food security and its potential uses in various industries. Although mothbean may be grown in a variety of soil types, it likes soil that drains well and has a pH between 6.0 and 7.0. To prepare the soil, plow and harrow it down to a depth of 20 to 25 cm. The distance between mothbean seeds is 20-30 cm, and the seeds are sowed 2-3 cm deep. The rows in which the seeds are sowed are separated by 60 to 90 centimeters. Food, feed, and industrial applications are just a few of the many uses for mothbeans. In many different cuisines, especially Indian and Pakistani cooking, the crop is used as a pulse. Additionally, livestock, especially cattle and poultry, are fed mothbeans. Starch, flour, and other products with added value are among the industrial uses of the crop. In many different cuisines, but especially in Indian and Pakistani cooking, the legume is utilized as a pulse. The crop is used to produce salad, curry, and dal, among other meals. Livestock, especially cattle and poultry, are fed mothbeans. The Tamil Nadu Agricultural University (TNAU) and the Indian Institute of Horticultural Research (IIHR) have created a number of recently released mothbean varieties. Advanced breeding methods, including as genetic engineering and marker-assisted selection (MAS), were used to create these types. All things considered, the recently introduced mothbean cultivars aim to strengthen climate resistance, advance sustainable agriculture, and increase nutritional security. Food security could be greatly enhanced by the use of legumes, especially in emerging nations. The crop is perfect for farmers with limited resources since it can grow in poor soil conditions and is resistant to drought. Another nutrient-dense crop that can supply a variety of vital micronutrients is the mothbean.

**Keywords:** Mothbean, *Vigna aconitifolia*, drought-tolerant, cultivation

### Introduction

Mothbean (*Vigna aconitifolia* L.) is a legume crop that belongs to the family *Fabaceae*. It is a warm-season crop that is widely grown in India, particularly in the states of Maharashtra, Madhya Pradesh, Rajasthan, and Uttar Pradesh. Mothbean is a drought-tolerant crop that can thrive in poor soil conditions, making it an ideal crop for resource-poor farmers. Mothbean is typically grown as a rainfed crop, and its cultivation is done during the kharif season. The ideal time for sowing mothbean is during the last week of June or the first week of July. The crop requires a well-drained soil with a pH range of 6.0-7.0. Mothbean is a low-input crop that requires minimal irrigation and fertilizers. Mothbean is a nutrient-rich crop that is high in protein, fiber, and various micronutrients (Ahmed *et al.*, 2023) <sup>[1]</sup>. The crop is a good source of energy, and its protein content is comparable to that of other legume crops. Mothbean is also rich in fiber, which makes it an ideal crop for promoting digestive health. Mothbean contains 22-25% protein, which is comparable to that of other legume crops. Mothbean contains 4-6% fiber, which makes it an ideal crop for promoting digestive health. Mothbean is rich in various micronutrients such as iron, zinc, and potassium (Choudhary *et al.*, 2021) <sup>[2]</sup>. India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. Pulses account for around 23% of the area under food grains and contribute around 9-10% of the total foodgrains production in the country. Approx. 30 M ha area under pulses cultivation, about 25 MT of annual production with avg. productivity of 851 kg ha<sup>-1</sup> (Avg. of 2018-19 to 2022-23).

Normal Area about 291 L ha (*Kharif*- 136 L ha + *Rabi*-155 L ha). The seasonal percent share to *kharif* area is 47% remaining 53% area goes to *rabi* pulses. Area & Production contribute in total pulses approx. 90% for both; M.P. (19% & 22%), Maharashtra (16% for both), Rajasthan (21% & 16%), Uttar Pradesh (8% & 10%), Karnataka (11% & 8%), Gujarat (4% & 6%), Andhra Pradesh (4% for both), Jharkhand (3% for both), Telangana (2% for both) and Tamil Nadu (3% & 2%). Ever highest area and production in total pulses was 307 L ha and 273 Lt. during 2021-22 and productivity of 902 kg ha<sup>-1</sup> during 2022-23. In *kharif* pulses of about 136 L ha, 33% (46 L ha) is covered by Tur followed by Urd 28% (36 L ha); Mung - 27% (37 L ha) and other minor *kharif* pulses 12% (approx. 17 L ha). Area & Production contribute in *kharif* pulses (94% for both); Rajasthan (29% & 21%), Maharashtra (15% & 19%), Karnataka (16% for both), Madhya Pradesh (14% & 12%), Uttar Pradesh (6% & 7%), Jharkhand & Gujarat (3% & 5% for each), Telangana & Odisha (3% for both), and Tamil Nadu (1% & 2%). (Directorate of Economics and Statistics, Ministry of Agri. & FW, 2018-19 to 2022-23).

### Soil Preparation and Sowing

Mothbean (*Vigna aconitifolia* L.) can be grown on a wide range of soils, but it prefers well-drained soil with a pH range of 6.0-7.0. The soil should be prepared by plowing and harrowing to a depth of 20-25 cm. Mothbean seeds are sown at a depth of 2-3 cm and a spacing of 20-30 cm. The seeds are sown in rows, and the rows are spaced 60-90 cm apart.

### Irrigation & Fertilization

Mothbean (*Vigna aconitifolia* L.) is a drought-tolerant crop, but it requires adequate moisture during the germination and flowering stages. The crop should be irrigated at an interval of 10-15 days during the dry season. Mothbean is a low-input crop that requires minimal fertilizers. The crop can be fertilized with organic manures such as farmyard manure or green manure.

### Uses as Food & Feed

Mothbean (*Vigna aconitifolia* L.) has various uses, including food, feed, and industrial applications. The crop is used as a pulse in various cuisines, particularly in Indian and Pakistani cooking. Mothbean is also used as a feed for livestock, particularly poultry and cattle. The crop's industrial applications include the production of starch, flour, and other value-added products. Mothbean is used as a pulse in various cuisines, particularly in Indian and Pakistani cooking. The crop is used to make various dishes such as dal, curry, and salad. Mothbean is used as a feed for livestock, particularly poultry and cattle. The crop is rich in protein and fiber, making it an ideal feed for livestock. Mothbean's industrial applications include the production of starch, flour, and other value-added products. The crop's starch can be used to produce various products such as paper, textiles, and adhesives (Gupta *et al.*, 2012) <sup>[4]</sup>.

### Impact of environmental conditions on varieties

Newly released varieties of mothbean with environmental impact are focused on climate resilience, *biofortification*, and sustainability.

### Climate-Resilient Varieties

The Indian Council of Agricultural Research (ICAR) has

developed 109 high-yielding, climate-resilient, and *biofortified* varieties of crops, including mothbean. These varieties can thrive in adverse weather conditions, reducing crop losses due to diseases and pests.

**Biofortified Varieties:** *Biofortification* involves improving the nutritional quality of food crops. ICAR has developed *biofortified* varieties of mothbean with enhanced nutritional content, such as iron and zinc-rich varieties.

### Sustainable Production

The new varieties of mothbean are designed to promote sustainable production practices, reducing the environmental impact of farming. For example, they are more water-efficient and require fewer chemical inputs.

Some of the newly released varieties of mothbean include those developed by the Indian Institute of Horticultural Research (IIHR) and the Tamil Nadu Agricultural University (TNAU). These varieties have been developed using advanced breeding techniques, including marker-assisted selection (MAS) and genetic engineering. Overall, the newly released varieties of mothbean are designed to promote sustainable agriculture, improve nutritional security, and enhance climate resilience.

### Food Security

Mothbean (*Vigna aconitifolia* L.) has the potential to contribute significantly to food security, particularly in developing countries. The crop is drought-tolerant and can thrive in poor soil conditions, making it an ideal crop for resource-poor farmers. Mothbean is also a nutrient-rich crop that can provide a range of essential micronutrients.

### Nutrient Management in Mothbean

Mothbean (*Vigna aconitifolia* L.) is a significant legume crop grown extensively in India. Its growth and production require efficient nutrient management.

### Macro-Nutrients

- 1. Nitrogen (N):** Nitrogen is a crucial macro-nutrient for mothbean growth. It promotes plant growth, development, and protein production.
- 2. Phosphorus (P):** Phosphorus is another essential macro-nutrient for mothbean growth. It supports plant growth, development, and energy production.
- 3. Potassium (K):** Potassium is a vital macro-nutrient for mothbean growth. It promotes plant growth, development, and water conservation.

### Micro-Nutrients

- 1. Iron (Fe):** Iron is a crucial micro-nutrient for mothbean growth. It supports plant growth, development, and oxygen conservation.
- 2. Zinc (Zn):** Zinc is another essential micro-nutrient for mothbean growth. It promotes plant growth, development, and protein production.
- 3. Copper (Cu):** Copper is a vital micro-nutrient for mothbean growth. It supports plant growth, development, and oxygen conservation.

### Nutrient Management Practices

- 1. Soil Testing:** Soil testing is crucial for determining nutrient deficiencies in the soil.

- Fertilizer Application:** Fertilizer application is essential for promoting plant growth, development, and production.
- Organic Farming:** Organic farming practices can improve soil quality, promote plant growth, and increase production.

### Effect of NPK Consortia on Mothbean

Mothbean (*Vigna aconitifolia* L.) is a legume crop that requires adequate nutrients for optimal growth and production. NPK (Nitrogen, Phosphorus, and Potassium) consortia are widely used to provide essential nutrients to crops.

### Benefits of NPK Consortia in Mothbean

- Improved Plant Growth:** NPK consortia provide essential nutrients for plant growth, leading to increased plant height, leaf area, and biomass production.
- Enhanced Nutrient Uptake:** NPK consortia improve nutrient uptake by plants, leading to increased nutrient availability and reduced soil nutrient depletion.
- Increased Yield:** NPK consortia have been shown to increase mothbean yields by up to 20-30% compared to control treatments.
- Improved Seed Quality:** NPK consortia have been shown to improve seed quality, leading to increased germination rates and seedling vigor.

### Optimal NPK Ratios for Mothbean

Nitrogen (N): 20-30 kg ha<sup>-1</sup>

Phosphorus (P): 10-20 kg ha<sup>-1</sup>

Potassium (K): 10-20 kg ha<sup>-1</sup>

Optimal NPK ratios may vary depending on soil type, climate, and other factors.

### Application Methods

- Basal Application:** Apply NPK consortia at sowing time.
- Top-Dressing:** Apply NPK consortia at 20-30 days after sowing.
- Foliar Application:** Apply NPK consortia as a foliar spray at 30-40 days after sowing.
- NPK consortia are a successful method of giving mothbean crops the vital nutrients they need, which improves plant growth, nutrient uptake, and yields. Soil type, climate, and other variables should be taken into consideration while determining the best NPK ratios and application techniques.

### Weed Management in Mothbean

Mothbean (*Vigna aconitifolia* L.) is a significant legume crop grown extensively in India. Weeds can significantly impact mothbean production, reducing yields and affecting quality. Weed management is a critical component of mothbean production. Cultural practices, physical removal, chemical control, and integrated weed management can all be effective approaches to managing weeds in mothbean. By selecting the most appropriate weed management strategy, farmers can help reduce weed growth, promote mothbean growth, and improve yields (Kumar *et al.*, 2023) [5].

### Types of Weeds

- Broadleaf weeds:** Broadleaf weeds, such as *Amaranthus*, *Chenopodium*, and *Portulaca*, can compete with mothbean for water, nutrients, and light.

- Grassy weeds:** Grassy weeds, such as *Echinochloa*, *Digitaria*, and *Panicum*, can compete with mothbean for water, nutrients, and light.
- Sedges:** Sedges, such as *Cyperus* and *Fimbristylis*, can compete with mothbean for water, nutrients, and light.

### Weed Management Practices

- Cultural practices:** Cultural practices, such as proper spacing, irrigation, and fertilizer application, can help reduce weed growth.
- Physical removal:** Physical removal of weeds, such as hand-weeding or hoeing, can be effective in controlling weeds.
- Chemical control:** Chemical control, such as herbicides, can be effective in controlling weeds. However, care must be taken to avoid damage to the mothbean crop.
- Integrated weed management:** Integrated weed management, which combines cultural, physical, and chemical control methods, can be an effective approach to managing weeds in mothbean.

### Pre-Emergence Herbicides

- Pendimethalin:** Pendimethalin is a pre-emergence herbicide that can be used to control broadleaf weeds and grassy weeds.
- Alachlor:** Alachlor is a pre-emergence herbicide that can be used to control broadleaf weeds and grassy weeds.
- Post-Emergence Herbicides**
- Imazethapyr:** Imazethapyr is a post-emergence herbicide that can be used to control broadleaf weeds and grassy weeds.
- Quinclorac:** Quinclorac is a post-emergence herbicide that can be used to control broadleaf weeds and grassy weeds.

### Insect and Pest Management in Mothbean

Mothbean (*Vigna aconitifolia* L.) is a significant legume crop grown extensively in India. Insect and pest management is a critical component of mothbean production, as various insects and pests can cause significant damage to the crop (Manolika *et al.*, 2007) [6].

### Major Insect Pests

- Aphids:** Aphids are small, soft-bodied insects that feed on plant sap, causing curled or distorted leaves.
- Whiteflies:** Whiteflies are small, winged insects that feed on plant sap, causing yellowing or stunted growth.
- Thrips:** Thrips are small, insects that feed on plant sap, causing stunted growth or distorted leaves.
- Pod borers:** Pod borers are larvae of moths that feed on mothbean pods, causing damage and reducing yields.

### Major Diseases

- Powdery mildew:** Powdery mildew is a fungal disease that causes a white, powdery growth on leaves.
- Leaf spot:** Leaf spot is a fungal disease that causes small, circular spots on leaves.
- Root rot:** Root rot is a fungal disease that causes roots to rot, leading to plant death.

### Integrated Pest Management (IPM) Strategies

- Crop rotation:** Crop rotation can help break the life cycle of insect pests and diseases.

2. **Sanitation:** Sanitation, such as removing weeds and debris, can help reduce insect pest and disease populations.
3. **Biological control:** Biological control, such as introducing natural enemies of insect pests, can help manage insect pest populations.
4. **Chemical control:** Chemical control, such as using insecticides and fungicides, can be used to manage insect pest and disease populations.
5. **Resistant varieties:** Resistant varieties of mothbean can help reduce the impact of insect pests and diseases.

#### Insecticides and Fungicides

1. **Imidacloprid:** Imidacloprid is an insecticide that can be used to control aphids, whiteflies, and thrips.
2. **Pyrethroids:** Pyrethroids are insecticides that can be used to control pod borers and other insect pests.
3. **Mancozeb:** Mancozeb is a fungicide that can be used to control powdery mildew and leaf spot.
4. Insect and pest management is a critical component of mothbean production. By using integrated pest management (IPM) strategies, such as crop rotation, sanitation, biological control, chemical control, and resistant varieties, farmers can help reduce the impact of insect pests and diseases on mothbean yields.

#### Water Management in Mothbean

Mothbean (*Vigna aconitifolia* L.) is a drought-tolerant legume crop that requires adequate water supply for optimal growth and production. Water management is critical in mothbean cultivation to ensure efficient use of water resources and minimize water losses.

#### Water Requirements

Mothbean requires about 400-500 mm of rainfall or irrigation water during its growth period. The crop requires more water during the flowering and pod-filling stages.

#### Water Management Practices

1. **Rainwater Harvesting:** Collecting and storing rainwater for irrigation can help reduce the demand on groundwater and surface water resources.
2. **Drip Irrigation:** Drip irrigation delivers water directly to the roots of the plants, reducing evaporation and runoff losses.
3. **Sprinkler Irrigation:** Sprinkler irrigation is another efficient method of irrigation that can help reduce water losses.
4. **Mulching:** Mulching helps retain soil moisture, reduce soil temperature, and suppress weed growth.
5. **Crop Rotation:** Crop rotation can help improve soil structure, increase water infiltration, and reduce soil erosion.
6. **Soil Conservation:** Soil conservation practices such as contour farming, terracing, and bunding can help reduce soil erosion and improve water retention.

#### Water-Saving Techniques

1. **Deficit Irrigation:** Deficit irrigation involves applying less water than the crop's full water requirements, which can help reduce water losses.
2. **Alternate Furrow Irrigation:** Alternate furrow irrigation involves irrigating every other furrow, which can help reduce water losses.

3. **Precision Irrigation:** Precision irrigation involves using advanced technologies such as sensors, GPS, and drones to optimize irrigation water application.

#### Benefits of Water Management

1. **Increased Water Use Efficiency:** Water management practices can help reduce water losses and increase water use efficiency.
2. **Improved Crop Yields:** Adequate water supply can help improve crop yields and quality.
3. **Reduced Soil Erosion:** Soil conservation practices can help reduce soil erosion and improve soil health.
4. **Enhanced Environmental Sustainability:** Water management practices can help reduce the environmental impact of agriculture and promote sustainable agriculture practices.

#### Conclusion

Mothbean is a significant legume crop that has various uses, including food, feed, and industrial applications. The crop is drought-tolerant and can thrive in poor soil conditions, making it an ideal crop for resource-poor farmers. NPK consortia are an effective way to provide essential nutrients to mothbean crops, leading to improved plant growth, enhanced nutrient uptake, and increased yields. Optimal NPK ratios and application methods should be determined based on soil type, climate, and other factors. Mothbean has the potential to contribute significantly to food security, particularly in developing countries. Further research is needed to explore the crop's potential and to develop new value-added products. Efficient nutrient management is critical for mothbean growth and production. Soil testing, fertilizer application, and organic farming practices can help improve soil quality, promote plant growth, and increase production. By adopting these practices, farmers can enhance mothbean production and improve soil health.

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