

Raised bed planting for boosting soybean yields and profits

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Raised bed planting (RBP) enhances soybean productivity and profitability through improved water and nutrient use efficiency as well as pest control. Despite requiring initial investment and specialized knowledge, its advantages include better yields and sustainability. Capacity building of farmer, providing financial incentives, and conducting on-farm research trials are pivotal for scaling adoption, validating the efficacy of RBP, and mitigating uncertainties across varied climatic conditions.

Keywords: Raised bed planting (RBP), Soybean cultivation, Water management

Soybean (*Glycine max* L.), is the most important legume-oilseed crop of the world. It contributes almost two-thirds of the protein (referred to as a complete protein) concentrate used as feed for cattle, fish and poultry and about one-fourth of the edible oil produced worldwide. Its role in control of diabetes and heart disease has been widely recognized.

World's 'Big-3' producers of soybean are Argentina, Brazil, and the United States. It is believed that soybean was introduced in India via Myanmar in the 10th century AD. Historical evidences indicate its cultivation on limited scale in the Kumaon Hills of Uttarakhand, eastern Bengal, Khasi Hills of Manipur, the Naga Hills, and portions of central India, including Madhya Pradesh.

In India, soybean (40% protein) accounts for 35% of all oilseeds grown and 25% vegetable oils produced, making it the most important oilseed crop in terms of area and second most important in terms of oil production after rapeseed-mustard. In addition to being an important source of protein

for animals, it can help overcome protein-energy deficiency in humans. India exports soybean de-oiled cake. Soybean consumption in India is rising due to availability of large number of soybean based food products and increasing awareness of its health benefits among masses.

Challenges in traditional soybean farming

Traditional cultivation practices like land preparation, manual planting and weed control largely practiced by small scale farmers are labour-intensive and time-consuming and limit a farmer's ability to cultivate larger areas. Traditional practices may not be as effective in controlling various pests (aphid - *Aphis glycines*; japanese beetle - *Popillia japonica*; cyst nematode - *Heterodera glycines*) and diseases (rust - *Phakopsora pachyrhizi*; white mold - *Sclerotinia sclerotiorum*; root rot - *Phytophthora sojae*) leading to crop losses.

Additionally, overuse of pesticides can harm beneficial insects and create resistance in pests. Intensive tillage harms beneficial microbes, decreases organic matter and disturbs the soil structure.

Traditional practices that rely heavily on fertilizers and pesticides can contribute to environmental pollution.

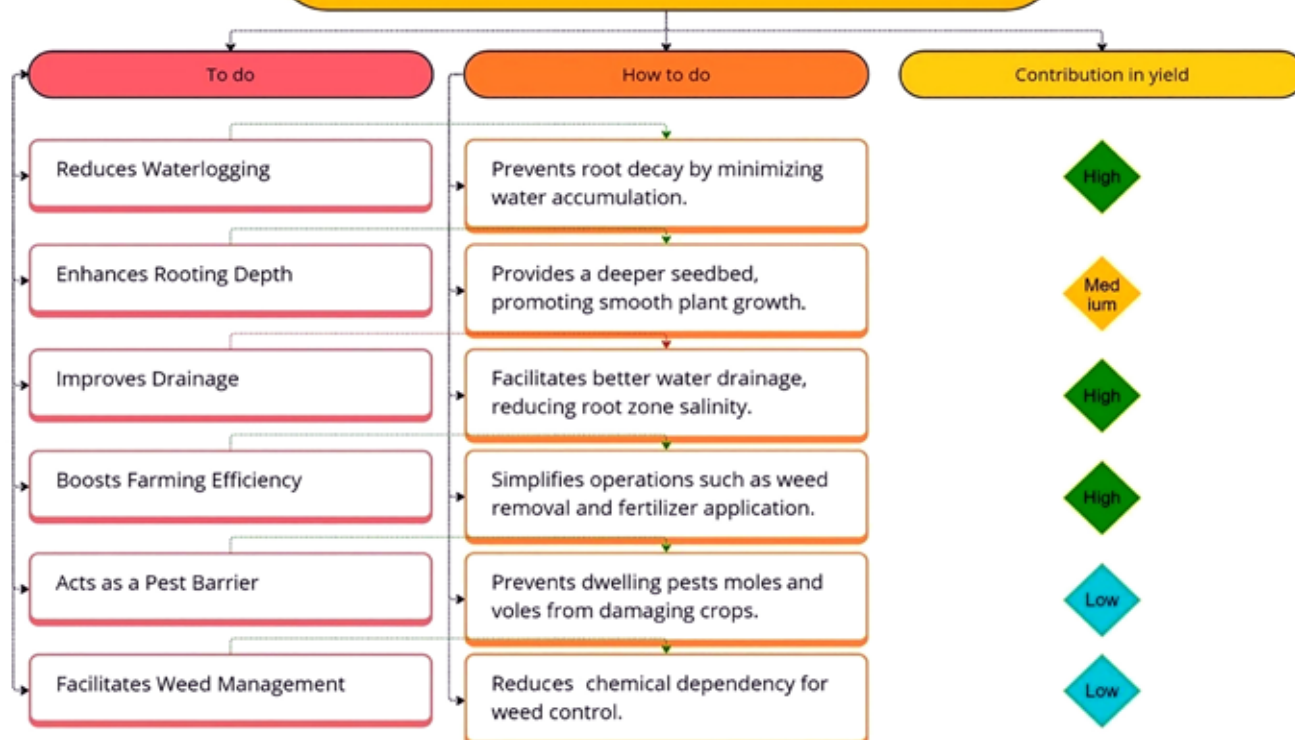
RBP technology

Adoption of RBP in soybean cultivation addresses many limitations of traditional methods. By utilizing RBP, farmers can enhance soil health, leading to increased yields. This approach not only improves productivity but also supports a more sustainable agricultural system.

Advantages over conventional methods

RBP enhances soybean cultivation by improving soil drainage, reducing water logging, and preventing root decay. It lowers root zone salinity and supports deeper rooting, leading to better yields. Additionally, RBP helps decrease greenhouse gas emissions, reduces weed problems, and promotes more efficient nutrient and water use. This method also acts as a physical barrier against pests like moles and voles, and facilitates easier weed management with less chemical dependency.

Key Benefits of Raised Bed Planting



Key benefits of raised bed planting in soybean cultivation

Concept and principles

RBP technology is an adaptation of the traditional hill and furrow row cropping system, where seeds are sown on elevated beds and water is applied to the furrows. This method enhances input (water, nutrients) use efficiency, which offers several benefits, including faster crop turnover, reduced energy and tillage costs, and lower greenhouse gas emissions from diesel use. Additionally, RBP improves soil health by maintaining regulated traffic, minimizing disruption of biopores, and reducing the oxidation of soil organic matter.

Equipment and materials needed

Seed-cum-fertilizer raised bed planter can be used to make RB easily. Owing to its improved water-use efficiency (WUE) and ability to increase farm output while using less inputs, RBP technology enhances farmers' livelihoods.

Agronomic benefits

Enhanced water management

RBP systems improve irrigation

efficiency (WUE/WP) by directing water to furrow bottoms instead of whole surface area thus requiring lesser quantity of water and enhancing drainage. They facilitate rainwater harvesting.

Improved soil health and structure

RBP significantly enhances soil health and structure for soybean cultivation. By elevating the planting beds, RBP improves soil drainage and reduces waterlogging, which prevents root rot and enhances aeration. This method also minimizes soil compaction and promotes deeper root growth,

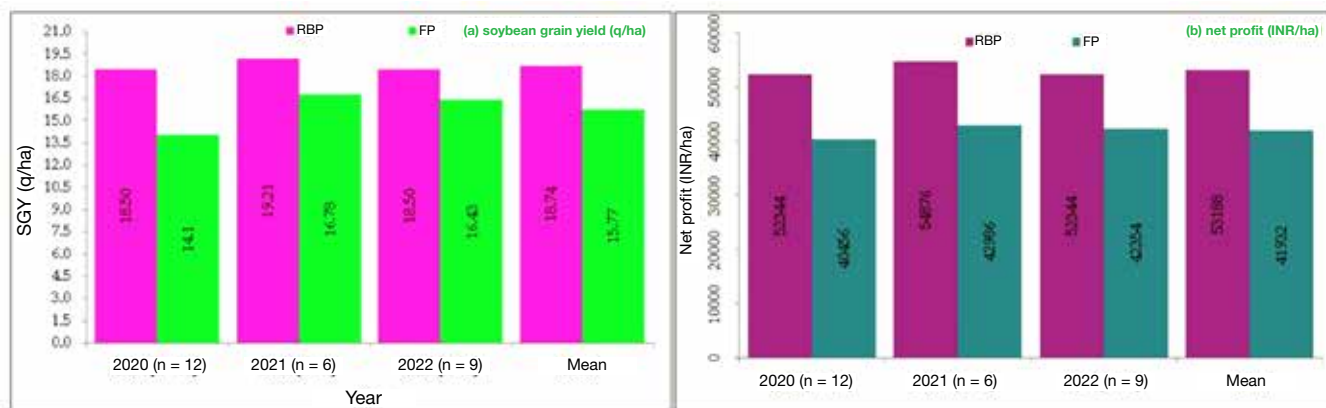
allowing plants to access more nutrients and water. The increased soil structure stability leads to better nutrient availability and reduced erosion. Furthermore, RBP supports regulated traffic, which helps preserve soil biopores and reduces soil organic matter oxidation, contributing to overall improved soil health and productivity.

Economic analysis

RBP system is known to boost yields and profits through improved water and nutrient use efficiencies and lesser weed population and



Field view of raised bed and soybean crop at different stage



Effect of planting techniques on soybean grain yield and net profit

with lower input expenses. Studies have shown 6-35% higher yields with 18-32% reduced water use and 8-43% increase in income with RBP in comparison to conventional flat sown method. The cost-effectiveness of RBP system depends on factors such as the scale of operation, climate and soil conditions, and labour availability.

Case studies and field trials

Field trials conducted by Borlaug Institute for South Asia (BISA) at farmers' fields (Nalanda, Nawada, and Munger) over three years (2020-2022) have revealed significant

improvement in soybean grain yield (SGY) and net profit with RBP in comparison to farmers' practices.

Farmer adoption and acceptance

Adopting new farming techniques can be challenging for farmers, but capacity building and educating them on the benefits of RBP and assisting with initial setup can help. On-farm research trials comparing RBP to traditional flat planting will provide valuable data to demonstrate the benefits.

benefits for soybean production, including better water management, improved soil health, weed and pest control, and economic gains. However, it requires higher initial investment, specialized implement and training on optimal bed size, spacing, and planting techniques. On-farm research trials conducted at farmers' fields using farmers participatory approach can play an important role in showcasing the technology and to win confidence of the farmers.

CONCLUSION

The RBP system offers numerous

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