

Raised bed planting

A proven technology under climate change scenario

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In the Indo-Gangetic Plains (IGP) of South Asia, the chance of crop loss increases when heavy monsoon rains create floods and water logging conditions under flat sowing. Crops in semi-arid and arid areas do not need to be irrigated as much when they are grown on a permanent raised bed, which also lessens the negative effects of excess water on crop output. Crops are grown on raised beds using the crop establishment technique known as bed planting. The bed planter includes movable blades that may be used to create raised beds of various widths and heights by moving the blades on the frame and the roller on the back. The multi crop bed planter, which has an inclined seed metering mechanism, is used to sow seeds into raised beds. Prior to planting each succeeding crop, permanent raised beds with little reshaping of the furrows between the raised beds are required to save cultivation costs and improve system sustainability. Additionally, it regulates the movement of machines, restricting compaction to the furrow bottoms, enabling the use of lower seeding rates than with conventional planting techniques, and minimizing crop lodging.

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RESOURCE conservation technique of raised bed planting, which was first used for wheat in the middle of the 1990s and achieved yields comparable to or greater than conventional tillage and sowing on the flat, is a promising one. Additionally, bed planting has numerous other advantages, such as the ability to mechanically control weeds, the ability to save irrigation water and reductions in lodging, sowing rate, and water logging. Permanent raised beds that retain stubble increase the possibility of direct drilling of all crops in the system, with accompanying advantages. For sugarcane, permanent beds provide crop flexibility, quick reaction to market opportunities, and intercropping. The size of the bed can range from 50 to 120 cm depending on the kind of soil and cropping strategy used. Each bed typically measures 67.5 cm from the middle of one to the middle of the

bed next to it, with furrows that are 37.5 cm broad at their widest point. Furrow-irrigated permanent raised bed (PRB) planting systems have emerged as key elements of low-cost, sustainable agricultural systems. The beds are kept permanently and just slightly shaped during sowing. Crops can be sown on PRB in a single pass without any prior tillage, maximizing the potential of the PRB technology. The PRB planters' inclined plate seed metering systems make it easier to apply fertilizer and seed at the appropriate locations in one operation, which improves crop



Raised bed planting of wheat

stand, productivity, and resource efficiency. It permits the application of fertilizer even in standing wheat, direct-seeded rice, and maize crops. Bed shaper and two-disc furrow openers make up the PRB planter. In the presence of residues, the double disc planter sows two rows of wheat at 30 cm row spacing and one row of maize at a 20 cm seed-to-seed spacing in the middle of the bed. In comparison to zero till tine openers, double disc furrow openers provide a smaller slit for the placement of seed and fertilizer as-well-as for managing maize residue. This minimizes damage to permanent beds.

Raised beds

Fresh beds: Additionally, elevated beds and ridges can be used to cultivate crops. They are especially helpful for clayey soils with heavy rainfall or other areas where poor drainage is probable. With this method, the land is divided

into a few long-raised bed strips that are spaced apart by furrows. On top of the bed surface, the crops are planted, and irrigation water is applied through the furrows. The lateral water circulation satisfies the crop water requirement while the bed surface stays nearly dry. Due to compaction created by tractor and equipment movement and irrigation water, it is easier for irrigation water to migrate laterally into the bed region, the infiltration rate of the furrow bottom remains nearly nil. For row crops like maize, soybean, cotton, sorghum, sunflower and dry beans, a single row is often planted on top of each bed; for crops like chickpea and canola, 1-2 rows are planted per bed; and for wheat, 2-4 defined rows, spaced by 15–30 cm depending on bed width, are typically employed.

Height of raised beds

Typically, raised beds are 10 to 30 cm high. The ideal height primarily relies on moisture and soil texture. Raised beds, for instance, are typically 20 to 30 cm high on clayey soils with heavy rainfall where poor drainage is likely to be an issue. Under the same circumstances, the bed height on coarse-textured soil could be between 15 and 20 cm. Raised beds have several benefits, including the

- Ability to do field tasks like weeding, fertilizer application and thinning as well as significantly better drainage than flat beds.
- Because they are created by dragging material from the nearby alleyways, they offer a thicker covering of topsoil and are therefore likely to be looser than flat beds.

Ridge-Furrow planting: In low rainfall regions, the greatest constraining element for crop production is the availability of water. Therefore, it is crucial for crop production in both semi-arid and sub-humid locations to create resource conservation techniques that will lower the need for irrigation water to maintain high grain yields and raise the WP. For high yields and WP in wheat and maize, ridge-



Raised bed potato

furrow farming (ridges that are each 30 cm wide and 15 cm high) can be particularly effective.

Permanent raised beds: Farmers who use fresh bed planting method often remove or incorporate crop residues, demolish the beds by tilling the soil, and then create the beds again before planting the following crop. Planting in permanent raised beds (PRBs) is a controlled traffic method that lessens soil compaction. As a result of chances to either lessen the negative effects of surplus water on agricultural productivity or to irrigate crops in semi-arid and desert regions for both irrigated and dry land areas, PRBs have historically been linked to water management challenges. The maize-wheat systems' sustainability can be improved, and cultivation expenses decreased by using the PRB technique. Permanent raised bed cropping systems can be used to increase productivity

while also saving water during field application. As excess water can be discharged more effectively than with basin/flood irrigation, furrow bed systems have also significantly reduced the risk of water logging. Raised bed planting has several benefits over traditional flat surface watering, including 30% average increase in grain yield, 73% increase in water use efficiency, 25% saving in applied irrigation water and 30-50% saving in the quantity of seed used for seeding.

Raised-bed planting efficiently collects water and distributes it where it is most needed, as opposed to farmers' usual practice of spreading water over the entire surface area. Raised-bed planting also resulted in labour and energy savings. One hectare (ha) of wheat planted in a raised bed required an average of 29.4 hours of water pumping, whereas a flat field required 43.9 hours. Farmers'

Table 1. Economics of raised bed planting in different crops

Name of technology	Cost of cultivation (₹/ha)		Gross returns (₹/ha)		Net return (₹/ha)		B:C Ratio	
	Demo	Local check	Demo	Local check	Demo	Local check	Demo	Local check
Raised bed wheat	35300	33900	84600	67920	49300	34020	2.40:1	2.00:1
Raised bed mustard	27900	24700	48720	34860	20820	10160	1.75:1	1.41:1
Raised bed maize	48600	45700	139656	118104	91356	73904	2.87:1	2.57:1
Raised bed arhar	24200	23500	73000	55000	48800	31500	3.01:1	2.34:1
Raised bed maize + arhar Intercropping	39900	35200	130600	93800	90700	58600	3.27:1	2.66:1
Raised bed maize + potato intercropping	59200	55300	264816	217128	205616	1612828	4.47	3.92
Raised bed potato	75400	70200	255000	204000	179600	133800	3.38:1	2.90:1



Raised bed potato + maize intercropping



Raised bed planting of maize

revenues increased because of the subsequent 33% decrease in labour and fuel expenditures.

Raised-Sunken beds: With around 72% of the total farmed area, rainfed rice is the main food crop in India's north-eastern region. However, the later growth stage of the rice crop frequently experiences soil moisture stress. Due to extreme moisture stress, farmers cannot harvest any crops during the winter (*rabi*) season. As a result, for the cultivation of *rabi* crops to be successful, suitable land arrangement is essential. In this context, a raised and sunken bed (RSB) system is a basic land structure that can be used to boost agricultural productivity in the paddies of India's north-eastern area through inter-plot water harvesting. To maximize water collection, RSBs are built to hold water until the soil can absorb it. Rice can be cultivated in sunken beds (30 cm deep) in areas with shallow water or high rainfall, and many vegetables are grown in raised beds. Cutting and filling is used to create RSB that are each 1 m wide (1:1 ratio). When RSB land configuration is used instead of farmers' traditional practice of mono cropping rice, there is a significant improvement in planting intensity, productivity, employment, and revenue for farmers. Under rain-fed situations, rice crops frequently experience soil moisture stress during later growth stages. Due to extreme moisture stress during the winter, farmers are unable to harvest any crops.

Benefits of raised bed planting of crops

- Irrigation water management has been simplified and made more effective. In comparison to flatbed approaches, it often uses 30% less water and increases crop yields by more than 20%. Compared to planting in a flat bed, FIRB planting saves 20% of the wheat seeds.
- Better drainage makes it feasible to produce upland crops more successfully during the wet monsoon. Better positioning, particularly top-dressed application, can boost fertilizer efficiency.
- Increased panicle/ear length, better tillering, and bolder grain.
- To increase protein content in wheat without causing lodging, farmers can administer N and irrigation water at the grain filling stage. Given that many farmers do not irrigate immediately after heading exactly to minimize lodging, reduced lodging can have a considerable, favourable impact on production. Water may therefore start to inhibit grain filling, resulting in a decreased yield.
- Planting beds enables irrigation prior to sowing, which gives the chance to reduce weeds before planting. Bed planted crops can be irrigated right away after seeding if pre-sowing irrigation is likely to delay planting.
- Early in the crop cycle, weeds between the beds can be mechanically managed.
- Wheat can be planted in a hand-

harvested rice field in a single pass. The bed planter reshapes the beds and furrows, plants the crop, and evenly distributes fertilizer along the seed or in between seed rows in the bed's centre, at a depth of 5 to 10 cm. Crop straws can be inserted into the beds of combine harvested rice fields by employing a shovel-style furrow opener fixed to the front of the bed planter frame. Without the proper equipment, farmers burn fewer of the rice straws before sowing the wheat and only partially contact the layers.

Conclusion

In any farming system, bed planting is closely tied to good crop and soil management techniques. Crop inputs (water, nutrients, energy, pesticides, etc.) and management practices in the specified agro-ecological zone work well to complement this practice of crop establishment. In systems based on maize, intercropping with micro-irrigation aids in increasing system productivity and profitability. A planting method of crops with ridges and furrows which helps water sensitive crops in adapting to high intensity rains by draining the excess water through furrows and under water scarcity situations help in irrigating the crop with limited water ultimately conserves all available natural resources.

Way forward

Several climate-smart agriculture (CSA) practices have been developed,

improved upon, and tested by various research organizations and farmers to respond to the challenges of climate change. The perceptions of climate vulnerability and reactions to climate resilient practices, however, differ with the bio-physical and socio-economic diversity of farm households because of knowledge gaps and fragmented information provided

to extension agents, policy planners, and farmers. The lack of biophysical and socio-economic knowledge integration in technology targeting prevents a wide range of farmers, particularly underrepresented and female farmers, from adopting it widely. A “one-stop-shop” for extension agents and planners to assist them in focusing portfolios of CRA practices under diversity

of farming practices for improved adaptive capacity of farming community, ensuring food security while minimizing agriculture’s environmental footprints is provided by raised bed planting technique on key CRA practices in intensive cereal based systems.

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Is the result of **eating too little, too much or eating an unbalanced diet** that does not contain the right quantity and quality of nutrients to be healthy.



The role of pulses

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MANY CAN BENEFIT FROM EATING PULSES



Infants and young children,
to meet their daily nutritional needs.



Vegetarians and vegans,
to ensure adequate intakes of protein, minerals and vitamins.

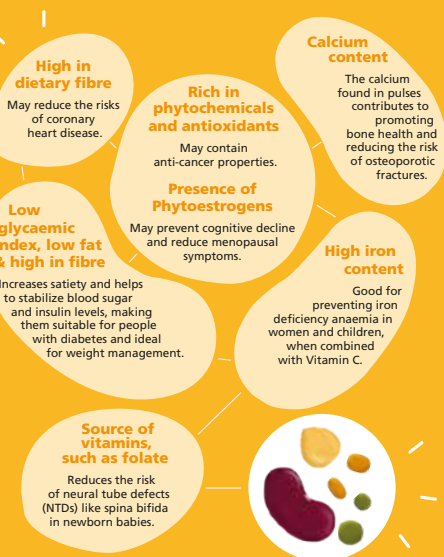


Women at reproductive age,
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pulses are gluten-free.

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