

River Bed Cultivation of Cucurbits

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SUMMARY

Climate change has had a negative impact on agriculture in recent years, and the rural poor are growing more exposed to unsustainable livelihoods. River areas are referred to as "Diara." Diara land agriculture continues to be done in the traditional way. Riverbed cultivation is a sort of vegetable forcing that allows for the production of primarily cucurbitaceous vegetables throughout the off season. River bed vegetable growers' earnings were mostly used to supplement their family's food security. Vegetable production on riverbeds is simple in terms of land preparation, water management, and other cultural traditions. Cucumber, bottle gourd, bitter melon, summer squash, round melon, and long melon are commonly grown together in northern India, whereas ridge gourd is grown in Rajasthan, MP, and UP. Stray animals, powerful windstorms, and extended periods of drought are the principal restrictions of diara cultivation. River bed cultivation is a pro-poor rural community programme aimed at increasing household income and improving food security for landless and land poor households in India.

INTRODUCTION

During the Mughal period, the traditional practice of diara cultivation was initiated, primarily using various cucurbits. It was chosen as a starting point for promoting inclusive economic growth for the benefit of landless people. River bed is a portion of land formed within a river as a result of sand deposition. Cultivation in riverbeds allows for off-season production of numerous cucurbitaceous crops, which is totally indigenous and innovative of Indian vegetable growers. The word "Diara" comes from the word "Diya," which means "earthen lamp." When rainwater gathers in the bowl-shaped surface systems (depressions) created between the natural levees on each side of the river during a rainy session, they resemble small "Diyas." According to the survey, riverbed agriculture accounts for 60% of total cucurbit growing area. During the summer season, river beds area yield 75-80 percent of total cucurbit output, which is available in the market from February to June. Such terrain is known as khaddar lands, char lands, dariayi, kachhar, doab, kochar, nad, riverine area, and nadiari in various parts of India.

How it comes to be

During the South-West monsoon, the alluvion and diluvion action of perennial Himalayan rivers results in the formation of diara plains. Due to yearly deposits of fresh silt and clay, vegetable crops can be cultivated on these soils during the monsoon. Following the monsoon season, the water in the riverbeds returns to its channel, leaving enormous regions dry. These plots of land are typically left undeveloped. The subterranean moisture evaporating from nearby rivers and streams makes the higher layers of land more conducive for growing early vegetable crops.

- The approach works effectively on marginal lands, in topographically flat places with river beds that are dry for one crop cycle (about 6 months), and on arable land that has been silted over or swept away by floods.
- Walking distance to village: no more than 30 minutes.
- The sand must be fine and small-grained, and the groundwater table must be at least 1m deep.
- Riverbeds or riverbanks can be farmed. When compared to riverbanks, riverbeds have a higher soil moisture content.

Table 1: River beds in India

States	Main river beds
Madhya Pradesh	Narmada, Tapti, Tawa, Mohana
Bihar	Ganga, Gandak, Sone, Kosi, Burhi Ganga
Andhra Pradesh	Tungbhadra, Krishna, Pennar, Papagni
Gujarat	Sabarmati, Vatrak, Panam-Orusung, Mohi-Banas, Tapti
Uttar Pradesh	Jamuna, Sarayu, Ganga, Ghaghra, Sharada, Ramganga, Gomati Rapti river bed

Diara land classification based on accurate position from the main stream

Main riverbed (low land) diara- The true riverbeds, with fine sand to coarse deposits on the surface, become available during non-monsoon seasons, i.e. December/January to May/June, till early rains set in. Bottle gourd and bitter melon are the main crops.

Main land (middle land) diara- These regions are located on the river's bank and vary greatly in width. During the rainy season, they are frequently swamped by the swelling of flood water. The depth of the major diara zone varies greatly depending on location. Watermelon, cucumber, luffa, pointed gourd, and muskmelons are the main crops.

Upland diara- These areas have been elevated as a result of continual deposition and are less frequently inundated than the main land diara locations. For all operational intents, these places are not much different from regular (non-diara) holdings. The primary crop is pointed gourd.

Where it works

Riverbed Diara- The area of land available for cultivation on both banks of the riverbed during the non-monsoon season.

Riverbank Diara- Agricultural strips of land located between riverbeds and natural levees or existing embankments.

Flood-affected Diara- Agricultural lands near to vulnerable reaches.

Flood Prone Diara- The region on both banks of the river beyond the levees or embankments. The Benefits of Riverbed Agriculture

The advantages of river bed farming include:

- High net yields per unit land area
- High yield and early maturity Irrigation is made easier.
- Low cultivation costs and highly fertile regions lower external mineral requirements.
- Weed growth is restricted.
- Cultural approaches and cost-effective labour facilities are used to control pests and diseases.
- There is no requirement for land ownership.
- Landless and marginal farmers' income and food security.

Characteristics of Riverbed soils

The soil on river beds is largely sand, and moisture seeps in from the nearby river. Cucurbit cultivation is best suited to well-drained loamy soils. Soil moisture is also essential for quick growth, and it should be at least 10% to 15% over the wilting threshold. Lighter soils are typically used for early crop yields, whereas heavier soils are typically used for late crop yields. Cucurbit development is aided by subterranean moisture in river streams and alluvial substrate in sandy riverbeds. In the hot and wet seasons, the soils should not fracture and should not become waterlogged. It should be supplied with a suitable amount of organic materials. Cucurbits prefer a neutral soil pH, which is between 6.0 and 7.0. pH below 5.5 is not good for cucurbit cultivation, and most cucurbits prefer a neutral soil pH, which is between 6.0 and 7.0. Water melon is the only cucurbit that is slightly salt tolerant, and Musk melon is slightly acid tolerant. 2016 (Patel et al.). The ideal temperature range for optimal growth and development is between 18 and 22°C. Leveling the lands is the first step in excellent soil management, followed by the application of gypsum to alkali soils and lime to acid soils in diara lands.

Cultivation

Farmers select riverbed plots, with plots perpendicular to the flow of the river. After the water recedes in October and November, and the south-west monsoon ceases, pits, trenches, or channels are prepared.

Planting systems

The majority of farmers chose the following planting system based on personal preferences and labour availability.

They are as follows:

Pit system of planting - Pits of 0.5 m diameter are excavated 1 m deep and 1 to 3 metres apart, depending on the crops, and planted with multiple seeds, the weak of which are thinned out. Circular pits with a diameter of 35-45cm and a depth of 90 cm are sometimes prepared.

Ditch system of planting - To regulate the availability of moisture and higher temperatures, trenches are excavated in a North-West orientation. To use the ditch system, dig a 1 m deep trench down the row, leaving 1 to 2 m (bitter gourd, khira) or 3 m (watermelon, bottle gourd, pumpkin) between rows. In the ditch, seeds are planted/spaced 1 m (watermelon, bottle gourd, and pumpkin) and 0.5 m (bitter gourd, khira) apart. The pits/trenches are filled with organic decomposing garbage, oil cakes, FYM, or any other material that has been mixed into the soil.

Seed rate, seed treatment, and sowing/transplanting time

The seed rate changes depending on the crop to be cultivated. Sowing an early crop is typically done in the first two weeks of November and the first week of December. The first week of January is ideal for late sowing. The seeds are planted in a trench at a depth of 3 to 4 cm and a distance of 45-60 cm. typically two seeds are sown in the same location. When the temperature is really low, pre-sprouted seeds are sown to ensure smooth germination. Pre-soak the seeds for 24 hours before placing them in a gunny bag, covering them with a cotton cloth, and keeping them in a warm spot for about a week for sprouting to begin. Sometimes damp seeds are wrapped in gunny bags and placed near the fire for speedy germination, and sprouting begins after 5-6 days. Planting occurs as soon as sprouts emerge from the seed coat. In general, 3-4 pre-germinated seeds per hill area are sown in pits.

Nutrient management

Previously, manures/fertilizers were not utilized in diara land agriculture, but farmers are increasingly employing fertilizers and manures to ensure crop growth. Because this gardening approach is only employed for one season, inorganic fertilizers and organic manures are used sparingly and with extreme caution. First, well-decomposed FYM or compost, caster cake, or groundnut is used. River silt is commonly used to increase the retentivity of moisture in the feeding zone. Organic manure provides warmth to germinating seeds or developing transplants. 30-60 g urea per pit will be effective during thinning. Chemical fertilizers, notably fertilizer combinations or nitrogenous fertilizers like urea, are top dressed in two split doses after 25-30 days of sowing, depending on weather circumstances and growth.

Water management

Cucurbits can live in diara terrain due to their deep root system. Pitcher irrigation is used in the early phases of germination and growth until the roots of the plants touch or are left in contact with the water regime beneath the sand. A trickle or sprinkler irrigation method is very useful for avoiding nutrient leaching losses in sandy soils.

Weed management

Fimbristylis dichotoma, *Euphorbia hirta*, *Eclipta prostrata*, *Sida* sp., *Polygonum* sp., and other weeds are common in diara land areas. Because the soil is quite loosened due to the surplus sands, these weeds can be removed manually by pulling. Herbicides should be avoided at all costs because they can be harmful to humans, animals, and fish when mixed with moving river water.

Thatch preparation

When the temperature drops to 1-20 degrees Celsius in north-west India during the winter months of December and January, new plants should be covered from frost and cold in their early stages. The thatch screen, which is formed of locally accessible materials such as paddy straw, Saccharam grass, or sugarcane leaves, protects the young plants. In the month of February, grass is laid over the sand as a bedding and mulch to protect the sensitive and young plants and fruits from blistering heat sand throughout the summer, and it also prevents the vines from drifting during strong winds. The use of polyethylene covers as a frost protection strategy is still being researched. This will be inexpensive and easily accessible to average growers.

Cropping pattern

In riverbeds, mixed cropping is commonly employed. Melon and Watermelon work well together. Summer squash, bottle gourd, round melon, cucumber, sponge gourd, bitter gourd, long melon are other cucurbits that are commonly grown together in northern India, ridge gourd in Rajasthan, MP, and UP, and pointed gourd in Bihar.

Harvesting and yield

Harvesting should take place when the fruits are soft and edible. Fruits that reach edible maturity should be harvested every 2-3 days, otherwise the quality deteriorates and the fruits harden due to seed maturity. Harvesting can be done at regular intervals from the end of June to the end of October. The potential production of several vegetables is shown in Table 2. Fruit harvesting begins in February-March (off-season), providing an early yield and a better return. Crops are delivered to local market centres for sale after harvesting.

Table 2. In diara fields, crop duration and yield of cucurbitaceous vegetables

Sr.No	Vegetables	Seed Rate (kg/ha)	Planting Time	Harvesting Time	Average Yield (q/ha)
1	Cucumber	2.5-3.5	Jan-Feb	March-June	225-250
2	Ridge Gourd	3.5-5	April-May	June- July	100-200
3	Bitter Gourd	4-5.5	Feb-March	May-July	100-150
4	Bottle gourd	3-4	Nov-Dec	March-July	200-350

Constraints

- A scarcity of high-quality seed
- The majority of these fruits are created through cross pollination before being selected for seed extraction. That is why river-bed fruits are of erratic quality, particularly in terms of sweetness and flesh colour, about which urban customers frequently complain.
- It has facilitated the preservation of natural variability, and farmers have willingly supported a continuing process of recombination and selection.
- Inadequate land availability
- The riverbed may remain flooded for an extended period of time.
- Vegetable growers do not own the available land.
- Fertility is extremely low due to extensive soil leaching.
- River-bed agriculture does not fit into any crop rotation, and cucurbits are specifically used for this sort of cultivation.
- The majority of the advantage is usually grabbed by the businessman and middleman who buy the cucurbits veggies in the summer and sell them in the market. As a result, tiny and marginal farmers who cultivated a decent crop on riverbeds or essentially on sand are denied a large share of revenues.

CONCLUSION

Riverbed farming may enhance farmers' susceptibility to environmental shocks because it is a low-impact, easy-to-learn, cost-effective method that allows landless households to produce underused marginal areas. This form of agriculture is most suited for small and marginal farmers who can labour in the fields with their family, producing a huge number of cucurbits and other vegetables at a low cost. It boosts marginal farmers' alternatives for long-term coping with the consequences of natural shocks like floods by exploiting underutilized resources and improving smallholder productive skills on marginal soils.

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