Land preparation for riverbed farming in Kailali District (Juerg Merz)

Riverbed farming (Nepal)

Bagar Kheti (Main Contributors: Elam Plus and Hari Gurung, Helvetas Nepal)

DESCRIPTION

Riverbed farming can be used to increase household income and to improve the food security of landless and land-poor households in the Terai area of Nepal.

It is estimated that about 8,000 hectares of riverbed land would be suitable for agricultural cultivation in the Kailali and Kanchanpur Districts in the Western Terai areas of Nepal. After the river water recedes in the post-monsoon season, vegetables are planted in ditches dug into the seasonal sand banks; the crops are harvested before the onset of the next monsoon. In 2006, Elam Plus of HELVETAS Swiss Inter-cooperation Nepal, assessed local practices of riverbed farming and piloted an improved approach with 670 farmers, mostly from the indigenous Tharu community. During the first year they cultivated 43 hectares. Since the initial results indicated that riverbed farming could increase the target population's income significantly, the programme was expanded from the initial two districts (Kailali and Kanchanpur) to two new districts (Banke, and Bardiya). The number of households was increased to 2000 in 2008 and 3165 in 2012 after the initiative won a Global Development Market Place award from the World Bank.

Establishment / maintenance activities and inputs: Requirements for riverbed farming:
• On average, the water table should not be lower than 1 m; when the water table is lower than this, too much labour is required.
• Plots are allocated perpendicular to the river flow in order to give each farmer access to a variety of land types (and moisture levels) suitable for different crops.
• Ditches are up to 1 m deep and 1 m wide. The length depends on how much land is available.
• A row-to-row spacing of 2–3 m (between the ditches) and plant-to-plant spacing of 0.5–1 m is required depending on the crop.
• The ditches are dug in an east-west orientation to maximize the amount of sunshine they receive and to minimise the collection of sand carried by the prevailing winds.
• Riverbed farmers can build shelters close to their plots so that they can be close at hand to fend off thieves and wild animals.

LOCATION

Location: Kanchanpur, Kailali Districts, Nepal

No. of Technology sites analysed:

Geo-reference of selected sites
- n.a.

Spread of the Technology: evenly spread over an area (4.0 km²)

In a permanently protected area?:

Date of implementation:

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions

Bitter gourd produced on riverbed land in Kanchanpur District (Juerg Merz)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ☐ improve production
- ☐ reduce, prevent, restore land degradation
- ☐ conserve ecosystem
- ☐ protect a watershed/ downstream areas – in combination with other Technologies
- ☐ preserve/ improve biodiversity
- ☐ reduce risk of disasters
- ☐ adapt to climate change/ extremes and its impacts
- ☐ mitigate climate change and its impacts
- ☑ create beneficial economic impact
- ☑ create beneficial social impact

Land use

Cropland

- Annual cropping: vegetables - other

Number of growing seasons per year: 1

Water supply

- ☐ rainfed
- ☐ mixed rainfed-irrigated
- ☐ full irrigation

Purpose related to land degradation

- ☐ prevent land degradation
- ☑ reduce land degradation
- ☐ restore/ rehabilitate severely degraded land
- ☐ adapt to land degradation
- ☐ not applicable

Degradation addressed

soil erosion by water - Wr: riverbank erosion

SLM group

- improved ground/ vegetation cover
- use different type of land for cultivation

SLM measures

agronomic measures - A2: Organic matter/ soil fertility

structural measures - S3: Graded ditches, channels, waterways

TECHNICAL DRAWING

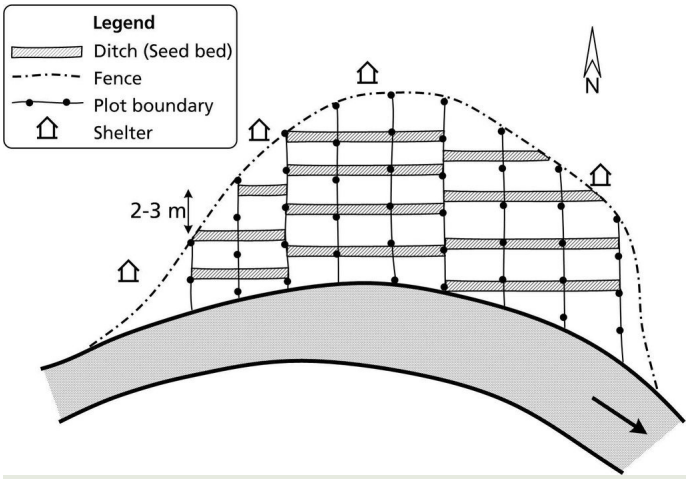
Technical specifications

Plots for riverbed farming are allocated perpendicular to the river flow and the ditches are dug in an east-west orientation.

Technical knowledge required for land users: moderate

Main technical functions: increase / maintain water stored in soil, Support Income Generation

Secondary technical functions: improvement of ground cover, increase in organic matter, Stabilizes the soil



Author: J Merz, AK Thaku

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **ha**)
- Currency used for cost calculation: **USD**
- Exchange rate (to USD): 1 USD = n.a
- Average wage cost of hired labour per day: n.a

Most important factors affecting the costs

All costs and amounts are rough estimates by the technicians and authors.

Establishment activities

1. Dig ditches in an east-west direction about 2 to 3 m apart. The ditches can be up to 1 m deep and 1 m wide; the length will depend on the shape of the land. (Timing/ frequency: None)
2. Apply fertilizer: farmyard manure/compost about 12 tonnes; urea about 100 kg; di-ammonium phosphate (DAP) about 120 kg; and potash about 30 kg per ha. (Timing/ frequency: None)
3. Plant seeds/seedlings using the appropriate row-to-row (RXR) and plant-to-plant (PXP) distance for at least one crop. A row-to-row distance of 3 m is required for bottle gourd, pumpkin, and water melon and 2 m for bitter gourd and cucumber; a plant-to-plant distance of 0.5 m is needed for cucumber and bitter gourd and 1 m for water melon, bottle gourd, and pumpkin. (Timing/ frequency: None)

Establishment inputs and costs (per ha)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Dig ditches and applying fertilizer and manure	ha	1.0	232.0	232.0	100.0
Equipment					
Sprayer, watering cans,spade	ha	1.0	42.0	42.0	
Fertilizers and biocides					
Seeds, chemical fertilizer	ha	1.0	267.0	267.0	
Construction material					
Plastic bags,mulching material	ha	1.0	21.0	21.0	
Total costs for establishment of the Technology				**562.0**	
Total costs for establishment of the Technology in USD				*562.0*	

Maintenance activities

1. Water new plots every 2 to 3 days; as the seedlings mature, water weekly or as needed depending on the weather and the soilconditions. (Timing/ frequency: None)
2. Replace seedlings that have died and replant seeds in places where they have not germinated (Timing/ frequency: None)
3. Top dress with nitrogen, phosphorous, potassium (Timing/ frequency: None)
4. Mulch with straw and grass (Timing/ frequency: None)
5. Weed and protect plants as needed (Timing/ frequency: None)
6. Protect the riverbed areas throughout the growing season as they are prone to attacks by thieves and wild animals, mainly jackals and monkeys. However, note that the reported losses to date have been very minimal. (Timing/ frequency: None)

Maintenance inputs and costs (per ha)

Specify input	Unit	Quantity	Costs per Unit (USD)	Total costs per input (USD)	% of costs borne by land users
Labour					
Maintaining plots	ha	1.0	42.0	42.0	100.0
Equipment					
Sprayer, watering cans,spade	ha	1.0	28.0	28.0	25.0
Fertilizers and biocides					
Seeds, chemical fertilizer	ha	1.0	84.0	84.0	25.0

Construction material					
Plastic bags, mulching material	ha	1.0	11.0	11.0	50.0
Total costs for maintenance of the Technology				**165.0**	
Total costs for maintenance of the Technology in USD				*165.0*	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1,000 mm
- [ ] 1,001-1,500 mm
- [x] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Thermal climate class: subtropics

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [ ] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [x] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [ ] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [ ] medium
- [x] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

Is salinity a problem?
- [ ] Ja
- [ ] Nee

Occurrence of flooding
- [ ] Ja
- [ ] Nee

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial)
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [ ] mechanized/ motorized

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [ ] men

Age
- [ ] children
- [ ] youth
- [ ] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled
- [x] landless

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [ ] leased
- [ ] individual

> 10,000 ha

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good

IMPACTS

Socio-economic impacts

farm income	decreased	increased ✓	
diversity of income sources	decreased	✓ increased	Provides vegetables for riverbed farming households
dependent on external agricultural inputs	increased ✓	decreased	

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved ✓	Riverbed crops can be exchanged for food grain; on average,this can provide an additional four month
conflict mitigation	worsened ✓	improved	Conflicts can arise when the land is being allocated and border conflict can arise between different groups
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)	worsened	✓ improved	Additional income can be used to cover school fees and health services
livelihood and human well-being	reduced	improved ✓	Provides alternative means of income as well as food security for landless and land-poor households
social status of local resource persons	decreased	✓ increased	
need for income usually met by migration and by off-farm daily wage labour	improved	✓ reduced	

Ecological impacts

water quality	decreased ✓	increased	Excessive use of fertilizers may affect water quality and the use of pesticides in the case of massive pest invasions may affect the water quality as well
soil cover	reduced	✓ improved	
soil loss	increased	✓ decreased	Minimize soil loss due to wind erosion
flood impacts	increased ✓	decreased	Crops can be lost during floods, cold spells and hailstormes

Off-site impacts

Local availability of fresh vegetables	reduced	✓ improved	

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	✓ very positive	
Long-term returns	very negative	✓ very positive	

Benefits compared with maintenance costs

Short-term returns	very negative	✓ very positive	
Long-term returns	very negative	✓ very positive	

CLIMATE CHANGE

Gradual climate change

annual temperature increase — not well at all ✓ very well

Climate-related extremes (disasters)
general (river) flood — not well at all ✓ very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology
- single cases/ experimental
- 1-10%
- 11-50%
- > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?
- 0-10%
- 11-50%
- 51-90%
- 91-100%

Has the Technology been modified recently to adapt to changing conditions?
- Ja
- Nee

To which changing conditions?
- climatic change/ extremes
- changing markets
- labour availability (e.g. due to migration)

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

Strengths: compiler's or other key resource person's view
- Riverbed farming provides a new source of income for landless and land-poor households

  How can they be sustained / enhanced? Continue to provide technical support through local resource persons. These persons can be supported through district-based instruments such as the Micro Enterprise Development Fund.
  Local governing bodies such as the district development committees, municipalities, and village development committees, can support riverbed farming with their own funds; can support farmers with the land leasing process, can help to identify primary stakeholders, and can also help by promoting policies that are favourable towards riverbed farming.
- Riverbed farming has a very high cost-benefit ratio and a very low investment requirement.

  How can they be sustained / enhanced? Continue to promote this technology among primary stakeholders.
- All services including the supply of quality seeds, tools, and materials are now processed through the local agrovets and agricultural extension is available through local resource persons. These are locally available and of high quality.

  How can they be sustained / enhanced? Agrovets, local resource persons, and their associations may need further capacity building through different channels such as the Micro Enterprise Development Fund, and/or the District Agricultural Development Office

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome
- Competition from riverbed products originating in India and a glut during the season Riverbed farmer groups need to improve their understanding of the value chain and their access to markets.
- Mineral fertilizer and biopesticides are now used to ensure a good harvest Promote sustainable soil management practices including the use of farmyard manure, urine collection, and bio-pesticides
- Land ownership of riverbed land is often contested Long term leasehold agreements need to be negotiated with land owners

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1691/

Linked SLM data
Approaches: Land distribution and allocation for riverbed farming https://qcat.wocat.net/af/wocat/approaches/view/approaches_2534/

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Key references
- Riverbed farming manual and local resource person training modules. Kathmandu, Nepal, HELVETAS Swiss Intercooperation Nepal: