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Technical Brief

Banana farming in flood deposited sandy soil

Practical Action: Transforming lives, inspiring change

May 2018

Introduction

Banana is one of the major and economically important fruit crops of Nepal. It has been traditionally grown in home yards for home consumption purpose. However increasing demands due to increase in consciousness on nutritional value and change in food habits have necessitated expansion of banana farming in Nepal. This technical brief describes step by step guide to establish banana farm in flood damaged soil.

Photo 1 Banana plantation inundated in flood water

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Problem/Context

In most of the flood affected areas, annual flash flood deposits sand on the land near the river, making it unsuitable for regular food crops like rice and wheat. The flash flood usually does not inundate crops for a long duration; however submerges small stature rainy season crops like rice that can die due to inundation. Sand deposition makes it unsuitable for growing other food crops even after the flood recedes. Root system of regular food crops does not go deep into the soil below the sand deposited due to flood so these crops suffer the most.

Sandy soil is characterised by low nutrient availability, low water holding capacity and poor physical attributes of soil. It needs longer time and much effort to completely restore the land into its original state after the sand deposition. As a result, farmers face difficulties to go back to normalcy and sustain their life. There are various strategies developed so far to revitalise flood degraded soil. However, most of the strategies require higher initial investment and/or take longer time to restore due to which farmers are unable to generate income as before. This technical brief has been developed since banana farming can be a suitable option to revitalise the flood degraded soil as well as a good source of regular farm income for vulnerable communities.

In most cases of sand deposition due to flood, sand is found only in the upper part of the soil. In sandy soil, planting crops that have deeper root systems one can get benefit as same as planting in normal soil. Banana plant is usually planted in a pit which is 0.5 to 0.75 m deep and in most cases flood deposited sand is 0.1 to 0.3 m above normal ground. So its root system does not easily get affected by the sand deposited. However, good irrigation system should be assured as sandy soil has poor water holding capacity.

How to establish banana orchard in flood deposited sandy soil?

Banana can be grown in variety of soil. However, while planting in flood prone area and sand deposited soil, regular management practice should be slightly amended. If sand deposition is above 0.5 m and the area gets inundate for longer duration (more than 2-3 days) during monsoon,then such site should not be considered for banana plantation.

These are the necessary things to be considered in each step of banana farming in flood affected area:

I. Variety selection

In flood affected areas, there is always a high chance of banana plant being submerged in flood during monsoon. If it is fully submerged for more than two days, plant can eventually die. Therefore tall variety plants with deep root system should be planted in such areas. In Nepal, people usually grow *malbhog* variety of banana in the areas which are prone to annual flood but are not inundate for longer than three days. Malbhog variety grows up to the height of 5 m and root goes down to more than 1 m deep into the soil. Production is quiet lower compared to hybrid varieties but fetch good market price because of its taste.

II. Propagation material

In Nepal, banana is propagated exclusively using suckers. Suckers are lateral shoot that develops from the rhizome near the mother plant and are categorically of two types,sword sucker and water sucker. Generally, sword suckers are preferred over water suckers as the plant developed from water suckers are weak and take longer to bear fruits. Sword suckers can be easily distinguished because of its well-developed base with narrow sword shaped blades at the early stages. Two to four months old suckers from healthy and high yielding mother plant should be selected for propagation.

Photo 2*Malbhog* variety of banana planted in flood induced sand bar in Chitwan, Nepal

III. Planting method

Banana suckers are usually planted in a 0.2 to 0.25 m furrow or pit of size 0.6x0.6x0.6 m^3at depth of 0.3 m. But in flood affected areas, suckers should be planted in a pit of size more or less equal to 1 m^3. Pit is filled with mixture of top soil and Farm Yard Manure (FYM) at 1:1 ratio and sucker is planted at 0.5 to 0.75 m depth depending upon the height of sand above original ground level. A total of 2 x 3 m spacing should be maintained between the plants.

IV. Crop management

Crop management begins with the planting, continues with crop maintenance during growth and development, and ends with crop harvest, storage and distribution. For good harvest, crop management strategy should be contextualised based on the soil type, topography, climate and availability and affordability of inputs. Crop management includes:

V. Nutrient management

A good fertiliser management for banana trees starts well before the plantation. Therefore it is best to conduct a soil test and plan for the optimum nutrition management. In general, banana plants require 200 g Nitrogen (N), 110 g Phosphorus (P), 250g Potassium (K) and 3-5 kg FYM per plant for successful production. Full dose of FYM, half dose of P and K and one third of N should be applied in a pit at the time of planting. One third of N should be applied during active vegetative growth stage and remaining half of P and K and one third of N should be applied during flowering stage. In flood prone areas, topdressing with additional half dose of P and K and one third of N should be done immediately after flood recedes.

While topdressing, a circular line should be dug 5 cm deep and 5-10 cm away around the trunk and fertiliser which should be placed in a line and covered with soil. Irrigation should be provided immediately after the fertilisation. If necessary, following micronutrients should be provided in addition to major nutrients:

- Yellowing of leaves is a symptom of iron deficiency, spray 0.5 per centFerrous sulfate,1 per cent urea added with wetting agent on the leaves especially in high pH >8.5 and calcareous soils.
- For zinc deficiency, spray 0.5 per centZinc sulfate solution along with wetting agent.
- For Boron deficiency, spray 0.5 per centBorax.

a. Mulching and irrigation

In flood affected areas, soil remain mostly sandy. Hence it cannot hold moisture for longer duration due to which mulching is required to conserve the soil moisture. Good irrigation system with frequent irrigation schedule should be planned to maintain optimum moisture during dry period. For efficient water management and to reduce electricity consumption, drip irrigation could be viable option for irrigating banana orchard in sandy soil during the dry season.

b. Drainage

Deep trench should be dug between the rows to drain water during flood. Also earthing up around the trunk should be done with clay soil to reduce flood damage to main trunk.

c. Weed management

Weed management is most effective when it integrates combination of strategies. There are various methods like manual, chemical, biological and cultural weed management techniques to control weed in banana orchard. However, planting short duration leguminous crops like cow pea and beans in empty spaces between the banana plants and casual manual removal of weeds helps controlling weed in a greater extent. Such practice of inter cropping of leguminous crops can also be a good source of additional income and restores soil quality in a long run.

d. Disease/pest management

Clean cultivation practice, good irrigation facility, balanced nutrient management and timely weed management reduces chances of disease and pest infestation. Major disease and pest that affects banana plantation and management are discussed below:

Table 1 .....

S.N.	Disease	Symptoms	Control
1	Panama wilt Fusarium oxysporum	Soil borne fungi enter through roots. Most serious in poorly drain soil Initial symptoms include yellowing of lower leaves, including leaf blades and petioles Yellowish to reddish steaks observed in pseudo stem Finally wilt	Uproot and burn infected plants Plantation should be avoided for 3-4 years in highly infected soil Use of disease free planting material/suckers Dipping of suckers in Carbendazim (10g/10 l water) followed by bimonthly drenching from 6 months after planting Use of quick lime near the base of the plant
2	Yellow sigatoka/ Leaf spot/streak Mycosphaerellamu sicola	Light yellowish spots on the leaf Spots enlarge, become oval and colour changes to dark brown Centre of the spot dies Spot coalesce killing large part of the leaf Common during rainy season in temperature above 21°C	Remove disease sucker, good drainage, weed free cultivation. Foliar spray of Copper oxychloride (3g/ litre water) or Thiophanatemethyl (1g/ litre water) or 0.1 per centPropiconazol
3	Anthracnose Gloeosporiummusae	Attacks flowers, skin and distal ends of banana head Large brown patches covered with crimson growth of the fungus Fruits turn black and shrivelled	Spray Chlorthanlonil (0.2%) and Bavistin (1%),4times at interval of 15 days
4	Bacterial wilt/Moko disease Pseudomonas solanacearum	Young plants are affected severely Yellowish discoloration of the inner leaf lamina at earlier stage Later, leaf collapses near the junction of lamina Tender lavesfrom suckers turn yellow and necrotic	Early detection and destruction of affected plant Removal of male flower immediately after last bunch of finger appears
5	Bunchy top virus (BBTV)	Transmitted by aphids Infected suckers develop narrow leaves which are chlorotic and exhibit mosaic symptoms	Use of disease free planting materials Control of Aphids Destruction of affected plants including rhizome
6	Mosaic virus	Plants are dwarf and mottled with distorted leaves. Transmitted by aphids.	Use of disease free planting materials. Control of Aphids. Destruction of affected plants including rhizome.

Table 2

S.N.	Insects	Damage and symptoms	Control
1	Pseudostem borer Odioiporuslongicollis	The grubs bore into the stem and feed within the stem Plant sap and blackened mass observed outside the hole bore by the grub Plant dies	Uproot and burn infected plant Place Celphos (3 tablets per plant) inside the pseudostem and plaster slit with mud Apply Carbofuran (3g) or Endosulphan (0.04%) or Carbyl WP (0.1%)
2	Rhizome weevil *Cosmopolites sordidus*	Larvae or grubs feeds by tunnelling in the plant Decaying of corm into mass of rotten tissue Leaves turn yellow and die	Adult feeds on dead or dried plant so destruction of such plants Use of clean planting materials Dipping of planting materials in Monocrotophos (0.5%) for 30 minutes
3	Banana Aphid *Pentalonianigronervosa*	Vector of virus Sucks cell sap and devitalise plants Plants become discoloured and malformed Appears in the lower surface of the leaves	Spraying of Monocrotophos (0.05%) or Malathion (0.1%) at interval of 10-15 days

Other important activities

Along with above management practice, following things should be carried out for better crop establishment and better harvest

- Gap filling to replace rotten suckers
- Regular inspection
- Slight digging and earthing up around the plant to keep weed under control
- Ploughing and incorporating remains of leguminous crop in to the soil to help revitalize flood damaged soil
- Removal of dried, yellow leaves and unwanted sucker growth in the soil which in long run restores soil quality

Conclusion

With increase in dietary consciousness, demand of banana is also growing day by day. However, due to agricultural trend of giving emphasis on cereal crop cultivation to banana production, present production status does not meet growing demand. As a result, almost 50 per cent of banana has to be imported from neighboring countries. Meanwhile, around 15 per cent of the lowland where rice is being produced as main crop suffers from annual floods. Every year such lowland and land adjacent to major river and their tributaries suffer due to flood and sand deposition. In most cases, farmers feel insecure to invest in such type of land and hence they keep such lands barren. So this technical brief is prepared to let farmers know and help boost understand of technique to cultivate and make use of such sand filled lands. Banana farming can be one of the best options to utilise such sand filled soil as well as to restore fertility and quality in a long run. However, farmers have to seriously follow above steps and techniques of banana farming in sandy soil.

Case-study

"Helping farmers switch to flood resilient farming"

When Krishna Gopal Tharu, 45, switched to commercial banana farming from traditional paddy farming, he was not sure if he had made the right choice by giving up traditional farming. He was fed up by paddy farming due to damage done by flood every year causing poor harvest and low prices though it was his main source of livelihood.

He started banana farming with support from Nepal Flood Resilience Project (NFRP). The project has helped hundreds of farmers in western Nepal to switch to alternative farming, making them more

Photo 3 Krishna Gopal Tharu sharing his opinion on banana farming

resilient to floods. Tharu's success with the alternative farming is gradually inspiring other small holder farmers in the area to invest in flood resilient farming. He has become a role model to his fellow villagers in Tediya Village of Bardiya District. Tharu made NPR 70,000 (£467) through the first harvest and is gearing up for the second season too.

Tharu who has five katta of land to sustain his eight-member family says, "I would have earned a maximum of NPR 7,000 (£ 47) had I grown paddy this year. That is why I am thinking to use rest of my land for banana farming."

Cost of solution

Though initial investment is higher in banana farming,farmers can make small profit in first harvest compensating initial investment. However, second harvest onwards up to four harvests, farmers can make substantial profit as they do not need to replant sucker, instead ratoon sucker is allowed to grow and replace mother plant. Investment during this period will only be in fertiliser and other management practice.

Table 3 Cost of cultivation for establishing banana orchard in 1 ha land

S.N.	Particular	Quantity	Cost (NPR)	Total cost (NPR)
	Land levelling	1 time	5,000	5,000
	Suckers @1000/ha	1100 (number)	20	22,000
	Land preparation (pit digging)	1000 (number)	15	15,000
	Fertilisers			
	Urea	0.341kgx1000	15	5,115
	Diammonium phosphate (DAP)	0.239 kgx1000	22	5,258
	Muriate of Potash (MoP)	0.416kgx1000	25	10,400
	Farm yard manure (FYM)	10kgx1000	2.5	25,000
	Other micronutrients	Lumpsum	10,000	10,000
	Irrigation channel (fixed cost)	lump sum	20,000	10,000
	Other chemicals (pesticide+fungicide)	Lumpsum	10,000	10,000
	Other management (1 season including labour cost)	12 month	2,000	24,000
Total initial cost				141,773

**1 GBP equals to 150 NPR*

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Flood Adaptive Nursery Technology was developed by Rakesh Khadka of Practical Action Nepal

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