Flood Adaptive Vegetable Nursery Technology

Technical Brief

Flash flood triggered by incessant rainfall or river overflow damages nursery seedlings every year in flood plains of Nepal[i]. A farmer may lose big in buying seeds and preparing the nursery again and could plant in the wrong season. These affect food security, income and nutrition since vegetables are important components for our diets[ii].

Flood damages nursery seedlings in many ways[iii]:-

- Decreasing oxygen level in the root zone. This impedes respiration (where energy is released from sugars) in the roots leading to the build-up of carbon dioxide, methane and nitrogen gases. Ultimately, the roots can suffocate and die.
- Toxic compounds such as ethanol and hydrogen sulphide can built up in the soil and damage plants.
- Upon complete submergence, photosynthesis (absorption of energy from the sun to produce sugars) can be inhibited and plant growth can slow or even stop.
- Excessive and prolonged moisture in soil tends to favour the growth of soil-microbes such as *Fusarium* spp., *Phytophora* spp. and *Rhizoctonia solani*, which can infect plant roots leading to diseases such as damping off in seedlings.

Though root zone aeration problem can be overcome by cultural operation, the damaged caused by flood can have everlasting effect in soil as disease causing microorganism like damping off thrives in moistened soil even after the flood water recede and soil may require treatment before establishing another nursery.

Remedial measures:

It is quite difficult to revive healthy seedlings after flood damage. However, possible flood damage can be prevented/minimised by adopting suitable vegetable nursery technology. Basically two types of nursery bed, i.e., raised bed nursery and *machan* nursery bed* can be adopted depending upon the trend of flood level in the area.

For both types of nursery bed, following things should be considered while selecting site for establishing nursery bed:

- Upland - less chance of flooding
- Good irrigation and drainage facility
- Abundant sunshine
- Near enough to manage and care

- Near the main garden to avoid damage of seedlings during transplanting

Nursery bed and its suitability

1. **Raised Bed Nursery**

This type of nursery bed can be constructed in the area where there are minimum chances of flooding during monsoon. Raised bed nursery allows better drainage and allows soil to heat up faster and stay looser, which promotes rapid plant and root growth as well as easier weeding[iv]. Raised beds can be achieved by simply mounding soil up to create a berm 15 cm higher than the surrounding pathways.

Procedure

- After site selection, clear the land and measure 1m wide of any convenient length (length as per the need).
- Dig it well at least to a depth of 0.3-0.45 m so that stones and roots lying underneath are dug out and thrown outside the nursery. If the soil has gravels, it should be sieved through a wire mesh to remove gravel.
- Mix farm yard manure (FYM) or compost at the rate of 5-10 kg/m^2 depending upon the fertility status of the soil. Inorganic fertiliser should be avoided as much as possible in nursery bed as it accelerates seedling growth making it prone to disease/insect infestation. If required then add 900 gm of 5-10-5 NPK (Nitrogen, Phosphorous, and Potassium) fertiliser per 9 m^2 of bed area after soil treatment.
- The soil should then be treated either by solarization or by chemical means to get rid from soil borne disease.
- Raise soil by 15 cm above the ground surface and dig 50 cm wide and 15 cm deep drainage canal around the nursery bed.
- Sow seed (described below - seed placing procedure in nursery bed).
- If necessary construct plastic roof to protect seedlings from rainfall.

Figure 1 Farmers preparing Raised Bed Nursery in Bardiya District

2. **Machan Nursery Bed**

Machan nursery bed is improved version of traditional nursery bed adopted by farmers as a coping strategy in flood-prone area of central Nepal. Its knowledge has been captured, improved and implemented in Nepal Flood Resilient Project (NFRP) funded by Zurich Foundation by Practical Action in Karnali region of Nepal. This type of nursery bed is suitable in the area where seasonal flood is prevalent and reaches more than 4 feet from ground level. Even the flood inundation for prolonged time cannot affect nursery seedlings raised in machan nursery bed.

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The space below machan nursery can be utilised to grow short duration spices like coriander or other leafy vegetables.

Bed preparation

Material required:

- Bamboo
- Straw
- Galvanised wire
- Fertile soil
- FYM/Compost
- Soil drilling tool
- Banana leaf/Black plastic sheet
- White Plastic sheet
- Seed

Procedure

Figure 2 Farmers constructing Machan Nursery Bed in Bardiya District

- After site selection, construct machan - 4 to 5 ft height (depending upon flood trend), 1 m wide and of convenient length (as per the need maximum 5 m).
- Spread bamboo culm as a bedding material at 4-5 ft height of machan.
- Place perforated black plastic sheet/banana leaf above the bamboo bed.
- Place 6 inch thick layer of rice straw above the plastic sheet/banana leaf.
- Place 7 inch thick fertile and treated soil (mixed with FYM/Compost at 2:1 ratio).
- Sow seed (described below - seed placing procedure in nursery bed).
- If necessary construct plastic roof to protect seedlings from rainfall.

Planting Seed/Nursery Management/Transplanting

Seed Sowing/Planting

Figure 3 Mulching

- After mixing FYM or compost in bed, level the bed with a stick.
- As in figure 1 and 2 draw a line 3 cm deep and 15 cm apart.
- Place 1-2 seed in line with the spacing of 10-15 cm.
- Cover the seed in row with soil mixed with manure. Do not press the soil.
- Cover the nursery bed with 5 cm thick layer of mulching material.
- Irrigate with rose watering can.
- If necessary construct plastic roof to protect seedlings from rainfall.

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Nursery Management:

- Remove mulching material after germination.
- Regularly monitor nursery to assure good soil moisture and free of weed and pest.
- Remove weed and diseased seedlings. If necessary use home-made organic pesticide to control disease and insect pest.

Transplanting

- Transplant seedlings after 21–30 days.
- Harden the crop by removing the plastic shade/roof few day before transplanting as this gives the seedling chance to get used to the direct sun and external environment.
- Reduce water at this stage but irrigate 2-3 hours before uprooting to loosen soil.
- Uproot carefully to minimise risk of root damage.
- Transplant at recommended spacing per crop early in the morning or late in the evening (from 6:00am to 10:00am or 4:00 to 6:00pm) and plants should receive water as soon as transplanting is done.

Figure 4 Nursery seedlings ready to transplant

Reference

[i] The Kathmandu Post: Vegetable Crops Ruined by Floods in Lalbandhi (retrieved 27/10/2016). *http://kathmandupost.ekantipur.com/printedition/news/2015-06-22/vegetable-crops-ruined-by-floods-in-lalbandi.html*

[ii] New Vision: How to Make a Good Nursery Bed (retrieved 27/10/2016). *http://www.newvision.co.ug/new_vision/news/1304424/nursery-bed*

[iii] Plant Scientist: How Flooding Affects Plants (retrieved 27/10/2016). https://plantscientist.wordpress.com/2014/02/25/the-effects-of-flooding-on-plants/

[iv] Sky Nursery: Raised Bed Garden Construction (retrieved 27/10/2016). http://www.skynursery.com/wp-content/themes/skynursery/docs/raised_bed.pdf

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