

Project ALA – 97/68

A GUIDE TO IMPROVING THE SURVIVAL OF SEEDLINGS

Prepared for the
Upland Development Programme
in Southern Mindanao (UDP)

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Oct 2003

A partnership programme sponsored by
the European Commission (EC) and the Government of the Philippines (GoP)
and executed by the Department of Agriculture (DA)

IMPROVING THE SURVIVAL OF SEEDLINGS

1. Objective

To plant a seedling, with a moist root ball full of actively growing roots, into a favourable soil moisture regime.

2. Significance

A seedling with plenty of succulent vegetation has a high transpiration rate which rapidly drains the moisture from its root ball. The rate of expansion of a young tree's roots into the surrounding soil is slowed down if the tree is wilting. If the surrounding soil is dry, the roots will stay within the moist root ball. The seedling will start to die if the root ball dries out and no water is added.

3. Recommendations

- 1 Harden off the seedlings for at least four weeks in the nursery before transplanting them in the field
- 2 Reduce the leaf area of the seedling available for transpiration.
- 3 Prevent the root ball from drying out before planting.
- 4 Avoid planting the seedling in dry soil unless post-planting watering is possible.

4. Action

a) Hardening off

Nursery stock that has been kept over-watered and partially shaded, up to the time it is planted out in the field, tends to have a low survival rate due to the "shock" of being planted in generally open sites with infrequent watering.

Hardening off is the gradual process whereby seedlings are conditioned to survive in the less favourable conditions they are likely to meet when planted in the orchard. *Hardening off* is especially important for seedlings raised in beds as their roots are greatly disturbed during lifting and transporting. Container plants are spared excessive disturbance.

i) *Aim*

The aim is to stop the development of soft, succulent growth and so conserve root ball moisture by lowering transpiration rates.

ii) *Procedure*

- 3-4 weeks before the planting date gradual reduce the amount of water given to the seedlings and increase the period between waterings (e.g. once a day days, once every two days, up to once every four days).

- Stop applying fertiliser as this promotes succulent growth.
- Take care not to allow the plants to seriously wither or wilt.
- At the same time as cutting down on the amount and frequency of water, gradually remove the shade until the seedlings are exposed to full sunlight.

b) Before, during and after transportation

i) Before leaving the nursery

- If planting in areas with long dry spells, select seedlings 12- 15 cm tall as larger seedlings are likely to die back. The shoot should be about equal to, but never more than 1.25 times, the root length.
- Three days before the seedlings are moved from the nursery for planting out, water them twice a day to bring the root ball soil up to field capacity. A last minute watering given just before moving the seedlings is inadequate.

ii) During transportation

Careless handling during transport can result in the damage and loss of a high proportion of the planting material. Losses can be reduced by taking the following preventive measures:

- Carry potted plants by the pot and not by the stem of the plant.
- Support plants with a bare root ball by the root ball, and not by the stem of the plant. This ensures the soil doesn't fall off tearing the roots.
- Transport seedlings in trays or boxes and keep them upright.

Drying of the roots is reduced if the plants can be transported on a cool, cloudy or rainy day. Whatever the weather:

- Cover the trailer or truck with tarpaulins or mats to shade the seedlings during the journey to the farms. This stops the sun and wind from drying out the roots. Keep humidity high by spraying the coverings with water before departure.
- Drive slowly to keep the seedlings from bouncing around. Avoid hitting bumps as this loosens the soil, damages the delicate roots and speeds up drying out.
- Go directly to the site without making unnecessary stops.

iii) At the farm

- Before unloading, dig a shallow pit 15 cm deep and big enough to hold the seedlings, under the shade of a tree or building.
- Stand the seedlings, in their containers, in the pit, and bank the excavated soil around the outside. This will help reduce evaporation.

5. Transplanting

Roots will not move into dry soil. Seedling mortality can be considerably reduced if the surrounding soil is moist at the time of transplanting seedlings. Planting is best done at the start of the rainy season after the first regular rains have fallen.

Prepare the planting holes before collecting the seedlings from the nursery. Once the holes have had a good soaking from the first rainstorms, collecting, transporting and planting of the seedlings can be done in quick succession. Fencing against livestock beforehand.

Tools needed for planting include:

- a spade for digging the hole and removing the soil;
- a crowbar for loosening and unearthing any rocks; and
- a *bolo* or machete for cutting any grasses or shrubs to be used for mulching the exposed soil around the seedling.

a) Staking

Once the planting system and distances have been decided:

- mark the place where each tree is to be located with a bamboo stake;
- clear vegetation from an area for a radius of 100 cm around the planting hole. (Note: On cogon-infested areas, the entire sod containing the grasses culms should be removed from around the site of the hole. This will reduce competition for soil moisture and nutrients. Spraying with herbicide is easier);
- Sink 2 cm long bamboo stakes to a depth of 50 cm into the ground to make it easier to find the seedlings if they have been planted in tall grasses.
- On flattish land, line the stakes at right angles to each other to make inter-cropping easier. On sloping and uneven terrain, line the stakes on the contours.

b) Hole preparation

Table 1 indicates there is considerable variation in the size of holes recommended. The main point to note is that the soil generally be at least 50 cm deep.

Table 1. Man-days of labour associated with different-sized planting holes

Source	Conditions	Hole size (width x width x depth) cm	Vol. (m ³)	No. at 2.7 m ³ /man-day
BPI, Baguio (1993?)	Loose soil	50 x 50 x 60	0.15	18
BPI, Baguio (1993?)	Stony and clayey soil	100 x 100 x 100	1.0	2.7
Jesse D Dagoon (1990)	Small trees (avocado)	50 x 50 x 50	0.125	22
Jesse D Dagoon (1990)	Large trees (mango)	100 x 100 x 100	1.0	2.7
Agrodok ((1998)	Humid areas	40 x 40 x 40	0.064	42
Purseglove (1984)	Humid areas	60 x 60 x 60	0.216	12.5

Obviously hole-preparation can be time-consuming. For example, the average output for digging soil is 2.7 m³ per man-day (FAO 1988). Planting 0.25 ha of rolling terrain using the triangular system, requires 29 mango trees, assuming 10 x 10 m spacing. It would take a farmer almost 11 days to prepare 29 holes, each 100 cm square by 100 cm deep.

If the soil isn't too stony, a hole 50 cm x 50 cm x 50 cm should be more than adequate. The farmer's other work loads will ultimately decide what can be achieved. It is important not to put him/her off planting trees. Planting mangoes in very fertile soils with adequate supplies of water throughout the year may result in luxuriant vegetative growth and poor cropping.

c) Planting the seedlings

Planting is best done during the rainy months, but it can be done at any time, provided irrigation is available. Bud union must not be covered by soil during planting.

i) Packing top soil around the root ball in the hole

Where there is evidence of soil profile development (the topsoil is usually darker than the sub soil), separate the topsoil from the subsoil, and use the topsoil for packing around the seedling. The replaced soil should be packed firmly around the root ball to get a good root-soil contact. If the air spaces are too large, moisture from the surrounding soil may not get to the roots.

ii) Hilling up the soil to minimise waterlogging

Hilling up the surplus soil from the hole around the base of the seedling, to beyond the rim of the planting hole, will prevent rain or irrigation water accumulating in the planting hole. (See: *A Guide to Tree Planting*).

iii) Setting the trees

Plant the seedlings as deep as when they were standing in the nursery with the stem straight up and aligned with the other trees in all directions. Water immediately.

iv) Apply mulch around the trees

Mulching is the covering of the soil with plant or crop residues, stones, gravel, sand or plastic, to simulate the effect of plant cover. It should be applied as soon as possible after planting the tree to protect the bare soil from rain drop impact.

Apply a 15 cm deep layer of mulch to cover the bare soil in the ring around the young tree. This will also help conserve soil moisture and reduce the need for watering during the hot dry season. To prevent the spread of disease do not let the mulch come within 15 cm of the stem of the tree. (See UDP's *A Guide to Mulching Fruit Trees*).