Deutsche Gesellschaft
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Zusammenarbeit (GIZ) GmbH

On behalf of

Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

TESTING PLANTATION OF

AVICENNIA MARINA

ON ACCRETION MUDFLAT WITH THE USE OF PROPAGULES COVERED WITH NET

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Bac Lieu, January 2013

1. BACKGROUND

Avicennia marina is a pioneering species on sheltered shores, capable of colonising many tidalhabitats, even very saline ones. It is one of the most common members of the intertidal flora, often forming single-species stands. Its roots reportedly aid accretion of sediment and accelerate land-building processes. Flowering occurs all year round. As with other members of this genus, it is cryptoviviparous, meaning that the seedling germinates on the parent tree, but remains enclosed within an outer pericarp which is normally shed when it falls on wet soil or when exposed to water.

Naturally germinated Avicennia marina covers an area of around 1,601 ha, or about 40% of the coastal mangrove forest area which stretches along most of the 56 km coastline of Bac Lieu Province (CTU, 2010). Further seawards, there are extensive alluvial mudflats, on many of which scattered seedlings and young trees of pioneering Avicennia can be seen.

Figure 1. **Accretion mudflat potential for plantation**

Planting on those mudflats with additional Avicennia could help to stabilize the ground and accelerate the mangrove development process in the province.

The project "Adaptation to Climate Change through the Promotion of Biodiversity in Bac Lieu Province" tried two traditional planting approaches for Avicennia marina on an area of 2 hectares in 2012.

The first approach required a nursery to germinate propagules and nurse them in plastic bags for about six months until the seedlings reached a height of some 40 – 60 centimeters.

The survival rate of seedlings was relatively low. Only around 30,000 out of 100,000 seedlings survived in the nursery for planting in 2012, raising the cost to around VND 7,000 per seedling planted. This approach also had an environmental short coming. Although planting workers were asked to collect the plastic bags after planting the trees, thousands of bags were still scattered over the planting sites or hanging on bushes surrounding the sites. It was difficult to control. The second approach used locally available wild seedlings that had germinated naturally. These were uprooted and transported to the site for planting. The cost for planting in this approach was around 3,500 VND per seedling but the survival rate was only about 30-40%. Within this context, the present pilot study adopted an innovative approach using available and environmentally-friendly materials to promote the natural regeneration of Avicennia on accretion mudflats.

This will form a basis for further studies and/or planning of Avicennia plantations.

2. OBJECTIVES

The objective of this study was to test the possibility of direct planting with fresh Avicennia propagules on accretion mudflats.

3. METHODS

In order to keep propagules from floating away after sowing, a piece of net (mesh size of 20 mm) was used to cover the whole area of each experimental plot. Wooden sticks and hooks were also needed to fix the net on the ground (Fig. 3).

Ten plots of one square meter in area. The plots were set up inside the erosion control barriers used to protect earlier plantings with nursery raised seedlings and wild seedlings. Each plot was planted with 40 propagules, giving a total of 400 propagules planted. Nine days after planting, the netting was removed from five of the plots; the remaining five plots were kept covered with netting as a control treatment.

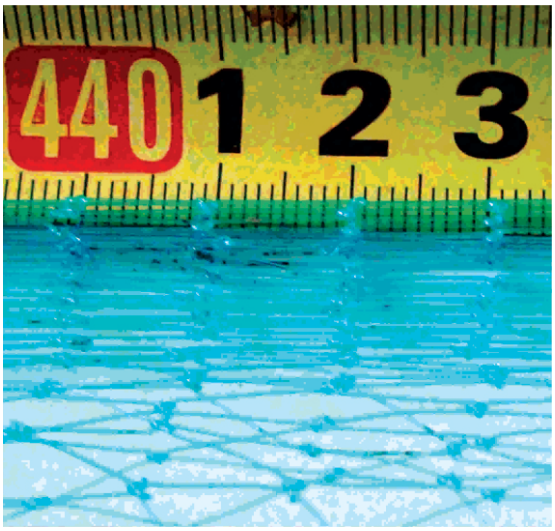

Figure 2. **Mesh size**

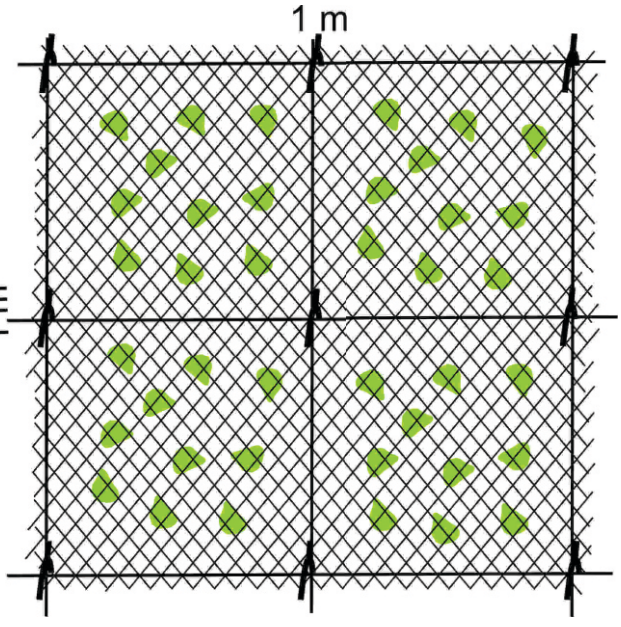

Figure 3. **Planting Model**

Planting was carried out on December 19, 2012 (07/11/2012 in Lunar calendar), 4 days after the predicted highest astrological tide of 2.2m (based on tidal predictions from Ganh Hao Hydrological Station, Bac Lieu Province) to minimise the effect of waves and high tides during seedling establishment.

The chart below (Figure 4) illustrates the tidal predictions of the site during the experimental period of one month. There appeared some days with no flooding at the site when tide was below 90 centimeters comparing to the tidal reference at Ganh Hao station. were set up at an elevation of 90 centimeters above the tidal reference zero of the provincial tide station at Ganh Hao.

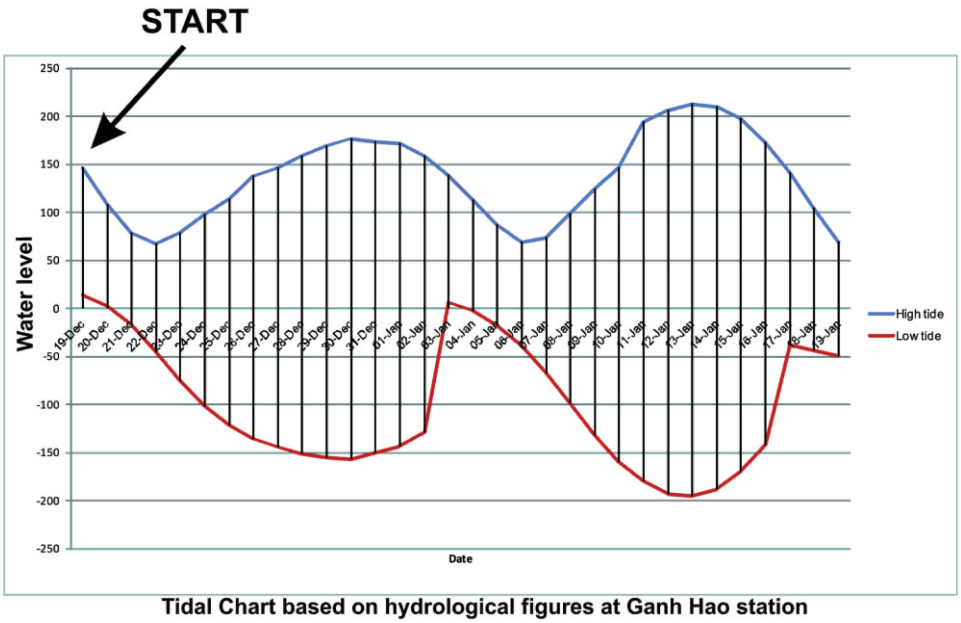

Figure 4: **Tidal chart for the experimental period**

Figure 5. **Experimental site – low tide**

Figure 6. **Experimental site – high tide**

Figure 7. **Measuring water collumn of the site**

4. RESULTS

The plots were first checked on December 28, 2012, nine days after planting. Many propagules had sprouted but it was impossible to assess the condition of the remaining propagules still buried beneath the mud without disturbing the plots. The netting was removed from five plots at this stage, since it would have been difficult to remove the netting once all the propagules had sprouted and their shoots had grown through the netting.

Figure 8. **Propagules of 9 days after sowing**

Figure 9. **Seedlings in 2 treatments 15 days from sowing**

A second check was carried out on January 03, 2013, fifteen days after planting and 6 days after removing the netting. At this stage, some seedlings had reached a height of 7 cm in plots from which the netting had been removed, but seedlings were somewhat smaller in the remaining five plots still covered with netting.
The last check was done on January 18, 2013 (07/12/2012 in Lunar calendar) when the seedlings had experienced an entire period of tidal circle. The overall results of this trial are summarised in Fig. 10.

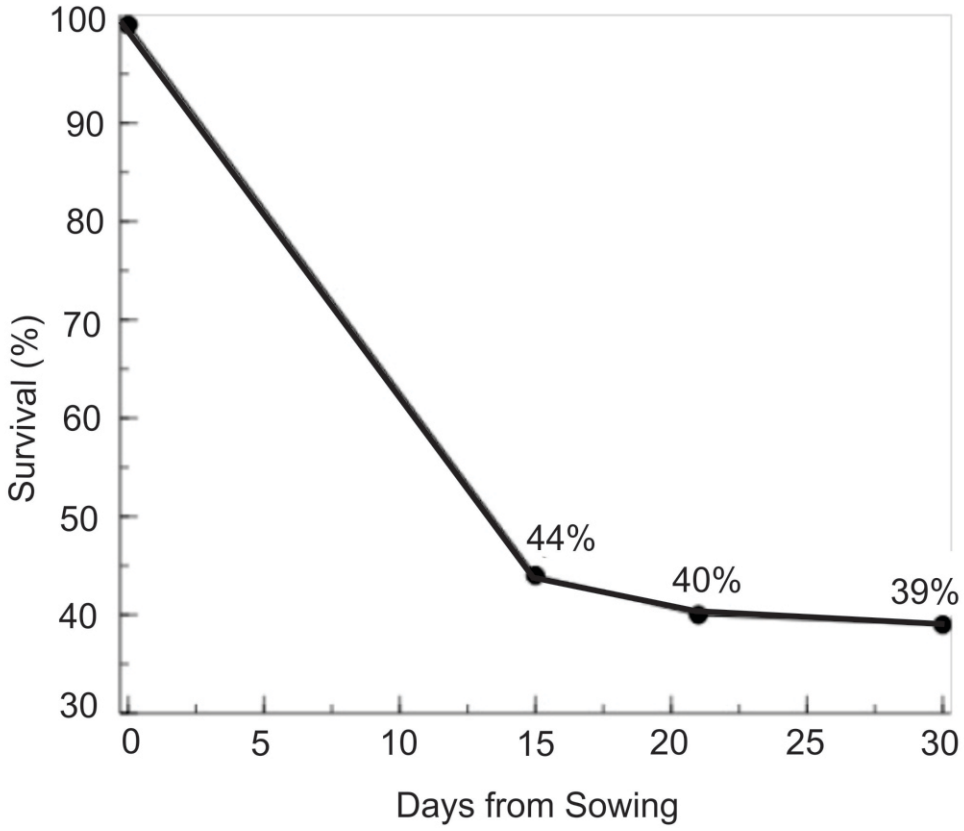

Figure 10. **Survival rates during the experiement**

More than half (56%) of the propagules sown either died or, more likely, were washed away within the first 15 days. However, by this stage, those that remained had relatively well-developed root systems, and there was relatively little seedling loss between 15 and 30 days after sowing. At 30 days after sowing, the survival rate was around 39%, or about 15 survivors per square metre. At this stage, there was no significant difference in survival or seedling growth (height 8-13 cm; collar diameter 2-3 mm; root length 20 cm) between plots from which the netting had been removed and those where the netting was retained.

From an afforestion perspective, the survival of only 1 to 2 seedlings per square metre would give a final stand density of 10,000 to 20,000 per hectare, more than sufficient to provide a high degree of forest cover and effective coastal protection.

Figure 11. **Seedlings one month from sowing**

Figure 12. **Root system one month from sowing**

5. DISCUSSION & CONCLUSIONS

There was very little difference in survival and growth between the two treatments (netting removed vs netting retained). Therefore, the removal of the netting seems to be the better approach since it is more environmentally-friendly and the netting can be reused several times.

Survival and growth in this trial was comparable with that achieved in earlier trials with nursery raised seedlings and with wild seedlings, but the cost of planting in this case is much lower due to the reduced labour involved in planting. With a survival rate of around 40% achieved in the month when the tide reached the highest level of the year, this planting method could be used all year round depending on the availability and quality of propagules.

Although the planting density in this trial was 40 per square metre, the survival rate of around 40% suggests that the initial planting density could be reduced to half (20 per square metre) or less, while still providing a final stand density of at least 10,000 per hectare. Alternatively, if high initial planting densities are employed, as in this trial, it might be possible or desirable to uproot some of the survivors and transplant them in the surrounding area, although this would increase the planting cost and some mortality of transplanted seedlings might also be expected.

In summary, direct planting of Avicennia propagules protected from floating away by netting or some other surface barrier for the first 1-2 weeks appears to be a very cost-effective method for planting this species on exposed mudflats.

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