15 Combination of side-grafting technique and informal germplasm exchange system in non-irrigated mango orchards in Thailand

Phichit Sripinta, Supattanakit Posawang, Chatchanok Noppornphan, Songpol Somsri and Bhuwon Sthapit

GPD ‘passport’

<table>
<thead>
<tr>
<th>GPD code:</th>
<th>09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus area:</td>
<td>Propagation and planting materials</td>
</tr>
<tr>
<td>Type of GPD:</td>
<td>Technique</td>
</tr>
</tbody>
</table>
| Species and varieties involved: | 3 species: *Mangifera indica*, *M. odorata* Griff, *M. duperreana* Pierre  
10 commercial varieties: Kaew, Chok Anan, Namdokmai, Pimsane Mun, Kheoi Morakot, Kheoi Sawei, Namdokmai No.4, Nam Dok, Mai-Sitong, Man Khunsri  
3 wild species: Khiya, JingReed and Pom |
| Name of location: | Mae Or-Nai subdistrict and Maena subdistrict, Chiang Dao district, Chiang Mai province, Thailand |
| GIS reference of location(s): | N 19°17’98”; E 99°01’76”; Elevation 527 masl |
| Name of farmer (data source): | Mr Suradet Tapuan and Mr Pleng Funphun |
Context and introduction

Chiang Mai province is located in the mountainous northern part of Thailand. Mae Or-Nai and Maena subdistricts in Chiang Dao district are mostly hilly, rainfed areas located in forest buffer zones in the mountains (500–1000 masl). In the winter the temperature is cool enough (minimum 14°C) for the cultivation of fruit such as lychees and strawberries. Much of the fruit-based farming system in northern Thailand can be described as agroforestry or agrosilvicultural production-oriented systems used on sloping lands in the highlands (Bradford et al., 2005). Tropical and subtropical fruit farming is an attractive option as it can contribute to home consumption as well as market products (Vangnai, 1996). The communities in the area have access to basic services and support systems such as sanitation, water, electricity, public health, schools, transportation, local markets and export markets to Japan. The higher mountains in this area are cut by steep river valleys and upland areas that border the central plains of Thailand. The Ping River lies in the lowlands of the Ping River watershed and is the main watershed catchment in this area. Traditionally, these natural features made several different types of agricultural cultivation possible, including wet-rice farming and fruit-tree-based home gardens in the valleys and shifting cultivation in the uplands. The forested mountains include stands of teak and other economically useful hardwoods that are dominant in the area.

Ten years ago, the Mae Or-Nai area contained marginal buffer forest lands that were not used for much fruit-based farming because of lack of irrigation. In response to growing demand for organic mango varieties for export markets, cultivation has been expanded to these dry hilltop lands in the proximity of buffer zones (Plates 33–36). Mango grown here is found to be good quality but the survival rate of commercial mango saplings is low. For this reason, some innovative farmers, such as Mr Suradet Tapuan and Mr Pleng Funphun, developed the technique of side-grafting (Plate 37) and have scaled the technique out from farmer to farmer, later supported by extension agencies of the Department of Agriculture.

Now, farmers in Mae Or-Nai subdistrict use side-grafting as a propagation technique for multiplying local and commercial mango varieties in the hilly landscape areas near forest buffer zones. This side-grafting technique, which is unique to this area, is especially popular in rainfed or non-irrigated areas where success rates of other techniques for grafting are very poor (Sripinta et al., 2012). This grafting technique helps to maintain mango varietal diversity as it strengthens the local seed system in which farmers exchange scions of commercial and local varieties. This propagation technique also favourably affects the productivity and quality of the mango trees as it ensures a higher survival rate for saplings and more vigorous mature trees. This in turn positively affects the livelihoods of local farmers. In particular, small- and medium-scale farmers are directly affected as they are often more dependent on rainfed orchards, for which this technique is most commonly used. Home consumption
of local fruit has also been perceived to increase, resulting in better family
nutrition. This technique has been identified as a good practice for diversity
management (GPD) as it is economically, socially and environmentally viable
and sustainable in the long term.

Methodology

For this chapter, information was collected from the men and women of Mae
Or-Nai community through participatory focus group discussions to identify
and document potential good practices for diversity and the knowledge keepers
of these practices. Subsequently, a checklist of questions was used to interview
key informants so that they could describe the good practice and also
demonstrate the steps visually.

Description of GPD: side-grafting of mango sapling
for rainfed mountain areas

Side-grafting is one propagation technique used for growing mango in rainfed
areas. Rootstock seeds are planted in advance in a field for two to three years,
then side-grafted with local and commercial cultivars. Three types of Mangifera
species – M. indica, M. odorata and M. duperreana – are used for rootstocks.
Planting the rootstock directly in the field results in mango trees with higher
survival rates compared with planting grafted saplings taken directly from a
nursery. Farmers then select the variety they would like to cultivate and collect
scions (local and commercial varieties) from many different mother trees in
their own orchards and from other farmers or villages. This is the preferred
practice because the number of different varieties sold at nurseries is low, often
limited to common commercial varieties. Some farmers even side-graft two
or three scions of different varieties on one tree, which they often then use
as a mother branch for taking further scions (Plate 36).

The side-grafting is carried out as follows (Plate 37): First, select a good heathy
branch and cut a vigorous dark green shoot about 7 cm long and containing
two or three mature buds, and remove all the leaves. Prepare the stock by making
a 5 cm-long slanting cut (U shape) at a height of between 30 and 50 cm above
the ground. Then, make a single smooth cut on both sides at the bottom of the
scion to form a wedge shape the same length as the cut on the stock. It is
important that the cuts on the two pieces are as similar in size as possible in order
to afford a greater chance of a successful graft union. Insert the scion into the
cut of the stock and wrap the graft with plastic upwards from bottom to top
to keep the cuts tight and to prevent drying. Cut the stock branch close to
the graft after several weeks have passed and the scion has begun to grow.
Wax the new cut with either flint coat (acidic) or red lime (alkaline). These are
chemical substances that protect mango branches from stem rot fungus damage
and from insects laying eggs in the exposed cut of the branches. Farmers tend
to prefer red lime to flint coat because it is cheaper.
Ten farmers perform this grafting method for all the other farmers in the project area. Two men farmers, Mr Suradect Tapuan and Mr Pleng Funphun, do the side-grafting on a large scale and charge for this service. They graft about 200 to 500 trees every season and receive 10 Baht (US$0.30) per successful graft. Other farmers perform this grafting method for their neighbours or family without asking for payment for the service. Grafting is always done in May during the rainy season to ensure a better survival rate for the young grafts.

This technique has been innovated by farmers and practised for more than 10 years, and approximately 35 per cent of farmers in Mae Or-Nai village use it to varying degrees in their plantations on sloping lands. Correspondingly, local orchards contain a large number of varieties of mango species, including *M. indica*, *M. odorata* and *M. duperreana*. Farmers mostly use *M. indica*, *M. odorata* and *M. duperreana* as rootstock to graft *M. indica* or *M. odorata* varieties or landraces. For instance, Mr Suradet Tapuan and Mr Pleng Funphun prefer to graft mostly *M. indica* Namdokmai and Man Khunsri varieties. However, on occasion they also graft local varieties like Kaeo and Talap Nak and some landraces of *M. odorata* that are unavailable for purchase from commercial private nurseries or formal seed exchange programmes. Farmers prefer these landraces and varieties because they are very strong, disease- and pest-resistant and perform well without access to irrigation.

**Impact on diversity**

*Mangifera* species such as *M. indica*, *M. odorata* or *M. duperreana* are cross-pollinated and are genetically highly diverse. *M. odorata* is regarded by botanists as a cultivated hybrid of *M. indica* and *M. foetida*, as it has never been found in the wild. Species, such as *M. indica* and *M. odorata*, have several varieties or forms recognized. The availability of *M. duperreana* is limited as its status is reported to be vulnerable (Kole, 2011).

The side-grafting technique maintains intraspecific diversity at the varietal level due to the fact that it often involves local and less common varieties like Man Khunsri or less common species like *M. odorata* and *M. duperreana* in the grafting process. Likewise, private nursery experts or custodian farmers applying this grafting technique often use scions from a wider range of local mother trees or varieties that are introduced from other areas compared with nurseries, which often have a much narrower varietal portfolio. Nurseries primarily sell commercial varieties like Namdokmai, Khieo Sawoei, Maha Chanok, Chok Anan or local varieties like Kaeo and Talap Nak, neglecting rare or more indigenous species and varieties. Lastly, this technique enlarges the area planted with mango trees, as grafted saplings from nurseries often do not survive the dry season in non-irrigated lands. As a result, the interspecific and intraspecific diversity in the area is more likely to survive.
Impact on livelihoods

Because of the introduction of the side-grafting technique, land on hilltops that was not used before can now be planted with mango trees, improving marginal lands while expanding the community’s cultivation capacity. This propagation technique improves the survival rate, productivity and quality of mango trees, which impacts harvest-time yields and, as a result, livelihoods derived from the sale of the fruit. As the technique is applied in rainfed areas, mostly small- and medium-scale farmers directly benefit by increasing their income through fruit tree cultivation. This grafting technique is relatively simple as well as economically, socially and environmentally viable over an extended time frame.

Both men and women farmers in the village received training or were provided with information about this technique by local experts from the government in order to improve and enlarge their mango production capacity. The increase in mango production has improved the well-being of farmer households in the target community. At the project site, local people have formed farmer groups and are selling mango fruit collected from home gardens and semi-commercial or commercial orchards to market outlets inside and outside the community. Later, women farmer groups received investment funds through a newly established cooperative dedicated to the production and distribution of several agricultural value-added products made from the fruit. Currently, through extended collaboration with various stakeholders, farmers in this community are enjoying several sustainable livelihood benefits as a result of the introduction of this grafting technique.

Factors favouring or hindering successful functioning of GPD

Farmers in the Mae Or-Nai area were in need of improved mango propagation methods, especially for rainfed areas, as many farmers in the target area do not have access to irrigation and there is a market for locally selected mango varieties. The likelihood of success was strengthened by farmers taking the opportunity to set up a village cooperative and collecting funds to invest in processing facilities to derive better economic profits from value addition processing.

The main factor that contributed to the success of this good practice was the execution of a government programme aimed at increasing mango production in this area by providing training for farmers on the application of this technique. The technique innovated by Mr Suradet Tapuan and Mr Pleng Funphun was noticed by the Department of Agriculture and scaled out through the government programme. In addition, the Export Growers Association (a group of farmers registered at the local government for export market) assisted farmers in value chain analysis assessments and worked to strengthen the capacities of value chain actors, thus empowering farmer groups
socially and economically. Other factors that contributed to the success of this practice were the accumulation of financial capital for the farmer groups through the purchase of shares by participating members, and guaranteed access to markets for products through diverse outlets and channels.

**Conclusion and a way forward for scaling up and dissemination**

This side-grafting technique is practical, cost-effective, sustainable, easy to adopt and results in increased diversity together with improved livelihoods. The practice has potential for local, national and even regional dissemination due to the fact that side-grafting can be applied to any mango tree and does not require much investment beyond a certain set of skills and associated knowledge. This technique can be part of set of good practices that can be scaled out beyond Thailand in similar areas by sharing skills and information. However, the success of the practice was also due to the very good work of extension, cooperatives, financing and linking to markets.

**References**


