

Farmer Extension Approach to Rehabilitate Smallholder Fruit Agroforestry Systems: the “Nurseries of Excellence (NOEL)” Program in Aceh, Indonesia

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Abstract

The tsunami of 26 December 2004 had a catastrophic effect on many communities in Aceh. Approximately 200,000 people were killed, 500,000 displaced, and local economies devastated. In affected areas, the loss from the tsunami included 48% of rice lands, 75% of uplands, 59% of tree crops, and 67% of livestock – further traumatizing communities who had suffered from decades of civil conflict. As a result of the two disasters (tsunami and conflict) many Acehnese communities have lost much capacity and experience regarding tree garden management. Additionally, a generation of young farmers was not mentored by their skilled elders, as it was dangerous to visit tree gardens outside of populated areas. As a result current tree management practices are non-intensive. Farmer access to quality tree germplasm, professional technical assistance, and market linkages is limited. To address these conditions, a program was designed to help farmers produce high quality germplasm, improve their tree garden management skills, and enhance their market awareness. The program developed community nurseries as a foundation for farmer group commitment and capacity building. Activities included: introductory nursery training, bi-weekly follow-up, intensive vegetative propagation training, technical consultations, cross-visits, market studies, nursery development, and demonstration plot establishment. In roughly 18 months, farmer capacity was greatly enhanced and a network of 50 “nurseries of excellence” (community nurseries) established which is responsive to the species and seedling quantity priorities of partners. The program of farmer extension approach is effective, replicable and applicable to sites in Indonesia and Southeast Asia where land rehabilitation and community livelihood enhancement are objectives.

INTRODUCTION

Nangroe Aceh Darussalam (NAD) or Aceh is the northern and western most province in Indonesia, covering an area of 57,000 km² with a population of just over 4 million – representing approximately 3% of the national area and 2% of the population (BPS, 2008). Oil and natural gas accounts for over 40% of the Aceh economies but employs less than 10% of the workforce. By contrast agriculture contributes only 24% of the economy but employees over 50% of the workforce (World Bank, 2006). Rural household economies are based on rice production for household consumption, fisheries for income generation, and tree crops for both income generation and household needs. In West Aceh tree crops provide 60% of farm household incomes. Across the province, smallholders cultivate from 0.5 to 2.0 ha of mixed tree crop systems under non-intensive management; key species are rubber, cacao, coconut, pinang and fruit species (Budidarsono et al., 2007).

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ricelands, 75% of upland systems, 59% of tree crops, and 67% of livestock (World Bank, 2006). The tsunami further traumatized communities that had suffered from decades of civil conflict. During the conflict it was dangerous to visit land outside of populated areas. Furthermore active tree garden management lapsed with many tree garden products not even harvested. A generation of young farmers was not mentored by their skilled elders. As a result of the tsunami and conflict disasters, many Acehnese communities lost much of their capacity and experience regarding tree garden management. The quantity and quality of products from many tree gardens are now limited. Additionally, the value chains for these products are long with many intermediaries separating farmer producers and consumers. Farmers rarely know where, to whom, and for how much their products are sold (Green, 2007).

For two years most of the post-tsunami assistance appropriately focused on rescue, relief and infrastructure repair work. Starting in 2007 many efforts began to focus on livelihood enhancement and land rehabilitation. A number of factors limited efforts to rehabilitate tree garden systems. Many of the aid agencies active in Aceh lacked staff, experience and information related to tree garden management. There was a significant loss of farmer expertise and tree resources as a result of the tsunami. There was limited supply of quality tree seedlings, limited awareness regarding the importance of seedling quality, limited experience with intensive tree management, and limited understanding of marketing linkages for tree products. Lacking technical capacity, most of the organizations supporting livelihood and land rehabilitation activities purchased seedlings in Medan for transport to Aceh. Even when purchased in Aceh, seedlings generally originate in Medan. Of the 45 fruit tree nurseries registered with the provincial government of Aceh only three produce seedlings; the others are “transit nurseries” that stock seedlings purchased primarily in Medan for resale in Aceh. Relying on seedlings purchased outside the province represents a number of missed opportunities for Aceh. First, monetary resources used to cover seedlings and transportation costs are not available for local investment. Second, the physical and genetic quality of the purchased seedlings is dubious to poor. In addition, physical damage occurs during transportation. Poor seedling quality leads to poor post-planting survival and performance. Finally, there is lost opportunity to build local technical capacity, tree nursery enterprises and related infrastructure.

The Rehabilitation of Agricultural Systems in Aceh – “Developing Nurseries of Excellence (NOEL)” Program is implemented by the World Agroforestry Centre (ICRAF) and Winrock International, through support from the Canadian International Development Agency (CIDA). The goal of the program is to support post-tsunami Aceh rehabilitation and reconstruction efforts in Aceh by improving agroforestry-based livelihoods and tree gardens with productive tree crops produced in community-based “nurseries of excellence”. The Program objective is to empower smallholder farmers – both men and women – to gain access to high quality planting materials and provide them with the skills necessary to establish and operate tree nurseries and tree gardens. In achieving this objective, the Program promotes women’s involvement and environmental sustainability. Initiated in April 2007, NOEL will continue to operate through March 2009. This paper summarizes the NOEL Program, its approach, activities and impacts.

METHODS

Farmer Extension Approach

The NOEL Program works with motivated farmers and partner groups committed to enhancing their agroforestry systems and market-orientation through the establishment of “nurseries of excellence”. Initial training is provided to farmer leaders to: analyse existing conditions, identify priorities, and develop work plans. Subsequent intensive assistance is provided to farmer groups associated with those farmer leaders to develop nurseries and execute work plans. The approach is flexible and dynamic, adjusting to actual priorities of each partner (Roshetko et al., 2007).

Location and Biophysical Conditions

The NOEL Program is implemented in Aceh Barat, Aceh Jaya and Pidie districts (Pidie was subsequently divided into two districts – Pidie and Pidie Jaya). All selected districts had been severely impacted by the tsunami and conflict and share common borders. Elevations in the selected districts range from 0 to 500 m a.s.l. Temperatures vary from 20-30°C, with parts of Pidie reaching 35°C. Annual rainfall varies from 2500 to 3700 mm (BPS, 2007, 2006, 2005). Common lowland crops are rice, peanuts, corn, chili peppers, tomatoes, potatoes, and vegetables. Common tree crops include rubber, cacao, coconut, and fruit species.

NOEL Staff

NOEL fielded three district teams, each consisting of a coordinator, two nursery specialists, and three farmer specialists. Field staff are supported by a Deputy Team Leader and administrative assistant in Banda Aceh; and a Team Leader in Bogor.

RESULTS AND DISCUSSION

Assessment and Prioritization

Early program assessments revealed that farmer access to quality tree germplasm, professional technical assistance, and market linkages was limited; and that few farmers had experience with or were aware of appropriate tree nursery production and management practices. Partners identified commodity (rubber and cacao) and fruit species as their highest priority; reflecting the importance of commodity crops for income generation and fruit crops for home consumption and income generation. The species with the highest demand were rubber and durian (21% each), followed by rambuttan (17%), cacao (15%), and mango (14%). Relative demand by species is presented in Figure 1. In Aceh Barat and Aceh Jaya rubber and cacao account for 34 and 20% of seedling demand, while in Pidie, fruit species account for 92% of demand and cacao 8%, showing a clear geographic difference in species priorities. Partners indicated seedling demand of 535,000 seedlings with 73% intended for planting on private land and 27% for market sale. These findings were found to be accurate, when cross-checked during district and provincial inception workshops and with each partner.

Partner Commitment

NOEL partners include farmer groups, dayahs (community Islamic organizations), non-government organizations (NGOs), international development organizations (INGOs), universities and local technical agencies. All partners commit to develop tree nurseries as a mechanism to build farmer capacity in tree seedling production and tree garden management. They also agree to promote women's involvement and environmental sustainability. To date six partners are woman farmer groups (some of which allow male members); over 30% of group members and training participants have been women. To protect forest resources, partners also agree that the seedlings produced in NOEL nurseries will not be used to convert natural forests to other landuse systems.

Nursery Field School

Nursery establishment and capacity building start with an introductory training course of 2-3 days. The training curriculum, based on the experience of ICRAF and Winrock, emphasizes: purpose of a tree nursery; location selection; nursery construction; soil and containers; seed quality and sowing; vegetative propagation (introduction); seedling care and protection; nursery management; and field planting (introduction). The training approach is strongly participatory, making it possible to adapt the training to the partners' specific capacity and needs. Some groups may focus on basic nursery establishment; other groups move quickly to advanced topics, such as vegetative propagation for example. By the end of the introductory training a basic tree nursery is operating and partners have developed a work plan to achieve their objectives.

NOEL staff meet with partners every two weeks checking progress and facilitate implementation of the work plan. This process is called the “nursery field school”. Visits are always planned according to partners’ schedules. Bi-weekly sessions start when partners join the program. Early visits focus on socializing the Program and assisting partners develop priorities. Following the introductory training, sessions focus on nursery management, and expand to advanced topics such as vegetative propagation and compost production. Once partners have developed sufficient nursery skills, sessions shift to other priority topics: farmer group management, leadership training, tree garden management, market evaluation or technical consultation with outside specialists for example. The “nursery field school” builds close relationships between partners and staff, providing good venues for formal or informal capacity building and experience sharing.

Nursery Training and Establishment

NOEL maintains a strong focus on capacity building. Since August 2007 the program held over 50 introductory nursery training courses and 12 one-day nursery training events, successfully training 1220 farmers and other partners. An additional 50 vegetative propagation training activities have been conducted, strengthening the skills of over 1000 farmer partners. Over 650 farmer partners in Aceh Barat and Pidie have participated in 24 training events on compost and organic fertilizer production. As a result of training and “nursery field school” activities partners have established 32 “nurseries of excellence”. An additional 18 “nurseries of excellence” have been established through spontaneous adoption of the technologies promoted by NOEL. These spontaneous (“susulan”) nurseries are established by neighboring individuals and organizations after observing the success of NOEL activities, or by individual partners who want to establish their own nurseries. “Susulan partners” seek assistance from NOEL staff or directly from NOEL partner groups. The Program provides susulan partners with basic technical material and knowledge required to establish a nurseries, with the level of support based on their needs. Susulan partners are invited to attend NOEL activities with local partner groups and are encouraged to develop a mentoring relationships with NOEL staff and partner groups. NOEL staff meet with susulan partners only when requested. The susulan process has proven to be an excellent way of expanding program impact, with an efficient and effective use of program resources.

Nursery Progress and Production

An evaluation of all nurseries was conducted based on the condition of the nursery, quality of the seedlings, and commitment and capacity of group members. The evaluation graded 26% of the nurseries very good, 48% good, 18% fair, and 8% as failed. Very good and good nurseries are those considered able to operate independently without further assistance. Fair nurseries have made good progress, yet require additional assistance from NOEL. Failed nurseries are those that are not functioning or operate at a very low level. Two of the failed nurseries ceased operating because the members demanded daily wages (this is the negative impact from early post-tsunami relief activities where farmers were paid to join activities). One nursery failed because of tensions between group members. The fourth failed nursery distributed its seedlings before ceasing operation, but achieved only 10% of its target. A 92% success rate in nursery establishment is excellent. This is a huge contrast to many post-tsunami, pre-NOEL community nurseries where farmer groups were provided short nursery training, but no follow-up technical support. Many of those nurseries failed.

It is worth noting that all 18 susulan nurseries were graded very good or good; while only 59% of the other nurseries were graded similarly. This reflects susulan groups’ strong commitment and self-interest in developing successful “nurseries of excellence”. On average, susulan partners may have stronger commitment as they sought help from NOEL, while other groups were first approached by NOEL.

Most of the nurseries stock about 5,000 to 10,000 seedlings. But there are also those with 25,000 to 50,000 seedlings or even more. A few nurseries produce only 1000

to 2000 seedlings. Susulan nurseries tend to be smaller scale – 5000 seedlings or less, but a few susulan nurseries are also large. As of early September 2008, “nurseries of excellence” had produced 402,500 seedlings – sufficient to rehabilitate a minimum of 2,100 ha. These data accounts for survival through the following 3 steps of seedling production: i) procurement of seed, ii) seed sowing and maintenance of seedlings, and iii) vegetative propagation. (A fourth step, post-planting survival, is evaluated after the seedlings have been planted in the field for a number of months). Each step is important and offers challenges. In Indonesia, farmer and farmer group access to quality tree seed is limited (Roshetko et al., 2008). In the NOEL Program tree seed was purchased from national research agencies (for rubber and cacao); purchased from commercial farmer groups (citrus); and collected locally by farmer partners and NOEL staff (fruit, rubber, and cacao). Once procured, seed is processed (cleaned, sorted) and distributed to partners. Partners and NOEL staff then sow seed and produce seedlings. Vegetative propagation is performed when seedlings are sufficiently mature and healthy. Table 1 summarizes seedlings produced by species type and district. The time required to produce healthy seedlings ready for field planted are provided in Table 2. Under NOEL conditions, a reasonable nursery planning horizon to produce healthy seedlings is about 1.5 years. NOEL partners are in the early stages of producing additional fruit, rubber and cacao seedlings, as well as timber, nitrogen fixing trees, and nilam seedlings. None of those seedlings are tallied here.

Through the end of August 9,100 seedlings had been sold by NOEL partners for approximately Rp 28 million (US\$ 3000). Most of those seedlings were cacao (6,000) or rubber (3,000) sold in west coast districts; the remainder were durian and rambutan. Partners have sold 600 kg of compost earning Rp 6 million (US\$ 650). Approximately 17,800 seedlings had been planted, mainly cacao (16,000), durian (1,700) and a few rambutan (15); rehabilitating 30 ha.

Average market price for seedlings is Rp 3,500/cacao seedling; Rp 9,000/grafted rubber seedling; and Rp 25,000/grafted fruit seedling. In January when the grafting process is finished, the commercial value of the 402,500 seedlings produced to date will be Rp 6,201 million (US\$ 674,000). Most of this represents non-monetary contribution to household economies – the seedlings produced by partners for the rehabilitation of their own land with the support of NOEL. Partners contribute include labor (sweat equity), land and local resources (materials for building nurseries, etc.). Partners intend to sell approximately 25% of their seedlings; at a commercial value of Rp 1,600 million (US\$ 175,000). The sale of 100,000 seedlings is reasonable as market studies have identified an annual tree seedling demand of 5,000,000 in Aceh for the next few years (Martini et al., 2008).

Other Technical Assistance

Besides nursery specific events, the NOEL also supports technical capacity building related to farmer group management, tree garden management (cacao, rubber, fruit and nilam), and marketing of tree products – including tree seedlings. These events include trainings, cross visits, internships, specialist consultation, and studies. Since April 2008, 42 such capacity building events have been held, training 712 partners. Additionally 19 bud wood gardens have been established as future sources of grafting material. The Program has also published or distributed 6 technical documents to support partners’ capacity building; and supported 7 Acehnese university students to implement research studies on topics related to smallholder agroforestry systems and household economics. During the remainder of the Program, NOEL will continue to assist partners strengthen their tree nursery and tree garden enterprises, particularly to develop market awareness and linkages.

Significance of the Term – “Nurseries of Excellence”

Excellence can be defined as “the quality or state of being outstanding or superior”; synonyms for excellence include “brilliance, superiority, distinction, quality”

and “merit”. The name “Nurseries of Excellence” indicates an approach to develop model “quality” community-oriented tree nursery enterprises that produce “superior” seedlings of the species and varieties prioritized by the community and local market. These nurseries are not intended to be examples of high-tech, resources-intensive enterprises; they are not intended to compete with industrial or research nurseries. “Nurseries of Excellence” use appropriate levels of technology that can be independently operated by communities in a cost-effective manner to produce the “superior quality” seedlings desired for either community use or market sale. By stressing “quality”, nurseries of excellence are “distinct” from typical tree nurseries promoted by community forestry or reforestation programs that usually stress the quantity of seedlings to be produced.

Equally important to producing quality seedlings, “Nurseries of Excellence” are a mechanism to build farmers (or other partners) technical capacity to establish and operate tree nursery enterprises. So three key issues immerge: capacity building, nursery enterprises, and quality seedlings. The steps in achieving a “Nursery of Excellence” can be summarized as:

- Building awareness of and interesting in the importance of quality tree seedlings and nurseries;
- Creating or strengthen technical capacity to establishing and operating tree nurseries that produce quality seedlings;
- Establishing quality tree nursery and related infrastructure (identifying and establishing seed sources, bud wood gardens, demonstration trials, etc.);
- Developing linkages with the formal germplasm sector (government and research agencies; universities; and the private sector) as sources of quality germplasm (seed, seedlings, grafting material, etc.), information, and extension support; and
- Networking with other community nurseries and the tree seedling sector to strengthen awareness of, understanding of, and access to tree seedling markets.

CONCLUSIONS

Tree crops play an important role in the household economies of rural Aceh. As a result of the tsunami and civil conflict many tree gardens were damaged or abandoned; and many communities lost experience and capacity regarding tree garden management. The recovery of these systems has been hindered by farmers’ limited awareness of and access to quality germplasm, limited experience with intensive tree management, and limited understanding of tree product market. Many recent efforts to rehabilitate tree gardens in Aceh have been based on importing tree seedlings from outside the province. That option is suboptimal as monetary resources are spent outside the target area, the physical/genetic quality of imported seedlings is dubious, and there is lost opportunity to building capacity and infrastructure related to tree seedling production and management.

The “Rehabilitation of Agricultural Systems in Aceh – Developing Nurseries of Excellence (NOEL) Program” was designed and implemented to empower smallholder farmers – both men and women – to gain access to quality tree seedlings and provide them with the skills necessary to manage tree nurseries and tree gardens. The NOEL extension approach, called the “nursery field school”, provides introductory nursery training and intensive follow-up to assist partners achieve their priorities related to tree nurseries and tree gardens. In 18 months of operation NOEL has greatly enhance farmer skills and resources. A minimum of 178 capacity building events have been conducted, training 3582 partners in tree nursery operation, tree garden management and related topics. Across all NOEL activities women’s involvement exceeds 30% of participants. A total of 50 “nurseries of excellence” have been established – 32 nurseries by program partners and 18 “susulan” (spontaneous) nurseries by other stakeholders after observing the success of NOEL activities. Total production of all nurseries is 402,500 seedlings. Partners plan to use approximately 75% of the seedling to rehabilitate their tree gardens; and sell 25% in tree seedling markets. Selling 100,000 seedlings is reasonable as studies document annual market demand of 5,000,000 seedlings in Aceh for the next few years. The commercial value of the seedlings intended for sale is Rp 1,600 million (US\$ 175,000).

The NOEL farmer extension approach demonstrates that a program of training, intensive follow-up extension, and material support can facilitate the successful development of farmer technical capacity, community tree nurseries, and related infrastructure – even with partners previously unfamiliar with tree nursery operations. Supporting susulan partners to spontaneously adopt nursery technologies to meet their own objectives is an effective and efficient means of expanding program impact. The NOEL program is effective, replicable and applicable to sites in Indonesia and Southeast Asia where land rehabilitation and community livelihoods enhancement are objectives.

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Tables

Table 1. Seedlings produced in NOEL nurseries by species type and district.

	Rubber	Cacao	Fruit	Total
Pidie	0	12205	89505	101710
West Aceh	81293	20904	13936	116133
Aceh Jaya	60929	40619	83085	184633
Sub-total	142222	73728	186526	402476

Table 2. Time required to produce healthy seedlings of various species.

Species	Production time	Source
Rubber (grafted)	8-12 months	NOEL experience
Cacao	4-6 months	NOEL experience
Durian (grafted)	7-10 months	NOEL experience; Purnomosidhi et al., 2007
Mango (grafted)	10 months	NOEL experience; Purnomosidhi et al., 2007
Rambuttan (grafted)	6-8 months	NOEL experience

Figures

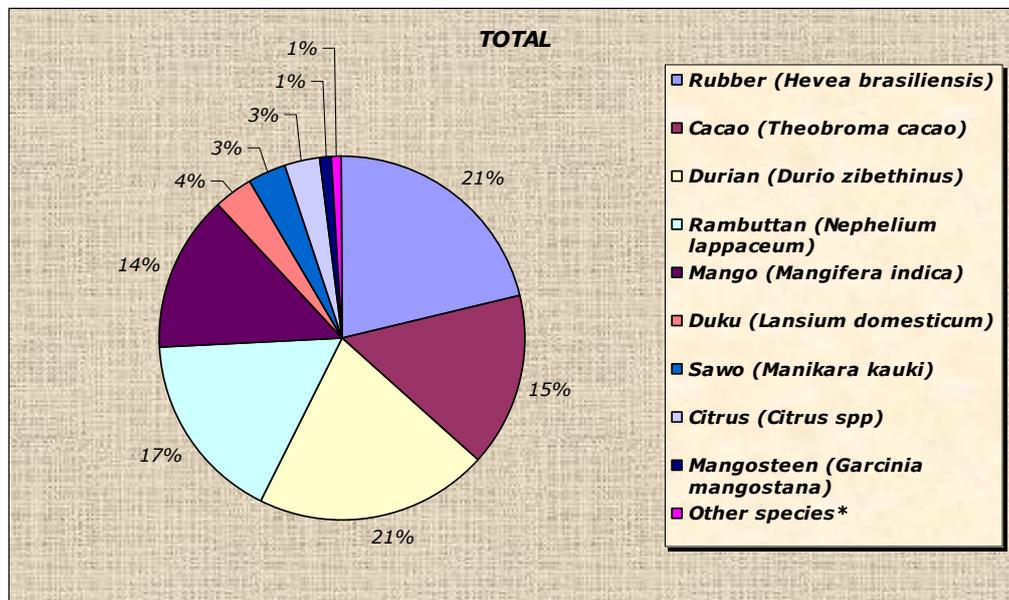


Fig. 1. Species prioritization based on seedling demand exercise completed by NOEL partners. Other species includes: melinjo (*Gnetum gnemon*), nangka (*Artocarpus heterophyllus*), mindi (*Melia azedarach*), nimba (*Azadirachta indica*), salak (*Salacca zalacca*), coffee (*Coffea robusta*), kwini (*Mangifera odorata*), and pinang (*Areca catechu*).