4.2.2 A survey of adoption of improved forages in Southeast Asia

Contributors: Werner Stür (CIAT), Phonepaseuth Phengsavanh (CIAT / NAFRI), Francisco Gabunada (CIAT/Leyte State University), Peter Horne (previously CIAT), Truong Tan Khanh (Tay Nguyen University), Viengsavanh Phimphachanhvongsod (NAFRI), John Connell (CIAT), and Federico Holmann (CIAT/ILRI).

Rationale

CIAT commenced forage research in Southeast Asia in 1992 with the introduction of a large range of forge accessions. In 2005, two major CIAT forage projects – the regional Livelihood and Livestock Systems Project (LLSP) and the bi-lateral Forages and Livestock Systems Project (FLSP) in Laos were completed (Table 42). By this time, the long-term commitment of CIAT and its partners had led to significant livelihood benefits and adoption of planted forages by a large number of smallholder households in the region. These were documented in a survey and impact studies and a summary of the results is provided in this section.

The survey commenced with assembling a list of households growing forages at pilot sites; from these lists up to 50 households were selected randomly for semi-structured interviews. More than 500 households were interviewed across all pilot sites. In addition, several well-targeted impact studies were conducted; these evaluated the impact of specific production systems such as cattle fattening, cow-calf production and herbivorous fish production.

Adoption of forages

Following a slow initial rate of uptake in the first few years, the adoption rate accelerated and almost 10,000 households had adopted planted forages at pilot sites by mid 2005 (Figure 47). Planted forages had also spread beyond project sites and the developed technologies were incorporated into development plans by local governments, NGOs and development projects. Adoption beyond project sites has been considerable (> 10,000 households) and is accelerating. Planted forages are becoming the 'normal practice' in many areas in the region.

The main forage species used were the grasses *Panicum maximum* 'Simuang', *Brachiaria humidicola* 'Tully' and 'Yanero', *Brachiaria* hybrid 'Mulato', *Brachiaria brizantha* 'Marandu', *Paspalum atratum* 'Terenos', *Setaria sphacelata* 'Lampung' and *Pennisetum* hybrid 'King grass' and the legume *Stylosanthes guianensis* 'Stylo184'. The reason farmers first grew grasses was that these have a much higher yield than legumes and quantity of feed (rather than quality) was the primary concern of farmers. The average area of planted forages on farms increased to about 2,500 m^2 with many farms having areas of 2,000 – 3,000 m^2 (Figure 48).

Farmers, almost exclusively, managed planted forages as cut-and-carry feed. Less than 5% of households at pilot sites reported that they occasionally graze their animals on planted forages. This is a significant departure from the perception commonly held in both the research and development community that forages should be used as grazed pastures. Farmers planted and managed forages like food crops, looking after each plant carefully. At several sites (e.g. Daklak, Vietnam), some households irrigated forages in the dry season. Another indicator of the intensity of forage production was the use of manure and fertilizer applied to forage areas. The vast majority of farmers (>90%) apply manure and/or fertilizer to their forages to ensure high productivity; only at sites with very extensive production systems (e.g. Malitbog, Philippines and Savannakhet, Lao PDR) was the use of manure for forages not yet adopted extensively.

Farmers use planted forages for many purposes (Figure 49). Almost all farmers used forages for cow-calf production with most using planted forages as a supplementary feed throughout the year or for providing feed when cows were kept

Table 42. CIAT forage research projects in Southeast Asia, 1992-2006.

Period	Project	Emphasis
1992–1994	'Forage Seeds Project', managed by CIAT and CSIRO (Australia) and funded by the Australian Government (AusAID). Working with national partners in Indonesia, Malaysia, Philippines and Thailand.	Introducing and screening of a broad range of forage germplasm (>500 accessions) for sub-humid environments.
1995–1999	'Forages for Smallholders Project' (FSP), managed by CIAT and CSIRO, and funded by the Australian Government (AusAID). Working with national partners in Indonesia, Lao PDR, Malaysia, Philippines, P.R. China, Thailand and Vietnam.	Developing appropriate forage technologies through regional and farmer participatory evaluation.
2000–2002	Phase-2 of the 'Forages for Smallholders Project', managed by CIAT and funded by the Asian Development Bank (ADB). Working with national partners in Indonesia, Lao PDR, Philippines, P.R. China, Thailand and Vietnam.	Participatory approaches to scaling out of forage technologies.
2003–2005	'Livelihood and Livestock Systems Project' (LLSP), managed by CIAT and funded by ADB. Working with national partners in Cambodia, Indonesia, Lao PDR, Philippines, P.R. China, Thailand and Vietnam.	Developing improved feeding systems (based on forages) to increase returns of livestock production and improve scaling out approaches.
2000–2005	'Forage and Livestock Systems Project' (FLSP), managed by CIAT and funded by the Australian Government (AusAID). The FLSP was a bi-lateral pilot development project in Lao PDR.	Participatory development and dissemination of forage technologies, including a large capacity building component.
2004-2005	Project Preparatory Technical Assistance (PPTA) to design a Participatory Livestock Development Project in Lao PDR, managed by CIAT in collaboration with ILRI and financed by the Asian Development Bank (ADB).	Working with ILRI to design a livestock development approach that would work in an ADB loan project in Laos. This integrated lessons learnt from past forage research in Southeast Asia.
2005–2007	Capacity Building for Smallholder Livestock Systems (CBSLSP), managed by CIAT and funded by the Asian Development Bank (ADB)	Using the approaches developed by the FSLP and LLSP, design an effective mentoring system that allows the rapid scaling out of forage and livestock innovations.
2006–2008	'Legumes for village pigs in Lao PDR' (L4PP), managed by CIAT and funded by the Australian Government (ACIAR).	Investigating the opportunities of using forage legumes as a protein source for pig production.
2007-2010	'Enhancing livelihoods of poor livestock keepers through increasing use of fodder', part of a SLP project operating in Ethiopia, Syria and Vietnam coordinated by ILRI; the Vietnam component is managed by CIAT; funded by IFAD.	Improve our understanding of the factors and processes that determine the success of fodder interventions in developing countries.

near the village for some weeks after giving birth. At some sites, farmers fed planted forages to draught cattle when they were used for ploughing or during period of flooding (e.g. Cambodia) when access to other feeds was difficult. Since 2002, a very exiting development has been the emergence of fattening systems for cattle. At first farmers in Daklak, Vietnam started to buy older thin cattle, to which they then fed planted forages for 2-3 months before selling them to traders for slaughter. This fattening/finishing of cattle before slaughter proofed to be a very profitable activity and many farmers, at other pilot sites where this idea was introduced, have

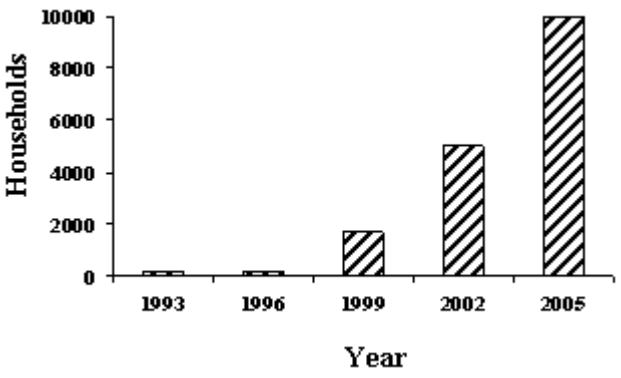

Figure 47. Farmers adopting planted forages at pilot sites (1993-2005).

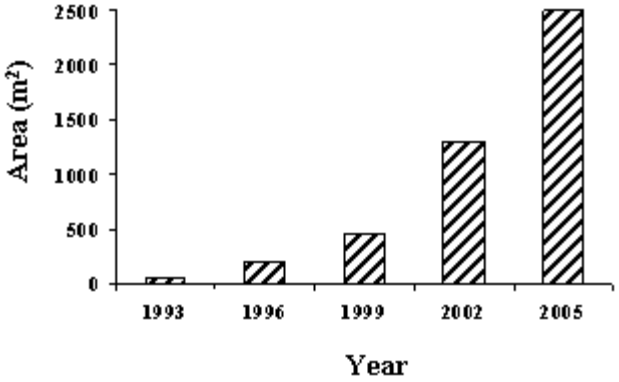

Figure 48. Average size of planted forages per household from 1993 to 2005.

also started to fatten cattle (Figure 49). In fattening systems, farmers used 100% planted forages rather than to use planted forages as a supplementary feed; this required approximately 800m^2 per animal. The main grasses used in these systems were *Panicum maximum* 'Simuang', *Pennisetum purpureum* 'Napier' and *Brachiaria* hybrid 'Mulato'. In these situations, farmers manage planted grasses very intensively with high rates of manure and fertilizer, and supplementary irrigation if available. Some farmers were using supplementary concentrate feed to achieve higher daily weight gains and there is an opportunity to introduce legumes as a source of cheap, farm-grown protein.

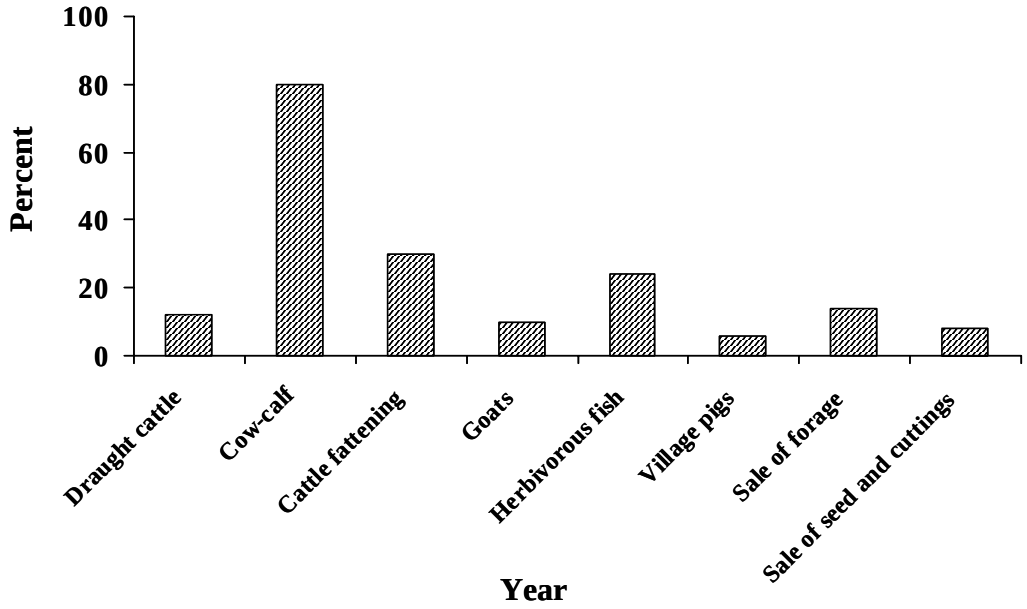

Figure 49. Use of forages in 2005.(total exceeds 100% as many farmers use forages for more than one purpose)

Several other unexpected forage uses developed. These were the feeding of planted grasses (mainly *P. maximum* 'Simuang') to herbivorous fish in Vietnam, feeding of the legume *Stylosanthes guianensis* 'Stylo 184' to village pigs in Lao PDR and the sale of fresh forage as feed to other farmers in Thailand and Vietnam (Figure 49).

Impacts

The main livelihood impacts of planted forages were considerable labor savings and higher income from increased sales of animals (from both improved animal productivity and the ability to raise more animals per household). These resulted in a significant increase in the return to labor from livestock production. The area of forage planted by farmers at almost all project sites was sufficiently large to experience not only labor saving but also substantial improvements in animal production (Table 43). An investment of 0.2 ha of planted forages is sufficient for fattening two cattle. At most sites, the area of planted forages was much larger than these minimum areas.

Several impact studies were conducted to document the impact of planted forages on the livelihood of households. Initially farmers grew forages in small areas on non-cropping land (e.g. road sides, between fields, on slopes not suitable for crops), however, households wanting to increase their forage area had to use areas that had previously been grown to crops. This has occurred at most sites with farmers converting their less productive cropping areas such as upper paddy fields to planted forage areas. This replacement of crops with planted forages reflects the higher returns from livestock production. Below are three examples.

Table 43. Minimum area of planted forages required for livelihood benefits.

Use of forages	Forage area
Saving labor (convenience)	300-500 m^2/farm
Fattening cattle or buffalo	800-1,000 m^2/animal
Cow-calf production	500-1,000 m^2/cow
Forages for herbivorous fish	500-700 m^2/pond
Legumes for pigs	100-250 m^2/pig

1. Cattle fattening: In Daklak, Vietnam, smallholder farmers started short-term fattening to finish cattle for sale to the slaughter house. Planted forages replaced less productive coffee plantations which had been planted when coffee prices were high. An impact study was conducted with 30 randomly selected households which compared cattle fattening with the previous use of the area where planted forages were now grown for cattle fattening. The average area of coffee replaced was 1,200 m^2. The mean daily liveweight gain of cattle in the fattening system was 669 g, based on planted grasses (mainly the grass *Panicum maximum* 'Simuang') and a small amount of concentrate feed (on average 2 kg/day). The net profit from fattening cattle was USD 511 per year compared with USD 90 for coffee from a 1,200 m^2 field, making cattle fattening a very attractive option.

2. Grass carp fish production: In Tuyen Quang, northern Vietnam, many households have fish ponds for producing grass carp. An impact study was conducted with 30 randomly selected households which compared fish production before and after adoption of planted forages. On average, farmers in the study had 2,400 m^2 of fish pond and had planted 540m^2 of forages (mainly *Panicum maximum* 'Simuang') to feed to their fish. One of the most important benefits of having planted forages was a saving of labor for feeding fish. The mean labor requirement for producing fish over one production cycle (8-10 months) was 648 hours before households had access to planted forages and 308 hours since planting forages, a very significant saving of scarce family labor. At the same time pond productivity increased from 75 kg to 122 kg of fish harvested per 100m^2 of pond, a 38% increase in productivity. Households also reported that they had been able to increase the area of fish ponds by almost 30% since using planted forages. The net income per fish pond increased from USD 84 to USD 283 and the return to labor increased from USD 0.25 to USD

1.28 per hour. The very significant benefits of using forage-based feeding systems, both in terms of net income and the much more attractive return on labor, explains the rapid uptake of this technology. The opportunities provided by planted forages – reduced labor and increased pond productivity – enabled many households to shift from raising some fish for home consumption to producing fish for the local market; a very profitable livelihood activity for households including those with very small land holdings as only small areas are required for ponds and forage plots.

3. Cow-calf production systems: A study, conducted in Ea Kar, Daklak, Vietnam, assessed the impact of adoption of planted forages on households practicing cow-calf production. The study used farmer group discussions and conducted 47 individual household interviews (27 household with planted forages and 20 households practicing traditional cow-calf production based on native feeds and extensive grazing). The main impacts of planted forages were larger herd size, a change in the management system from grazing to partial confinement (and providing cut-and-carry feed), a change from native cattle breeds to cross-bred animals, increased sales and higher returns to labor. The mean herd size was 6.9 animals for adopters and 4 animals for non-adopters (which was close to the average herd size of adopters before they had planted forages). Adopters were also able to raise crossbred (Red Sindhi x Native) cattle (77% for adopters and 27% for non-adopters), which have higher nutritional requirements but also a higher sale value than native cattle. The average income from the sale of cattle during the preceding year was USD 756 for adopter and USD 441 for non-adopters. Farmers who adopted forages were able to substantially reduce or eliminate altogether the large amount of labor needed for supervised grazing, with only a small additional amount of labor required for cutting grass. On average, adopters were spending less than half the amount of time looking after their cattle than the non-adopters (3.0 versus 6.8 hours/day) resulting in higher returns to labor. Returns to labor for adopters were USD 0.69 per hour, compared to USD 0.18 per hour for non-adopters.

Other very significant cash income generation opportunities were the sale of fresh forage to livestock producers and traders, particularly in Thailand and in northern Vietnam, and from feeding legumes to pigs (see next section, 4.2.2). At many sites, early adopters also obtained benefits from the sale of planting material and more recently from the sale of seed. In all cases, households used the additional income from sales of livestock to improve living conditions for the family, for educational expenses of children and to invest into their agricultural production.

Lessons learnt

Many important lessons for the successful development of planted forage systems and scaling out of forages for smallholder farmers emerged from this research. These can be grouped into those that are essential, and those that make technology development and scaling out easier or more difficult.

1) Essential components

- Livestock have to be important to the livelihood of farmers in the target area otherwise they will not be willing to invest the time and effort needed to evaluate and integrate planted forages.

- Farmers must have and recognize that they have a problem with feeding their animals. Traditional, communal feed resources are insufficient to support the production system and farmers are forced to invest more and more time in feeding their livestock. This must be recognized as a problem by farmers, and provides the entry point for working together.

- Employing a participatory approach to engage with farmers in developing and integrating forages into their farming system. Addressing the main problem (often labor shortage or lack of feed) ensures that

farmers are willing to invest time and effort in evaluating the use of planted forages.

- Encouraging farmer learning, experimentation and innovation (Horne and Stür 2005); farmers will develop uses and ways of integrating and managing planted forages that are appropriate for their situation (e.g. forages for herbivorous fish, legumes for village pigs, using cut-and-carry for *Brachiaria humidicola*). This has resulted in high-impact systems that are compelling examples for others to adopt.

- Having suitable, well-adapted forage varieties that can deliver significant improvements to livestock production systems. There are many cases where ill-adapted species had been introduced previously without success, but widespread adoption occurred once a well-adapted variety was introduced (Tuhulele *et al.* 2007; Gabundada *et al.* 2007).

- Having long-term commitment. The forage technology development phase takes several years, as those involved have to evaluate, adapt and innovate with planted forages before these will provide significant livelihood benefits. Often, farmers realized that planted forages opened new opportunities and changed their livestock management and feeding system to take full advantage of the new feed resource. This process of learning and innovating takes time, however, the process can be quite fast when new sites are linked to more advanced sites where expertise in participatory forage technology development has already been developed. One example is Cambodia which benefited from experience from other countries and was able to develop fodder banks for feeding cattle during the flooding period within 2 years; a process that would have taken 3-5 years previously.

- Scaling out has to be based on compelling examples of a group of farmers receiving significant livelihood benefits from having adopted planted forages. These become learning sites for scaling out.

- Engaging key stakeholders such as development practitioners (extension service, animal health worker, NGOs and development projects) and service providers (such as traders and suppliers) is needed in scaling out successful forage technologies.

- Linking producers to markets. A better understanding of what markets demand and pay for different products generates interest and demand for improved feeding systems among farmers.

2) Factors that make it easier or more difficult to develop and scale out planted forages

- The degree of change of the production system required to integrate planted forages effectively. For example, the idea of planting forages on their own land and using this for cut-and-carry is relatively easy for farmers who already keep animals in pens and go out to cut natural feed from communal areas. The required system change is relatively small. On the other hand, farmers who manage their livestock in extensive systems (such as free-range grazing) have to make several significant changes to their management system to be able to take advantage of planted forages.

- The need for fencing increased the cost of planting forages. It is easier and cheaper to grow planted forages in areas where all animals are already constrained or penned, as no fences are required to protect the forage plots from grazing animals. In areas with unsupervised grazing, the need for a secure fencing adds significantly to the cost of utilizing planted forages and greater benefits are needed to offset these costs. There has been a trend for local government to prohibit free grazing, at least for part of the year, and to make animal owners responsible for damage to crops and planted

forages. Such regulations help the adoption of planted forages.

- Ease of propagation; being able to propagate forages vegetatively promotes the spread of forages as farmers are not dependent on suppliers of seed. Dependence on seed requires the development of seed supply systems which provides an additional hurdle.

- Champions of particular forage technologies can accelerate the scaling out process. Without a project or a local champion, scaling out will still happen as long as the developed planted forage examples provides significant livelihood benefits but the rate of spread may be slow (Tuhulele *et al.* 2007).

- Population density and infrastructure also play a role in scaling out of forage technologies. Intensive farming systems with high population density are more conducive to the spread of good ideas and technologies from farmer-to-farmer than more extensive systems where there is less contact between farmers. For example, the rate of adoption was much slower in the extensive farming system (and poor road system) of Central Kalimantan compared with the fast uptake of planted forages for cattle fattening in more intensive farming systems in the Central Highlands of Vietnam.

Conclusions

Planting forages on their own land was the key factor that enabled smallholder farmers to improve livestock production. Planted forages significantly improved household income and, most importantly, the returns to labor from livestock production. The initial benefit from planted forages was, almost invariably, labor savings from easy access to feed. Subsequently, improved growth of animals receiving planted forages emerged and farmers look for ways of maximizing the opportunities provided by the new resource. This led to improved feeding and management systems, which provided significant benefits to farmers.

Participatory approaches to technology development were an essential component of success and produced several unexpected innovations such as forages for herbivorous fish production. Scaling out requires different methodology from participatory technology development and the involvement of a different set of stakeholders. This was most successful in cases where scaling out was based on high-impact, compelling examples which had been developed and adopted by a group of smallholder farmers.

The key role of planted forages in enabling smallholder farmers to intensify their extensive livestock production system and become more market-oriented has been accepted by development agencies in Laos. Similarly, the participatory approaches developed for forage technology development and scaling out have attracted interest from development practitioners. Both forage technologies and approaches for working with smallholder farmers have been integrated into large development project, ensuring that the results of our research have widespread impact.

Adoption of planted forage technologies is continuing to accelerate and the main challenges now are to (a) help farmers to continue to improve animal productivity to become more competitive, enable regular supply of animals and to link more effectively with markets to ensure maximum returns for higher quality animals, (b) address non-feed production constraints such as animal health, animal management, input supplies and marketing, and (c) address factors limiting scaling out such as supply of planting material of the most suitable forage varieties, and ensure access to useful information and training for new practitioners engaged in forage and livestock research and extension.