Participatory forage technology development in Southeast Asia[1]

Ralph L. Roothaert[2], Le Hoa Binh[3], Ed Magboo[4], Vu Hai Yen[5], Judith Saguinhon[6]

Abstract

Lack of adoption of forage technologies has been attributed to the lack of involvement of end-users in the multi-stage research process. The Forages for Smallholders Project went through various stages of conventional and participatory research, and developed a framework for forage technology development and scaling out. The process and results of these technology developments are described for pilot sites in Malitbog, Philippines, and Tuyen Quang, Vietnam. Unexpected farmers preferences and practices shaped the technologies. Participatory impact assessments were carried out. Benefits were numerous, such as increased animal productivity, reduced labour requirements, and increased education for women and children. Household income increased by 29% on average in Vietnam. The project found a solution to a common dilemma in the scaling out process: avoiding top down replication of technologies and increasing effective use of project resources. The paper concludes with twelve lessons learned on the process of participatory research, and five lessons learned on adoption of forage technologies by smallscale farmers.

Key words

Participatory research, forage, evolution, Vietnam, Philippines, impact, scaling out, lessons

Introduction

Despite Asia's economic boom in the early nineties, many agricultural households have remained poor. In 2000, 849 million people in Asia still lived in poverty, 158 million of which in the Southeast Asian region (Gryseels et al., 1997). Poverty is often concentrated in the remote upland areas, where investments in infrastructure and government services have lacked behind. The upland areas are also the homes for many different indigenous peoples, living their ethnic traditional lives. One thing the upland farming communities have in common is the importance they attach to livestock. Although milk consumption is relatively uncommon in Southeast Asia, livestock provide

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[2] Centro Internacional de Agricultura Tropical (CIAT)/ International Livestock Research Institute (ILRI), P.O. Box 5689, Addis Ababa, Ethiopia. E-mail: r.roothaert@cgiar.org
[3] National Institute of Animal Husbandry, Vietnam
[4] Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development
[5] Tuyen Quang Province Department of Agriculture and Rural Development, Vietnam
[6] Malitbog Municipal Agriculture Office, Philippines

manure for the low external input farming system, traction, and a source of capital accumulation which can provide income at times when needed. Livestock is a pathway out of poverty; when livestock rearing is successful and resulting in mature offspring being sold, capital is often invested in other opportunistic businesses that provide a high rate of return. Rearing of ruminants such as cattle and buffaloes is traditionally time consuming. Many hours are spent herding, or collecting local forages to carry home. Grazing areas are scarce, and if at all available, consist of low quality grass such as *Imperata cylindrica*.

National and international research programmes in the past have generated a range of improved forage and feed technologies with the aim to increase livestock production in the tropics. These technologies have proved productive on research institution's farms, but have not had much impact on feeding practices by smallholder farmers in SE Asia. One of the reasons for this lack of adoption has been the absence of research facilitation to adapt the innovations to something that would suit the smallholder farm conditions and household dynamics.

The regional initiative called the Forages for Smallholders Project (FSP[7]) realised that the only way to increase adoption of improved forage technologies was to involve end-users in the innovation process. This paper describes how farmers' participation in experimentation evolved during the project . Results are described in terms of technologies tailored within diverse conditions, and impacts on livelihoods. The second phase of the project focused on dissemination. The active role of partners and farmers are eluded in this paper. The paper concludes with generic and technical lessons learned.

Evolution of research approaches within the Forages for Smallholders Project

From 1992 to 1994, CIAT and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) evaluated more than 500 forage species and varieties for adaptation to climate, soils, pests and diseases, in a few representative sites in SE Asia. Conventional methods for screening forages in nurseries were used, and farmers' land was sometimes rented (Table 1). Only after the number of candidate species and varieties were reduced to a manageable size, farmers' involvement became feasible. FSP started regional evaluations of selected species and varieties on communal sites, and asked farmers to rate their performances in terms of growth characteristics and pest and disease resistance. Gradually, experimentation shifted from communal sites to individual farmers' plots, and methods were developed to facilitate appropriate farmer participatory research (FPR). FPR is an iterative process, going through various stages and providing opportunities for feedback. Horne et al. (2000) developed a diagram which proved very useful for clarifying the research concept to various stakeholders (Fig.1.).

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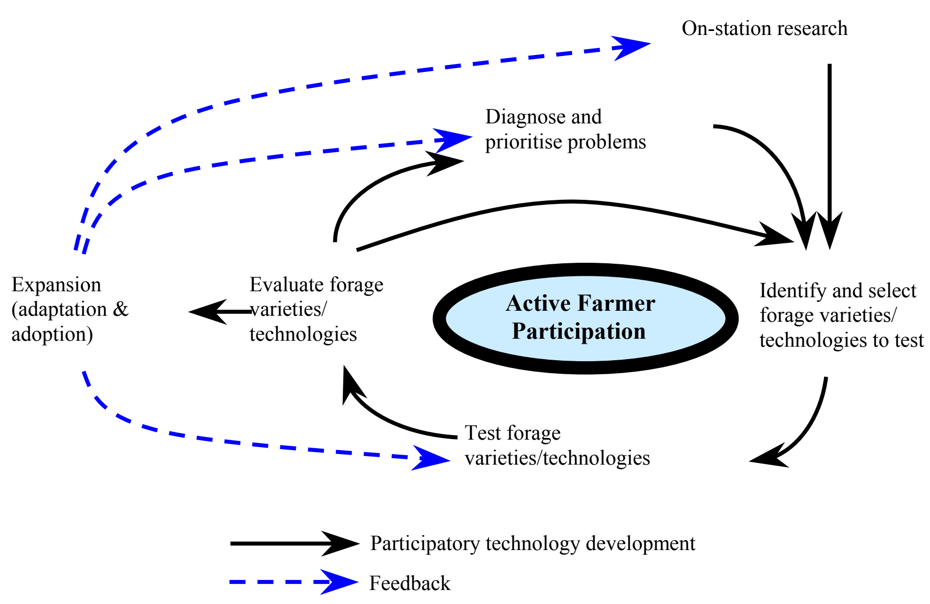
[7] FSP was convened by CIAT, and funded by AUSAid from 1995-1999 and Asian Development Bank from 2000-2003.

Table 1. Formal and informal stages of forage evaluation (adapted from Roothaert et al., 2003).

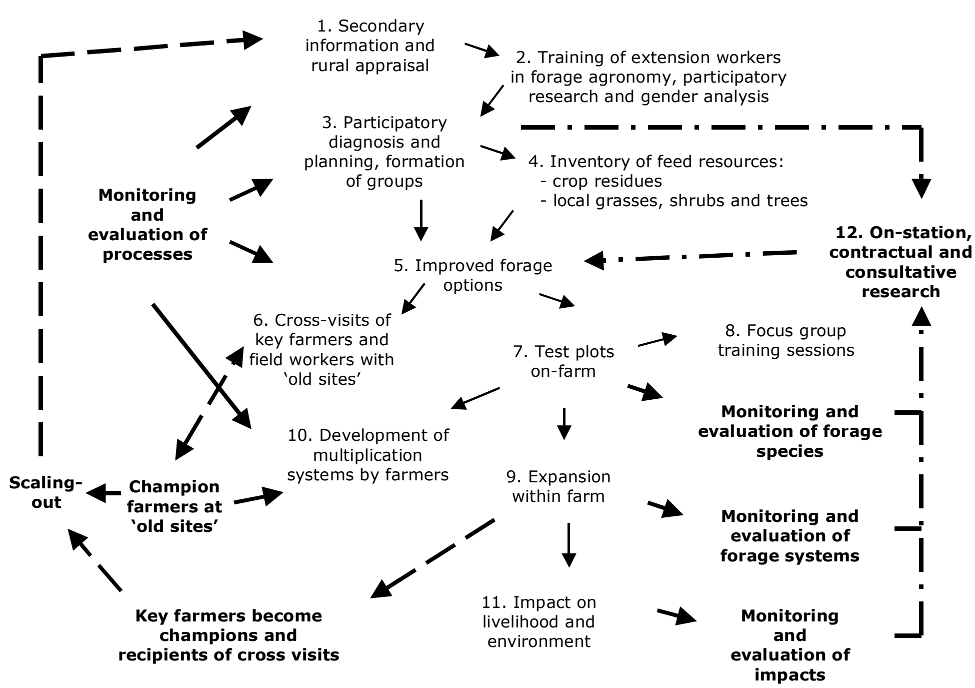
Stage of evaluation	Number of species and accessions	Number of locations	Management	Type of farmer participation
1. Nursery, 1992-1997	Many (>50)	Few	Researchers manage	Contractual
2. Regional evaluation, 1995-1999	Few (<20)	Many	Farmers manage	Consultative
3. Formal farmer evaluation, 1997-2001	Few (6-8)	Many	Farmers manage and evaluate	Collaborative
4. Informal farmer evaluation, 1999-2003	Few (2-6)	Many	Farmers make decisions, manage and evaluate	Collegial

Figure 1. Diagram of the iterative research process for forage technology development (Horne et al., 2000).



Facilitation of FPR as portrayed in Fig 1. was an essential aspect of the project, but in order to increase impact beyond pilot communities, a more holistic approach was needed. During the second phase of the project, a strategy was developed for selection of sites to scale out, selection and training of partners, facilitation of knowledge flows, development of skills for farmers, and methods for monitoring and evaluation. Fig. 2 shows the various steps in the process. The first step was to gather secondary information and to carry out a rapid rural appraisal with a wide range of stakeholders in a particular area. Officers and field workers of agricultural extension authorities would be trained in forage agronomy, participatory research, and gender analysis. During these courses, the more active and motivated field workers were identified (step 2). The selected extension workers were assisted in their first participatory diagnosis and planning exercises with their communities (step 3). Forage options that would complement existing feed resources were discussed and selected (steps 4 and 5). Within a new community, a key farmers would be delegated for a cross-visit to champion farmers at other experienced sites (step 6). New farmers would normally follow a pattern of expansion within their own farms; they would start with small plots of new forage species and varieties, often only a few m^2 per species. They would evaluate the new forages using a variety of criteria, ranging from agronomic performance to ease of harvesting. Expansion would normally occur in an opportunistic way, when planting conditions were favourable. At this stage, enough forage would be available to compare palatability of forage species for animals, and evaluate grazing persistence. After about 1 year, farmers would start to perceive effects on animal productivity, soil fertility, or erosion control (steps 7 to 11). The broken arrows at the right indicate links to strategic research, the broken arrows on the left indicate the scaling out process.

Figure 2. Strategy for scaling out the research process (Roothaert and Kerridge, 2002)



Development and diversity of forage systems

Results of early nursery and regional forage variety evaluations in Hainan (China), Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam were published in proceedings of a workshop held in Indonesia (Stür, 1998). In this section we analyse what has happened since then in terms of forage technology development at two locations: Malitbog, Philippines, and Tuyen Quang, Vietnam.

Malitbog is situated at 8° N latitude, 700 m above sea level, with an annual rainfall of 1830 mm, 10 wet months (more than 50 mm), and a soil pH between 6 and 6.5. The farming system is based on maize, rice, banana, coconut and a variety of root and vegetable crops. Cattle are traditionally kept grazing or tethered on steep degraded hills covered by *Imperata cylindrica*. Based on performance in nursery and regional forage evaluations (Stür, 1998), 30 accessions of grasses, herbaceous and shrub legumes were recommended for use by farmers. Results from participatory diagnosis (PD) showed that major issues in animal production were lack of feed during the dry season or during planting season, and labour requirements for finding enough feed. After PD and planning exercises with farmer groups were held, farmers started small plot evaluations in their own farms. A few more years of collaborative and collegial farmer experimentation and expansion on farm resulted in significant areas covered with forages for multiple uses. Table 2 shows the varieties that most farmers were growing in 2002, how they integrated them in their farms, and the main uses. The collaborative and collegial research has provided us with several unique findings. First of all, although the initial recommended list of forages were mostly legumes, the five most appreciated and widely cultivated forage types in Malitbog are grass species. Secondly, early adoption of forages occurred at plot level, but these grasses are now mostly grown in lines along steep slopes, intercropped with food crops. Forages in general were very much appreciated for their effect on reduced soil and water run off. The combination of high biomass productivity of grasses for feed and their capacity to contain soil has been a major factor for adaptation and adoption. *Setaria sphacelata* has been cultivated by the largest number of farmers, because they value its very dense root system, resulting in dramatic natural terrace formation. These forage soil conservation structures have also saved farmers money in terms of reduced fertiliser wash off. Although it was initially feared by scientists that Setaria would not produce well enough during the dry season, this has been no important constraint for farmers, perhaps due to improved water infiltration as a result of the particular innovative system.

Tuyen Quang is situated at 21° N latitude, 40 m above sea level, with an average annual rainfall of 1640 mm, 7 wet months (more than 50 mm), and a soil pH of 5-6. The mixed faming system consists of wetland rice and fish ponds in the lowlands; fruit trees, vegetables and tea near the homes, and forest plots on the hill tops. Cattle and buffalo are kept for meat (sale) and draft power, and fed on natural vegetation from the forest plots. Pigs are intensively raised and fed. Fifteen grass, herbaceous- and shrub legumes were recommended for use by farmers based on nursery evaluations at four sites in Vietnam. PD with farmers in Tuyen Quang indicated four major problems related to livestock production: Lack of good animal breeds, animal diseases, feed shortages especially

Table 2. Forage systems adopted in Malitbog, Philippines, 2002.

Species (ranked in order of number of farmers growing them)	Planting and harvesting system	Type of animal fed to (in order of importance) and other uses.
Setaria sphacelata var. Splendida and cv. Nandi	Contour lines along steep slopes, cut and carry from lines and plots. Grazing.	Feed for cattle, goats, pigs, horses[8] and carabao. Planting materials. Soil and water conservation.
Pennisetum purpureum ex-Xavier[9]	Contour lines along steep slopes, cut and carry from lines and plots.	Feed for cattle, goats, horses and carabao. Planting materials. Soil and water conservation.
Paspalum atratum	Contour lines along steep slopes, cut and carry from lines and plots.	Feed for cattle, goats, horses and carabao. Planting materials. Soil and water conservation.
Panicum maximum CIAT 6299 (Tobiata) and T58 (Simuang)	Contour lines along steep slopes for T58 only. Cut and carry from lines and plots. Grazing of contour lines after harvest of maize.	Feed for goats, cattle, carabao, horses. Planting materials. Soil and water conservation.
Brachiaria ruziziensis	Contour lines along steep slopes, cut and carry from lines and plots.	Feed for cattle, goats, carabao and horses. Planting materials. Soil and water conservation.
Arachis pintoi	Plots for cut and carry or for grazing. Little is planted along contours or as cover crop.	Feed for goats, cattle, carabao and horses. Planting materials. Soil and water conservation. Soil fertility improvement.
Flemingia macrophylla	Plots, contour lines along steep slopes and hedges. All for cut and carry.	Feed for cattle, goats, and carabao. Planting materials. Soil and water conservation. Soil fertility improvement.
Gliricidia sepium var. Retalhuleo	Plots and hedges. All for cut and carry.	Feed for cattle, and goats. Planting materials. Soil and water conservation.

during the dry cold season, and lack of cheap feeds for fish and pigs. The results after subsequent participatory research with farmers in terms of forage systems adopted are presented in Table 3. The participatory process in Tuyen Quang also yielded some important findings. The mostly grown and appreciated forage was *Panicum maximum* for the feeding of fish. This grass has some characteristics that make it ideal for this purpose; it has smooth, soft leaves and it floats on the water for the carp to feed on. It is also high yielding and stays green during the cool dry season. *Paspalum atratum* did not perform as well as other grasses in nursery and regional evaluations in Vietnam in terms of yield potential, persistence and seed production, but it has been highly appreciated by farmers because of its growth form, ease of propagation by tuft splits, smoothness, staying green during the cold dry season, and good on-farm yields. *Stylosanthes*

[8] Setaria is toxic to horses only when fed in big amounts.
[9] This variety was obtained from Xavier University, Cagayan de Oro, in the early nineties. The plants are tall, broad leaved, and non-hairy. It distinguishes itself from other many other *P. purpureum* varieties in a characteristic of being glabrous at the upper side of the leave blades. In appearance it compares to King grass from Indonesia and to Pennisetum hybrid cv. Merker.

guianensis has mainly been appreciated for its suitability as pig feed. Since all forages were only used for cut and carry, the tall growth form of *Brachiaria brizantha* has been found preferable to the more spreading and lower other *Brachiaria* spp. which were identified in the earlier evaluations. In contrast to the Malitbog experience, forages were grown in fodder banks rather than contour lines, and intercropped with fruit trees.

Table 3. Adopted forage systems in Tuyen Quang, Vietnam, 2002.

Species (ranked in order of number of farmers growing them)	**Planting and harvesting system**	**Type of animal fed to (in order of importance) and other uses.**
Panicum maximum T58	Cut and carry from fodder banks. Intercropped with fruit trees.	Fed to fish, buffaloes, cattle and pigs. Erosion control. Sale of planting materials and seeds.
Paspalum atratum	Cut and carry from fodder banks. Intercropped with fruit trees.	Fed to buffaloes and cattle. Sale of planting materials and seeds.
Pennisetum purpureum	Cut and carry from fodder banks.	Fed to buffaloes and cattle.
Stylosanthes guianensis CIAT 184	Cut and carry from fodder banks. Intercropped with fruit trees. Some contour hedgerows.	Fed to pigs and cattle. Soil fertility improvement. Erosion control.
Brachiaria brizantha	Cut and carry from fodder banks.	Fed to buffaloes and cattle.
Boehmeria nivea	Cut and carry from fodder banks, intercropped in fruit trees.	Fed to pigs, fish, buffaloes and cattle.
Trichantera gigantea	Cut and carry from fodder banks.	Fed to buffaloes and pigs.
Leucaena leucocephala	Cut and carry from live fences. Contour hedgerows.	Fed to buffaloes and cattle.
Gliricidia sepium	Live fences.	Fencing.

Most farms in Tuyen Quang consist of a forest plot on top of the hill, which is not supposed to be used for logging or cultivation, but which is exploited for other purposes such as grazing, browsing and collection of other forest products. FSP in collaboration with Thai Nguyen University carried out a study to assess farmers' use and perception of fodder resources from these forests. Local fodder plants traditionally provide the biggest bulk of cattle and buffalo feed. Indigenous grasses such as *Thysanolaena maxima, Narenga Fallax*, and *Saccharum arundinaceum*; and indigenous trees such as *Ficus heterophylla*, *F. lacor, Strebulus asper* and *Brousonettia papyrifera* were found superior to other indigenous plants in terms of providing green forage during the cold dry season (Ta Thi Thu Thuy et al., unpub.). Initial laboratory analysis revealed promising nutritive value for the tree species in particular. The community and researchers have been encouraged to experiment on management practices to optimise seasonal fodder production from these species, and on propagation methods.

Impacts

In 2001 and 2002, impacts studies were carried out in several countries and sites, using a combination of participatory methods and conventional surveys (e.g. Bosma et al., 2003). In the Philippines, the project had a significant effect on the quantity and quality of available forage; farmers who were growing forages derived 67% of the feed resources from improved cultivated forages, whereas before the project this amount was negligible. Farmers mentioned several benefits from these forages: improved body condition and overall health of animals; increased quantity and quality of work by draught animals; larger amounts of collectable manure due to reduced herding-time and increased numbers of offspring. Estimated amount of time saved due to new forages ranged between 30 minutes and 2 hours per day in southern Philippines. Life became more relaxed as it was easier to plan activities when animals were not grazing. Involvement of women and children in tasks like herding and collecting local forages diminished, and men became increasingly responsible for livestock tasks. The reduction or disappearance of tethering and herding also resulted in less destruction of crops. Consequently, the production of maize, banana and vegetables, and the income from animals' work outside the farm, increased. Net yearly income per household from animal production increased from $54 to $157 in the farming community at Malitbog. Planting forages in contour lines increased crop production slightly and contributed another $22.50 to yearly income. The reduction in labour requirements allowed households to make $36 per year from other activities. Most farm households expanded their herd size after joining the project, and consequently the time available for off-farm work decreased, offsetting partially increased income from livestock.

In Tuyen Quang, Vietnam, farmers reported higher yields of forages compared to native grass. The high yields of new forages allowed farmers to keep more animals or to keep animals in zero grazing feeding systems. Improved forages enabled other farmers to start keeping animals, as they were able to produce sufficient fodder from their small plots. The average estimated contribution of new forages to animals' diets was 53% during summer and 32% during winter. Ruminant productivity increased in terms of faster growth of animals, higher price received for the animals at the market due to better body condition, increased working capacity of draught animals, and increased amounts of manure. The productivity of fish increased as the period until marketing was reduced from 11 months to 9 months.

As was the case in the Philippines, saved time was an important benefit for most farmers keeping ruminants. The number of labour days per year required for raising large ruminants was 258 for farmers *without* forages versus 149 for farmers *with* forages. The mean number of saved days for fish production was 30 days per year, which corresponds to approximately 40 minutes per day. Women and children benefited most from the reduction in time spent cutting, carrying and herding. They used this extra time for other farm activities, and educational and cultural activities. Forages had a positive effect on other crops due to soil conservation and manure availability.

In Vietnam, improved forage systems also had a pronounced effect on income levels and welfare. Net income from ruminant-fish production systems increased from $99 to $199 per year. The time saved allowed households to increase their income from other, mainly agricultural activities, resulting in an additional yearly income of $52 per household. Farmers were grouped in four income classes; the majority were in the class that earned between US$301 and US$736 per year per household. An increase of $152 from the livestock system therefore corresponds, on average, to an increase in total household income of 29%. Poorer farmers who depended more on livestock due to small land areas, benefited the most from the improved forages. Other positive effects on rural development included a reduction in the number of farming conflicts, rehabilitation of barren land, and reduced use of pesticides.

Scaling out and up

Scaling out is geographical spread to cover more people and communities, and involves expansion within the same sector or stakeholder group (IIRR, 2000). Within the complex smallholder farming systems and diversity of local cultures and practices, aims to replicate forage systems without an adaptation process would result in low adoption, in a similar way as top down strategies of the past didn't work. On the other hand, there is also the wish to make the process more time and capital efficient, i.e. to avoid elaborate interactions with every new farmer. The FSP did find such a compromise. The selection of new areas and new communities would still require relatively high investments in terms of time for rapid rural appraisals (several days) in a new region and PD and planning with communities (1-2 mornings). Staff time was saved though in terms of facilitating the research process. Very often he research would be collegial or completely farmer led, the emphasis of facilitation time being only in monitoring and evaluation. The facilitation of cross visits by champion farmers from old sites would partially replace staff time. Table 4 shows how the aggregated numbers of PD and other activities in six FSP countries in SE Asia led to numbers of new farmers planting forages. On average, about 18 farmers would participate per PD. Many of these farmers were encouraged by what they saw and heard during the following cross visit and about three-quarters of participating farmers would start planting forages. As a result, a total of 4,155 new farmers have started to grow and experiment with forages from 2000 - 2002.

Table 4. Scaling out activities and number of new farmers experimenting with forages.

Year	No. of participatory diagnoses (PD) conducted	No. of farmers who participated in the PD	No. of new groups	No. of cross visits organised	No. of farmers participating in cross visits	No. of new farmers planting forages
2000	45	1087	52			748
2001	151	2173	179	187	1330	1537
2002	101	2148	52	141	1833	1870
Total	297	5408				4155

Scaling out implies a need of increased numbers of staff to facilitate the research and development process. The selection process for fieldworker trainees has been described earlier. It is emphasised that training courses need to be multi-faceted; new knowledge, skills and attitudes are equally important.

Lessons learned

Process of FPR

- The myth that 'participatory research is easy and anyone can do it' is not true. There are people who are naturally gifted with abilities to listen, show respect, have interest in others, be flexible, or be able to enjoy or bear field conditions. At the other side of the scale, people find it very hard to acquire these skills. In a similar way, not everyone excels in conventional research. Participatory research done wrongly can waste farmer's time, damage community trust and willingness to collaborate. There is a need to screen facilitators.
- Practice makes perfect. Training alone in participatory approaches is not very effective unless it is followed by field work with mentoring opportunities.
- Reporting and analysing qualitative data and information remains a challenge for many field workers and scientists. Training and practice remains to be required. Qualitative data are often collected and accumulated in ad hoc ways, without thinking much in advance on what to do with the information. Careful planning of the qualitative data collection process helps analysis and interpretation.
- Anecdotal or unexpected information can add tremendous value to a project or even change its course significantly. Many important farmer innovations have resulted from it. Facilitators need to develop a sixth sense for this phenomenon.
- There is usually no reporting language that fits all. Reporting needs to be done in a language for the most appropriate user, be it donor, institution, field workers, or community. Translation might be needed into one or more other languages, either simultaneously during meetings, or written in reports. Considerations need to be made to serve international public goods versus development and empowerment of communities. Careful targeting of time and capital resources for translation is needed.
- Situations are dynamic and participatory diagnoses don't reflect the truth forever. Revisiting PD is essential about every two years. Planning and implementation of research need to be adjusted accordingly.
- Capacity building or advocacy of participatory approaches are necessary at various levels, not only for field workers. Scaling up[10] of approaches will facilitate scaling out.

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[10] **Vertical scaling up** is moving higher up the ladder. It is institutional in nature and involves other sectors/ stakeholder groups in the process of expansion – from the level of grass-roots organizations to policymakers, donors, development institutions, and investors at international levels. Vertical scaling up includes **institutionalisation** (often referred to as 'mainstreaming', especially in the participatory literature). This implies getting institutions to accept and internalise the underlying principles of an innovation so that these will remain as guiding principles of practice even after the initial innovative project or program has come to an end (IIRR, 2000).

- Confrontational methods during advocacy of participatory approaches often result in adverse effects. In adverse conventional environments, working in the margin yields more progress in terms of acceptance and institutionalisation.
- It is difficult to develop sincere relations with communities for participatory research in the shadow of livestock dispersal programmes or other projects that supply substantial agricultural inputs free or on loan. Individual or communal objectives for participation remain obscure, due to wishful expectations. This often results in strenuous planning and implementing community based research.
- Memoranda of understanding and research agreements with key partner institutions have been very instrumental for successful project implementation.
- Initially there is a strong demand for formal research procedures by all stakeholders. The formal type of research is increasingly replaced by more informal research. For many researchers and field workers this complicates matters. Skills for collecting, reporting, analysing and interpreting qualitative data are required. The shift to more informal research methods, however, indicates increased community ownership of the process and a development phase of innovations.
- Many research and development projects have the following words in their goal statement: improvement of livelihoods, increased equity and sustainable natural resources management. The pathways of reaching the goal need to be flexible. As end-user environments are dynamic, local priorities change, new opportunities for innovations arise, hence flexible outputs and activities can result in higher efficiency and impact. Imperfect community problem diagnosis at the start is more common than not, and doesn't need to be disastrous.

Forage adoption

- Non availability of forage seed in rural areas is a major bottleneck to adoption of forages. In many humid regions decentralised local seed production has been difficult or impossible, but vegetative multiplication of planting materials appeared a practical alterative. Many farmers have become skilled and efficient in vegetative multiplication systems, serving many other clients. Subsidies for local production of seed or panting material are useful initially, but should be phased out soon after.
- Within the nation as a whole, there are often large variations in climate and soil type providing suitable niches for forage seed production. Centralisation of seed production is preferable in this regard, taking advantage of optimal niches. Import and export of large quantities of seeds are impractical due to strict regulations and extremely lengthy procedures in most developing countries. Grass seeds loose viability during bad storage in the process.
- FSP results in SE Asia show that grass based technologies are preferred over legume based technologies for livestock production. Grasses generally have the following advantages: they produce more biomass, they establish faster, they are easy to propagate vegetatively, cattle and buffaloes traditionally feed on them. Legumes on the other hand serve special niches, multi-purposes and certain animal categories. The potential of tree legumes is very much under-utilised due

to some practical agronomic problems for farmers, such as lengthy establishment phase, which could be overcome.

- Diversity of forage options is essential, as these options suit the diversity of farming systems, niches, topography, fertility, microclimates, livestock, labour availability, customs, farm size, etc.
- In smallholder systems, improved grass and legume forages are rarely the sole feed resource for livestock. The impact of improved forages have been in systems where they serve a strategic supplementary role with existing basic feed resources.

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