Smallholder strategies and alternatives for sustainable integration of ruminants in upland crop livestock systems in Northern Vietnam

Y. Eguienta [1,2,3], C. Martin [1,2], J.C. Castella [1,4], Ph. Lecomte[2], O. Husson [1,2]
[1] *Mountain Agrarian Systems (SAM) Program, Vietnam Agricultural Science Institute (VASI), Thanh Tri, Hanoi, Vietnam*
[2] *Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Av. Agropolis, 34398 Montpellier Cedex 5, France,* [3] *Centre National d'Etudes Agronomiques des Régions Chaudes (CNEARC), Av. Agropolis, 34398 Montpellier Cedex 5, France,* [4] *Institut de Recherche pour le Développement (IRD), 213 rue Lafayette, 75480 Paris Cedex 10, France, and International Rice Research Institute (IRRI), Los Banos, Laguna, Philippines*

Introduction. Animal husbandry is a strong component of many of the diverse production systems of the mountainous *Bac Kan* province, one of the poorest in Northern *Vietnam.* As in most of Southeast Asia regions, smallholder farms on less than 2 ha provide the backbone of crop-livestock agriculture (Devendra and Sevilla, 2002). Buffaloes and or cattle have a critical role in the system, as draft animals, capital, and sources of fertilizer, 80% of households have at least one head (Eguienta, 2000). Since decollectivization (1980s and 1990s), the institutional, social and environmental contexts of agricultural production have dramatically changed. Population has grown, successive land use policy changes have driven the poorest to the hillside and back to their ancestral practices (Castella *et al.*, 2002). The increasing pressure of slash-and-burn cultivation systems has a deleterious impact on forest resource in the area. Steady reduction of the fallow cycle depletes soil fertility and exacerbates erosion (Husson *et al.*, 2001). However, livestock management systems remain unchanged. Animal feeding still relies on extensive roaming on meadows, forests and post harvest residue resources (Eguienta, 2000). Therefore, combined with agricultural pressure on land, there are significant social tensions and conflicts between and within villages reflecting the current imbalances between components of the agrarian crop-livestock-forest system. In such a context, facing the food needs of an increasing population and the necessity for renewed local smallholder practices, identifying household groups as potential targets for organizational and technical innovation transfer appeared a first step to improve crop-livestock interactions. The aim of the study is to characterise household diversity in terms of objectives, resource use, constraints and needs, and subsequent livestock management strategies and practices, in order to identify intervention points specific to each kind of farmer, profiling the ways for a diffusion of appropriate, sustainable innovations.

Analyzing animal husbandry through a systemic approach. In such systems effective natural resource management appraisal requires a holistic and systemic approach of the livestock farming system defined as "a combination of resources, animal species, techniques and activities mobilized by a community or a farmer, to convert natural resources into livestock production" (Lhoste, 1993). The data collection framework included field observations, exhaustive household surveys and interviews with key community members. It aimed to characterise households, cropping and livestock systems and links between activities. Two villages with particularly contrasting ethnic situations were studied: *Phieng Lieng* populated primarily by the *Tày* ethnic group with production systems based on lowland rice cultivation and *Ban Cuon* a *Dao* village with a large tradition in shifting cultivation on terraces and hillside. A total of 143 households (78%) were studied. Qualitative and quantitative data were analysed in a multiple correspondence factorial analysis (MCFA) to initiate a typology, discriminating household into homogenous types. Main active parameters were: irrigated rice food self-sufficiency SAL, draft need satisfaction levels STR, labour force TMO, slope/rice area ratio PEPA, number of buffalo, BU, total cultivated area TEX, age of the farm DEB and of the family head AGE, For each parameter classes were built as a compromise between maintaining an equilibrium between classes and accepting the limitations of these classes.

Crop-livestock farmer typology With 8 active and 4 supplementary class variables the first two axes of the MCFA account for 22% of the total variance. The "cropping systems" axis, is associated to SAL, *STR, PEPA; the second a "livestock/time" axis, BU, DEB, AGE* four main groups arise. Along the "livestock/time" axis, groups A and B are the young farmers (less than 38 years), who began to raise livestock after 1992 and own one or two buffaloes. Groups C and D are more established households who have been raising livestock since 1992 or earlier, with household heads older than 38 years, and who own three or more buffaloes. Along the "cropping systems" axis, groups A and D represent households with large rice-field areas. They are rice self-sufficient and gain income from selling surplus rice. They make minimal use of the hillsides, limiting themselves to some maize crops for pig feeding and small fruit tree or industrial plantations. Draft needs are high because of their large rice-field possessions. Groups B and C are households with few rice fields. They cannot meet their food-sufficiency needs with lowland rice, and compensate by heavily cropping the hillsides (Castella and Erout, 2002). Given their small rice field areas, their draft needs are easily satisfied by their buffalo herds, presenting them with the potential to evolve toward a market-based buffalo/cattle raising system. According to this repartition and other qualitative data the groups were described according to their ethnicity, mechanization and livestock diversification, and cattle surveillance practices. Crossing the groups with recent evolution patterns along these last descriptors led to a comprehensive and detailed view of 10 types having particular past trajectories and projects.

Identifying sustainable livestock feeding management systems Complementary alternatives to free grazing need to be developed to allow a better maintenance or growth of buffaloes and accompany the shift to cattle resulting from the mechanisation, in a way that fits the agricultural practices. Technical itineraries could be incorporated such as integrating forage production into innovative cropping systems. No tillage, direct seeding in grass or legumes covers techniques are already being tested in the area. The innovation is to develop a rotational cropping system incorporating two to four years of forage production, serving both as forage for animals and improved fallow vegetations controlled through punctual grazing to provide the right seeding cover at the right period. Short-term introduction of a cold-resistant post rice harvest crop like oats in the fall could be managed in the same way. Long-term communal improved pasturelands, growing grass hedges can just as well occur outside agricultural spaces. Making a better use of crop residues through conservation techniques could be promoted. However, the implementation and adoption of such innovations remain a problem. The integration of these components into livestock feeding systems need to be particularly considered with reference both to household types and to the community level as a whole. I.e. *Tay* households which maintain minimum livestock to meet their draft needs (types A, D1 and D4) will not take as much ownership in communal-based livestock management schemes as *Dao* households whose income relies on a larger number of livestock (types B2 and C1). The implementation of any of the above components requires significant initial labour input, and may also require chemical inputs i.e. to masterise the covers; this places the improvement of crop-livestock management practices in conflict with traditional cultivation practices. Farmers will need to make cost-effective decisions regarding the application of their labour force and according to their type will more or less adopt the proposal. On the other hand the entry of the animal interacting on the covers could also be a strong adoption factor of conservative agriculture techniques.

The role of research-development The proposed crop-livestock innovative practices requires scientific references and improved farmer knowledge of the following: optimal crop covering/ livestock use and species adaptation, winter resisting species/varieties for post harvest covers, cost effective fertilizing practices; minimal chemical input costs specifications on each resource management (cutting, on-the-spot grazing, rotation length, stocking rate, etc.); production levels of forage crops, as well as their nutritional values regarding animal needs, forage conservation methods for dry periods. Research also needs to be pursued inside the farm environment. This as an effective way to remain aware of the constraints faced by farmers and to co-construct animal feeding systems adapted to the farmer types or projects.

Conclusion The results are instructive in discriminating household types as potential targets for organizational and technical innovations for improving crop-livestock interactions. Innovations could be proposed for systems in which animal husbandry activities complement and interact in a synergic way with agricultural production, rather than competing with it. Problem solving in crop-livestock interactions in this region need to begin with a solid understanding of the multi-component livelihood strategies of the farmers involved. These alternatives need to be effectively organized both spatially to minimize labour requirements and temporally, to avoid conflicts with labour peaks and to ensure that the needs of livestock are met during the most crucial periods of the year. Identifying the most effective arrangement of resources in space and time necessitates the use of participatory diagnostic tools for improved communication and decision-making. Characterization of livestock systems and farmer situations are possible activities for research-development. Cultivated fields producing forage crops are an entry point for a better integration of agriculture-livestock systems, and can be complemented by further interactions, such as organic fertility management and labour efficiency. The development and intensification of sustainable animal husbandry practices through this kind of integration has the potential to equally benefit agricultural production and to improve the living standards of mountainous people. Finally, the intensification of livestock systems could further offer access to a more market-based cattle production.

References

Castella J.C., Husson O., Le Quoc Doanh and Ha Dinh Tuan 1999. Implementing the ecoregional approach in the Red River Basin uplands, Vietnam. In: (Kinh N.N. et al. Eds.) Towards an Ecoregional Approach for Natural Resource Management in the Red River Basin of Vietnam. The Agricultural Publishing House, Hanoi, Vietnam. pp. 75-94.

Castella J.C., Tran Trong Hieu, Eguienta Y. 2002a. Crop-livestock interactions in northern Vietnam uplands. II. Use of spatial graphic models as a common language between researchers and local stakeholders. SAM Paper Series 12, Vietnam Agricultural Science Institute, Hanoi, Vietnam

Devendra C, Sevilla C.C. 2002. Availability and use of feed resources in crop-animal systems in Asia. Agricultural Systems 71: 59-73.

Eguienta, Y. 2000. Diagnostic des systèmes d'élevage bovo-bubalin dans une zone de montagne du Nord Vietnam, district de Cho Don, province de Bac Kan. M.Sc. Dissertation, CNEARC, Montpellier.

Husson O., Castella J.C., Ha Dinh Tuan, Naudin K. 2001. "Agronomic diagnosis and identification of factors limiting upland rice yield in mountainous areas of northern Vietnam." SAM Paper Series 2, Vietnam Agricultural Science Institute, Hanoi, Vietnam

Lhoste P., Dollé V., Rousseau J., Soltner D. 1993. Manuel de zootechnie des régions chaudes : Les systèmes d'élevage ». CIRAD. Collection Manuels et précis d'élevage. Ministère de la Coopération. pp. 287.

Tran Quoc, H., 1999. Le processus de différenciation des exploitations agricoles dans une commune du Nord Vietnam: Commune de Ngoc Phai, Province de Bac Kan. Unpublished M.Sc. Thesis, IRRI / VASI / IRD / CNEARC, Montpellier, France. 164 p.

Eguienta Y.K., Martin C., Lecomte P. and Husson O. 2002. Crop-livestock interactions in northern Viet Nam: issues, diversity of farmers' responses and alternatives for sustainable integration of animals in upland agricultural systems. In: (J.C. Castella and Dang Dinh Quang eds.) Doi Moi in the Mountains. Land Use Changes and Farmers' Livelihood Strategies in Bac Kan Province, Viet Nam. The Agricultural Publishing House, Ha Noi, Viet Nam.

Eguienta Y., Martin C., Castella Jean-Christophe, Lecomte P., Husson O.

Smallholder strategies and alternatives for sustainable integration of ruminants in upland crop livestock systems in Northern Vietnam. In : Proceedings of the international conference : responding to the increasing global demand for animal products

Penicuik, 2002: BSAS, 121-122

International Conference : Responding to the Increasing Global Demand for Animal Products, Merida (MEX), 2002/11/12-15.