Agronomic diagnosis and development of direct sowing techniques

Upland rice-based cropping systems in mountainous areas of Northern Vietnam

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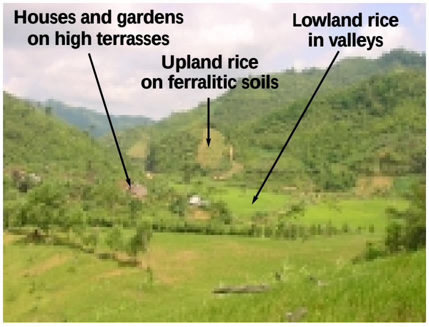
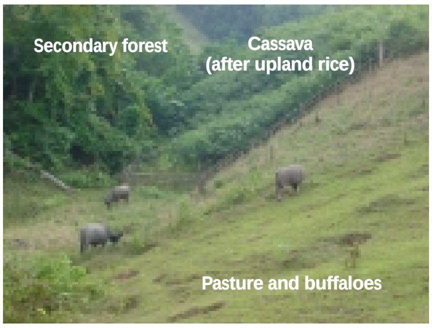
Agronomic diagnosis

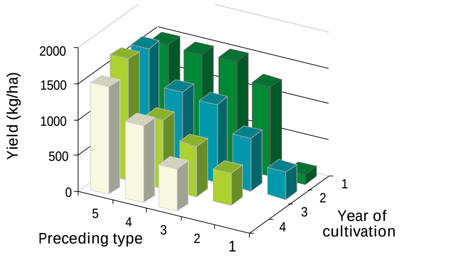
In the mountains of Northern Vietnam, with the rapid population growth, the high pressure of cattle and changes in land tenure, the traditional systems of slash-and-burn are no longer sustainable and have been banned. It is extremely urgent to propose to farmers simple, low-input, sustainable agronomic practices and cropping systems, enabling long-term settlement on field after forest clearing. A rapid but sound and clear agronomic diagnosis was conducted in 1998/1999. Major cropping situations and land use types were identified.





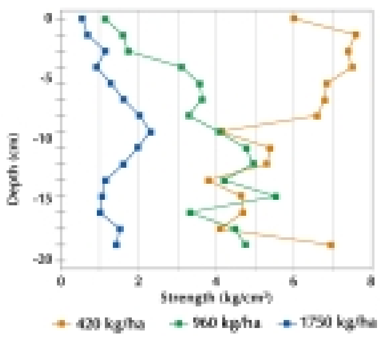
Main factors limiting upland rice yield (at various scales) were identified and ranked: Between fields, upland rice yield variations mainly are explained by preceding vegetation type and number of years of cultivation after slashing and burning the forest. Within field, major factors limiting rice yield are soil physical and chemical characteristics, in relation to poor biological activity. These factors reflect, at various scales, the level of soil regeneration (during fallow periods, but limited by intensive cattle grazing and extraction) or degradation (especially erosion during cultivation periods). At both scales, yield also can be put in relation to weed pressure.

Rice yield as a function of preceding vegetation type and number of cultivation

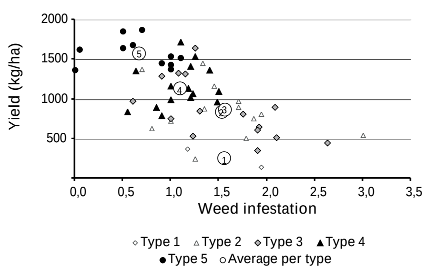


Type 1: Old pasture (over 20 years)
Type 2: Less than 10 years-old forest or 10-20 years-old forest, heavily grazed
Type 3: 10-20 y.o. forest moderately grazed or over 20 y.o. forest, heavily grazed
Type 4: 10-20 y.o. forest not grazed or over 20 y.o. forest, moderately grazed
Type 5: Over 20 years-old forest, not grazed

Rice yield as a function of soil compaction

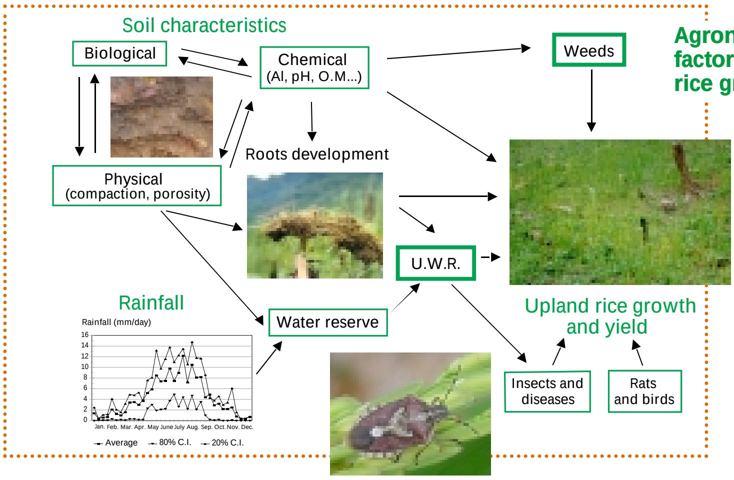


Rice yield as a function of weed pressure and preceding vegetation type



Rainfall and soil physical characteristics determine water reserve. Soil physical and chemical characteristics limit roots development. As a consequence, useful water reserve (UWR) is very limited. Together with high weed pressure, this leads to poor plant development. Weak plants also have low resistance to pests and diseases. As a consequence, yields are low (1 t/ha on average) and unstable.

Agronomic diagnosis: factors limiting upland rice growth and yield



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Development of cropping systems based on direct sowing techniques

Direct sowing techniques were adapted to local conditions as they can address the actual causes of the problems, not only the symptoms. First, they were tested in small plots. Most promising systems were then applied in large plots, across the toposequence, in farmers 'conditions. Practical and economical solutions could be proposed to and developed with farmers. These techniques are based on two main principles: 1. Replace mechanical ploughing by biological improvement of soil structure, and 2. Always keep the soil covered with living or dead mulch.

Improvement of soil structure by plants with strong root systems and development of biological activity

Earth worm and galeries

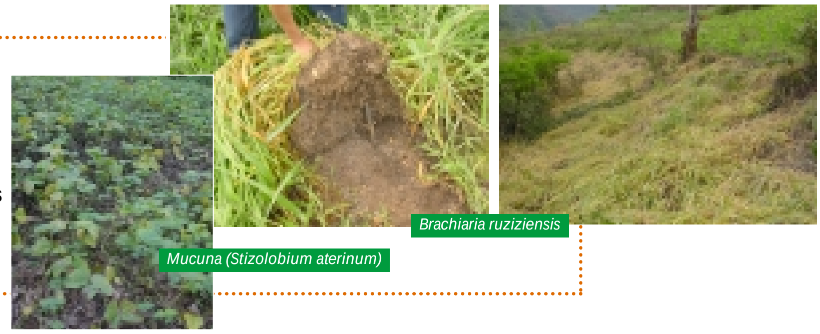
Brachiaria humidicola

Brachiaria brizantha

Erosion control and mulch production

Soil always covered with living or dead mulch:

- Prevents erosion
- Increases infiltration
- Reduces evaporation
- Buffers temperature
- Helps development of micro and macro organisms
- Controls weeds
- Increases organic matter content and provides nutrients



Mucuna (Stizolobium aterinum)

Brachiaria ruziziensis

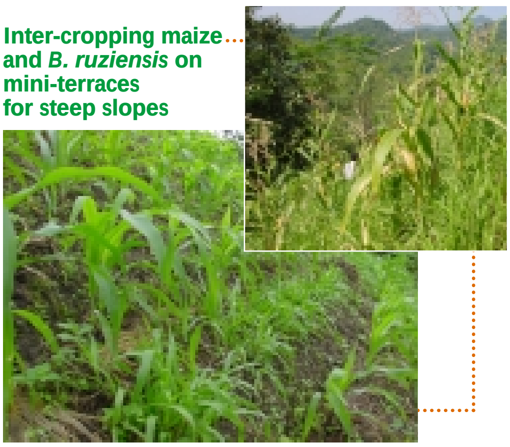
Weeds control by a thick mulch

Direct sowing in mulch

Ecobuage or slow soil cooking for rapid improvement

1.7 t/ha, first year, on degraded soil, without fertiliser

Inter-cropping maize and *B. ruziensis* on mini-terraces for steep slopes



Crop rotation and diversification

Maize, soyabean, peanuts, etc.
Forages production

Vietnam Agricultural Sciences Institute

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