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Food-crop-based production systems as sustainable alternatives for *Imperata* grasslands?

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Abstract. Purely annual crop-based production systems have limited scope to be sustainable under upland conditions prone to infestation by *Imperata cylindrica* if animal or mechanical tillage is not available. Farmers who must rely on manual cultivation of grassland soils can achieve some success in suppressing *Imperata* for a number of years using intensive relay and intercropping systems that maintain a dense soil cover throughout the year, especially where leguminous cover crops are included in the crop cycle. However, labour investment increases and returns to labour tend to decrease in successive years as weed pressure intensifies and soil quality declines.

Continuous crop production has been sustained in many *Imperata*-infested areas where farmers have access to animal or tractor draft power. *Imperata* control is not a major problem in such situations. Draft power drastically reduces the labour requirements in weed control. Sustained crop production is then dependent more solely upon soil fertility management. Mixed farming systems that include cattle may also benefit from manure application to the cropped area, and the use of non-cropped fallow areas for grazing. In extensive systems where *Imperata* infestation is tolerated, cassava or sugarcane are often the crops with the longest period of viable production as the land degrades.

On sloping *Imperata* lands, conservation farming practices are necessary to sustain annual cropping. Pruned tree hedgerows have often been recommended for these situations. On soils that are not strongly acidic they may consistently improve yields. But labour is the scarcest resource on small farms and tree-pruning is usually too labour-intensive to be practical. Buffer strip systems that provide excellent soil conservation but minimize labour have proven much more popular with farmers. Prominent among these are natural vegetative strips, or strips of introduced fodder grasses.

The value of *Imperata* to restore soil fertility is low, particularly compared with woody secondary growth or *Compositae* species such as *Chromolaena odorata* or *Tithonia diversifolia*. Therefore, fallow-rotation systems where farmers can intervene to shift the fallow vegetation toward such naturally-occurring species, or can manage introduced cover crop species such as *Mucuna utilis* cv. *cochinchinensis*, enable substantial gains in yields and sustainability. Tree fallows are used successfully to achieve sustained cropping by some upland communities. A variation of this is rotational hedgerow intercropping, where a period of cropping is followed by one or more years of tree growth to generate nutrient-rich biomass, rehabilitate the soil, and suppress *Imperata*. These options, which suit farmers in quite resource-poor situations, should receive more attention.