

1. INTRODUCTION

In Southeast Asia, maize is the second most important staple food and a major component of animal feeds. As the demand for maize is rapidly outpacing the supply and suitable land for intensive lowland agriculture is no longer available, farmers are growing more maize in the uplands. However, the cultivation for agricultural food crops using low-level inputs in the uplands, especially on acid soils, has been shown to collapse because of *Imperata* weed infestation.

Once *Imperata* infest the field, the farmers may only have one or two harvests before the weeds completely cover the land. Thus, farmers abandon the field when they can no longer control the *Imperata* as the cropping period proceeds, and cultivation is no longer economic.

This study investigates and compares management strategies to control *Imperata* at various stages of infestation in maize cultivation. Specifically, this study identifies the most probable nutrient constraining maize yields and favoring *Imperata* infestation in the study area.



2. METHODOLOGY

Study Area

The field research was conducted in the buffer zone of Lore Lindu National Park (LLNP), about 50 km south-east of Palu, the capital of Central Sulawesi, Indonesia.

The experimental site is located in the rainforest margins of Napu Valley at Dodolo village, with an average elevation of 1140 m asl.

Selected fields were currently or in the past under continuous maize cultivation, directly adjacent to a forest and surrounding croplands, and with different degrees of *Imperata* infestation.

Experimental Fields

Table 1: Categorization of selected cultivated area by degree of *Imperata* infestation using 500 shoots m² as reference for full coverage of *Imperata* shoots m²

Field	Degree of <i>Imperata</i> infestation	Shoots counts m ²	Range of infestation (%)	Cleared from natural forest	Years of maize cultivation
A	Low [1% - 25 %]	12 - 130	2.4 - 20.6	2001	2
B	Medium [26% - 50 %]	131 - 250	26.2 - 50.0	1996	4
C	High [51% - 75 %]	277 - 355	55.4 - 75.0	1995	5

Experimentation

The study was carried out in two sets of field experiments. The first experiment, a two cropping cycle on all three fields (A, B, C). As treatment, land preparation method (deep hoeing or herbicide application) superimposed with a cropping strategy (NPKS fertilizer application or mucuna relay or without both as control). Residual effects were measured in the subsequent crop cycle. The second experiment was a one cropping cycle on low (A) and high (C) infested fields. Shallow hoeing as land preparation method superimposed with the same cropping strategy. The purpose of the combined treatments was to control and suppress *Imperata* re-growth, and for soil fertility maintenance or enhancement.

3. RESULTS

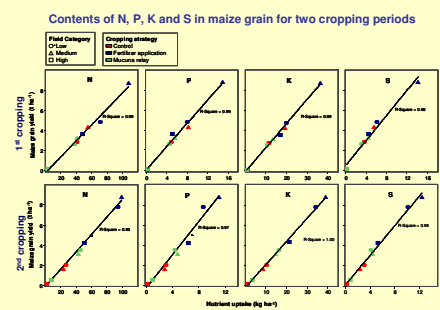
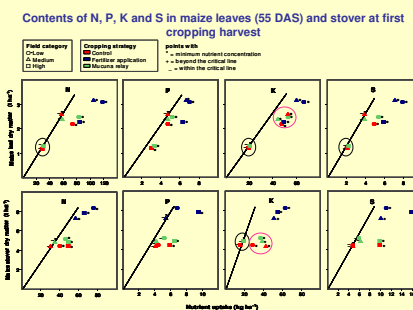
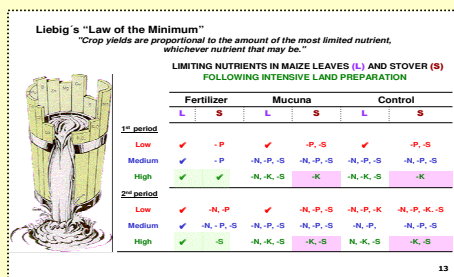
Deep hoeing and herbicide (glyphosate) application are equally effective, while the shallow hoeing has limited success.

A superimposed crop management practice (a soil fertility enhancement strategy) during maize cropping is vital after *Imperata* control.

The effective elimination of initial *Imperata* infestation opens up the opportunity to enhance and supply the nutrients needed by maize for its growth and DM production with the application of fertilizers.



The analysis of nutrient levels in maize DM suggests that among the four nutrients, K was the primary factor determining the low grain yield in the high-infested field.



4. CONCLUSION

- Imperata* eventual invasion of a field can be avoided by maintaining or improving soil fertility status from the onset of cropping to avoid the depletion of soil nutrients to levels limiting for crop productivity.
- The key concept lies in correcting the limiting nutrients in the infested fields with the right kinds and amounts of fertilizer in order for the crop to achieve an optimum yield.
- Ultimately, if no economic return can be derived from cultivating the fields, farmers would eventually abandon the land or seek other potential cultivation areas in the forest areas and leaving the fields more vulnerable to *Imperata* invasion.