

The WaNuLCAS model can predict some of the biophysical benefits and consequences that are commonly attributed to agroforestry systems.



The shallow rooting system of *Gliricidia* causes competition (Left) for nutrients and water with maize roots. The deep rooting system of *Peltophorum*, leads to less competition and reduces N leaching (right)

- The WaNuLCAS model version 2.0 was used to simulate different scenarios on a daily time step for 9 years for some of the described cropping systems (Table 1) established on an Ultisol at the Biological Management of Soil Fertility (BMSF) Project site (4° 31' S, 104°55' E), Kotabumi, Lampung, Indonesia.
- An annual total rainfall of 3102 mm (1 Nov 1997 – 31 Oct 1998) was used in the simulations

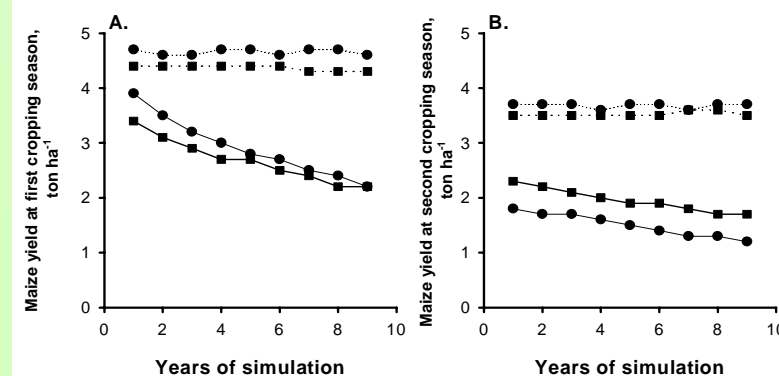
Farmers have a simple terminology for soil fertility by using the distinction '**hot**' versus '**cool**'. A C_{org}/C_{ref} ratio of 1 is a soil just derived from forest, called '**cool**' by farmers; values towards 0 are increasingly '**hot**', while values above 1 are '**cooler than cool**'.

Table 1. Scenario of cropping systems for WaNuLCAS simulations

Cropping systems	Explanation
1. Maize-maize monoculture	Without fertilizers
2. Maize-maize monoculture	With fertilizer 90 kg N ha ⁻¹ , every planting
3. <i>Peltophorum</i> +maize-maize hedgerow intercropping	Without fertilizer
4. <i>Peltophorum</i> +maize-maize hedgerow intercropping	With fertilizer 90 kg N ha ⁻¹ , every planting

Note: (+) multiple cropping; (-) followed by

Example 1 : Predicted Maize Yield

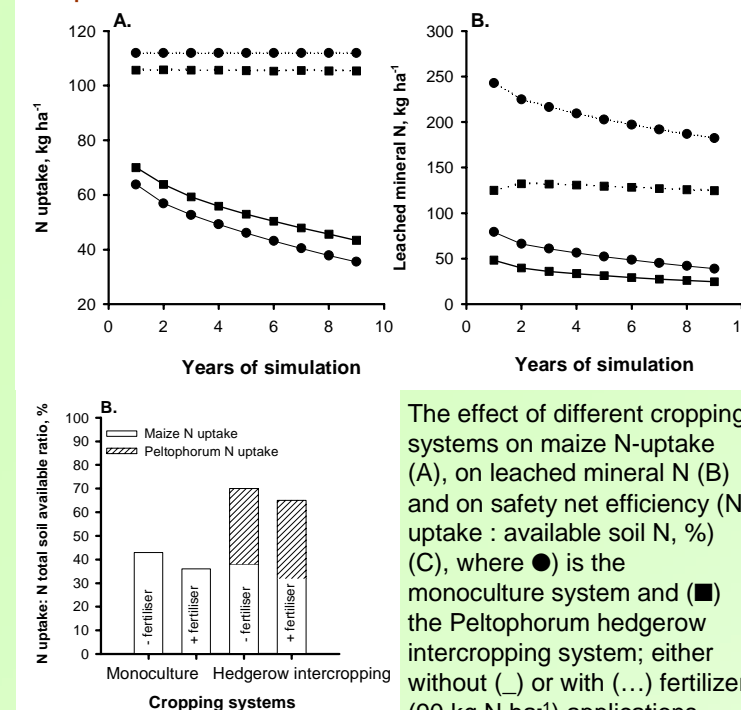


Maize yield of the first cropping season (A) and maize yield of second cropping season (B), where (●) is the monoculture system and (■) the *Peltophorum* hedgerow intercropping system; either without (—) or with (...) fertilizer application (90 kg N ha⁻¹)



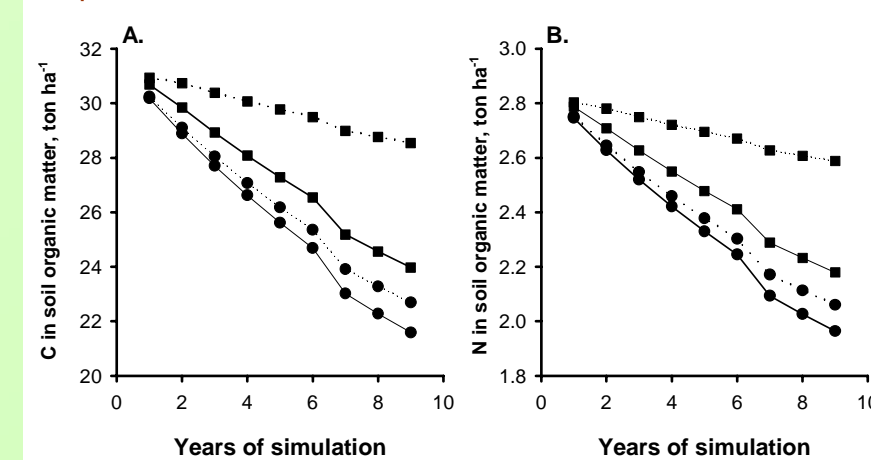
Dark colored soil, rich in organic matter, moist soil....COOL SOIL

Example2 : Predicted N balance



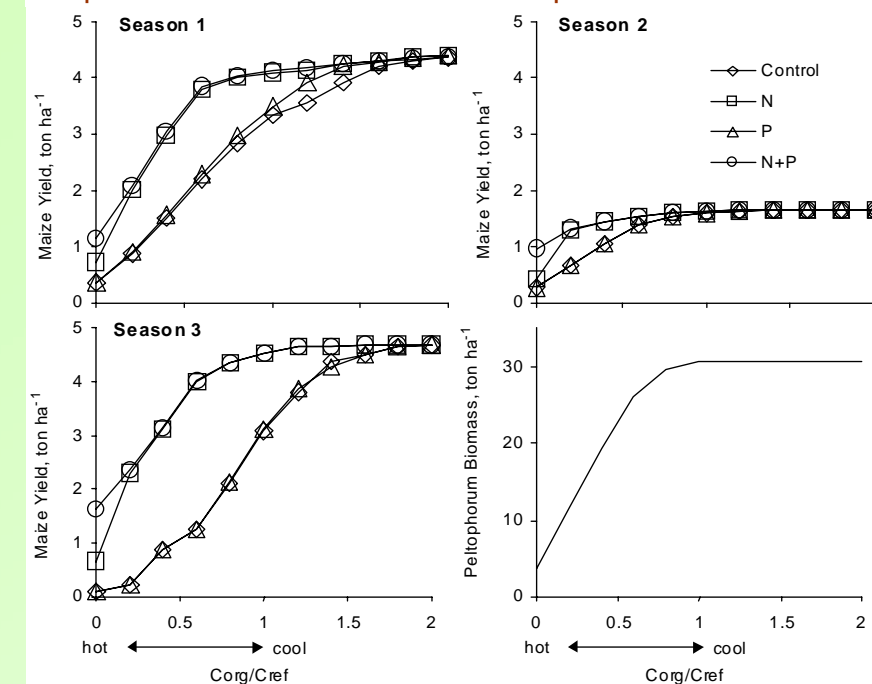
The effect of different cropping systems on maize N-uptake (A), on leached mineral N (B) and on safety net efficiency (N-uptake : available soil N, %) (C), where (●) is the monoculture system and (■) the *Peltophorum* hedgerow intercropping system; either without (—) or with (...) fertilizer (90 kg N ha⁻¹) applications

Example 3 : Predicted soil C and N-total in SOM



Trends of C-total in soil organic matter (A) and N-total in soil organic matter (B) in different cropping systems where (●) is the monoculture system and (■) the *Peltophorum* hedgerow intercropping system; without (—) and with (...) fertilizer (90 kg N ha⁻¹) applications.

Example 4 : Native soil C and fertilization in fallow - crop rotation



Hedgerows of *Peltophorum* in fields of maize



Organic layer under (9 years) *Peltophorum* woodlots

Predicted yield of maize over three seasons (season 1 and 3 in the wettest part of the year (December – March) for two subsequent years, season 2 in the drier April – June period, after two years of fallow dominated by the local tree *Peltophorum*, as a function of the initial organic matter content of the soil, with or without the use of N and/or P fertilizer.

Conclusion

Overall this example shows that we can translate the '**coolness**' property of the soil to the model and make sensible predictions of the responses to soil organic matter, the use of fertilizer and the difference between seasons and years.

In the near future we hope that the model can be used by agricultural extensionists with the help of researchers to answer such questions, and to do a large number of 'mental experiments' that can help the farmers in learning faster and wasting less time on systems where the negative interactions will dominate over the positive ones.