# ADAPTATION to CLIMATE CHANGE:

## Is the Quesungual system an option for smallholders in dry hillsides agroecosystems?

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**The answer is YES.** Local experience over the past 15 years, and results of research, have demonstrated that the use of Quesungual Slash and Mulch Agroforestry System (QSMAS) has a high potential to improve food security in vulnerable regions while protecting the environment.

QSMAS is a smallholder production system with a group of technologies for the sustainable management of soil, water and nutrients in drought-prone areas of hillsides agroecosystems of the sub-humid tropics. In southwest Honduras (Central America), the system has been proved to be resilient even to extreme climatic events such as El Niño (1997) and hurricane Mitch (1998).

QSMAS integrates local and technical knowledge and provides resource-poor farmers an alternative to replace the non-sustainable, environmentally unfriendly slash and burn (SB) traditional production system.

The technologies used in QSMAS can be synthesized in the form of four basic principles. Following the principles, we provide a brief technical explanation of their impacts, and the science behind those principles that support the recommendation of QSMAS as an option to achieve food security in fragile areas. Our conclusion is that QSMAS can provide an option for farmers to adapt to, as well as contribute for mitigation of, climate change, while reducing some of the negative effects of agriculture on the environment.

## The four basic principles...

### 1 No slash & burn

Management (partial, selective, and progressive slash-and-prune) of natural vegetation.

### 2 Permanent soil cover

Continual deposition of biomass from trees, shrubs and weeds, and through crop residues.

### 3 Minimal disturbance of soil

No tillage, direct seedling, and reduced soil disturbance during agronomic practices.

### 4 Improved fertilizer practice

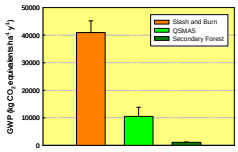
Appropriate application (type, amount, location) of fertilizers.

## ...& the science behind them

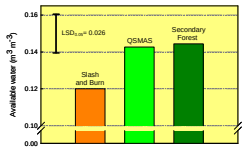
**IMPACTS of the PRINCIPLES:**

- **Green house gases (GHG):** Reduced carbon emissions.
- **Soil-plant-atmosphere continuum:** Reduced impact of raindrops, reduced runoff and soil losses through erosion, increased infiltration and water holding capacity, reduced evaporation and increased use of green water, and improved crop water productivity.
- **Soil physical quality:** Improved soil aggregation and therefore improved soil structure.
- **Soil chemical-biological quality:** Improved soil organic matter, soil biological activity, source of nutrients and fertilizer use efficiency; and minimized risk for crop failure.

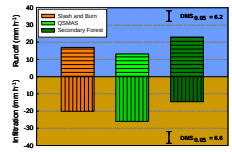
**The above can be summarized as increased C synthesis and accumulation, accelerated nutrient cycling and improved crop water productivity in a resilient production system, thereby enhancing support for livelihood in rural areas.**

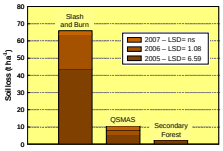



**GHG emission:** QSMAS reduces the risk (42%) for global warming potential (GWP) compared to slash and burn (SB) system (20 year scenario).

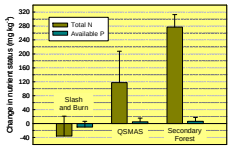



**Soil water:** QSMAS improves dry season adaptation of crops through higher soil water availability together with reduced runoff and increased infiltration compared to SB.

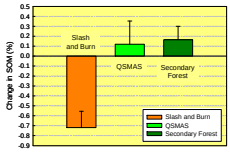


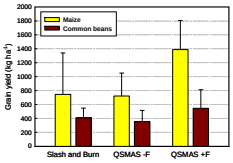




**Erosion:** QSMAS protects soil by markedly reducing soil losses (~7.5 times in two years) compared to SB system.




**Soil quality:** QSMAS improves soil nutrient status and soil organic matter (SOM) content (0-20 cm soil depth) compared to SB system (after one year).




**Honduras (2005-06):** Productivity is higher in QSMAS than in SB system (-F = no fertilizer).

**QSMAS also provides environmental services:**

- Increase of soil quality and resilience
- Increase of water quality and availability
- Recuperation of degrading soils
- Mitigation of greenhouse gases fluxes
- Improved C capture
- Conservation of biodiversity
- Mitigation of impact related to natural disasters and/or climate change

**Honduras (2007): value of environmental services**

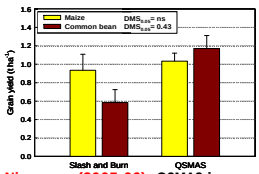
**US$ 2,240 per hectare**

considering: (i) Soil and water (runoff, infiltration, water holding capacity, and soil losses); and (ii) C capture (soil organic carbon)

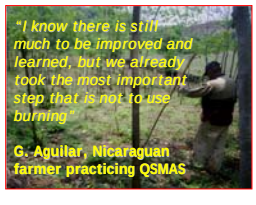
## Is QSMAS suitable for adoption by small farmers in other tropical sub-humid ecoregions?

**The answer is YES.**

Experience over three years of on-farm participatory validation in Nicaragua (Somotillo) and Colombia (Suárez) suggests that QSMAS will be readily accepted and adopted by smallholders in similar agroecosystems. It also received strong support from local authorities and policy makers.

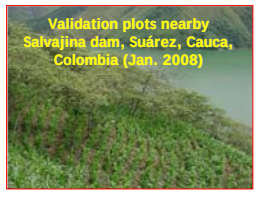



**Nicaragua (2005-06):** QSMAS improved net income (83%) compared to SB system.

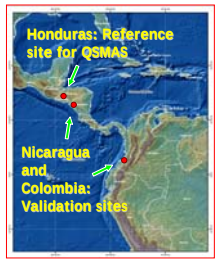


*"I know there is still much to be improved and learned, but we already took the most important step that is not to use burning"*

G. Aguilar, Nicaraguan farmer practicing QSMAS



Validation plots nearby Salvajina dam, Suárez, Cauca, Colombia (Jan. 2008)

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