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Potential of *Crotalaria* spp. in the Agroecological Restoration of Fruit Orchards in the Soconusco, Chiapas, Mexico

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Introduction

Fruit growing is an important source of income in the Soconusco region of Chiapas, where total orchard acreage exceeds 40,000 hectares (SIAP, 2010). Rambutan (*Nephelium lappaceum* L.), a tropical fruit tree native to the Malaysian and Indonesian archipelagos (Tindall, 1994) is largely unknown in Mexico, and acreage is small. The main production area for local and export markets is the Soconusco region in Chiapas, where agro ecological conditions are considered ideal for a promising development of this system (Vanderlinden *et al.*, 2004). Rambutan orchards are being established and acreage is increasing with little regard for proper technology, crop management and good managing practices, not to mention adequate postharvest processing and marketing procedures. Considering the economic and industrial benefits that this tree offers, development of an ecologically sound Rambutan-based agro system seems justified, and has led to the present research on legume/Rambutan intercropping as a means to establish a sustainable agro ecological management of this fruit crop in the Soconusco region. By determining the affluence of different species of native legumes associated with Rambutan it is possible to evaluate the ability of insect fauna to regenerate and to analyze the changes in biomass production as well as the effects of the association of legumes on the productivity of the Rambutan system and on the fertility of the soil.

Material and Methods

Research was initiated in August 2006, in a one-hectare Rambutan lot in the Soconusco region of Chiapas, Mexico; the experimental plot is located as follows: 15° 21' N, 92° 33' W, over 335 m.a.s.l. Climate is defined as warm humid tropical with daily medium temperatures ranging from 26.5°C to 28.7°C, and an average yearly precipitation of between 2500 and 3200 mm. The *Nephelium* orchard was established in 2000, using an 8 x 8 m spacing. Selected buds were grafted on scions obtained from a local nursery.

Table 1. Characteristics of the integrated treatments in the Rambutan orchard

Factors	Description of the treatments
A ₁	1. Rambutan + <i>Crotalaria spectabilis</i> (Forrage 'Chipilín')
A ₂	2. Rambután + <i>Crotalaria longirostrata</i> (Edible 'Chipilín')
A ₃	3. Rambután + <i>Vigna unguiculata</i> (Cowpea)
A ₄	4. Rambutan without legumes (mechanical weeding)

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An experimental area of 1,536 m² was selected for this investigation, in four 24 x 16m plots using a completely randomized experimental design with 6 repetitions.

Table 2. Parameters of weed and insect population dynamics

Variables	Methods
• Weed Diversity	Number of species per m ²
• Weed Abundance	Number of individuals / species per m ²
• Weed Biomass	Dry Biomass (gm ⁻²) per specie and m ²)
• Insect Abundance	Number of individuals / species and per sample (40 x 40 cm traps)
• Insect Diversity	Number of species per trap

Results and Discussion

Legumes intergrown within the Rambutan plantation initiated a notable change in the structure of weed coenosis. Upon rotation with *C. spectabilis* was obtained a total biomass production of 1,918 kg ha⁻¹ (Figure 1). *C. Spectabilis* contributed with 82% of total biomass and weeds only 18%. This legume produced satisfactory weed control during its growth and development period inside the Rambutan agrosystem.

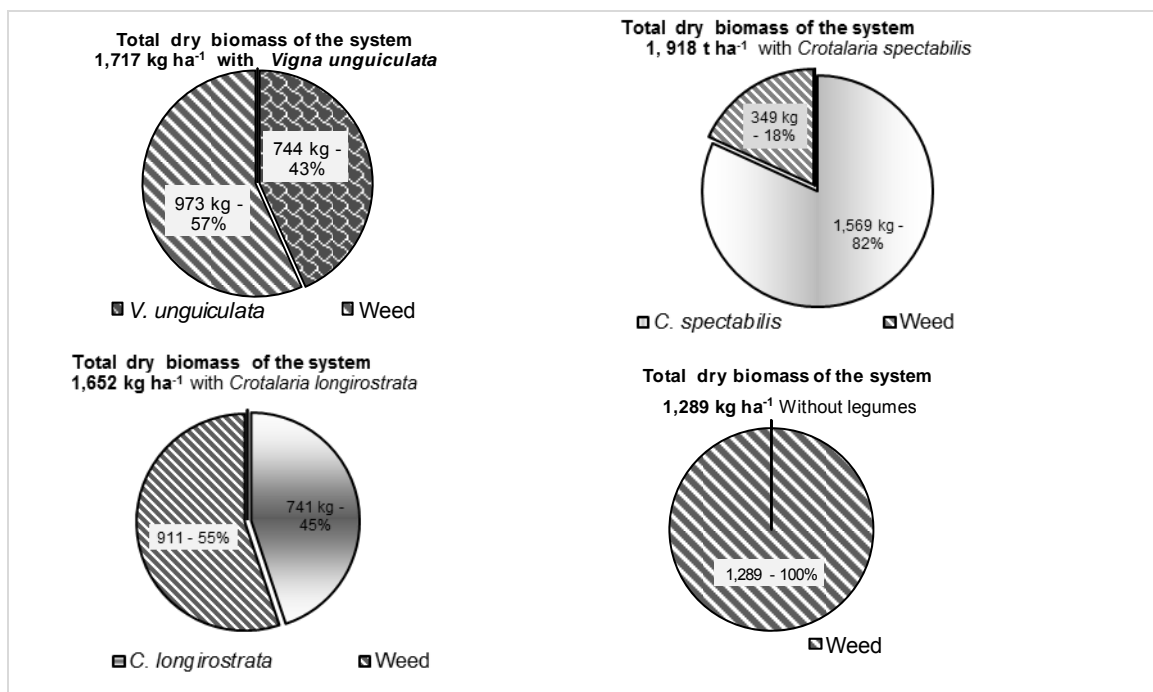


Figure 1. Total dry biomass production of Rambutan agro systems intercropped with different legumes

The fast growth habits of *C. spectabilis*, is evident in “Chipilin” (*C. spectabilis*) by its height, which averages 2.25 m. The abundant blooming of this legume played a very important role in the rehabilitation of the insect population during the period from November 2006 to February 2007. Blooms attracted insects of the Lepidoptera, Hemiptera (Aphididae) and Hymenoptera (Meliponidae) species. Their activities resulted in enhanced pollination and established communities with low pest risk to the Rambutan crop.

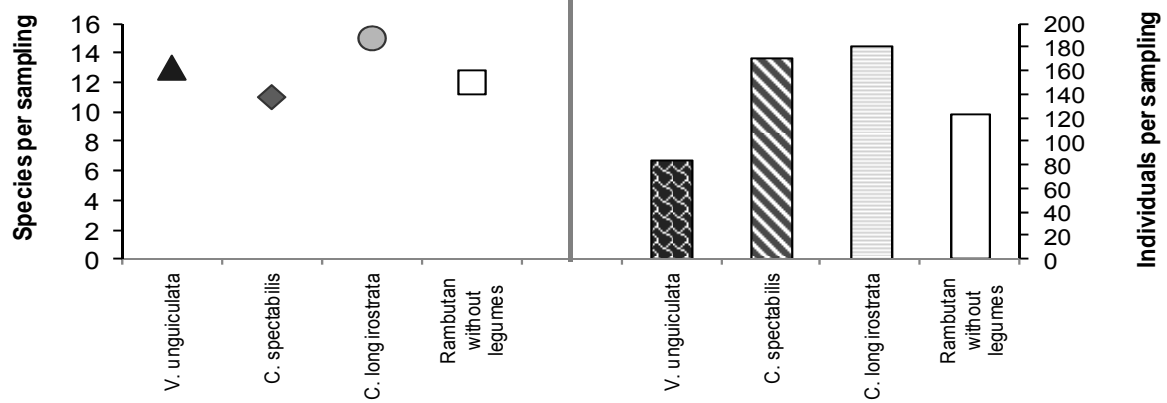


Figure 2. Insect Diversity in different Rambutan/legume associations

Soil organic carbon in the 0 – 10 cm layer in the Rambutan orchards interplanted with legumes was clearly superior to that registered in the Rambutan system without legumes. Organic carbon percentage for the sites with legumes fluctuated between 2.67 and 2.83%, whereas Rambutan systems with no legumes reached 2.16% (Figure 3).

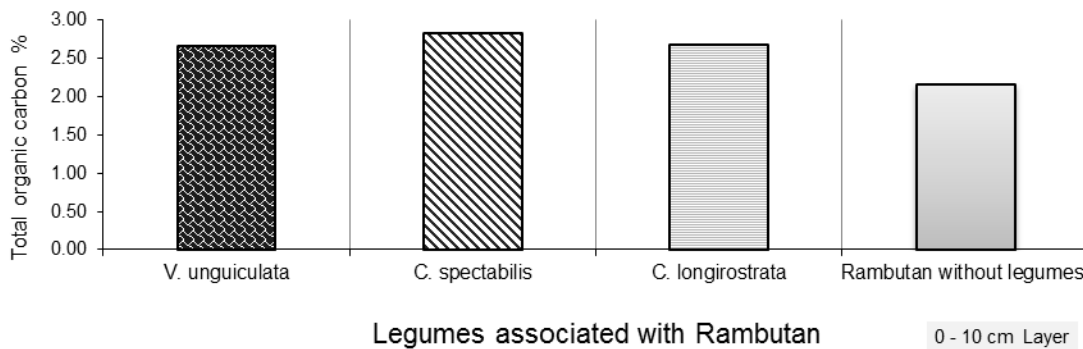


Figure 3. Soil organic carbon content in Rambutan orchards interplanted with different legumes and without legumes.

Nitrogen level of the soil in the 0 – 10 cm layer was higher in soils with legumes as occurred with organic carbon. Results showed N contents consistently superior to those in the site without legumes

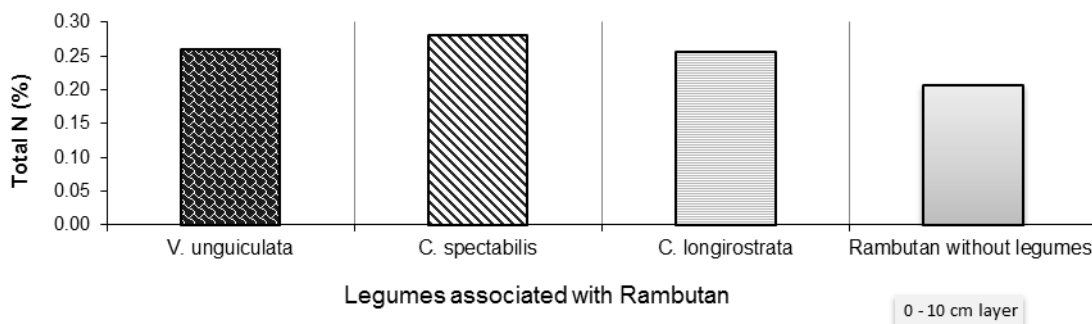


Figure 4. Total N content in Rambutan/Legume and Rambutan without legume interplants

Rambutan performance in the plot interplanted with 'Chipilin' was significantly better than the other treatments. Rambutan fresh fruit production was 5,194 kg ha⁻¹ at this site. The plot intercropped with eatable Chipilin yielded 2,447 kg ha⁻¹ and the no legumes system produced 3,187 kg ha⁻¹. The highest performance shown in the *C. spectabilis* site is the result of a higher number of panicles per tree, and fruit per panicle. The best fruiting and performance in the treatment with *C. spectabilis* is the product of the frequent visits of the stingless bees (Meliponidae), which are considered the most important pollinators in the Rambutan orchards in the Soconusco region.

Conclusion and Outlook

Results of this work in the Rambutan agrosystem demonstrate in a meaningful way that the evaluated *Fabaceae* species change the composition of the vegetal biomass, cover the soil, improve the fertility of the soil and increase the diversity and abundance of the insect fauna. These agro ecological changes enhance Rambutan performance and provide an additional income source for producers

References

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