which correspond to the three-pronged goal of sustainable development: (i) ecological sustainability (through increased ecosystem resilience), (ii) economic stability (through diversified, less risk-prone sources of income), and (iii) social well-being (through lower emigration).

Keywords: *coffee plantations, ecological sustainability, economic profits, social well-being, Mexico*

PP5.1.6. Productivity of Conilon coffee in agroforestry system and monocrop in the Brazilian Amazon

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Due to the economic, social and environmental advantages of agroforestry systems, its adoption in the Amazon can be one of the alternatives of promoting the sustainability of agricultural production in this region. The objective of this work was to evaluate the effect of two coffee crop systems (monocrop and agroforestry system) on the productivity of different cultivars of conilon coffee (*Coffea canephora*). The research was conducted at Embrapa Acre, in Rio Branco-Acre, Brazil (10º1'30"S, 67º42'18"W, 160 m of altitude). A randomized complete block design was used in split plot, with six treatments and six replications. Plots were represented by coffee crop systems and subplots by conilon coffee cultivars (BRS-Ouro Preto, Robusta Tropical and Espirito Santo), with 14 coffee plants per subplot. The agroforestry system was composed of coffee, açaí (*Euterpe oleraceae*), andiroba (*Carapa guianensis*) and banana (*Musa* sp). Production coffee data was related to the first harvest. They were subjected to variance analysis in the SISVAR software and means were compared by Tukey test at 5% probability. There was no interaction between the factors studied. The cropping systems had no influence on the processed coffee productivity. However, there were significant differences in productivity among the studied coffee cultivars. Cultivars BRS-Ouro Preto and Robusta Tropical were the most productive and did not differ among themselves, with an average productivity of 0.59 and 0.52 kg of processed coffee per plant respectively; while the cultivar Espirito Santo differed from the others with productivity almost 50% lower than the others (0.28 kg of processed coffee per plant). It is assumed that the absence of effect of cropping systems on the coffee productivity was due to the spacing adopted and age of the forest species in the SAF, which had not yet grown enough to promote positive or negative interactions, to influence the coffee productivity.

Keywords: *Amazon, coffee, multi-strata, native tropical species*

PP5.1.7. Uniformity of fruit ripening of Conilon coffee in agroforestry system and monocrop system

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The objective of this work was to evaluate the effect of two coffee cropping systems (monocrop and agroforestry system) on the uniformity of fruit ripening of different cultivars of conilon coffee (*Coffea canephora*). The research was conducted at Embrapa Acre, in Rio Branco-Acre, Brazil (10º1'30"S, 67º42'18"W). A randomized complete block design was used in split plot, with six treatments and six replications. Plots were represented by coffee crop systems and subplots by conilon coffee cultivars (BRS-Ouro Preto, Robusta Tropical and Espirito Santo). The agroforestry system was composed by coffee, açaí (*Euterpe oleraceae*), andiroba (*Carapa guianensis*) and banana (*Musa* sp). Data of coffee

ripening were collected in the first harvest. At the first harvest of coffee, sample of 200g of coffee fruits were removed each plot and quantified by counting of the unripe, ripe (cherry) and dry fruit. Subsequently was calculated the proportion of coffee fruits at each maturation stage. The ripening stage of coffee fruits was different in the two cropping systems. There was a slight improvement in uniformity of fruit ripening from the agroforestry system. Fruits of coffee plants in monocrop, in other words under full solar radiation, showed maturity stage advanced than the fruits from agroforestry system, which were shaded. In the monocrop there was a higher percentage of dry fruits (40%) and a smaller fraction of green fruits (19%), while the opposite occurred in the agroforestry system, where only 20% of the fruits were dried and 29% green. The percentage of mature fruits was 41 and 51% in monoculture and agroforestry systems, respectively. The coffee cultivars showed similar behavior. All cultivars had 37% of dry fruits. Vitoria and Espírito Santo cultivars showed 24% of green fruits and BRS Ouro Preto 25%. The percentage of ripe fruit was 31% in BRS-Ouro Preto and 37% in other.

Keywords: *Amazonian Region, Coffea canephora, multi-strata*

PP5.1.8. The efficiency of cocoa pollination in agroforestry systems under bio-fertilizer application

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In the humid tropics, a significant amount of the agricultural landscape where cocoa (*Theobroma cacao*) is grown is managed as agroforestry systems and pressures to intensify cocoa production are likely to increase. The current trend for agricultural intensification in cocoa cultivation worldwide aims at significant reductions or total elimination of the shade canopy. However, losing the shade canopy implies losing the potential to produce valuable ecosystem services and particularly cocoa pollination. Pollination is a limiting factor of cocoa production that has been investigated in the 70's and 80's essentially by trapping methods. The genus *Forcypomia* sp. is acknowledged to be the main insect responsible for cocoa pollination, when other insects such as ants and *Trips* sp. would play a secondary role, essentially for self-compatible varieties of cocoa. However, these species were trapped in the immediate surrounding of the tiny cocoa flowers and no study has succeeded so far in observing and describing the insects actually visiting the inside of the cocoa flowers. We used a digital video recording system that allowed us to monitor and record all insects visiting cocoa flowers of three self-incompatible clones CATIE-R4, CATIE-R6 and PCMT-58 from 6:30 am to 11:30 am. The cocoa trees were monitored in low-flowering season and in high-flowering season in Turrialba, Costa Rica. The leaf litter was collected around the cocoa trees to investigate the presence of eggs of pollinators or predators. The cocoa trees were planted at 1111 trees per ha, associated with *Cordia alliodora*, *Cedrela odorata, Erythrina poepiggiana* and *Musa* sp. They were compared with and without bio-fertilizer application. Our results show that the diversity and the frequency of insects visiting cocoa flowers are influenced by the flowering period and do not rely specifically on the *Forcypomia* genus. Video recording and further histological cuttings made on visited flowers demonstrated the important role played by a number of species in cocoa pollination and fecundation. These results open good perspectives for the ecological intensification of cocoa production in Agroforestry Systems.

Keywords: *fecundation rate, insect diversity, pollination services, video recording*

5.2 New tools and paradigms

PP5.2.1. Biomass quantification in trees on farms: challenges and promising directions

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