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“Filling gaps and removing traps
for sustainable resource management”

Coffee Fruit Load Dynamics in Open and Shaded Systems Along an Altitudinal Gradient

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Abstract

It is well known that coffee yield is sensitive to climatic variations, in particular extended dry spells and extreme temperatures during the fruit development phase. Shading coffee is promoted as a management practice to reduce fruit drop by buffering extreme temperature and improving soil moisture. We investigated the effect of three coffee cultivation systems, i.e. Coffee-Open (CO), Coffee-Banana (CB) and Coffee-Shade tree (CT), along an altitude gradient on (a) microclimate (temperature, relative humidity) and soil water content, (b) fruit drop and branch die-back over two years of production (2015 and 2016). We monitored coffee fruit development on 810 coffee trees in 27 plots (30 coffee trees/plot), which were distributed homogeneously along an altitude gradient (1100–2100 m a.s.l.). Additionally, we recorded temperature and relative humidity in 18 of the 27 plots, and soil water content in 16 of the 27 plots. We found a lower temperature amplitude and lower maximum temperature in shaded systems, confirming the notion that shade improves microclimate for coffee grown beneath it. While, soil moisture did not differ across cultivation systems. CO had the largest fruit drop ($56 \pm 17\%$), followed by CB ($46 \pm 10\%$) and CT ($36 \pm 10\%$) averaged for 2015 and 2016. In the mean CB experienced the largest fruit load per stem at harvest, as a result of intermediate fruit initiation and intermediate fruit drop along the production cycle. Moreover, differences in fruit load across systems varied along the altitude gradient. At low altitude, CT had lower fruit loads than CO and CB, while at high altitudes there were no differences in fruit load across systems. Our results indicated that 1) improved understanding of the cropping systems effect on coffee production cycle (fruit initiation and fruit drop) can help to develop shade management schemes which help to increase coffee yield, due to reduced fruit drop and branch die back. That 2) Effect of shade type and intensity in coffee production cycle varies along the altitudinal gradient, thus shade management strategies need to be adjusted to the prevailing environmental conditions.

Keywords: Altitude, climate change, *Coffea arabica*, fruit drop, fruit load dynamics, shade