Coffee Growing: Sun or Shade?

Sun cultivation of coffee (Laura Tangley, Research News, 22 Nov., p. 1299) is not only a potentially bad thing for birds, but lethal for coffee itself in habitats with a distinct dry season. Despite observing an initial spike in coffee-berry production, we have documented severe damage or "*Mal de Viñas*" in Guatemala (*1*) from insufficient shade, which leads to massive coffee tree death, often in less than a year. Similar problems occur elsewhere in Central America (*2*). Not only do plants suffer from drought stress, elevated ambient temperature, soil erosion, and loss of soil organic matter, but they experience leaf tissue damage and altered carbohydrate metabolism (*3*). *Coffea arabica*'s evolutionary origin as an understory plant favors low light (*4*) and presents distinct limits to breeding for heavy flowering and fruiting under full sun. Large plantations in Guatemala that converted to open-sun cultivation in the 1980s are now restoring shade tree growth.

The fact that sun cultivation fails in some regions but is successful in others is a complex and poorly understood problem that relates to local rainfall, cloud cover, and the species under cultivation (*C. robusta* is more tolerant of high light and temperature than *C. arabica*).

The question of labeling coffee as "environmentally friendly" is also tricky. Open-sun plantations are structurally and biologically depauperate, and they require much higher agrochemical inputs (primarily fertilizer) than traditional shaded coffee. It may be true, as Robert Rice speculates, that a plantation with a single species of shade tree and heavy pesticide use is no more friendly than a sun plantation. But the main difference in agrochemical use between sun and shade plantations is not in pesticide, but fertilizer use. Herbicide use also increases with the degree of sun exposure because of increased weed growth, and chemical elimination of flowering plants can affect nectar-feeding arthropods more than conventional manual weeding. Arthropod diversity and herbivore pressure on coffee are notoriously low relative to what occurs in the shade tree canopy (*5*). Even in plantations with just one or two species of shade tree (*Inga* spp., for example) we have found most of the arthopod prey base for birds concentrated in the overstory (*5*). Chemical applications occur in the coffee shrub understory. On the other hand, soil-dwelling species such as the cicada nymphs mentioned by Young (Letters, 3 Jan., p. 12) or the larvae of scarab beetles are at risk, and these may be significant food resources for birds. The ecological intricacies of coffee management systems must be studied with sound quantitative methods before generalizations about "friendliness" can be made.

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"Atomi Gonfi"

The article "Giant atoms cast a long shadow" by Ivan Amato (Research News, 19 July 1996, p. 307) describes Rydberg atoms, but contains a statement that makes this