

Mulching Discourse

Mulching consists of covering the topsoil with organic residues to protect the soil from erosion caused by heavy rainfall, to retain moisture and to decrease surface soil temperature. This is particularly beneficial to unshaded coffee and during dry periods. Mulching also reduces weed establishment, helps to maintain soil structure by adding organic matter, enhances the microbial activity in the soil and adds nutrients as it decomposes.

Mulching is practised more frequently in Africa than in Latin America, but increasing land shortage in some areas has led to a decrease in mulching, as sources of mulch are becoming scarce. Cutting, carrying and applying mulch is labour-intensive and is unpopular where labour is scarce or expensive relative to the returns from coffee production. With the trend towards intensive cultivation of dwarf coffee varieties without shade, there is an argument in favour of mulching. This is particularly the case in areas characterized by a defined dry season where soil temperatures may be sufficiently high to cause root damage and the topsoil becomes dry, limiting nutrient uptake.

Soil temperatures in the warmer coffee areas of East Africa can exceed 30 C, resulting in rapid loss of soil moisture and rapid decay of soil organic matter. Root damage occurs at temperatures of 35 C and above. Mulching can reduce the temperature at the soil surface by 4– 5 C. Above a soil temperature of 25 C, the rate of humus decomposition exceeds its formation. Mulching helps in two ways: by decreasing soil temperature and by adding organic matter.

Mulching is highly beneficial in tropical zones with long dry seasons and torrential rainstorms, as it prevents loss of topsoil and fertilizer, increases rainfall penetration and reduces moisture loss through evaporation. It was observed in Kenya that 230 mm of rainfall penetrated to 1.4 m under a 15 cm mulch of Napier grass (*Pennisetum purpureum*), but to only 6 cm in bare soil trampled by pickers (Pereira and Jones, 1950).

Mulching replaces nutrients removed by the coffee crop. Results from Tanzania show that annual application of a mulch of dried banana leaves (at 25 t/ha) replaced the nutrients removed at harvest and even provided an additional nutrients (Robinson and Hogwood, 1965). Materials vary in their effect: in Ghana, mulching was shown to increase yields by up to 150%, the best sources of mulch being *Tripsacum laxum* (Guatemala grass) and *Chromolaena odorata* (Siam weed), which improved yields considerably more than either coffee husk or banana trash (Afrifa *et al.*, 2003). Mulch supplies a disproportionate amount of potassium, which may antagonize the uptake of magnesium in some soils. If this occurs, a foliar spray of magnesium-sulphate might be required. The use of sisal residues as mulch in Kenya resulted in a rise in soil pH, with a resultant nutrient imbalance.

A wide range of materials can be used as mulch, including by-products of coffee, as well as processing and trash from other crops. Material shedding seeds should be avoided as a source of mulch, and live grass stems may take root at the nodes. Banana leaves are particularly useful and convenient if grown as an intercrop with the coffee bushes. Dried grasses and weeds can also be used, and the larger perennial grasses such as Napier and Guinea grass (*Panicum maximum*) are suitably bulky, but about 1 ha of grass crop is needed for mulching 1 ha of coffee.

Crop residues such as maize and sorghum stover are also used. Mulch is usually applied at the end of the rainy season and should be at least 10 cm deep, leaving a gap around stem bases. Mulching alternate rows each year is also effective. Inert plastic-based materials used for weed control and moisture retention in horticultural crops are generally not economically viable for use in coffee.

It has been suggested that increased damage from leaf miner in Kenya was associated with the increased use of mulching in the 1950s. This may be due to increased survival of pupae under the mulch. However, the use of broad spectrum insecticides also increased in Kenya at the same time, which decreased the pupae's natural enemy populations and therefore, might have had a greater effect on the leaf miner than mulching. Mulch reduces the incidence and severity of many diseases, both because it reduces moisture and nutrient stress – which are predisposing factors for many diseases – and the improved microbial status of soils under mulch increases the antagonistic effects operating against soil-borne pathogens. Possibly the greatest danger derived from using mulch is fire: a tinder-dry layer of dead stems and leaves at the height of the hot dry season is easily ignited

Cover crops and intercrops

Leguminous cover crops are sometimes used effectively in coffee plantations and serve many of the same functions as mulch, with the added advantage of nitrogen fixation. Cover crops can be used in unshaded, widely-spaced coffee plantations, but also provide a temporary check on topsoil erosion when the soil is bare in a new plantation. The disadvantages are mainly the labour required to keep the growth in check, and the competitive effect of the cover crop on the coffee. In drier areas, competition for moisture is a critical factor and the main benefits of added nitrogen and weed suppression occur in areas with adequate moisture throughout the year. The weed-suppressant effect may be important where labour for weeding is scarce or expensive.

Cover crops are more suited to robusta areas, but choice of species is critical. Numerous procumbent, spreading legumes are used as ground cover, e.g. *Indigofera endecaphylla*,

Calopogonium mucunoides, *Vigna oligosperma*, *Crotalaria anagyroides*, *Mucuna* spp., *Arachis pintoii* and *Mimosa invisa*.

Intercropping can take many forms. Permanent perennial intercrops play an important role both as shade and in providing a diversified income. Annual crops such as beans are also important in providing an alternative source of income, and are often grown between rows of young or stumped coffee.

Intercrops such as pigeon pea and sorghum can provide a degree of temporary shelter and shade for young coffee.

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