Effect Of Fig Tree (*Ficus Sycomorus*) On Soil Quality And Coffee Yield.

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Abstract

In the coffee based land use system of Nduuri in Embu District, Kenya, farmers have devised several methods of replenishing soil fertility namely use of sweet potatoes in rotation, use of farm yard manure (FYM), use of crop residues and planting fig trees (Ficus sycomorus) in coffee farms. Farmers claim the fig tree modifies the microclimate and improves soil fertility. Six farmers recorded the weights of coffee berries harvested from coffee trees under the fig tree and outside the fig tree. 100-berry weight as well as the weight of a used cooking oil tin full of berries was also recorded. Soil samples were taken from under the fig tree and outside the fig tree canopy for analysis. Results indicated no significant difference (P=0.05) in yield or soil quality under the fig tree or outside. However because of apparent numerical difference and given the many other uses of the fig tree farmers could be advised to plant/retain the fig trees in the coffee farms. In the process farmers will also be contributing to the conservation of biodiversity.

Background

The Nduuri PLEC demonstration site is located in Kagaari North Location, Embu District. It is within the agro-ecological zone classified as the Upper Midlands 2 (UM) by Jaetzold and Schmidt (1983). The area receives about 1250mm of rainfall per annum and its soils are classified as humic NITOSOLS.

In a Participatory Rural Appraisal (PRA) conducted in 1998 the farmers indicated soil fertility as a major constraint to crop production in the area. In the recent past the situation has been made worse by low coffee returns as a result of which farmers are unable to purchase inorganic fertilizers to replenish the fertility. Farmers have devised several methods of replenishing soil fertility namely use of sweet potatoes in rotation, use of farm yard manure (FYM), use of crop residues and planting fig trees (*Ficus sycomorus*) in coffee farms. Farmers claim the fig tree modifies the microclimate and improves soil fertility. Other uses according to ICRAF (1992) include fuel wood, fruit, beehives, medicine (milky juice), mulch, ornamental, dune fixation and traditional ceremonies. The fruits (figs) are eaten by livestock, birds and wild animals. Farmers

indicated they got the idea from visits to Thika area, a major coffee growing area 100km away from Nduuri. By allocating the trees to the coffee niche the farmers would at the same time be conserving the species and adding to the biodiversity of the landscape. The study is being conducted to verify if the fig tree enhances soil fertility and increases coffee yields.

Objectives

To assess the effect of the fig tree on soil quality and coffee yield.

Materials and methods

During a reconnaissance survey of the Nduuri village, 3 farmers that were using the fig tree as a shade tree were selected. In each farm 2 fig trees were used for the observations. Fifteen coffee trees under the canopy of the fig tree were marked with permanent pegs. A similar number of trees were marked outside the canopy. Farmers were requested to maintain uniform management practices throughout the coffee farm e.g. weeding. The participating farmers were issued with half-kilogram tins and a notebook and shown how to record the number of tins harvested from the marked areas. 100-berry weight as well as the weight of a full tin was also recorded from under the fig tree and outside. 100-berry weight was obtained by counting at random 100 berries of coffee and weighing during each harvest. Frequent visits were made to the farmers by the extension agent and the PLEC team to monitor the progress of the experiment. The work was done during the main coffee crop season of October 1999 to January 2000 and the minor crop season of April to June 2000. During the main crop season of October 2000 to January 2001 and the minor crop season of April to June 2001 the participating farmers were increased from three to six but due to poor rainfall observations were made only on 3 farmers during main season and on 2 farmers during the minor season.

Soil samples were also taken from the various marked areas and subjected to complete chemical analysis.

A farmers' meeting was organized after the four crop seasons in order for the participating farmers to discuss their experiment with the rest. At the meeting the PLEC team researchers gave the preliminary results of the farmers' experiments and every one had the opportunity to raise pertinent issues for discussion.

Results and discussion

The means of the yields of coffee under the fig tree and outside the fig tree for the two seasons are tabulated on Table 1:

Table 1. Mean yields of coffee, 100-berry-weight and ½kg-tin weights from under and outside the fig tree canopy

	Main crop season (Oct. '99/Jan.00)	Minor crop season (April/June 2000)	100-berry-weight (gm)	½kg-tin wt (gm)
Under fig tree	35.4kg	9.4kg	171	451
Outside fig tree	28.8kg	8.0kg	165	447
Rainfall	821.6mm	219mm		
CV%	43	35		

There was no significant difference (P=0.05) between the yield of coffee under the fig tree and outside the fig tree. However to the farmer every 15 trees under the fig tree add 6.6 kg to his yield during the main season that translates into extra income considering that the farmer is not putting any extra effort or incurring extra cost for maintaining the fig tree.

During the main coffee crop season (October/January) there was a 22.9% increase in yield compared to the minor season (April/June) (17%). This could be because as the farmers observed it was during this minor season that the fig trees shed their leaves making no marked difference between the microenvironment under the fig tree and outside.

The ½ kg *kasuku* weight as well as the 100-berry-weight was numerically higher for berries harvested under the fig tree than from outside indicating the relative positive influence the fig tree has on the coffee.

During the main crop season of October 2000 to January 2001 the area received only 290.4mm of rain, which was far below the 821.6 received during a similar season the previous year. As a result only 3 out of the 6 participating farmers had any coffee harvest. Two out of the three farmers only picked coffee under the fig tree canopy and nothing outside. During the minor crop season of April to June 2001 only 2 farmers out of the 6 had some harvest since the coffee had not recovered from the previous drought. In one of the farms there was no harvest outside the fig tree canopy.

The results of soil analysis are indicated on Table 2.

Table 2. Chemical composition of the soils under and outside the fig tree

	P (ppm)	Total N%	C%
Under fig tree	20.8	0.24	2.73
Outside fig tree	16.7	0.24	2.76
CV%	27	6	9

Soil analysis indicated low levels of organic carbon according to the broad ratings of Landon (1984). However there was no significant difference (P=0.05) between the soil under the fig tree and that from outside the fig tree canopy (Table 2).

In general the soils had adequate levels of available P according to Landon (1984) (ranging from 13.33 to 24.3 ppm). The general trend was for the soil under the fig tree to have a higher P than from outside the fig tree.

The soil had moderate levels of total N (0.19% to 0.27%) (Landon, 1984) but the levels under the fig tree and outside were not significantly different (P=0.05)

During the group meeting some concerns were raised in regard to use of the fig tree:

1. Some farmers felt that the microenvironment under the fig tree would encourage coffee rust, coffee berry disease and coffee thrips (*Diarthrothrips coffeae*) to thrive. The participating farmers had this to advise:

- Trimming away the lower branches of the fig tree leaving the canopy high over the coffee trees
- Bending the coffee trees outwards in order to open up the coffee tree to reduce humidity
- They observed that in July/August when the weather is cold and conducive for outbreak of coffee berry disease the fig tree will have shed its leaves thus leaving bear twigs. The shading effect will therefore be minimal.
- They observed that thrips did not infest under shade

2. Availability of fig tree seedlings was another concern raised by some farmers. One of the participating farmers was willing to assist in the acquisition of the seedlings.

Farmers listed the benefits of the fig tree generally as being provision of firewood, fodder, mulch and soil fertility replenishment. The farmers' perception on the fig tree was that the fig tree 'brings the water up'.

The effect of the fig tree on the apparent good performance of coffee could be as a result of several factors. The fig tree might be deeply rooted and draws water from a large depth. This water will be in high concentration in its roots and will diffuse into the surrounding soil for uptake by the coffee roots. Another way the fig tree may be benefiting the coffee is by shedding its leaves which act as a mulch which preserves moisture. Decomposition of the mulch adds organic matter to the soil resulting in higher coffee yields. The fig tree shading also reduces evapo-transpiration of the coffee plants. This could explain why during the drought of 2000 coffee berries only developed on coffee trees under the fig tree in two of the three farms. The effect of these factors combined is possibly bringing about this apparent yield increase and soil improvement.

Conclusion and recommendation

The fig tree appears to be beneficial since it provides shade during drought although during a cold season it could encourage diseases especially coffee berry disease. However as the Nduuri farmers observed this does not appear to be a problem since during the cold July/August cold season the fig tree sheds leaves.

Given the many other uses of the fig tree and the demonstrated yield increase especially during drought the farmers could be advised to plant/retain the fig trees in coffee. In the process farmers will also be contributing to the conservation of biodiversity. There is need to make further observations from all the six farmers since there was nearly a crop failure as a result of the 2000 drought.

References:

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