INFLUENCE OF THE SHEA BUTTER TREE ON AGRICULTURAL YIELDS IN NORTHERN IVORY COAST

Louppe Dominique [1*]

Corresponding author: dominique.louppe@cirad.fr

Affiliations: (1) CIRAD, UPR BSEF, F-34398 Montpellier, France

Introduction

The shea butter tree is of crucial importance in the Sudan and Sudan-Guinea zones of West Africa. Farmers protect this tree in their crops mainly because it produces fruits used in traditional meals, cosmetics and medicine. With the possibility of adding 5% of shea butter to chocolate, the economic value of this tree has grown.

Consequently, in shea tree parklands, it seemed worth finding out whether there might be conflicts between the tree's fruit yields and crop yield. The effect of the shea tree on agricultural yields was therefore studied over four consecutive years, in smallholder crops in the Korhogo region (northern Ivory Coast).

Material and methods

Preliminary cotton yield measurements taken near 10 trees, in plots measuring 5 meters wide by 15 m long, divided into subplots one meter wide from the foot of the tree to outside the canopy, showed that no influence of the tree on cotton yield was significantly detectable beyond five meters from the tree trunk. It thus appears that no control plot is necessary beyond 10 meters from the foot of the tree, justifying the use of the protocol described below.

Yields were harvested in concentric rings centered on the trunk of the trees and divided into four sectors directed towards the cardinal points (Figure 1). Harvesting was carried out up to ten meters from the foot of the tree. For each tree, a total area of 300 square meters was harvested. The shea trees sampled were isolated, and more than twenty meters away from their nearest neighboring tree. The mean canopy radius was 4.6 m. The harvests concerned 53 trees or 1,272 plots of land amounting to a total area of 1.59 ha.
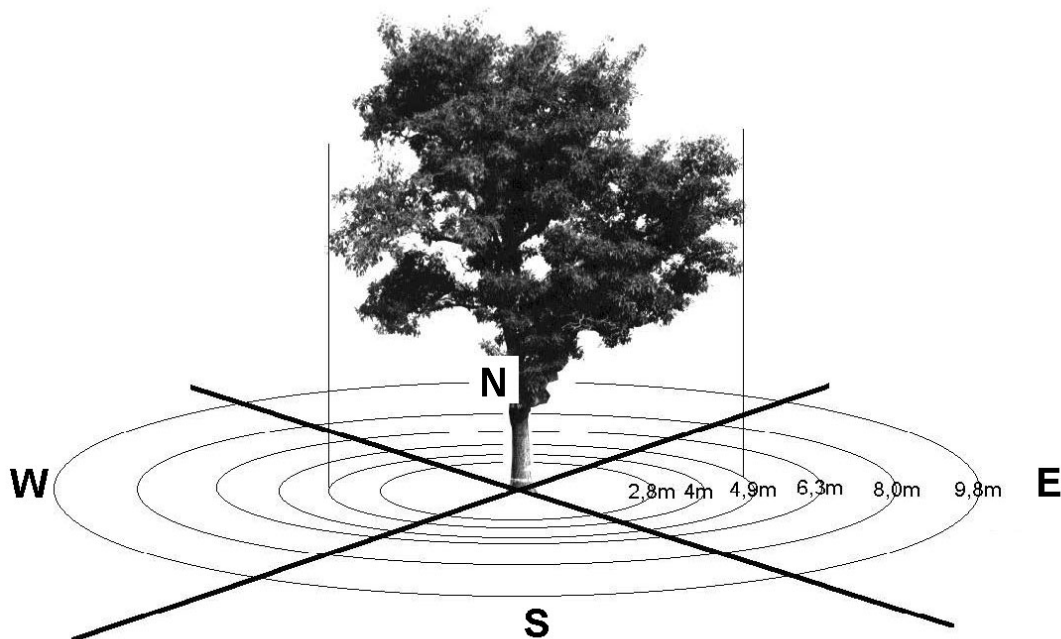

Figure 1: System used to measure agricultural yield variations under a shea tree.

Results

Table 1: Crop yields (kg/ha) depending on the distance from the foot of the tree (mean canopy radius = 4.6 m)

Crops	Number of sampled trees	Mean quadratic distance from the foot of the tree						Means [1]
		1.99 m	3.45 m	4.46 m	5.64 m	7.19 m	8.92 m	
Cotton	Year 1 : 14 trees	868 $_D$	1184 $_C$	1240 $_{BC}$	1318 $_{BC}$	1547 $_A$	1333 $_B$	1325
	Year 2 : 10 trees	453 $_C$	724 $_B$	708 $_B$	795 $_{AB}$	876 $_A$	903 $_A$	810
	Year 3 : 10 trees	490 $_B$	786 $_A$	798 $_A$	759 $_A$	777 $_A$	789 $_A$	757
Peanut	9 trees	234 $_C$	275 $_B$	332 $_A$	310 $_{AB}$	303 $_{AB}$	297 $_{AB}$	296
Corn	10 trees	1183 $_B$	1584 $_A$	1620 $_A$	1492 $_A$	1512 $_A$	1250 $_B$	1409

[1] Total yield in a total of 300 square meters (kg/ha).
$_{ABCD}$: 2 data items (in the same row) with the same letter are equivalent at the 5% statistical limit.

Table 2: Yield losses and gains (kg/tree and kg/ha) compared to ring 6, which was considered as a control outside the direct influence of the tree

Crops	Yield variations (kg/tree) compared to ring 6	Yield variations (kg/ha) with 20 trees/ha (distance between trees: 22 m)
Cotton year 1 - total yield: harvest 1 + harvest 2	- 0.24	- 4.8 (- 0.4%)
Cotton year 2 - total yield: harvest 1 + harvest 2	- 2.80	- 56.0 (-6.2%)
Cotton year 3 - total yield: harvest 1 + harvest 2	- 0.97	- 19.4 (-2.5%)
Cotton years 2 and 3: on fertile soils	- 0.86	- 17.2 (-2.3%)
Cotton years 2 and 3: on infertile soils	- 2.73	- 54.6 (-8.6%)
Peanut on fertile soils	+ 0.47	+ 9.4 (+3.2%)
Peanut on infertile soils	- 0.24	- 4.8 (-3.9%)
Corn on fertile soils	+ 4.78	+ 94.0 (+7.5%)

The influence of the orientation (data not presented) was not perceptible except for corn (yield was lower in the South and was better at the canopy limits in the E, W and N directions) and for the second cotton harvest (better cotton yield in the North than in the South).

There were fewer cotton bolls per plant in the shade than in full sunlight, but the bolls were heavier in the shade. Shade also delayed cotton maturation, so the cotton had to be harvested in two goes.

Discussion

Overall, yield was lower within the first few meters around the foot of the tree. The shea tree generated low yield losses (under three kg per tree) for the cotton and peanut crops on less fertile soils. Conversely, the tree led to better corn and peanut yields at the canopy edge, on the most fertile soils.

This may have consequences for the future of shea parklands if cotton is the main crop. Harvesting cotton in two goes was very important to prevent fouling of the cotton fibers by dust in the wind (which reduced the cotton selling price for the producer). This gives much more work to the farmer and it may encourage some farmers to fell their trees and sell them for firewood or charcoal making, especially if the loss in cotton yield is greater than the monetary income resulting from the

sale of shea fruits or butter. (NB: it is slightly more complex than presented here because the money from cotton sales is for men and the money from shea trees is mainly for women).

References:
Kessler JJ (1992). The influence of karité (*Vitellaria paradoxa*) and néré (*Parkia biglobosa*) trees on sorghum production in Burkina Faso. Agroforestry Systems 17: 97-118.
LouppeD, N'Dour B, and Samba ANS. (1996). Influence de *Faidherbia albida* sur l'arachide et le mil au Sénégal. Méthodologie de mesure et estimations des effets d'arbres émondés avec ou sans parcage d'animaux. In : Peltier R (ed.) Les parcs à faidherbia. Bois et forêts des tropiques, Cahiers scientifiques n°12: 123-139.

Keywords: Shea (*Butyrospermum paradoxum* syn. *Vitellaria paradoxa*), crop yields, peanut, cotton, corn, Ivory Coast.
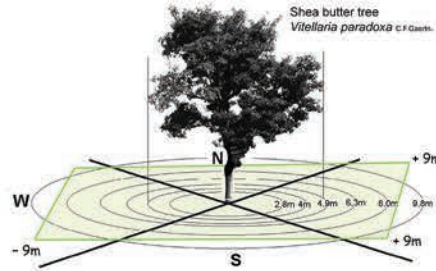
Shea butter trees impact crop yields

Shea butter fruits

Dominique Louppe
CIRAD - UPR Bsef
dominique.louppe@cirad.fr

A unique protocol

Shea butter tree
Vitellaria paradoxa C.F.Gaertn.

N
W
E
S
+ 9m
+ 9m
– 9m
2.8m 4m 4.9m 6.3m 8.0m 9.8m

Harvesting and yield mesurement: the example of groundnuts

1. Groundnut crop
2. Delimitation of concentric rings
3. Labelling and weighing of harvests

4. Storing harvests under a shelter
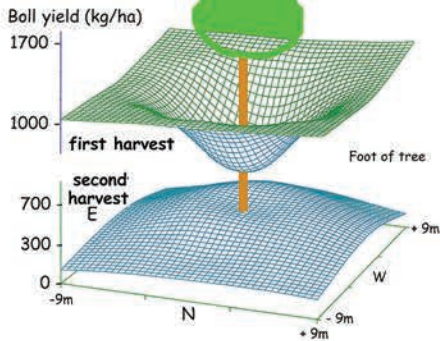5. Separating pods and leaves
6. Air drying of pods and leaves
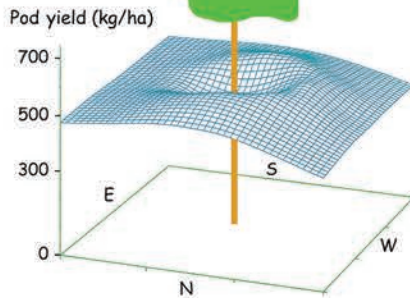7. Weighing of dry pods and leaves

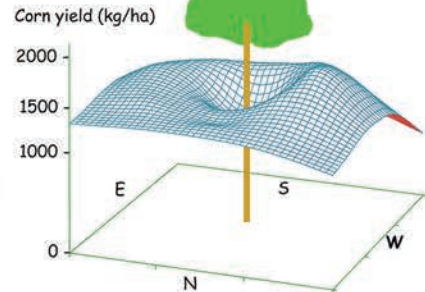## Results: variation in yield under and close to the tree

Cotton

Boll yield (kg/ha)
1700
1000
first harvest
second harvest
700
300
0
E
N
W
-9m
- 9m
+ 9m
Foot of tree
+ 9m

−0.4 to −2.3%

Groundnut

Pod yield (kg/ha)
700
500
300
0
E
S
N
W

+3.2%

Maïze

Corn yield (kg/ha)
2000
1500
1000
0
E
S
N
W

+7.5%

Change in yield per hectare with 20 trees per hectare compared to a treeless crop