Understanding soil fertility management practices of cocoa farmers in the Centre and South region of Cameroon

Urcil, Kenfack Essougong[123]; M. Slingerland[1]; L. Woittiez[1]; K. Giller[1]; S. Mathe[3]; P Ijang Tata Ngome[4]; W. Vanhove[5]; P. Boudes[6]; C. Leeuwis[2]

[1]Plant Production Systems, Wageningen University & Research
[2]Knowledge Technology and Innovation, Wageningen University & Research
[3]International Institute for Tropical Agriculture, Yaounde, Cameroon
[4]Institute for Agricultural Research and Development, Yaounde, Cameroon
[5]Ghent University, Ghent, Belgium
[6]Agrocampus Ouest, Rennes, France

Abstract

In Africa, cocoa yields remain low, partly due to soil fertility constraints. Peoples' perceptions, closely coupled with their knowledge are key factors explaining their behaviour. We investigated Cameroonian cocoa farmers soil fertility perceptions, knowledge and management practices (SFMPs). Soil fertility perception, inputs access, local habits and experience influence farmers' SFMPs. Farmers rely on (in)organic fertilisers, weeding residues and trees planting to enhance soil fertility. The main reason for not using soil fertility technologies varies from one technology to another. Farmers prioritise practices to increase yield and view SFMPs as the least important practices. Developing a stepwise approach to cocoa farming, considering farmers' priorities and practices' returns on investment is recommended to foster sustainable cocoa intensification.

Keywords: Adoption, prioritisation, intensification, knowledge, perceptions

Introduction

There is a spatial and temporal variability of cocoa yield and a large yield gap in the cocoa sector. Poor soil fertility is considered an important cause of low yield in Africa. In cocoa farming, continuous harvesting without soil amendment leads to fertility decline; part of the nutrients exiting the system through cocoa beans harvesting. This accentuates low yield and contributes, in some areas, to forest degradation and deforestation due to cocoa farm expansion. Thus, it is impossible for farmers, even in the early production phase to sustain yield without appropriate SFM. Consequently, enhancing soil fertility is essential to increase cocoa production with minimum negative environmental impact. The implementation of these practices requires farmers' recognition of soil fertility deficiency. To improve the design of interventions that aim at increasing cocoa yield through better cocoa soil management, understanding current farmers knowledge, perception and management of soil fertility is essential. This study intends to raise our understanding of how Cameroonian cocoa farmers comprehend, view and manage soil fertility; and how important for yield they consider SFMPs compared to other cocoa farming practices.

Methodology

Study area and data collection

Study carried out in two cocoa production area: Mvila (South region) and Mbam-and-Inoubou (M&I, Centre region) purposively chosen.

Table 1. Main differences between the studied area

	Division	
	Mbam and Inoubou	**Mvila**
Mean Temp (°C)	25	24
Dominant Soils	Haplic ferrallisols, and Ferralic cambisol	Acric Ferralsols
Rainfall (mm)	1300	1650
Dominant Vegetation	Low shrub savannah rich in *Imperata cylindrica*, Gallery forest	Humid dense forest

Semi-structured survey 120 farmers (60 per division; including 94 Men and 26 Women), purposively chosen;

14 practices scored from 0 to 5 to indicate their importance to obtain high yield;

4-Point Likert-Scale assessment of farmers' knowledge of soil fertility indicators

Summary respondents socioeconomic characteristics

In Mvila and M&I respectively, on average, farmers are 50 and 52 years old, have 17.6 and 17.2 years of experience in cocoa farming; own 4.6 and 3.3 ha of cocoa, and produced 979 and 792 kg of dry cocoa beans annually.

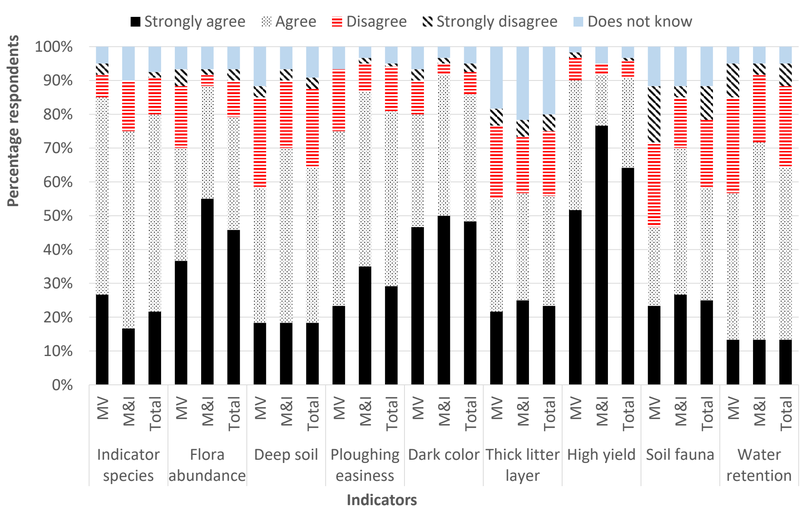

Figure 1: Farmers Knowledge of Soil fertility indicators

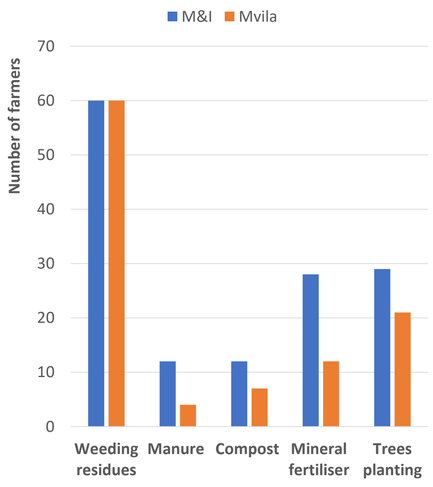

Figure 2: Farmers' distribution according to SFMP's implemented

Results and Discussion

Farmers knowledge of soil fertility indicators and SFMPs

Major indicators of fertile soils are high yield, flora abundance and dark colour soils (Figure 1). In M&I, farmers use more SFM technologies than in Mvila. 28-29 farmers in M&I use inorganic fertilizer and tree planting against only 12-21 respectively in Mvila. In both areas, all the farmers rely on weeds residues to improve soil fertility whereas compost and manure are rarely used (Figure 2).

Reasons explaining the non-use of soil fertility technologies

Table 2. Percentage of farmers mentioning reasons for not using SFM technologies distributed over 5 categories and frequency of farmers mentioning specific reasons within categories

	Technologies				
Reasons stated	Mineral fertilisers	Manure	Compost	Trees planting	Total for all technologies
1. Inability due to affordability/availability (%)	**56**	**26**	**21**	**4**	**30**
Lack of capital	44	1	4	2	51
Unavailability	28	35	26	1	90
2. Inability due to labour requirements (%)	**2**	**27**	**22**	**3**	**15**
Lack of labour/time	3	12	16	2	33
Arduousness	0	25	15	0	40
3. Satisfying soil fertility level (%)	**16**	**10**	**9**	**19**	**13**
Satisfying soil fertility level	21	14	13	13	61
4. Knowledge/Experience (%)	**14**	**36**	**48**	**73**	**39**
Lack of knowledge on how to use	10	13	7	1	31
No previous experience	8	30	36	7	81
Unawareness utility for cocoa	0	7	7	0	14
Non-mastering production techniques	0	0	17	0	17
Lack of knowledge fertilising trees	0	0	0	41	41
5. Others (%)	**11**	**0**	**0**	**0**	**3**
Destroy the soil	6	0	0	0	6
Fear of dependency	4	0	0	0	4
Promotion of organic agriculture	4	0	0	0	4
Total number occurrence	128	137	141	67	473

Table 2 shows that farmers hardly use manure/compost because they are insufficiently available, require much and arduous labour, and knowledge and experience, which are lacking. Inorganic fertilizers are seen as costly, not always available, and not necessarily needed or beneficial to the soil.

Cocoa farming practices ranking in terms of contribution to high yield

SFM technologies such as fertilizer application (rank 12), planting soil fertility enhancing species (rank 13) and manure/compost (rank 14) score lowest of factors contributing to high yield (Table 3).

Table 3. Mean score and rank cocoa farming practices with respect to their importance for high yields

Farming practices	AEZ			t-test
	M&I	Mvila	Mean	***p*-value**
Harvest well ripe pods	4.45 (3)	4.60 (1)	4.53 (1)	**0.256**
Appropriate fermentation	4.58 (1)	4.45 (5)	4.52 (2)	**0.387**
Appropriate drying	4.58 (1)	4.30 (6)	4.44 (3)	**0.106**
Insecticides application	4.25 (7)	4.50 (3)	4.38 (4)	**0.174**
Shade management	4.17 **(8)**	4.50 **(3)**	4.34 (5)	**0.03****
Fungicides application	4.10 **(9)**	4.51 **(2)**	4.31 (6)	**0.041****
Pruning	4.25 (5)	4.28 (7)	4.27 (7)	**0.844**
Uses improved varieties	4.37 (4)	4.07 (8)	4.22 (8)	**0.062**
Sanitary harvest	4.32 (6)	4.02 (9)	4.17 (9)	**0.117**
Sorting cocoa beans	3.97 (10)	3.95 (10)	3.96 (10)	**0.946**
Appropriate storing	3.90 (11)	3.73 (11)	3.82 (11)	**0.568**
Fertiliser application	3.07 (12)	3.58 (12)	3.33 (12)	**0.104**
Planting species fertilising the soil	2.70 (13)	3.04 (13)	2.87 (13)	**0.279**
Manure/Compost application	2.86 (14)	2.27 (14)	2.57 (14)	**0.097**

** Means differences significant at 5%
In brackets, rank by decreasing order of importance from 1 (most important) to 14 (least important)

Conclusion

Farmers mostly use indicators visible at first sights such as high yield and dark colour of soil to assess soil fertility. To enhance soil fertility, all farmers just leave weed residues on the fields. Up to 30 farmers use mineral fertilizer and /or tree planting in M&I whereas less do in Mvila. Inorganic fertilizer is perceived as expensive. Compost and manure have several barriers in terms of low availability, high labour demands for application, and lack of knowledge. Farmers attach little value to SFM technologies for high yield. Further investigations on the interdependencies between various cocoa farming practices and their combined effect on yield are needed. This could pave the way to formulate a stepwise approach to cocoa farming to address the concern of low yield. Such an integrated approach should be accompanied by measures that increase inputs access and guarantee high returns on investment to foster sustainable cocoa intensification.

Acknowledgements

Research financially supported by the Department of Plant Production Systems at WUR through the CocoaSoils program, on behalf of the Norwegian Agency for Development Cooperation (NORAD). IRAD and ICRAF supported field work implementation.

References

Kome, G. K., Enang, R. K., & Yerima, B. P. K. (2018). Knowledge and management of soil fertility by farmers in western Cameroon. Geoderma regional, 13, 43-51.

Meijer, S. S., Catacutan, D., Ajayi, O. C., Sileshi, G. W., & Nieuwenhuis, M. (2015). The role of knowledge, attitudes and perceptions[...] Int.J.Agr.Sust, 13(1), 40-54. https://doi.org/10.1080/14735903.2014.912493

Wessel, M., & Quist-Wessel, P. M. F. (2015). Cocoa production in West Africa, a review and analysis of recent developments. NJAS - Wag J of Life Sc., 74-75, 1-7. https://doi.org/10.1016/j.njas.2015.09.001

van Vliet, J. A., & Giller, K. E. (2017). Chapter Five - Mineral Nutrition of Cocoa: A Review. In D. L. Sparks (Ed.), Advances in Agronomy (Vol. 141, pp. 185-270): Academic Press.

More information: Urcil Kenfack Essougong (urcil.kenfackessougong@wur.nl)

www.cocoasoils.org