Nutrient Management in Coffee- Influence on Nitrogen Uses Efficiency (NUE) and Carbon Footprint (CFP)

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Knowledge grows

Introduction

Due to climate change, the suitability for coffee will decrease drastically by 2050[1]. Improving NUE and reducing CFP are key challenges for coffee production worldwide and represent the main action points regarding regenerative and climate-neutral crop production.

Materials/Methods

From 2014 to 2021, five long-term trials were conducted in four countries (Table 2). Current farmer's practices were compared with balance nutrient practices including soluble Ca, Mg, and micronutrients. The NUE indicators used were the Partial Productivity Factor of Nitrogen (PPFN) and agronomical Nitrogen Uses efficiency (ANUE). The CFP was calculated following IPCC protocol from the factory to the farm gate.

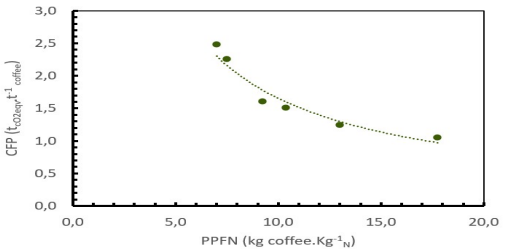

Figure 1: If NUE increase the CFP reduce.

Trial	Country	Period	Species	Variety	Nutritional practices	N rate kg.ha^{-1}	Mean yield t.ha^{-1}	PPFN* kg coffee.kg^{-1} N	ANUE* kg^{-1} N	CFP t coffee eq.t^{-1} coffee
1	Vietnam	2014-2017	Robusta	TR4	Urea +PKS	325	3,00b	9,23	--	1,61
					(45% NH_4-N - 55%NO_3-N) +PKSCaMgBZn	325	3,37a	10,36	--	1,51
					No Nutrients	0	0,69a			--
2	Ivory Cost	2016-2018	Robusta		Only N low Rates	99	1,60b	16,16	9,19	--
					N low rates + PKCaMgB ZnS	105	3,37c	32,09	25,52	--
					N high rates PKCaMgB ZnS	200	3,39c	17,30	13,50	--
3	Brazil	2015-2021	Arabica	Catuai-99	No N + PKCaMg	0,0	1,33c			
					Urea + PKCaMg	400	2,80b	7,00	3,67	2,48
					(50% NH_4-N - 50%NO_3-N) + PKCaMg	400	3,00a	7,50	4,18	2,26
4	Colombia	2017-2020	Arabica	Castillo®	No N + PKCaMgB ZnS	0,0	1,67a	--	--	--
					Urea + PKCaMgB ZnS	260	2,03ab	7,78	1,32	--
					(50% NH_4-N - 50%NO_3-N) + PKCaMgB ZnS	260	2,43bc	9,33	2,88	--
					(25% NH_4-N - 75%NO_3-N) + PKCaMgB ZnS	260	2,66c	10,24	3,78	
5	Colombia	2014-2019	Arabica	Caturra	Urea + PKSMg	200	2,60a	13,00	--	1,25
					(45% NH_4-N - 55%NO_3-N) +PKSMg+CaBZn	200	3,55b	17,75	--	1,05

Table 1: Influence of the nutrient management practices on NUE and CFP in coffee.

Results/Discussion

Nitrogen rates and balance influence directly productivity, the NUE, and the CFP. An Increase in NUE reduces the CFP (Fig,1). Balanced nutritional programs without Urea, including K, P, Ca, Mg, S, B, and Zn improve significantly the coffee yield, and the NUE and reduce the CFP (Trial 1,2,3,4,5). Low N rates without any balance reduce significantly the yield and NUE (Trial 2). Increasing the nitrates share in the nutritional programs in a balance with the other nutrients increase significantly the productivity and the NUE, as well as reduces the CFP in coffee production systems (Table 1)..

Conclusion/Perspectives

Coffee farmers can increase coffee yields, reduce the CFP, and increase NUE if they improve nutrient management practices by changing N sources and by balancing NPK inputs with other essential nutrients like Ca, Mg, B, and Zn.

References:

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