



# Fertilizer Recommendation CACAO

**Cacao provides one of the world's most appreciated delicacies: chocolate. Yet, it is also one of the most jeopardized crops. Yearlong overexploitation has led to staggering drops in production levels and degradation of its resource base. Like with every crop, sustainable production starts in the soil. AgroCares has the technology and the ambition to maintain cacao's most precious production factor: the soil.**

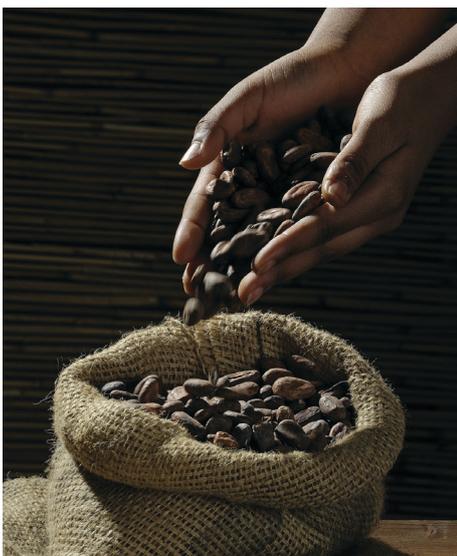
For every ton of dry cacao about 35 kg of Nitrogen, 5 kg of Phosphorus and 50 kg of Potassium are removed from the soil. Yet, only a fraction of these nutrients is replenished. This is especially true for smallholder farmers in West-Africa. Continuous mining of the soil for nutrients results in declining soil fertility levels, which in turn causes declining yield levels and/or crops that are more susceptible to diseases.

## The 4R Strategy

AgroCares provides on-the-spot technology to determine the soil fertility status and generate a soil management recommendation to reach a certain yield. Notably, just applying fertilizers (whether organic and/or mineral) is not enough. When it comes to proper soil management it is all about obeying the 4R strategy: right amount, right timing, right type and right placement. The recommendation module of the SoilCares Adviser Africa app includes all these elements.

## AgroCares Fertilizer Recommendation

The fertilizer recommendation provided by AgroCares apps consists of two parts: a soil correction plan and a correction for crop removal. With the first part we secure the sustainable use of the soil for years to come. The soil correction brings the soil to an adequate production level. At this level, the soil is resilient and robust and can support crop growth. The correction for crop removal replenishes the nutrients that are withdrawn from the soil at each harvest.



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This approach works for perennial crops as for annual crops, except that for perennial crops the crop removal is typically much lower compared to annual crops and for perennial crops the right placement (method) is dependent on crop stage.

**At planting**, the roots are still shallow and frequent placement is necessary. As there is no harvest yet, maintaining a healthy soil is paramount. In this phase the soil correction plan is dominant

**When the crop gets older**, and the root system becomes more developed, the frequency of application can be reduced. Yet, harvests take off and the crop removal correction becomes more important.

**In the mature stage of the crop**, the soil has been productive for years and special care needs to be taken for possible micronutrient deficiencies. At this stage, regular analyses with AgroCares Lab-in-a-Box are recommended.

**Table 1. Crop nutrient uptake rates.**

Nutrient uptake for cacao (kg/tonne)	
N	20.9
P	7.6
K	41.7
Zn	0.01
CaO	3.3
MgO	2.5

**At all stages**, the recommendation includes organic and mineral fertilizers because we regard integrated soil fertility management (ISFM, including the combined use of organic and mineral fertilizers) as the most appropriate way to maintain or improve the productive capacity of soils.

## Micronutrients

Apart from the macronutrients cacao is often fertilised with micronutrients: Mg, Ca, Mn and Zn. B and Zn are commonly reported micronutrient deficiencies and can be overcome by applying specific micronutrients. Ca and Mg are known to contribute to the resistance against black pod. However, it should be noted that for both nutrients the danger of toxification (overfertilisation) exists. In general terms, a healthy soil with sufficient soil organic matter is more resistant to micronutrient deficiencies.

## The effect of soil composition

There is some debate about the effect of soil composition on the quality (taste) of the cacao expressed in phenolic compounds. There are (unvalidated) arguments that Mg improves the chocolate taste by increasing the polyphenol and sugar contents in the beans and that Zn can contribute to an improvement of the fermentation through producing enzymes that can help cacao bean fermentation. Scientific evidence shows that overfertilisation reduces the polyphenols, flavan-3-ols and anthocyanins contents in cacao.