

Fertilizer

A distinction should be made between the nutrient requirement for the crop and the requirement relevant for business management, which is used in profitability calculations.

Nutrient requirement for plants (fertilizer recommendation)

- Objective: Calculation of the fertilizer quantity to be spread on the field (at particular times)
- Calculation: Calculation of the nutrient absorption efficiency of a specific plant according to the use and requirement of nutrients by plants considering the available nutrients in the soil (e. g. from the previous applications) as well as calculation of a possible removal of nutrients by water and estimate of nutrients.

Nutrient requirement relevant for business management

- Objective: Quantities of nutrients, which must be removed from the soil in order to balance the removal of nutrients as a result of a cultivation of a specific plant.
- Calculation: According to the approximate formula:
- Content of nutrients (e. g. kg N per 1 dt cereals and/or straw)
 - × Yield (e. g. dt cereals and/or straw per 1 ha)
 - = Nutrients removal (e. g. kg N per ha)
 - × Requirement factor (e. g. 1,1 for 10% of additional nutrients to meet a lack as a result of wastage, absorption efficiency)
 - = Nutrient requirements (e. g. kg N per 1 ha)
 - Nutrient return from plant residues remaining on the ground (e.g. 40%)
 - = Balanced nutrient requirements (e.g. kg N per 1 ha)

Nutrient content/removal: kilograms of pure nutrients contained in the harvested products per certain quantity of yield (per dt, t, ha). For business calculations it is helpful if the nutrients removal of by-products (straw) is measured separately in order to calculate what has been removed and what is left on the field for the following crop. The nutrient value of the straw and stubble residues can be taken from tables.

Requirement factor: The nutrient requirements for plants in certain climate and soil as well as cultivation systems (considering the nutrient removal necessary to produce a certain quantity of crops) are calculated

The requirement factor takes into consideration losses of Nitrogen (through removal by water, volatisation, etc.) generally more Nitrogen should be applied than the quantity removed by the harvested plants. The total requirement factor implied in this case can be calculated according to the potential yield of the crop.

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N-requirement factors for agricultural crop land
according to precipitation and soil analysis

Soil appraisal	Precipitation (mm/year)		
	< 650	650 - 750	> 750
< 45	1.2	1.3	1.3
45 - 65	1.2	1.2	1.3
66 - 85	1.1	1.2	1.2
> 85	1.1	1.1	1.2

Source: LIP Freising-München (according to data collection of Middle Franconia)

Nutrient requirement: is the necessary quantity of nutrients to be applied to the soil in kg of pure nutrients (organic or mineral) in order to allow a sustainable production of a certain quantity of cereals under certain climate and soil conditions. The reference of the nutrient requirement to a certain unit of weight is only possible within the yield ranges. The application should be calculated based on the expected yield as if the optimum is exceeded then the Law of Diminishing Returns is applicable

Return of nutrients: is the available nutrients (equivalent to mineral fertilizers) from the previous crop which should be considered in the calculation as well as the available Nitrogen from legumes if grown. The available nutrients can be utilised by the following crops. They represent an output, which allows the reduction in the calculation of the nutrient requirements for the crop.

Since the balanced nutrient requirements are measured in kg of pure nutrients, the calculation of the costs should be based on the prices of the pure nutrients per kg. The organic manure is treated in the calculation like mineral fertilizers, which is correct, if the nutrients contained in the produced manure are evaluated with the same prices per kg of pure nutrients as the output.

The Nitrogen requirement factor for legumes is usually assumed to be zero which is based on the trait that they convert nitrogen gas from the air to a plant available form. Therefore, they do not need nitrogen fertilizer, and will add nitrogen to the soil.

From the operational point of view the costs of fertilizing for soil improvement purposes should be included into total overhead costs, since they are not incurred by a specific crop.