



CALCULATING FERTILIZER APPLICATION

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Background

Matching fertilizer application rates to crop needs is an essential component of optimizing crop production. Different crops require various rates of the major nutrients – nitrogen (N), phosphate (P_2O_5) and potassium (potash, K_2O) – due to variations in soil types and properties. Meeting these N- P_2O_5 - KO_2 (abbreviated as N-P-K) requirements without over applying any of these nutrients is possible by blending various types of fertilizer to give the correct ratio. This allows farmers to apply the correct rate of a particular blended fertilizer. Other considerations such as cost of available fertilizers and crop micronutrient requirements also need to be considered when blending fertilizers.

Annual applications of P_2O_5 and K_2O may not be required, depending on how much is available in particular soils, and the amount of P_2O_5 and K_2O that is required to meet production goals for the specific crop to be grown. Nitrogen is more mobile in soils and therefore must be applied every season to non-legumes, with N requirements based on the crop to be grown, soil type and expected yields. These recommendations are generally made in conjunction with soil test reports.

The first step in applying the correct rate of fertilizer is calculating crop nutrient requirements. A soil test result is the only way to measure how much P_2O_5 and K_2O are available in soils, and soil tests are available through several private and public laboratories. An explanation of how to perform soil tests and interpret results is available on your Soil testing results interpretation handouts.

A farmer is advised to apply 40 kg nitrogen per ha to his crop as basal fertilizer at the time of planting.

- 1) How much CAN fertilizer should be applied to meet the recommendation? How many bags of CAN should he buy from a fertilizer dealer?

Solution: According to the fertilizer recommendation the farmer would apply 40 kg nitrogen per ha. However, CAN contains only 21% nitrogen, meaning that the amount of CAN required is: $40.0/0.21 = 190$ kg CAN. Now, one bag of CAN fertilizer weighs 50 kg. Therefore, $190 \text{ kg CAN}/50 \text{ kg/bag} = 4$ bags. Therefore 4 bags per ha are required.

- 2) How much DAP fertilizer should be applied to meet the recommended amount of nitrogen?

Solution: According to the fertilizer recommendation the farmer would apply 40 kg nitrogen per ha. However, DAP contains only 18% nitrogen, meaning that the amount of DAP required is: $40.0/0.18 = 222$ kg DAP. Now, one bag of DAP fertilizer weighs 50 kg. Therefore, $222 \text{ kg DAP}/50 \text{ kg/bag} = 4$ bags. Therefore 4 bags per ha are required.

A farmer is advised to apply 20 kg phosphorus per ha on 5-acre field. How many bags of triple super phosphate (TSP) or single super phosphate (SSP) should be bought?

Solution Caution: For phosphorus fertilizers, the % indicated on the bag refers to % available P_2O_5 ; So to convert % phosphorus to % P_2O_5 , multiply by 2.3.

Calculating fertilizer application rates

i. Nitrogen fertilizers

ii. Phosphorus

• 1 hectare is equivalent to 2.47 acres; 5 acres are equivalent to $5.0/2.47 = 2.02$ ha.

• A recommendation of 20 kg P/ha translates into $20 \text{ kg P/ha} \times 2.3 = 46 \text{ kg } P_2O_5 /\text{ha}$. Amount of P_2O_5 required for 2.02 ha is equal to $46 \text{ kg } P_2O_5 /\text{ha} \times 2.02 \text{ ha} = 93 \text{ kg}$.

• For TSP containing 45% P_2O_5 , amount of TSP required is $100/45 \times 93 = 206 \text{ kg TSP}$, or $206 \text{ kg}/50 \text{ kg/bag} = 4$ bags.

• SSP contains 20% P_2O_5 , therefore amount of SSP required for 2.02 ha is $100/20 \times 92.5 \text{ kg} = 462.5 \text{ kg}$, or $462.5 \text{ kg}/50 \text{ kg/bag} = 9$ bags.

If DAP was to be applied, the following computations hold: DAP contains 46% P_2O_5 , Therefore amount of DAP required for 2.02 ha is $100/46 \times 92.5 \text{ kg} = 201 \text{ kg}$, or $201 \text{ kg}/50 \text{ kg/bag} = 4$ bags

For potassium fertilizers, the percentages indicated on the bag refers to % water-soluble K_2O ; to convert % potassium to % K_2O , multiply by 1.21. After soil testing, a farmer is advised to apply 60 kg potassium per ha (60 kg K/ha) to his potato crop. How much muriate of potash (KCl) should he apply?

Solution

<p>iii. Potassium</p>	<p>For potassium fertilizers, the percentages indicated on the bag refers to % water-soluble K_2O; to convert % potassium to % K_2O, multiply by 1.21. After soil testing, a farmer is advised to apply 60 kg potassium per ha (60 kg K/ha) to his potato crop. How much muriate of potash (KCl) should be applied?</p> <p>Solution</p> <ul style="list-style-type: none"> • 60 kg K/ha = $60 \times 1.21 K_2O/ha = 72.6kg K_2O/ha$ • Therefore $72.6 K_2O/ha \times 2.02 ha = 146.65 kg KCl$ is 60% K_2O. • KCl required is $100/60 \times 146.65 = 244.4 kg$ are required or $244.4/50 \approx 5$ bags/ha
<p>Reference Links – book, journal paper, magazine, brochure, bulletin, fact sheet, web etc.</p>	<p>(http://www.kalro.org/navcdp)</p> <p>Adopted from Maguire Rory, Alley M, Wysor, W.G (2019) Fertilizer Types and Calculating Application Rates. Publication 424-035. Virginia Cooperative Extension</p>
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