CALCULATING FERTILIZER APPLICATION RATES

Background

Matching fertilizer application rates to crop needs is an essential component of optimizing crop production. Different crops require varying rates of the major nutrients – nitrogen (N), phosphate (P₂O₅), and potassium (potash, K₂O) – due to variations in soil types, soil test phosphorus and potassium levels, and nutrient ranges of different crops. Meeting these N-P₂O₅-K₂O (sometimes abbreviated as N-P-K) requirements without overapplying any of these nutrients is possible by blending various types of fertilizer to give the correct N-P₂O₅-K₂O ratio. This allows you 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.

Applications of P₂O₅ and K₂O may not be required annually, depending on how much is available in particular soils, and the amount of P₂O₅ and K₂O that is required to meet production goals for the specific crop to be grown. Nitrogen is much 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.


Calculating fertilizer application rates

The first step in applying the correct rate of fertilizer is calculating crop nutrient requirements. A soil test is the only way to measure how much P₂O₅ and K₂O are available in soils, and soil tests are available through several private and public laboratories. An

Demand driven research for food security and income generation
### Nitrogen Fertilizers

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 calcium ammonium nitrate (CAN) fertilizer should he apply? 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 kg CAN/50 kg/bag = 4 bags. • Therefore 4 bags per ha are required.

2) How much diammonium phosphate (DAP) fertilizer should he apply? How many bags of DAP should he buy from a fertilizer dealer?

**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 kg DAP/50 kg/bag = 4 bags. • Therefore 4 bags per ha are required.

### Phosphorus

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

**Solution** Caution: For phosphorus fertilizers, the % indicated on the bag refers to % available P<sub>2</sub>O<sub>5</sub>; So to convert % phosphorus to %P<sub>2</sub>O<sub>5</sub>, multiply by 2.3.

• 1 ha 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 kg P/ha x 2.3 = 46 kg P<sub>2</sub>O<sub>5</sub> /ha. Amount of P<sub>2</sub>O<sub>5</sub> required for 2.02 ha is equal to 46 kg P<sub>2</sub>O<sub>5</sub> /ha x 2.02 ha = 93 kg.
iii. Potassium

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

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

If he were to apply DAP, the following computations hold:

- DAP contains 46% $P_2O_5$,
- Therefore amount of DAP required for 2.02 ha is $100/46 \times 92.5$ kg = 201 kg, or 201 kg/50 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**

- 60 kg K/ha = 60 x 1.21 $K_2O$/ha = 72.6 kg $K_2O$/ha
- Therefore $72.6 K_2O$/ha x 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