



# Estimating N fertilization needs – Annual crops

## What are Annual crops?

Annual crops are those which life cycle occurs in one growing season, starting from seed to flower.

## How much Nitrogen (N) do Annual crops need?

Nitrogen needs are the result of the balance between crop N requirements, N inputs and N losses.

- **Crop N requirements** are based on expected yield levels (ton) and N removal by amount of harvested crop (kg N/ton). Crop N removal values for annual crops relevant in Afghanistan:



| Crop               | Nitrogen removal<br>kg N / ton of yield | Crop              | Nitrogen removal<br>kg N / ton of yield |
|--------------------|---|-------------------|---|
| <b>Field crops</b> |   | <b>Vegetables</b> |   |
| Rice               | 15 - 20                                 | Cabbage           | 3                                       |
| Wheat              | 20 - 30                                 | Cantaloupe        | 3                                       |
| Maize              | 15 - 30                                 | Onion             | 3                                       |
| Cotton             | 45 - 60                                 | Potato            | 4                                       |
| Barley             | 33 - 34                                 | Tomato            | 2                                       |
| Legumes            | 33 - 60                                 |                   |   |



- **N inputs** include soil N from organic matter and previous crops, especially legumes. In Afghanistan, soil N is expected to be marginal, due to low content of soil organic matter and/or poor establishment of legumes.
- **N losses** are considered with the N uptake Efficiency (%), which estimates the amount of applied N recovered by the plant. It is closely related to irrigation efficiency, and it ranges between 20-50%, although it could be as high as 80-90% when using drip irrigation.

$$N \text{ rate (kg N/ha)} = \frac{\text{Expected Yield (ton/ha)} \times \text{Crop N removal (kg N/ton)} - N \text{ Soil (kg N/ha)}}{N \text{ uptake Efficiency (\%)/100}}$$

## Example:

What is the N rate for a Wheat crop with an expected yield of 2.5 ton/ha?

$$N \text{ rate (kg N/ha)} = \frac{2.5 \text{ ton/ha} \times 25 \text{ kgN/ton}}{30\% / 100} = 136 \text{ kg N/ha} \quad \rightarrow \quad \text{Urea rate (kg N/ha)} = \frac{136 \text{ kg N/ha}}{46\% / 100} = 295 \text{ kg urea/ha}$$

## When and how should N be applied?

Nitrogen should be plenty in periods of peak demand, and rates should be split to reduce leaching losses. At planting, the fertilizer can be broadcasted or band placed. During the season, it will be broadcasted (topdressing). Example of splits and application timing for relevant crops in Afghanistan:

- **Rice** – 1/3 before or short after crop establishment, 1/3 at early tillering, and 1/3 panicle initiation.
- **Wheat** – 80% at planting, 20% at flowering / grain filling stage
- **Potato** – 1/3 at planting and 2/3 at emergence
- **Melon** – 2/3 before planting, 1/3 during fruit swelling
- **Onion** – 1/3 before sowing or planting, 1/3 at fully expanded leaf stage, and 1/3 just before bulbification
- **Tomato** – 1/4 before planting, and 3/4 divided in 2 or three splits.

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**Reference:** International Rice Research Institute (IRRI), 2007; Bill Peacock, UCCE Tulare County. Pub. NG2-96; Plant Nutrition and Food Security, Chapter 8: Nutrient management guidelines for some major field crops, FAO 2006; OMAFRA; Agronomy Handbook. A&L Agricultural Laboratories; Crop Nitrogen Guidelines. Cornell University, University of Vermont, USDA; M.S. Reiter, S.B. Phillips, J.G. Warren, R.O. Maguire. Nitrogen Management for White Potato Production. Virginia Cooperative Extension, Publication 438-012; IFA World Fertilizer Use Manual, 1992.

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