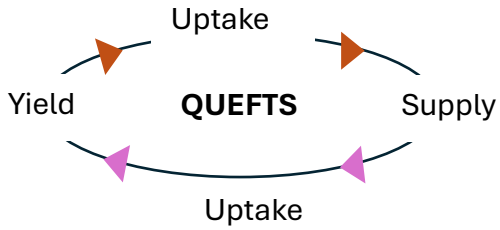
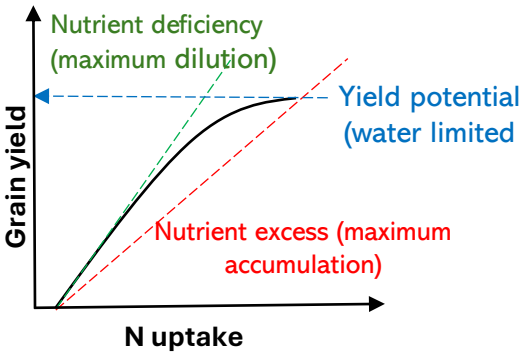
Tailored fertilizer advice analytical methods

Developing fertilizer advice requires knowledge of the yield gap and the yield response to nutrient applications. In AgWise we have four different approaches that we use based on data availability and quality and objective of the advisory.

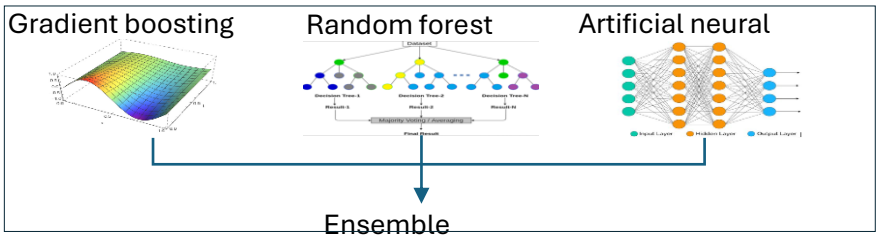
The **first approach** uses QUEFTS crop model to determine the soil nutrient supply and the yield gap. Using yield measurements from field trials under different nutrient applications, the soil nutrient supply is determined.





The second approach is based on using machine learning algorithms where the yield is models as response to nutrients and biophysical factors such as soil and weather.

$$Yield \sim N_{fertilizer} + P_{fertilizer} + K_{fertilizer} + AEZ + Soil + Weather + DEM$$



The third approach integrates QUEFTS and Machine learning. Several machine learning algorithms are used to model the soil nutrient supply estimated using QUEFTS as a response to geospatial variables sourced at scale.

$$N_{soil\ supply} \sim soil + elevation + reference\ yield\ class$$
$$P_{soil\ supply} \sim soil + elevation + reference\ yield\ class$$
$$K_{soil\ supply} \sim soil + elevation + reference\ yield\ class$$

The fourth approach refines the third one by incorporating the yield ceiling for rainfed farming. This yield ceiling (water limited yield) is simulated at scale for several climate scenarios using crop models such as DSSAT and Oryza. Having the spatial and temporal variation in yield ceiling makes the fertilizer advice more contextualized.

How to choose which approach to use

Data Requirements: The complexity and accuracy of the models depend on the availability and quality of data. While the first two approaches rely mainly on field trials data, the third and fourth approaches incorporate extensive geo-spatial and climate data.

Complexity: The complexity increases from the first approach to the fourth, with the incorporation of advanced modeling techniques and data requirements.

Accuracy: Generally, as the complexity increases, the accuracy and precision of fertilizer advice tend to improve, especially in estimating soil nutrient supply and yield potential under varying conditions.

Applicability: The choice of approach depends on the availability of data, computational resources, and the specific requirements of the target audience. While simpler models may suffice for initial fertilizer advice, more complex models offer better precision and adaptability to diverse conditions.