

TOWARDS A NEW WAY OF ASSESSING each variety's needs for nitrogen



Calculating the nitrogen requirements of wheat is a must in order to provisionally determine the total amount of nitrogen to be applied. ARVALIS is currently working on a new method of estimating this requirement for bread wheat. This in turn will help to adjust it depending on the variety's potential for accumulating protein in the grain.

The amount of nitrogen that should be applied through fertilisation is equal to the difference between the plant's total need for nitrogen, adjusted for the estimated level of mineral nitrogen reserves remaining in the soil after harvest, and the nitrogen supplied by the soil. For cereals, this provisional need for nitrogen is assessed by multiplying the target yield by the nitrogen unit requirement expressed in kgN/100kg, called the "b" ratio.

The number of nitrogen units needed by bread wheat is adjusted depending on the variety. However, the range is moderate. Average requirements are 3kgN/100kg, but this can go from 2.7 to 3.3kgN/100kg, and those figures have now been divided into three categories : 2.8, 3.0 and 3.2kgN/100kg. The number of units required is calculated using results from experiments targeted at optimum yield (neither nitrogen deficiency nor excess). Figures obtained under such conditions are characteristic and repeatable.

In cases of deficiency, the need in nitrogen has proved to decrease when the rate is reduced; conversely, the need increases when there is an excess of nitrogen.

This need, which can be called "yield need", is an important concept from a varietal point of view. It translates as the conversion of absorbed nitrogen into yield ratio. Therefore, a variety with a lower nitrogen unit requirement is more efficient: it needs to absorb less nitrogen to produce 100kg of grain at its full yield potential.

In a given agronomic situation, having applied the optimum amount of nitrogen to achieve full yield potential, the protein content of the grain varies greatly from one variety to the next. In this case, protein content figures are similar to the protein content trend line values linked to harvest yields. The protein content varies by up to 1% for varieties with a similar yield. Some varieties show an average trend of 11.5% protein, having used the optimum amount

of nitrogen to reach the yield potential, and some are below that figure. This is partly due to the negative correlation between protein content and yield.

The yield-protein combination becomes the main production objective

Bread wheat markets, and in particular new markets and existing export markets are currently demanding a rather high protein content. An 11.5% protein content target has become the norm within the industry. However, the protein content of the French harvest has tended to decrease over the last few years, due to several factors (weather conditions, regulatory constraints, etc.). Several action levers are available to improve this situation, starting with optimising fertilisation input methods and using management tools during the season. However, considering the high stakes involved, and the difficulty in determining the yield-protein content combination due to unpredictable weather conditions (which impacts on nitrogen absorption and transfer to the grain), the “protein objective” should definitely be taken into account from now on when working out the nitrogen requirements of a soft wheat crop. Up to now, this was only calculated in order to reach a given variety’s yield potential.

For durum wheat, the aim, often mentioned in contracts, is to reach 14% protein content, in order to stop the grain losing its vitreous aspect. This is also the case for hard wheat (improved milling wheat varieties), with a minimum protein content level often set at 14 or 14.5%. Therefore, the minimum nitrogen requirement of those two crops is the previously mentioned “b” yield-requirement ratio. This is then adjusted for each variety, depending on its protein content potential when optimum fertilisation has been applied to reach the crop’s yield potential. This is why ARVALIS is proposing to work on traditional bread wheat varieties in the same way as on durum and hard wheat varieties.

Number of nitrogen units required by traditional bread wheat varieties to deliver quality

The aim is to reach 11.5% protein content. A method is being developed based on experiments carried out to measure the impact of the amount of nitrogen applied on a large number of yield and quality components. The aim is to be able very soon to offer a parameterization of the amount of nitrogen required by bread wheat varieties involved in post-registration trials. This method will take into account the risk of increasing mineral nitrogen reserves in the soil at harvest time (post-harvest residual nitrogen), if the requirement, and therefore the nitrogen input have increased excessively. Results from experiments will help to adjust application rates to meet additional needs without significantly increasing post-harvest residual nitrogen levels.

Christine Le Souder - c.lesouder@arvalisinstitutduvegetal.fr

Jean-Pierre Cohan - jp.cohan@arvalisinstitutduvegetal.fr

Josiane Lorgeou - j.lorgeou@arvalisinstitutduvegetal.fr

Philippe du Cheyron - p.ducheyron@arvalisinstitutduvegetal.fr

ARVALIS - Institut du vegetal

May 2016

Bread wheat markets, including new markets and existing export markets are currently demanding rather high protein contents.



« ARVALIS is proposing to work on traditional bread wheat varieties in the same way as on durum and hard wheat varieties. »