

Hybrid wheat - A different wheat crop?

By B. Bodson, J. Franc, J-P. Destain, M-H. Durdu and A. Falisse

Dia 1

Varieties of hybrid wheat obtained by chemical castration appeared on the French market nearly ten years ago. However their commercial success was limited and short-lived due to their limited performance as opposed to varieties resulting from classical selection at that time. Since 1994, several hybrid wheats have again been added to the National French List after performing successfully in official trials. These varieties and others have since been registered for growth in Belgium and Germany.

Since the 1993-1994 season, an evaluation of hybrid varieties has taken place in our research programme to study their growth and agronomic performance.

As early as the 1994-1995 season, following observations carried out during the first year, trials of seed rate, nitrogen fertilisation and crop intensification have complemented varietal trials. These experiments aim to determine whether the management of hybrid varieties should be similar to that recommended for classical varieties and if not, to propose adaptations in order to allow optimal expression of their potential. I will present a synthesis of the results of the first three years of trials and certain characteristics of these hybrids identified during this experimentation.

The experiments were carried out during the 1993-1994, 1994-1995 and 1995-1996 seasons in Loncée (Gembloux) as part of a series of "Cereal Trials" carried out each year by the Faculté Universitaire des Sciences Agronomiques de Gembloux and the Belgian Federal Ministry of Agriculture.

Crops were sown at the end of October or beginning of November after sugar beet or seed potatoes in loamy soils which are representative of growing conditions in the main Belgian cereal growing region. Agronomical inputs (herbicide, fungicide, insecticide and growth regulators) applied to the crops correspond to good agricultural practices.

First, we are looking at the comparison between hybrid and classical or pure line varieties

A comparison was carried out on thirty varieties (20 hybrids and 10 classical varieties) in 1993-1994, ten varieties (4 hybrids and 6 classical) in 1994-1995 and 18 varieties (9 hybrids and 9 classical) in 1996. The hybrids used in the trials are varieties already registered or being evaluated through research by Hybritech, Hybrinova, Zeneca Seeds and New farm Crops. They are compared to varieties chosen from those that perform best in Belgium.

Each year, half the replicates were treated with growth regulator and fungicides, the others did not receive any treatments. Seed rate and nitrogen fertilisation were as normally recommended for the conditions in the field.

The first table presents the yields obtained with hybrids already commercialised (Domino, Hynoprecia and Hynoseha), together with the most interesting under current evaluation and with some

classical varieties such as the late cultivars Estica and Ritmo present in all three years of trials and the early cultivars Sideral and Tremie each present in two years out of three.

Dia 2

The first year, the yield of the hybrid Domino is better than the mean of classical varieties but is at the same level of the best of them: Ritmo.

Dia 3

The second year, the three hybrids are also better than the mean of classical varieties, and only Hynoprecia has a lower yield than the best classical varieties.

Dia 4

The third year, all the hybrids are better than all the classical varieties, and some hybrids not yet commercialised present a large increase of yield.

The results show that the hybrid varieties gave yields which were always superior to the average of the classical varieties but not always superior to the yield of the best of these varieties. Amongst all the varieties in the trial (not included in the table), certain hybrids perform less well. The hybrids Domino, Hynoprecia and Hynoseha are early-type varieties, while the others are later. Maybe a comparison can be made between varieties of same earliness because, for certain years, especially the 1994 harvest, early varieties can be penalised compared to later varieties relative to their yield potential.

Examination of yield components does not allow the increase in yield to be attributed to one component. As for classical varieties, the high performing hybrid wheats can be superior due to a high thousand grain weight or to a larger number of grains resulting from more ears or to high ear fertility. The variability between hybrid varieties is similar to that between classical wheats.

During stem elongation, growth vigour is almost always higher in the hybrids than in the classical varieties. At ear emergence, this difference is reduced.

The behaviour towards fungal diseases is very variable as shown by the yield differences between treated and untreated plots. Technological quality is also very variable: varieties such as Hynoprecia show good baking quality whereas others such as Domino should be classified as feed wheat.

Seed rate

Due to this higher vigour and to the cost of seed production, it is interesting to look at the optimal seed rate.

Dia 5

During the two year trials, we are testing four seed rate: from the recommended seed rate for wheat drill in end October -beginning-November three hundred grains per square meter until one hundred grains/m².

The first year you can see that for Domino, a reduction of seed rate down to 165 gr/m² has no consequence on the yield, for the classical varieties Soissons the decrease becomes important down to 230 gr/m².

Dia 6

In 95-96, you can see again that the yield of the hybrid varieties decreases less rapidly than for Rialto.

Thus during the two year trials, the optimal seed rate of the hybrids is lower than those of the classical varieties.

Nitrogen dressing

Dia 7

The responses to nitrogen dressing of the classical variety "Pajero" and of a hybrid HA6AB were compared throughout the 1995-1996 season. This table gives the yields for some of the 20 dressing treatments tested in the split plot trial. Yields obtained with the hybrid are greatly superior to those of the pure line.

Dia 8

Comparison of the yield results can be done by calculation, for each variety, of response surfaces where the dependant variable \bar{Y} (yield) is given as a function of nitrogen dressings at each of the three fractions (X_1, X_2, X_3) in the equation (Oger, 1994):

$$\bar{Y} = a + \sum_{i=1}^3 b_i 0,99^{x_i} + \sum_{\substack{j=1 \\ i < j}}^3 b_{ij} 0,99^{(x_i + x_j)} + b_{123} 0,99^{(x_1, x_2, x_3)} + \sum_{j=1}^3 d_j x_j$$

of the dressing

Based on this equation, it is possible to calculate, with a good degree of precision, the yields for all the intermediate dressing treatments within the range of fertiliser levels compared. On the basis of this, the dressings which give the yield maxima and greatest profitability, taking into account the ratio 1 kg N= 4 kg wheat, can also be calculated.

Dia 9

The nitrogen dressing which gives the maximum yield is similar in the splitting schedules but the rate of the total amount and of the fraction at flag leaf are lower for the hybrid.

Dia 10

For the economical optimum it is the same but the difference between classical and hybrid is only twenty kg of nitrogen.

It appears that the "optimal" dressings are lower for the hybrids than for the "pure line" varieties.

Dia 11

In 1994-1995 and 1995-1996, with help of fertiliser enriched with ^{15}N , balances of the utilization of nitrogen fertiliser have been measured. In 1995, this measurement was made on the hybrid Hynoprecia and the classical variety Torfrida, based on a dressing of 150 kg N ha^{-1} given in three fractions of 50 kg, the plant recovery of N fertiliser is higher for the hybrid than for the classical variety. In 1996, on the hybrid HA6AB and the classical variety Pajero based on two dressings of 165 kg N ha^{-1} (in three fractions: 50 kg - 50 kg - 65 kg) and of 215 kg N ha^{-1} (in three fractions: 50 kg - 50 kg - 115 kg). The recoveries are very similar for the hybrid and the classical variety.

Dia 12

After the three first years in our research programme on hybrid wheat, it seems that the agronomical value of hybrid wheats is, as for classical varieties, very variable from one cultivar to another. Only the best of them show superiority to classical varieties for grain yield. The greatest difference observed between a hybrid and the average of the group of classical varieties taken as reference was around 16 %. On average, it is around 7 %, when crops are protected against disease and lodging. This value is similar or slightly superior to that mentioned by some authors in the literature.

More recent varieties, not yet marketed, seem to perform better with yield gains approaching 800 to 1000 kg ha^{-1} , which is necessary to compensate the greater cost of the seed. This is confirmed in our trial results of this last agronomic season.

The possibility to reduce the sowing density observed during two years has also allowed the cost increase to be reduced.

The nitrogen dressing balance results for 1994-1995 and those of the fertilisation trial in 1995-1996 indicate the possibility of better nitrogen utilisation by the hybrid but are partially contradicted by the balance determined in 1995-1996.

These results should be compared with those of Oury et al in 1995 who concluded that hybrids utilize nitrogen better, especially during the grain filling period.

Dia 13

These preliminary results show that hybrids should compete with classical varieties if improvement continues and the agronomic conditions such as seed rate and nitrogen fertilisation are optimised.

Dia 14

This last slide presents results obtained in 97 where you can see in a comparison between the actually best varieties grown in Belgium and some hybrids varieties very probably commercialised next year that the yield difference is 3 or 4 hundred kg/ha with normal nitrogen dressing but when we use a nitrogen dressing adapted this difference becomes greater and very interesting.