

PROTOCOL FOR THE EXAMINATION OF VALUE FOR CULTIVATION AND USE OF WINTER WHEAT VARIETIES

Harvest 2018

Raad voor plantenrassen
(Rvp; Plant Variety Board)

Commissie Samenstelling Aanbevelende Rassenlijst
(CSAR: Recommended List Committee)

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1. Introduction

This protocol sets out the procedures to be used for the examination of the Value for Cultivation and Use (VCU) of winter wheat varieties in the Netherlands.

VCU testing of winter wheat varieties comprises the following items:

- Regional yield trials spanning a total of three years – a two-year trial period (NL1 and NL2) for varieties to be included in the National List followed by a third year of testing (RL3) for varieties to be included in the Recommended List;
- Inoculated disease test to determine the resistance to fusarium ear blight;
- Disease test under natural infection conditions to determine the resistance to mildew (NL1, NL2 and RL3);
- A test to determine the sensitivity to pre-harvest sprouting (NL1, NL2 and RL3);
- Baking quality tests (NL1, NL2 and RL3).

This protocol is based on the assumption of sufficient basic knowledge of the husbandry of winter wheat. Commonly used methods and treatments are not explicitly described. Unless otherwise indicated it is assumed that the agronomy should follow the best local practice of an average Dutch arable farm.

Varieties exclusively qualifying for VCU testing in The Netherlands are:

- Varieties applied for listing at the Plant Variety Board and
- Varieties listed already in one or more member states of the European Union or
- Varieties which are otherwise approved for marketing in The Netherlands.

After NL2 the *Raad voor plantenrassen* (Rvp; Plant Variety Board) decides whether or not the variety can be included in the National List. Varieties included in the National List are approved for marketing.

After RL3 the *Commissie Samenstelling Aanbevelende Rassenlijst* (CSAR; Recommended List Committee) decides whether or not the variety can be included and classified in the Recommended List.

See the annex for contact details.

2. Examination of the Value for Cultivation and Use

2.1. Trial Seed

The seed to be used for the trials must be submitted by 25 September at the latest. The submitted seed must not have been treated. The Trials Coordinator makes an inventory of the quantity of seed needed per variety, treats the seed and distributes it among the Trial Operators. Along with the seed, the Trials Coordinator submits a list specifying the thousand grain weights and, if possible, supplies information on the germination rate of the seeds.

Each Trial Operator must inform the Trials Coordinator of the amount of seed required for the varieties to be tested. The applicant must submit to the Trials Coordinator the amount of seed of each variety to be tested as specified by the Trials Coordinator. The identity of the varieties in the trials is to be checked by breeders and variety testers on the basis of their knowledge (of these varieties). The Trials Coordinator retains 100 grams of untreated seed of each variety that is tested in the regional trials in a conditioned seed-store.

If necessary, that sample can be used for authentication purposes. The authentication samples are stored for a period of three years. The seed supplied by the applicants is exclusively meant to be used for the official examination of the Value for Cultivation and Use. Residual seed must be returned to the Trials Coordinator.

2.2. Trial design

2.2.1. General

Yield trials must be carried out in complete replicates, each replicate being subdivided in sub-blocks of 5, 6 or 7 plots. The varieties of each replicate should preferably be grown in a single lane. In case replicates need to be split, due to the local farming conditions, varieties must not be removed from their original sub-block. If treated and untreated trials are carried out at the same location, the trials must be separately randomised. The plots must be at least 1.4 m wide and their length must be at least three times their width. Yield trials must consist of two replicates if the plot area is at least 7.5 m² and must consist of three replicates if the plot area is less than 7.5 m².

2.2.2. Regional yield testing

Each testing cycle (NL1, NL2 and RL3) comprises treated yield trials at 6 locations and untreated yield trials at 5 locations.

The trials should be carried out in the different regions as follows:

Region	Number of treated yield trials	Number of untreated yield trials
Northern marine clay	2	2
Central marine clay	2	1
Southwestern marine clay	2	2

In case of several locations per region the locations must be well distributed across the region. Each trial must consist of two or three replicates (see 2.2.1).

2.2.3. Special Tests

Fusarium ear blight

Resistance to fusarium ear blight is tested in two trials, each trial comprising 2 completely randomised replicates. One trial is operated by a breeding company (2 complete replicates with a plot-size of about 1 m²) and one trial is operated by the Trials Coordinator (2 complete replicates with a plot-size of 1.35 x 4 m). Each plot is inoculated three to four times around the time of flowering, the first time when the early-flowering varieties start flowering, and the last time when the late-flowering varieties have reached the final flowering stage. If necessary a standard variety with a low fusarium score can be included in the trial.

Mildew observation trial

Two breeding companies carry out a so-called 'row trial' performed in two complete replicates and do the observations to test the resistance to mildew. The varieties are tested under natural infection conditions. The minimum plot-size is at least 0.5 m². The infection is scored at several moments and expressed as a percentage of infected leaf area on a 1-9 scale (1 = breeding objective). If necessary, a standard variety with a low mildew score can be included in the trial.

Disease observation trials

The Trials Coordinator carries out a disease observation trial in two replicates in the central marine clay region with a plot-size of 1.35 x 4.5 m. Infections occurring under natural infection conditions must be observed and scored in the same way as in the untreated yield trials. Lodging must also be assessed. The trial must be managed in the same way as an untreated yield trial, but it should not be harvested. If the disease observation trial is combined in one trial with a fusarium observation trial, the entire trial must be treated with a growth regulator (CCC) and the part of the trial in which the fusarium observations are done must be treated with fungicide.

Pre-harvest Sprouting tests

Every year the Trials Coordinator operates a test (in two replicates) for pre-harvest sprouting. In each replicate 15 stems are cut at two different times from one of the treated yield trials in a clay region. A preliminary trial is carried out using a variety that is sensitive to sprouting in order to determine the first sampling time. The stems (30 to 40 cm including the ear) are bundled and wetted, after which they are suspended in an area with a high relative humidity (close to 100%) at normal temperatures (15-20 °C). Visible sprouting is assessed after one week and again 12-14 days later and scored on a 1-9 scale (1 = breeding objective – no sprouting).

Baking quality tests

Every year, varieties are tested by Labor Aberham for baking quality in a grinding, dough and baking test. Baking quality samples are obtained by composing a mixed sample per variety of the replicates of each treated yield trial from each clay region. See section 2.7 for further details.

2.3. Varieties to be tested

Standard varieties

All the A (generally recommended) and N (newly recommended) varieties of the Recommended List are included in the regional yield trials as standard varieties. If a standard variety is withdrawn from further testing, the breeder concerned must report this withdrawal to the Trials Coordinator and to CSAR. The variety concerned will then automatically be classified as a B variety in the Recommended List.

Varieties to be tested

There is no limit to the number of varieties that can be tested in a regional yield trial. The applicant is obliged to supply the results of at least two trials of new varieties submitted for testing, tested at least in duplicate including 3 standard varieties from the A- or N-category of the latest Recommended List and carried out at different locations in the Netherlands.

2.4. Trial layout, Trial operations and Husbandry

The trial plan is an incomplete block design with discard plots on either side of the trial. The Trials Coordinator sets up the trial plans and sends them to the Trial Operators. Trial fields must be as regular as possible. The trial field must be uniform, or must have undergone treatment to make it uniform without any after-effects. In case of drained trial fields the trial lanes must run parallel to the drains and the plots must be drilled across the direction of the drains. Treatments and husbandry should be done in the direction of the trial lanes as much as possible. Furthermore the agronomy should follow best local practice of an average Dutch arable farm. This also holds for the preparation of the seedbed and for weed control.

Residual herbicides containing 100 % isoproturon must not be used in weed control because of variety differences in sensitivity to such products. Sowing times should comply with local practice. The trials should be sown in the period between 15 October and 10 November. Different sowing times may be used in extreme years. The right plant population is achieved by adjusting the seed rate depending on the thousand seed weight and the germination percentage. The seed rate should be adjusted to reach 100% germination. Adjusted seed rates are included in the list of thousand seed weights which is supplied to the Trial Operators. Seed rates may differ due to differences in soil type, sowing conditions or sowing time. The seed rate for hybrid varieties is 2/3 of the seed rate of non-hybrid varieties.

Fertiliser should be applied taking into account the advisory publications for arable farming. To this end, the Trial Operator takes a soil sample in spring to determine the mineral Nitrogen concentration as a basis for additional fertilisation. The Trial Operators may adjust the fertilisation on the basis of their experiences with the trial fields concerned. Moreover the Nitrogen fertilisation for untreated trials may be reduced if the lodging risk is considered too high by the Trial Operator. The total amount of N is to be applied in at least three applications, the first application as early in spring as possible, the second (optionally divided in two dosages) at stem elongation and the third application shortly before the first awns become visible (stage 49 in the Zadoks growth scale).

In two adjacent replicates, foliar diseases are to be controlled following best local practice, i.e. always control of ripening diseases at flag leaf stage (T2) and control of foliar diseases at an earlier stage (T0 and T1), depending on infection levels, with due allowance for the fact that the maximum level of infection of the standard varieties is 5% of their leaf area. No control of foliar or ripening diseases must take place in the other two replicates. Insects (aphids) must be controlled following best local practice. The plants must be regularly checked for aphids. If insecticides are to be used the entire trial must be treated.

The two treated replicates in a clay region should always be treated with CCC or Medax Top. Trials on sandy and peat soils should be treated following best local practice; untreated trials may be treated with CCC or Medax Top if necessary and after consultation with the Trials Coordinator. The front side and backside of the plots must be trimmed to their final length after emergence (before or after winter). Numbered labels must be placed at the front side of the plots. The pathway between the replicates is also to be used for the treatments.

A trial may be ended prematurely due to irregular or poor emergence of the crop, or at a later stage due to other irregularities or poor growth. In May the Trials Coordinator gathers information on the condition of the trials and shares that information with the applicants. If there is any doubt about the validity of a particular trial the Trials Coordinator, the Plant Variety Board and interested applicants inspect the trial together. The Trials Coordinator and the Plant Variety Board will then establish the validity of the trial for further examination. The same action is to be taken if anything should go seriously wrong later in the season. The Plant Variety Board has the final responsibility for decisions about the validity of trials for further examination. The financial compensation is reduced by 60% if a trial is ended before 15 March and by 30% if it is ended later, but before the time of harvest.

2.5. Observations and measurements during the growing season

2.5.1. Data recording

The field observations are to be carried out by the Trial Operator. The Trials Coordinator will also make random observations for inspection purposes. The observations can be recorded either electronically or in writing in an approved format specified by the Trials Coordinator. The plot records are to be sent to the Trials Coordinator at three different times, i.e. after ear emergence, just before harvest and after harvest (yield data). All records (including agronomical data) must be submitted to the Trials Coordinator as shortly after harvest as possible.

2.5.2. Characteristics to be observed

Characteristics should be scored at the widest possible range of scores. A high score implies a negative assessment of the characteristic concerned and a low score a positive assessment (1 = breeding objective). Disease observations must be repeated if a disease situation should change in any way. Observations are finalised when the earliest variety starts showing senescence. The level of infection is to be expressed in a score, with 1 indicating no infection and 9 severe infection. The scores must correspond to the level of infection; if the highest level of infection in a trial corresponds to score 5, the highest reported score must also be 5, and not 9. At each time of observation the levels of infection of the most and least infected plots must be reported as a percentage of infection. For a reliable statistical analysis it may be necessary to convert the field observations into a different scale.

Plant population after emergence

If there are no differences in plant population and if the plant population is sufficient, no observations need to be made. If the plant population with good establishment is too low, plants from three plots (3 x 0.25 m² per plot) must be counted. In the event of major differences in plant population (>20%) between plots all plots and all replicates must be scored. A low score then indicates a high plant population. The plots with the highest and the lowest score must also be counted (3 x 0.25 m² per plot).

Winter hardiness

Any winter damage must be scored on a 1-9 scale, with 1 indicating the least winter damage and 9 the highest winter damage. In addition, an impression must be given of the degree of winter damage in the plots with the most and the least winter damage.

Straw strength

In the event of lodging several observations must be made, the first observation immediately after lodging. The assessment should be repeated if further lodging develops. The last observation should be made just before harvest. The observations must be recorded on a 1-9 scale, with 1 representing the least amount of lodging and 9 the most. In addition, an impression must be given of the degree of lodging in the plot with the most lodging and of that in the plot with the least lodging.

Length of the straw

The length is to be measured in cm. All replicates of three trials (treated and untreated at northern marine clay, central marine clay and southern marine clay locations) are to be measured.

Earliness of ear emergence

Observations are to be made at the time when the ears of the earliest variety have been emerged. The observations are to be scored on a 1-9 scale, with 1 being early and 9 late. In addition, an impression must be given of the degree of ear emergence in the earliest and the latest plots. Observations are to be made in all replicates of three trials (treated and untreated at northern marine clay, central marine clay and southern marine clay locations).

Ripening date

The ripening date is to be recorded on a 1-9 scale, with 1 being early and 9 late. The observations with the highest and the lowest scores must also be described. Only treated replicates are to be observed.

Mildew

Observations are to be made at the following times (providing plants are actually infected):

1. before ear emergence (preferably Zadoks growth stages 31-32)
2. after ear emergence (Zadoks growth stage 59)
3. two to three weeks after ear emergence.

In the case of observation times 2 and 3 the top three leaves must be examined. If there is no clearly visible increase in mildew after the first observations there is no need for any further observations.

Yellow rust

Yellow rust observations must be made as soon as one of the varieties shows any infection. All plots must then be regularly examined.

Brown rust

Brown rust observations must be made as soon as 5 to 10% of the foliage of the first infected plots shows any infection.

Septoria tritici blotch

Observations are to be made at a stage that provides good discrimination between the plots.

Septoria nodorum blotch

Observations are to be made at a stage that provides good discrimination between the plots.

Snow mould, leaf infection (*Fusarium nivale*)

Observations are to be made – in untreated as well as in treated trials - at a stage that provides good discrimination between the plots.

DTR (*Pyrenophora tritici-repentis*)

Observations are to be made at a stage that provides good discrimination between the plots.

Fusarium spp.

Observations are to be made at a stage that provides good discrimination between the plots.

Shedding

Shedding must be assessed on a 1-9 scale, with 1 indicating the least number of grains lost and 9 the most. In addition, an impression must be given of the extents of grains lost in the plots with the most and the least grain losses.

Other observations

Any other observations that may be of importance in examining the trial must be carried out, for example in the case of irregularities, poor establishment, damage to any of the plots, structural damage, damage caused by drought or birds, losses during harvest, etc.

2.6. Harvest

2.6.1. Harvesting method and time of harvest

The trials are to be harvested with a plot combine harvester at the time when at least 90% of the varieties have reached a moisture content of 15 to 16%. If this should be impossible due to the weather conditions in a particular year, the samples must be dried to a moisture content of 15% immediately after harvest. Each trial is to be harvested in one go. If, due to adverse weather conditions during the harvesting, it proves to be impossible to harvest a trial in one go, then at least the replicate that is being harvested at the time must be completely harvested.

2.6.2. Determination of the yield

The yield can be determined in two ways:

1. all samples are dried until constant moisture content of at most 15% is achieved, after which the yield of each plot is recorded;
 2. the yield of each plot is recorded and the moisture content of each plot is determined.
- Specific weight is determined of samples cleaned at farm level, if necessary corrected for moisture content.

2.6.3. Sampling

For quality testing purposes (see 2.7) samples (5 kg per variety) are to be taken of the 6 treated trials from the marine clay locations. A list specifying the varieties that are to be sampled is to be submitted to the Trials Coordinator as soon as possible. In spring the Trials Coordinator sends the Trial Operators a list specifying the required samples per variety. After the yields have been determined the Trial Operators take a sample of each plot. The Trial Operators then combine those samples into a mixed sample per variety. The mixed samples are labelled and dispatched to the Trials Coordinator. The labels and sample bags are supplied by the Trials Coordinator. The Trials Coordinator specifies the following on the label: the trial location, the crop, the variety name/code and the sample weight. The samples must be submitted to the Quality Coordinator or to the Quality Testing Operator by 1 October at the latest.

2.6.4. Harvested grain

The grains remaining after the sampling must be combined into a single mixed lot, to be sold as feed.

2.7. Quality testing

2.7.1. Selection of locations

Locations whose samples have a sufficient Hagberg falling number and protein content are selected for the baking quality tests.

In a year with few cases of pre-harvest sprouting, the Hagberg falling numbers are determined of two varieties sensitive to sprouting from all treated trials. At least one of these varieties must be a variety to be tested in the baking quality tests. The Trials Coordinator proposes the two varieties to be evaluated to the *Werkgroep Rassenonderzoek Granen* (Working Group for the Examination of Cereal Varieties). If those two varieties have a sufficient Hagberg falling number it is assumed that the other varieties in the trial concerned will also have a sufficient Hagberg falling number. If a lot of pre-harvest sprouting is observed in a particular year, or in case of doubt after the analysis of the two varieties sensitive to sprouting, the Hagberg falling number of all the samples must be determined. The Trials Coordinator must indicate whether the harvesting conditions of the year concerned have been conducive to pre-harvest sprouting. The criterion for determining whether or not samples from a particular trial are to be included in the evaluation is a Hagberg falling number of 180.

The protein content of the samples is to be determined by NIR methodology. The protein content of the samples must be at least 10.5%.

2.7.2. Varieties to be tested

Every year 4 to 6 standard varieties with a hardness of the grain equal to or greater than that of the variety 'Warrior' must be tested. The standard varieties must be chosen so as to ensure that the range of variation in all baking quality characteristics specified in the Recommended List is adequately covered. The Trials Coordinator will propose a list of standard varieties every year. All second and third year varieties which, in the first or in the first and second year's tests respectively, were found to be classified as "bread making quality wheat" or "mixed quality wheat" are to be tested. The Trials Coordinator will determine which first year varieties of the breeders concerned must be tested.

2.7.3. Baking quality characteristics to be determined

Labor Aberham determines the following characteristics:

- aspects according to the ten-point system of Labor Aberham
- protein content
- Zeleny sedimentation
- Kernel hardness
- Hagberg falling number

2.8. Log

All the operations described in this chapter, plus any irregularities or unforeseen matters that may affect the trial results must be recorded in a log. After the trials have been harvested the log must be submitted to the Trials Coordinator, who will keep it for six years.

Annex 1: Schedule for baking quality tests

Time	Action	Who
Harvest	Take samples of VCU trial material	Trials Coordinator and Breeders
1 October at the latest	Submit samples to Trials Coordinator	Breeders
October	Submit samples of 2 varieties from all locations (1 kg) to Labor Aberham for determination of the Hagberg falling number. Have the protein content of all the samples (0.5 kg) tested at one of the breeding companies (NIT)	Trials Coordinator
October	Have the protein content of all the samples (0.5 kg) tested at one of the breeding companies (NIT)	Trials Coordinator
October	Inventory at breeders to determine which first-year varieties must be tested	Trials Coordinator
End of October	Selection of trial locations on the basis of Hagberg falling numbers and protein contents	Trials Coordinator
Beginning of November	Submit samples (1.5 kg) to Labor Aberham for quality analysis	Trials Coordinator
Beginning of November	Submit samples (5 kg) to the milling industry of varieties which have already been tested for 2 years	Trials Coordinator
December/January	Processing of Labor Aberham's results	Trials Coordinator
End of January	Discussion of results and determination of the classification of varieties	Trials Coordinator and Plant Variety Board
Beginning of February	Send the results of the baking quality tests to the breeding companies	Trials Coordinator
April	Evaluation of the baking quality tests	Working group for the Examination of cereal varieties

Annex 2: contact details

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