

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

Harvest 2024

**Board for Plant Varieties (Rvp) and
Recommended List Committee (CSAR)**

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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 (RL1 and RL2) 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, in which yield and various variety characteristics are determined;
- Inoculated disease tests to determine the resistance to fusarium ear blight (RL1 to RL3)
- Disease tests under natural infection conditions to determine the resistance to mildew (RL1 to RL3);
- a test to determine the sensitivity to pre-harvest sprouting (RL1 to RL3);
- baking quality tests (RL1 to RL3).

In this protocol, it is assumed that sufficient basic knowledge of winter wheat cultivation is available; commonly used methods and treatments are not explicitly described. If not indicated otherwise, it is assumed that cultivation is carried out as on the average Dutch arable farm.

Only varieties that have been applied at the Board for Plant Varieties for inclusion in the Dutch National List and varieties that are already registered in the National List of one or more EU Member States or that otherwise are approved for marketing in The Netherlands will be eligible for VCU testing.

Based on the data from VCU testing, after the end of RL2, a decision is taken by the Board for Plant Varieties (Rvp) on inclusion in the National List, with which a variety is approved for marketing. At the end of RL3, the Recommended List Committee (Commissie Samenstelling Aanbevelende Rassenlijst (CSAR)) takes a decision on inclusion and classification in the Recommended List.

See Annex 2 for contact information.

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 September 25th at the latest. The submitted seed must not have been treated. The Trials Coordinator inventories the amount of seed needed per variety, treats the seed and distributes it among the Trial Operators. Along with the seed, a list of the thousand-grain weights and, if possible, data on germination rate of the seed is sent by the Trials Coordinator to the Trial Operators.

The applicant must submit to the Trials Coordinator the amount of seed of each variety to be tested as specified by the Trials Coordinator. Each Trial Operator shall declare to the Trials Coordinator the desired quantity of seed of the varieties to be tested. The identity of the varieties in trials is verified based on the (variety) knowledge of breeders and variety testers. The Trials Coordinator retains 100 grams of untreated seed of each variety tested in the regional yield trial in a conditioned seed storage. If necessary, this sample can be used for identity verification. The samples are stored for three years. The seed supplied by the breeders is exclusively meant to be used for the official examination of the Value for Cultivation and Use.

2.2. Trial design

2.2.1. General

Yield trials are carried out in complete replicates. These replicates are subdivided in subblocks of 5, 6 or 7 plots. Preferably, the varieties should be grown in a single lane per replicate. 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 trials, untreated trials and trials with restricted disease control are carried out at the same location, the trials should be randomised separately. The width of a plot is to be at least 1.4 metres and the length of a plot is at least 3 times its width. Yield trials are carried out in two replicates if the plot area is at least 7.5 m² and in three replicates if the plot area is less than 7.5 m².

2.2.2. Regional yield testing

The regional testing (RI1 to RI 3) is conducted at 6 locations. At 3 locations 3 trials are sown: a treated yield trial, a yield trial with restricted disease control and an untreated yield trial. At the other 3 locations 2 trials are sown: a treated yield trial and an untreated yield trial. The yield trials should be spread over the regions in the following way:

Region	Number of treated yield trials	Number of untreated yield trials	Number of yield trials with restricted disease control
Northern marine clay	2	2	1
Central marine clay	2	2	1
Southwestern marine clay	2	2	1

In case of multiple locations per region, the locations should be well distributed across the region. Each trial consists of two or three replicates (see 2.2.1).

2.2.3. Special tests

Disease tests in the regional testing:

Fusarium ear blight

Resistance to fusarium ear blight is tested in two trials, each trial comprising two completely randomized replicates. One trial is conducted by a breeding company (2 complete replicates with a plot size of about 1 m²) and one trial is conducted by the Trials Coordinator (2 complete replicates with a plot size of 1.35 x 4 metres). Each plot is artificially inoculated 3 to 4 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 will be included in the trials.

Mildew test

Resistance to mildew is tested in two trials under natural infection conditions. One trial is conducted and observed by a breeding company and one trial is conducted by the Trials Coordinator. Each trial comprises two completely randomized replicates. The plot size is at least 0.5 m². Infestation is observed as percentage of affected leaf area on a scale of 1 to 9 at several moments. If necessary, a standard variety with a low mildew score will be included in the trials.

Disease observation trial

A disease observation trial will be conducted by the Trial Coordinator in the Central Sea Clay Region in two replicates with a plot size of 1.35 x 4.5 metres. Disease infestations occurring under natural disease pressure will be observed in the same way as in the untreated yield trials. Lodging resistance will also be observed. The trial will be treated in the same way as an untreated yield trial, but will not be harvested. If the disease observation trial is combined with a fusarium trial in one trial, the whole trial should be treated with CCC and the part with the fusarium trial should be treated with fungicide.

Pre-harvest Sprouting tests

A test for resistance to pre-harvest sprouting is carried out by the Trials Coordinator annually (in two replicates). For this purpose, in each plot 15 stems are cut from one of the treated yield trials on clay soil at two moments. To determine the first moment, a preliminary test is carried out with a sprouting-sensitive variety. The stems (30-40 cm including ear) are tied together in a bundle and wetted, after which they are hung away in a climate room at high humidity (close to 100%) and a normal temperature (15 - 20 °C). One week and 12-14 days after hanging the bundles in the climate room, the visible sprouting is assessed on a scale of 1 to 9 (1 = breeding target – no sprouting).

Baking quality tests

The varieties are tested annually by Labor Aberham for their characteristics for baking quality in a milling-, dough- and baking-test. The samples are obtained by compiling a mixed sample for each variety from the treated replicates of each regional yield trial on clay soil.

In the framework of the PPS Wheat with baking Quality, additional samples will be taken from all types of yield trials (treated trials, untreated trials and trials with restricted disease control) for conducting baking quality tests by the milling industry, the NBC and WUR.

For further details, see section 2.7.

2.3. Varieties to be tested

Standard varieties

In the regional yield trials, all A (generally recommended) and N (newly recommended) varieties of the Recommended List are included as standard varieties. If a standard variety is withdrawn from further testing, the breeder concerned must notify the Trials Coordinator and the Recommended List Committee (CSAR) before September 16th.

The variety concerned will then be automatically classified as a B variety.

Varieties to be tested

There is no limit to the number of varieties that can be tested in the regional yield trials. The applicant is obliged to submit results of new varieties obtained from at least two trials, each trial at least in duplicate with 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 scheme is an incomplete block design with discard plots on either sides of the trial. The trial schemes are created by the Trials Coordinator and sent to the Trial Operators.

Fields for conducting trials should be as regular as possible. These fields should be uniform or have had pre-treatments to make it uniform without any after-effects. If a trial field is drained, the trial lanes should run parallel to the drains and the plots should be drilled across the direction of the drains. Operations and husbandry should be carried out as far as possible along the length of the lanes. Furthermore, the agronomy should follow best local practice of an average Dutch arable farm. Seedbed preparation and weed control should correspond to this.

Sowing time of the trials should comply with local practice. The trials should be sown in the period between October 15th and November 10th. Different sowing times may be used in extreme years. For proper sowing density, the seed rate is adjusted to the thousand-grain weight and germination percentage. The seed rate is adjusted to reach 100% germination. The list of thousand-grain weights includes a recommendation for the seed rate. Seed rates may vary due to differences in soil type, sowing conditions or sowing time. For hybrid varieties, seed rate is 2/3 of the seed rate of non-hybrid varieties.

Fertilisation is based on the fertiliser recommendation base for arable farming. For this purpose, a soil sample is taken by the Trial Operator in spring and the stock of N mineral is determined as a base for additional fertilisation. The Trial Operator can adjust the fertiliser level based on his experience with the field concerned. Furthermore, for the untreated trials N application rate can be reduced if the lodging risk is considered too high by the Trial Operator. The total amount of N is applied in at least three applications, the first application as early as possible in spring, the second application (in two applications if necessary) at the start of stem elongation and the third application shortly before the emergence of the first ears (stage 49 according to Zadoks cs).

In the treated yield trials, foliar diseases are controlled according to common best agricultural practice. The basic principle is that standard varieties should never be affected by diseases to a greater extent than 5% of their leaf area. Leaf disease control will always be carried out at the flag leaf stage (T2) and, depending on infection levels, leaf disease control should also be carried out at an earlier stage (T0 and T1). In the yield trials with restricted disease control, leaf diseases are only controlled at the flag leaf stage (T2). This T2-spraying has to be done at the same moment and with the same fungicide (and dose) as the T2-spraying in the treated trial grown at the same location. In the untreated yield trials no control of leaf diseases and maturity diseases will take place.

Insect control (aphids) should be carried out following best local practise. Regular checks for presence of aphids should take place. If insect control is carried out, all trials grown at a location (untreated yield trial, treated yield trial and yield trial with restricted disease control) should be sprayed.

The treated yield trials and the yield trials with restricted disease control in a clay region will be sprayed twice with low dose of CCC or Medax Top. Trials on sandy and peat soil are treated in accordance with best local practice; untreated trials may be sprayed with a low-dose CCC or Medax Top if necessary and after consultation with the Trials Coordinator.

The front side and back side of the plots must be trimmed to their final length after emergence (before or after winter) and numbered labels must be placed at the front side of the plots. The pathway between replicates is also used for the treatments.

A trial may be terminated mid-term due to irregular or poor emergence of the crop or at a later stage due to occurrence of irregularities or poor growth. In May, the Trials Coordinator collects data on the condition of the trials and informs the applicants. If there is any doubt about a trial, the Trials Coordinator, the Board for Plant Varieties and interested applicants will inspect the trial together. The Trials Coordinator and the Board will then establish the validity of the trial for further examination. In case of calamities later in the growing season, the same line should be followed. The final responsibility for decisions on whether trials are included or not lies with the Board for Plant Varieties. In the event of termination before April 15th, the trial allowance will be reduced by 60% and in the event of later termination but before the time of harvest by 30%.

2.5. Observations and measurements during the growing season

2.5.1. Implementation

Field observations will be carried out by the Trial Operator. Random observations will also be made by the Trials Coordinator. Observations may be recorded both electronically and in writing according to a format established by the Trials Coordinator. The results per plot will be sent to the Trials Coordinator at three different moments, namely after ear emergence, just before harvesting and after yield determination. All data should be sent to the Trials Coordinator as soon as possible after harvesting.

2.5.2. Characteristics

Characteristics should be scored at the widest possible range of scores. A high score means a negative assessment of the characteristic concerned and a score a positive assessment (1 = breeding target). For all diseases, an observation should be repeated if there is a change in the disease situation. Observations are finalised when the earliest variety starts showing senescence. The level of disease infection is expressed in a score, with 1 indicating no infection and 9 severe infection. Scores should correspond with 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. For each observation, the level of infection of the most and least infected plots should be reported as a percentage of infection. For a reliable statistical analysis it may be necessary to transform 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 is regularly too low, three plots (3 x 0.25 m² per plot) should be counted. In case of large plant population differences (>20%) between plots, all plots and all replicates should be scored. A low score is a high plant population. The plots with the highest and lowest plant population should also be counted (3 x 0.25 m² per plot).

Winter hardiness

If winter damage occurs, winterhardness should be observed on a scale of 1 to 9, where 1 is the least winter damage and 9 is the highest winter damage. In addition, an impression of the degree of winter damage in the plot with the highest winter damage and in the plot with the least winter damage should also be given.

Straw strength

If lodging occurs, several observations should be made. The first observation should be made immediately after the occurrence of lodging and this should be repeated when new lodging occurs. The last observation should be made just before harvesting. Observations are recorded on a scale from 1 to 9, where 1 is representing the least amount of lodging and 9 the most. In addition, an impression should be given of the degree of lodging in the plot with the most lodging and the plot with the least lodging.

Length of straw

Measurement in centimetres. Measure all replicates of three trials (treated and untreated at Northern Marine Clay, Central Marine clay and Southwestern Marine clay).

Earliness of ear emergence

Observations are to be made at the time when the ears of the earliest variety have been emerged almost completely. Observations are to be scored on a scale of 1 to 9, where 1 is early and 9 is late. In addition, an impression of the degree of ear emergence in the earliest and the latest plots should be given. Observations are to be made in all replicates of three trials (treated and untreated at Northern Marine Clay, Central Marine Clay and Southern Southwestern Marine Clay).

Ripening date

Observations should be made on a scale of 1 to 9, where 1 is early and 9 is late. The highest and lowest score should also be described. Only treated replicates are to be observed.

Mildew

The first observation should be made as soon as the most susceptible varieties are affected. If subsequent mildew infection increases, the observation should be repeated after about two weeks each time.

Yellow rust

Observation should be started as soon as one of the varieties is affected. Subsequently, all plots should be assessed regularly.

Brown rust

Brown rust should be observed as soon as 5-10% of the leaves are affected in the earliest affected plots.

Septoria tritici blotch

Observations should be made as soon as sufficient differences between plots occur.

Septoria nodorum blotch

Observations should be made as soon as sufficient differences between plots occur.

Snow mould, leaf infection (*Fusarium nivale*)

Observations should be made as soon as sufficient differences between plots occur. Observations will also be made in treated trials as soon as sufficient differences between plots occur.

DTR (*Pyrenophora tritici-repentis*)

Observations should be made as soon as sufficient differences between plots occur.

Fusarium spp.

Observations should be made as soon as sufficient differences between plots occur.

Shedding (Grain loss before harvest)

If shedding occurs, it should be observed on a scale from 1 to 9, with 1 indicating the least grain loss and 9 is the most grain loss. An impression should also be given of the degree of grain loss of the plot with the most grain loss and of the plot with the least grain loss.

Other observations

Furthermore, all observations that may be important in examining the trial should be made, such as irregularities of the trial, damage to any of the plots, soil structure damage, drought damage, bird damage, losses during harvest.

2.6. Harvest

2.6.1. Harvesting method and time of harvest

Yield trials are harvested with a plot combine harvester at the time when at least 90% of the varieties have reached 15-16% moisture content. If this cannot be achieved due to adverse weather conditions in a given year, samples must be dried to 15% moisture immediately after harvest. The harvest of a trial takes place in one go. If, due to adverse weather conditions, it proves to be impossible to harvest a trial in one go, then at least the replicate, which is in progress, must be completed.

2.6.2. Yield determination

Yield determination can be done in two ways:

1. the entire yield of each plot is dried and brought to a constant moisture content of no more than 15%, 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;

In treated trials, hectolitre weight is determined of samples cleaned at farm level. In the framework of the PPS Wheat with baking Quality, it is possible that hectolitre weight is also determined in the untreated trials and in the trials with restricted disease control. The determination of hectolitre weight can be made by using NIR with corrections for moisture content.

2.6.3. Sampling

For the purpose of quality testing (see 2.7.), samples will be taken (10 kg per plot or the whole yield of a plot in case the yield is less than 10 kg) from the 6 treated trials, the 6 untreated trials and the 3 trials with restricted disease control. In spring, the Trials Coordinator will provide the Trial Operators with a list of the samples required for each variety. After yield determination, the Trial Operator shall take a sample for each plot. The samples are labelled and sent to the Trials Coordinator. The labels and sample bags are provided by the Trials Coordinator. The label will state the following: trial location, crop, variety name/code and sample weight. The samples should reach the Trials Coordinator by October 15th at the latest.

2.6.4. Harvested seed

The seed remaining after sampling should be combined into a single mixed lot, to be sold as feed wheat.

2.7. Quality determination

2.7.1. Selection of locations

For the baking quality test on which the baking quality figures in the Descriptive Variety List will be produced, locations are selected whose samples have a sufficiently high Hagberg falling number and protein content. In a non-sprouting-sensitive year, Hagberg falling numbers are determined of two sprouting-sensitive varieties from all treated trials. At least one of these varieties must be a variety from the baking tests. The Trials Coordinator shall propose to the Working Group Variety Testing Cereals which two varieties are to be assessed. If these two varieties have a satisfactory Hagberg falling number, it is assumed that the other varieties in the trials concerned also have a satisfactory Hagberg falling number. If much sprouting is found in a year, or in case of doubt after analysis of the two sprouting-sensitive varieties, all trial samples are analysed for Hagberg falling number. The Trials Coordinator should indicate whether it is a sprouting-sensitive year. The limit for accepting samples from a given trial is an average Hagberg falling number of 220. The protein contents of the samples are determined using NIR analysis. The protein contents of the trial samples should be 10.5% on average over the trial.

2.7.2. Varieties to be tested

Each year, 4 to 6 standard varieties are tested with a hardness of the kernel equal to or harder than the hardness of the Warrior variety. The choice of varieties is made in order that for all baking quality characteristics listed in the Recommended List, variation is adequately covered. The Trials Coordinator will propose the list of standard varieties annually. All second- and third-year varieties will be tested for which testing in the 1st, respectively 1st and 2nd year showed that they were in the "Baktarwe" or "Vultarwe" group. The Trials Coordinator will make an inventory at the concerned breeding companies to determine the first-year varieties which need to be tested.

2.7.3. Baking quality characteristics to be determined

The following characteristics are determined by Labor Aberham:

- Aspects according to the 10-point system of Labor Aberham
- Protein content
- Zeleny sedimentation
- Kernel Hardness
- Hagberg falling number

Next to this, the milling industry, the NBC and WUR will conduct baking quality tests with samples taken from the treated trials, the trials with restricted disease control and the untreated trials. Appointments about these tests will be made in the framework of the PPS Wheat with baking Quality

2.8. Log

All operations described in this chapter, as well as irregularities and unexpected matters, which affect the trial results, should be recorded in a log. After harvesting the trial, the log shall be sent to the Trials Coordinator, who shall keep the log for six years.

Annex 1: Schedule baking quality tests

Time	Action	Who
Harvest	Making samples of VCU trial material	Trials Coordinator + Breeders
October 15 th at the latest	Delivery of 10 kg samples to Trials Coordinator	Breeders
October	Send samples of 2 varieties from all locations (1 kg) to Labor Aberham for determination of fall number	Trials Coordinator
October	Have all samples (0.5 kg) tested at one of the breeders for protein content (NIT)	Trials Coordinator
October	Inventory at breeders: determination of first-year varieties to be tested	Trials Coordinator
End of October	Selection of trial locations based on Hagberg falling numbers and protein contents	Trials Coordinator
Beginning of November	Send samples (1.5 kg) for analysis to Labor Aberham	Trials Coordinator
Beginning of November	Send samples of varieties that have already been tested for 2 years to the milling industry	Trials Coordinator
December / January	Processing of Labor Aberham results	Trials Coordinator
End of January	Discussion of results and determination of classification of varieties	Trials Coordinator and Board for Plant Varieties (Rvp)
Beginning of February	Distribution of baking quality test results to the breeders	Trials Coordinator
April	Evaluation of the baking quality test	Working Group Variety Testing Cereals

Annex 2: Contact information

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