

Phytosanitary procedures

Testing of potato varieties to assess resistance to *Globodera rostochiensis* and *Globodera pallida*

Specific scope

This standard describes the testing of potato varieties to assess resistance to the potato cyst nematodes, *Globodera rostochiensis* and *Globodera pallida*. It should be used to fulfil requirements mentioned in PM 9/- *National regulatory control system for Globodera rostochiensis and Globodera pallida* (in preparation).

Specific approval and amendment

First approved in 1990-09¹.

Revised and edited as an EPPO Standard in 2006-09.

Introduction

The test described here is intended to be used in official schemes for testing new potato varieties for resistance to potato cyst nematodes (PCN). By including a standard or reference population of potato cyst nematodes and by comparing the nematode multiplication rate on a new cultivar with that on a reference cultivar, it is possible to relate the new cultivar to internationally recognized levels of resistance. It is also envisaged that the test could be used to provide a comparative measure of the virulence of populations of potato cyst nematodes. For further background information refer to Mugniéry *et al.* (1989).

The test procedure proposed in this EPPO Standard should be reviewed regularly. In particular, the virulence characteristics of potato cyst nematode populations in Europe should be closely monitored. The standard nematode populations used in the tests should be representative of the virulence groups found during this monitoring.

Definition of resistance

A potato cultivar should be regarded as resistant (to potato cyst nematodes) when it significantly inhibits the development of the particular population. The degree of this resistance should be quantified and all the varieties ranked according to a standard scoring notation (see Table 1), indicating their potential use for control measures in relation to local conditions.

Test procedure

- 1 The resistance test should be performed in a quarantine facility; either outside, in glasshouses, or climate chambers.

- 2 The test should be performed in pots each containing at least one litre of soil (or suitable substrate).
- 3 The soil temperature in the test containers during the course of the test should not exceed 25°C and the test containers should be adequately watered.
- 4 When planting the test or control variety one potato eye plug of each test or control variety should be used. Removal of all stems except one is recommended.
- 5 The variety 'Desirée' should be used as a standard susceptible control in every test. Additional fully susceptible control varieties of local relevance may be added as internal checks. The standard susceptible control variety may be changed if research indicates that other cultivars are either more suitable or more accessible.
- 6 The following standard populations of potato cyst nematodes should be used in resistance tests against pathotypes Ro1, Ro5, Pa1 and Pa3:
Ro1 Ecosse (may be obtained from D. Mugniéry or E. Grenier, INRA, France)
Ro5 Harmerz (may be obtained from B. Niere, BBA, Germany)
Pa1 Scottish (may be obtained from J. Pickup, SASA, United Kingdom)
Pa3 Chavornay (may be obtained from D. Mugniéry or E. Grenier, INRA, France).

Other populations of local relevance may be added. For these populations, records of how their pathotype was determined should be available.

As new potato cultivars with different sources of resistance are developed, standard nematode populations will be

¹Approved as a Council recommendation (OEPP/EPPO, 1992).

Table 1 Standard scoring notation

Relative susceptibility (%)	Score
< 1	9
1.1–3	8
3.1–5	7
5.1–10	6
10.1–15	5
15.1–25	4
25.1–50	3
50.1–100	2
> 100	1

A score of 9 indicates the maximum level of resistance.

reviewed regularly with regards to their virulence against these potato cultivars. Similarly, if as a result of monitoring it is found that the virulence characteristics of potato cyst nematode populations in Europe have changed, the standard nematode populations described here should be reviewed.

- 7 The identity of the standard population should be checked using appropriate methods. It is recommended that at least two resistant varieties or two differential standard varieties of known resistance capacity are used in the test experiments.
- 8 The potato cyst nematode inoculum (Pi) should consist of 5 infective eggs and juveniles per ml of soil. It is recommended that the number of nematodes to be inoculated per ml of soil is determined in hatching experiments. The nematodes may be inoculated as cysts, or as eggs and juveniles in a suspension.
- 9 The viability of the cyst content used as inoculum source should be at least 70%. It is recommended that the cysts are 6–24 months old and are kept for at least 4 months at 4°C immediately prior to use.
- 10 There should be at least 4 replicates (pots) per combination of potato cyst nematode population and potato variety tested. It is recommended to use at least 10 replicates for the standard susceptible control variety.

- 11 The duration of the resistance test should be at least 3 months and the maturity of developing females should be checked before breaking up the experiment.
- 12 Cysts from the 4 replicates should be extracted and counted separately for each pot.
- 13 The final population (Pf) on the standard susceptible control variety should be determined by counting all cysts from all replicates and the eggs and juveniles from at least 4 replicates.
- 14 A multiplication rate of at least 20x (Pf/Pi) on the standard susceptible control variety should be achieved.
- 15 The coefficient of variation (CV) on the standard susceptible control should not exceed 35%.

Other statistical tests may be applied at a later stage if there is evidence that those tests will increase the precision of the test results.

- 16 The relative susceptibility of the tested potato variety to the standard susceptible control variety should be determined and expressed as a percentage according to the formula:

$$\frac{Pf_{\text{test variety}}}{Pf_{\text{standard susceptible control variety}}} \times 100\%$$
- 17 If a tested potato variety has a relative susceptibility of more than 3%, cyst counts will suffice. In cases where the relative susceptibility is less than 3%, eggs and juveniles should be counted in addition to cyst counts.
- 18 Where the results of tests in the first year indicate that a variety is fully susceptible to a pathotype (e.g. score \leq 3), there is no requirement to repeat these tests in a second year.
- 19 If the tested cultivar is not fully susceptible, the results of the tests should be confirmed by at least one other trial performed in another year. The arithmetic mean of the relative susceptibility in the 2 years is used to derive the score according to the standard scoring notation (see Table 1).

References

- Mugniéry D, Phillips MS, Rumpfenhorst HJ, Stone AR, Treur A & Trudgill DL (1989) Assessment of partial resistance of potato to, and pathotype and virulence differences in, potato cyst nematodes. *Bulletin OEPP/EPPO Bulletin* **19**, 7–25.
- OEPP/EPPO (1992) Recommendations made by EPPO Council in 1990: Evaluation of resistance to potato cyst nematodes. *EPPO Technical Documents* no. 1013, 66–67.