The yield of potatoes resistant to *Heterodera rostochiensis* on infested land

By

F. G. W. Jones, Diana M. Parrott and T. D. Williams

Rothamsted Experimental Station, Harpenden, Herts, England

Yields of a resistant potato variety bred from *Solanum tuberosum* ssp. *andigena* were adversely affected when their roots were invaded by *H. rostochiensis* larvae of a pathotype unable to multiply in them. Yields were inversely proportional to pre-cropping population density. Populations decreased slowly when the resistant variety was grown continuously but showed a tendency to increase after 4-5 years. There was some evidence that pathotypes 1 and 1,2 increased slightly (pathotypes B and C of other workers) whereas pathotype 2 (pathotype A) remained much the same. The dominant gene for resistance from *Solanum tuberosum* ssp. *andigena*, that from *S. multidissectum* and both together appeared to confer some tolerance to the injury caused by root invasion. Yields after methyl bromide fumigation were so increased that it seemed likely that pathogens other than *H. rostochiensis* were also controlled. Although a significant linear relationship could be fitted to the relationship between the yield of an experimental resistant variety bred from *S. tuberosum* ssp. *andigena* and the logarithm of the pre-cropping population density, the real relationship is probably sigmoid.

To compare the yields of nematode resistant and susceptible potato varieties on land heavily infested with potato cyst-nematode, *Heterodera rostochiensis* Woll., two field trials were done on light sandy soil at Woburn Experimental Station. The first ran from 1960 to 1966 and the second was in 1966 only. The long-term trial included a susceptible and a resistant variety each grown continuously and in different sequences, and some fallow plots. Alongside the trial some potato varieties with two or more genes for resistance were grown continuously. The second experiment compared the yields of a susceptible variety and three resistant varieties on land heavily and lightly infested with *H. rostochiensis*. The lightly infested plots had been disinfested by methyl bromide fumigation. The long-term experiment showed the effect of a resistant variety on *H. rostochiensis* population densities and on pathotype frequencies.

The results of a third, earlier field trial at Iron Bridge Farm, Norfolk (Williams, 1958) showed that there is a curvilinear relationship between the yield of tubers and the logarithm of the initial population density.

Materials and Methods

Resistant potato varieties of known genetic constitution were supplied by Dr. H. W. Howard, Plant Breeding Institute, Cambridge and Dr. J. M. Dunnett, Scottish Plant Breeding Institute, Pentlandfield. (Table I).
Long Mead, the field where the first two trials were done, had grown susceptible potatoes frequently in the past. The *H. rostochiensis* population was typical of the farm of which it forms part (Table II) and similar to most fields in South East England. On resistant varieties with genetic constitutions *Ab*, *ab*, *AB* and *AB*C grown in pots, the population produced respectively 8%, 70%, 4% and 2% of the cysts on susceptible Arran Banner (*ab*). Except for 1964, when more fertiliser was unintentionally applied, the trial area received a uniform dressing of 8890 kg/hectare (7 cwts/acre) of compound fertiliser applied to the seed bed. To minimise soil movement, the direction of ploughing was reversed every year. Potatoes were hand planted into ridges drawn in the same places from year to year. Plots were 2.84 × 2.29 m (9 ft 4 in by 7 ft 6 in) and accommodated twenty plants in four rows of five, 0.71 m (28 in) between rows and 0.46 m (18 in) between plants in the rows. To isolate plots from their neighbours, discards 0.71 m (28 in) wide were left between plots across the rows and 0.91 m (36 in) wide in the rows. The first trial contained four randomised blocks of ten treatments and the second five replicates of eight treatments randomised independently.

The field at Iron Bridge Farm where the third and earlier trial was done.