Project Report

Identification of genotypic specific reactions to different strains of Tobacco Rattle Virus (TRV) in potato

Ref: 807/239

Final Report : October 2003

MFD Dale, DJ Robinson *SCRI*

2003

Project Report 2003/12

Additional copies of this report and a list of other publications can be obtained from:

Publications
British Potato Council
4300 Nash Court
John Smith Drive
Oxford Business Park South
Oxford
OX4 2RT

Tel: 01865 782222
Fax: 01865 782283
e-mail: publications@potato.org.uk

Most of our reports, and lists of publications, are also available at *www.potato.org.uk*

Contents

Preface

Recent BPC/SEERAD-funded work at SCRI has shown that some potato varieties (e.g. King Edward, Nadine, Saxon Shepody etc) can become systemically infected with spraing-causing tobacco rattle virus without necessarily exhibiting symptoms. These infections can act as a reservoir of virus that non-virus infected nematodes can pick up. This is probably an important mechanism by which previously 'clean' fields become infected. The virus is known to be highly variable and this project was established, with BPC funding, to investigate varietal differences in response to infection by two different serotypes. It did not investigate overall (non-variety specific) differences between the virus strains.

Three sites were used, where different virus strains were known to exist in the nematode populations. Soil was taken from each site and used in parallel glasshouse trials. Although the overall incidence and severity did vary between sites, relative rankings of cultivar spraing susceptibility were similar for each site/virus strain. The researchers have not attributed the differences in incidence and severity between sites to virus strain/variety combinations, suggesting environmental factors and the timing and extent of nematode activity may be more important. Nematode populations were not measured, since this gives little indication of the number of viruliferous nematodes. The BPC has also funded initial work into a specific, PCR-based virus/nematode diagnostic, in a separate project at SAC and SCRI.

As expected, some of the potatoes became persistently infected with TRV and carried this infection into the sprouts when the tubers were grown on, as confirmed by ELISA tests. There was only a single instance of this at Bagthorpe and Burrelton together, including field and glasshouse trials. In contrast, at Tayport, two thirds of the varieties used were systemically infected in the field and/or the glasshouse trial. This was the site with the highest incidence of symptoms by far. It seems likely that there were low levels of systemic infection at the other sites in some varieties but that these were below the resolution of the tests, which only involved three tubers from each plot.

Other published work at SCRI has demonstrated that the presence or absence of symptoms or systemic infection is probably dependent on the timing of nematode activity relative to developments in tuber physiology. This means that while some varieties are more symptom-prone (those with low ratings on the NIAB scale), these are actually less likely to get a systemic infection, since this rarely coincides with symptoms in crops. Varieties with scores between 5 and 7 on the NIAB scale are capable of having either symptomatic or systemic infections, and varieties with the highest resistance are less likely to be infected at all.

It is noteworthy that Record is the only variety never to become infected at all indicating it may provide a useful source of resistance for breeding purposes. The so-called spraing sensitive varieties (e.g. Pentland Dell), whilst exhibiting higher incidences and severities of symptom, nevertheless exhibited the potential to pass the virus on to daughter tubers.

Dr Ewen Brierley, British Potato Council

Summary for levy payers

Project aims

It is known that TRV (spraing) is highly variable, but little is known about how different potato cultivars respond to different strains of the virus. Strains of TRV are grouped into serotypes, with 'PRN' and 'RQ' the main serotypes in the UK, though others do exist and further serotypes are known in mainland Europe. This short project aimed to identify three sites in the UK infected with Tobacco Rattle Virus and assess the responses of a range of potato germplasm to exposure (in the field and glasshouse) to strains representing the two principal serotypes of TRV found within the UK for any inherent differences. The three sites included: 1) the reference site for the UK 'NIAB' list at Bagthorpe (we have confirmed that the virus at this organic site is a member of the 'PRN' serotype); 2) a site near Burrelton (Perthshire) - also organic - we have confirmed the virus as 'RQ' serotype, distinct from that at the Bagthorpe site and with a different vector nematode; and 3) a site near Tayport (Fife), a known ‘PRN’ Strain, used as a reference site for previous SCRI research.

Work undertaken and key findings

Three field trials were undertaken during 2002 to assess the response of a range of varieties to TRV. The sites, as described in 2.1, were tested during January/February to confirm the presence of viruliferous nematodes and confirm the nematode species and the virus serotype present. The site sampling also allowed the identification of the most infective areas where the site/grower allowed a degree of choice in locating the field trials. Soil was removed from suitable areas at the three sites for use in the glasshouse tests based at SCRI to complement the field trials and also in order to ensure results should problems arise during the growing season in field or glasshouse. The field trials consisted of 15 varieties each with eight replicate and randomised plots with two plants per plot, arranged in blocks.

Following senescence, all tubers were harvested from the individual plots. Tubers were sliced and scored for symptoms on a 1 to 9 index where 1 represents severe spraing symptoms and 9 indicates complete freedom from symptoms. A score for each plot and an overall score for each variety were calculated, using a scoring system that emphasises the contribution from tubers that display symptoms and are therefore known to have been infected, and so minimises any contribution from tubers and plots that may have escaped infection due to the patchy nature of the virus within sites. The incidence of spraing for each variety at each site was calculated as the percentage of tubers scored in classes 1 to 4, taken over all eight plots. A combined score, taking into account both symptom severity and incidence and allowing for the differences in relative incidence between sites, was calculated for each variety at each site. The results for the main field trials are summarised in Appendix 1, while the full data are given in Appendix 2. The results for the glasshouse trials using soil from the three sites are summarised in Appendix 3 and the full data are given in Appendix 4.

Three-tuber samples from each field plot and also from the glasshouse plots were set aside at harvest, stored and, following dormancy break, the developing shoot/leaves were tested using ELISA for presence/absence of TRV. The results of the ELISA tests are given beside the field / glasshouse results in appendices 2 and 4 respectively.

All three field trials gave good results for the purposes of the project, the very wet growing season during 2002 helping/favouring activity of the vector nematodes and hence spraing development. As can be seen in results summarised in Appendix 1, Maris Bard and Pentland Dell developed severe spraing symptoms at all three sites, although the percentage of tubers affected varied considerably between sites. Claret and Lady Balfour were also consistently affected, although both symptom severity and incidence were generally rather lower than in Maris Bard or Pentland Dell. At the other extreme, importantly, no tuber of Record was affected at any of the sites. Bintje, Hermes, Saturna and Saxon were affected only at site 3, where the overall incidence of spraing was greatest and, even at this site, the numbers of tubers of these varieties affected were small. The remaining six varieties, King Edward, Nadine, Romano, Santé, Shepody and Wilja were generally intermediate in

both symptom severity and incidence. In the glasshouse tests (Appendices 3 & 4) with soils from sites 1 and 2, few plants were infected, as judged by the incidence of symptoms in the spraing-susceptible varieties Pentland Dell and Maris Bard. The tests with soil from site 3 (Tayport) were satisfactory and the results generally agree with those from the field trials and with the NIAB scores.

Although the TRV isolates are diverse in their biological properties, comparison of the responses of 15 potato varieties at the three TRV-affected sites provided no evidence of differences that could be directly attributed to differences among the virus isolates at those sites. The overall rankings of the 15 varieties are generally consistent across the three sites. Such differences as were observed (Appendix 1) were largely attributable to differences in the overall level of incidence of disease among the sites. Thus, although several varieties produced spraing symptoms only at site 3, the numbers of tubers affected were small relative to varieties such as Maris Bard and Pentland Dell, and this low relative incidence combined with the lower overall incidence at sites 1 and 2, resulted in hardly any affected tubers at these sites. The "combined score", while somewhat arbitrary, attempts to allow for differences in incidence between sites but to combine differences in incidence among varieties with differences in symptom severity. On this criterion, all the varieties behaved similarly at each site. In particular, there was no evidence that resistance broke down significantly at any site, or that highly spraing-sensitive varieties could escape being affected.

Differences in overall incidence among the sites probably reflect differences in the numbers of viruliferous nematodes present, as well as differences in their activity at a critical time for disease induction, which is probably around the time of tuber initiation. Nematode activity, in turn, will have been affected by environmental variables, especially soil water content and temperature. The overall incidence of spraing observed within individual varieties will also be affected by tuberisation patterns i.e. extended period or relatively short 'exposure' period and also whether tubers are initiated early during a higher risk period or later in the season when the vector nematodes may be less active/deeper due to drier conditions and have a wider choice of plant roots to feed on. Additional testing of a range of important weed hosts at the Tayport site in 2003 indicated that infection occurred very early in the growing season. Notably, some weed species such as chickweed were mostly infected within a few weeks of establishment in the field, indicating a lot of viruliferous nematode activity had occurred; the results are summarised in Appendix 5.

Conclusions

The incidence of spraing symptoms varied considerably among three sites where *Tobacco rattle virus* (TRV) was known to occur. However, there was no evidence that this variation reflected differences in the ability of the TRV isolates at the different sites to infect potato varieties. It is important that, while tested over a limited number of sites/serotypes, the varieties with known resistance to TRV maintained that resistance while under a degree of pressure. Instead, the incidence of spraing is likely to depend on the numbers of viruliferous nematodes present at a particular site and on environmental factors that affect their activity at critical times during the crop's development. Environmental factors, as well as genotype, also influence whether or not spraing symptoms develop as a result of infection. Importantly, the inherent resistance of Record, identified recently by SCRI as a major gene, conferred complete resistance to the different serotypes of TRV and offers an effective source for breeders and growers to utilise in new cultivars. The confirmation of TRV in a range of weeds may offer a practical bioassay to plot TRV infections within fields.

Experimental section

Introduction

Tobacco rattle virus (TRV) is transmitted by free-living nematodes of the family Trichodoridae (trichodorids; Robinson and Harrison 1989). These animals are vermiform (long, thin and cylindrical) soil-inhabiting ectoparasites that feed on the roots of a large range of plant species, both weed and crop plants. They are generally found in lighter, open-textured soils down to a depth of about 80 to 100cm. Feeding by the nematodes causes little evident damage to the various weed hosts. However, at sufficiently high population levels the nematodes can severely physically affect the roots and growth of many crop plants, resulting in varying degrees of yield loss, hence the common name of 'stubby root nematodes'. The trichodorid nematodes have relatively short bodies, approximately 0.5 to 1.5mm in length, and only the solid, anterior section of their stylet (15μm) is protractible. Consequently, these nematodes tend to feed only on the root-tip epidermal and root hair cells. This probably explains why the tubers of a potato crop are most vulnerable to nematode feeding and transmission of the virus during the period of initial tuberisation rather than later in the season when the periderm of developing tubers will restrict the ability of the nematode to reach the cells in the cortex. The nematodes feed by browsing from cell to cell and, when they settle to feed, they ingest the contents of a cell in approximately 4 to 6 mins (Brown and McFarlane, 2001). When they feed on virus infected plants, they ingest virus particles and some of the virus particles become adsorbed at specific sites of retention in the cuticle lining of the oesophageal tract. Transmission subsequently occurs when the nematode next feeds, with the oesophageal bulb gland secretions releasing virus particles and conveying them into the plant root cells. Both adult and juvenile nematodes can transmit the virus, though the virus is not retained through moults. However, because these nematodes aggregate around feeding sites, individuals that have become virus-free probably re-acquire the virus from feeding on the same roots as viruliferous individuals. The nematodes are usually found in patches in fields. Often, high population densities comprise several species, only one of which may be carrying the virus. Conversely, low density populations may consist of a single efficient vector species.

Trichodorid nematodes, often in association with TRV, are distributed throughout most of Europe and the former Soviet Union. Countries where both virus and vector occur include Belgium, Britain, Bulgaria, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia, Sweden and Switzerland, and they are also widespread in North America. Research at the Scottish Crop Research Institute (SCRI) has identified a high degree of specificity between different TRV isolates and individual vector species (Ploeg *et al.*, 1992). These studies demonstrated that individual strains of TRV can only be transmitted by one, two or three species of trichodorid nematodes. Consequently, in a field situation known to have a 'spraing', or 'corky ring-spot' problem, while typically several trichodorid species may be present, only one of these species may be viruliferous.

The virus has one of the widest host ranges, particularly among weed species, of any known plant virus. It can infect more than 400 monocotyledonous and dicotyledonous species across over 50 families. Interestingly, the virus does not usually become systemic in most of these hosts, often remaining in the roots of plants which do not exhibit foliage symptoms. However, several species are invaded systemically and some of these, such as *Stellaria media*, may show no obvious foliar symptoms. Some of the more common agricultural weed species known to carry the virus are given in Table 1 and such weeds act to perpetuate the virus within sites and nematode populations. In a few cases the virus can be transmitted through the seed, with up to 10% transmission rates found in *Viola arvensis* (Cooper and Harrison, 1973).

TABLE 1: COMMON WEED SPECIES KNOWN TO ACT AS HOSTS OF *TOBACCO RATTLE VIRUS*.

Weed	**Common name**
Capsella bursa-pastoris	shepherd's purse
Chenopodium album	fathen, lambsquarters
Polygonum aviculare	knotgrass, knotweed
Polygonum convolvulus	bindweed, wild buckwheat
Senecio vulgaris	Groundsel
Stellaria media	Chickweed
Taraxacum officinale	Dandelion
Viola arvensis	field pansy, violet

Infection by TRV causes a number of different responses in potato plants including necrotic rings and lines (known as spraing, corky ringspot, *Pfropfenbildung, kringerigheid*) in the tuber flesh (Calvert and Harrison, 1966), and stem-mottle (distortion, stunting and mottling, typically confined to one or a few of the shoots produced from an infected tuber) and aucuba in the foliage (Harrison and Robinson, 1981). Many tubers exhibiting spraing symptoms give rise to virus-free progeny plants. Systemic infections exhibiting few tuber symptoms also occur. Spraing symptoms cause a significant problem in potato production in Europe and North America, with the processing industry and supermarkets rejecting consignments with as few as 3% to 5% of the tubers showing spraing symptoms. It is thought that spraing incidence is gradually increasing in a number of potato growing areas. Possible reasons for this are the dissemination of the causal agents, increased use of irrigation on potato fields at crucial growing times, changes to new, more sensitive cultivars (Carlsson, 1986; Sandgren 1995) and other epidemiological and agronomic factors. TRV (spraing) is highly variable, but little is known about how different cultivars respond to different strains of the virus. The variation is most easily recognized serologically, which leads to the grouping of strains into serotypes. 'PRN' and 'RQ' are the main serotypes in the UK, though others do exist, and further serotypes are known in mainland Europe.

Materials and methods

Three field trials were undertaken during 2002 to assess the response of a range of varieties to TRV. The three sites included: 1) the reference site for the UK 'NIAB' list at Bagthorpe (we have confirmed that the virus at this organic site is a member of the 'PRN' serotype); 2) a site near Burrelton (Perthshire) - also organic - we have confirmed the virus as 'RQ' serotype, distinct from that at the Bagthorpe site and with a different vector nematode; and 3) a site near Tayport (Fife), a known 'PRN' strain used as a reference site for previous SCRI research. The sites were tested during January /February to confirm the presence of viruliferous nematodes and confirm the nematode species and virus serotype present. The site sampling also allowed the identification of the more infective areas where the site/grower allowed a degree of choice in locating the field trials. Soil was removed from suitable areas at the three sites for use in the glasshouse tests based at SCRI to complement the field trials and also in order to ensure results should problems arise during the growing season in field or glasshouse. The field trials consisted of 15 varieties each with eight replicate and randomised plots with two plants per plot, arranged in blocks.

Following senescence all tubers were harvested from the individual plots. Tubers were sliced and scored for symptoms on a 1 to 9 index where 1 represents severe spraing symptoms and 9 indicates complete freedom from symptoms. Symptom scores for each plot were calculated as the mean of individual tuber scores within three units of the lowest score in that plot, and overall scores for each variety were calculated from the plot scores in the same way. This scoring system emphasises the

contribution from tubers that display symptoms and are therefore known to have been infected and so minimises any contribution from tubers and plots that may have escaped infection due to the patchy nature of the virus distribution within sites. The incidence of spraing for each variety at each site was calculated as the percentage of tubers scored in classes 1 to 4, taken over all eight plots. A combined score, taking into account both symptom severity and incidence, was calculated for each variety at each site as

(Symptom score X Relative incidence) + 9(1- Relative incidence)

where the relative incidence is the incidence for that variety divided by the greatest incidence for any variety at that site.

Three tuber samples from each field plot and also from the glasshouse pots were set aside at harvest, stored and, following dormancy break, the developing shoot/leaves were tested using ELISA for presence/absence of TRV.

During the project, in the following year to the TRV field trial at Tayport, a range of the most common weeds growing within the site were tested for TRV about 4 weeks after emergence prior to weed control being applied to the barley crop. Details of the different weeds sampled are presented in Appendix 5.

Results

The results for the main field trials are summarised in Appendix 1, while the full results are given in Appendix 2. The results for the glasshouse trials using soil from the three sites are summarised in Appendix 3 and the full results are given in Appendix 4.

All three field trials gave good results for the purposes of the project, the very wet growing season during 2002 helping/favouring the activity of vector nematodes and hence spraing development. As can be seen in the results summarised in Appendix 1, Maris Bard and Pentland Dell developed severe spraing symptoms at all three sites, although the percentage of tubers affected varied considerably between sites. Claret and Lady Balfour were also consistently affected, although both symptom severity and incidence were generally rather lower than in Maris Bard or Pentland Dell. At the other extreme, importantly, no tuber of Record was affected at any of the sites. Bintje, Hermes, Saturna and Saxon were affected only at the Tayport site, where the overall incidence of spraing was greatest, and even at this site the numbers of tubers of these varieties affected were small. The remaining six varieties, King Edward, Nadine, Romano, Santé, Shepody and Wilja, were generally intermediate in both symptom severity and incidence. In the glasshouse tests (Appendices 3 & 4) with soils from sites 1 and 2, few plants were infected, as judged by the incidence of symptoms in the spraing-susceptible varieties Pentland Dell and Maris Bard. The tests with soil from site 3 (Tayport) were satisfactory and the results generally agree with those from the field trials and with the NIAB scores.

Additional testing of a range of important weed hosts at the Tayport site in 2003 indicated that infection occurred very early in the growing season. In some weed species such as chickweed the majority of plants were infected within a few weeks of establishment in the field indicating a lot of viruliferous nematode activity had occurred. The results are summarised in Appendix 5.

Discussion of project findings

Although the TRV isolates are diverse in their biological properties, comparison of the responses of 15 potato varieties at the three TRV-affected sites provided no evidence of differences that could be directly attributed to differences among the virus isolates at those sites. The overall rankings of the 15 cultivars are generally consistent across the three sites. Such differences as were observed

(Appendix 1) were largely attributable to differences in the overall level of incidence of disease among the sites. Thus, although several varieties produced spraing symptoms only at site A, the numbers of tubers affected were small relative to varieties such as Maris Bard and Pentland Dell, and this low relative incidence combined with the lower overall incidence at sites 1 and 2 resulted in hardly any affected tubers at these sites. The "combined score", while somewhat arbitrary, attempts to allow for differences in incidence between sites but to combine differences in incidence among varieties with differences in symptom severity. On this criterion, all the varieties behaved similarly across the three sites. In particular, there was no evidence that resistance broke down seriously at any site, or that highly spraing-sensitive varieties could escape being affected.

Although glasshouse tests offer the possibility of some control over environmental variables that is not available in field trials, the environment in a glasshouse is quite artificial. In particular, water supply is never limiting and temperatures are often higher and can be difficult to keep down in sunny weather. The trials with the three soils reported here were all done in the same glasshouse but, for practical reasons, had to be set up at different times. Thus, the conditions at the time of tuber initiation may have been different in each case. When the glasshouse tests work well, as with site 3 soil, results are similar to these obtained in the field, although with minor discrepancies that might bear further investigation but glasshouse tests can fail, as with soils from sites 1 and 2. Note that, although the field trials at all three sites described here gave useful results, conditions in 2002 were particularly favourable for nematode activity and field trials can also fail. Differences in overall incidence among the sites probably reflect differences in the numbers of viruliferous nematodes present, as well as differences in their activity at a critical time for disease induction, which is probably around the time of tuber initiation. Nematode activity in turn will have been affected by environmental variables, especially soil water content and temperature (Cooper & Harrison, 1973; van Hoof, 1975; van Hoof, 1976). The overall incidence of spraing observed within individual varieties will also be affected by tuberisation patterns i.e. extended period or relatively short 'exposure' period and also whether tubers are initiated early during a higher risk period or later in the season when the vector nematodes may be less active/deeper due to drier conditions and have a wider choice of plant roots to feed on.

We have previously reported that several varieties, including King Edward, Romano, Santé and Wilja, when exposed to site A soil in glasshouse tests, became systemically infected with TRV but did not develop spraing symptoms (Xenophontos *et al.*, 1998). In contrast, in the field tests reported here, these varieties developed spraing symptoms at Tayport, as well as at the other two sites. In tests on a small number of the field grown plants, TRV was detected by ELISA in the foliage of Wilja at Tayport and of Romano at Burrelton, indicating systemic infections. These observations suggest that the outcome of infection of a TRV susceptible variety, i.e. whether the plant becomes systemically infected or develops spraing symptoms, is affected by environmental factors as well as by the genotype.

Unlike the response to infection, resistance to infection in Record seems to be largely unaffected by environmental factors. No infection was recorded at any of the field sites, or in previous glasshouse tests (Xenophontos *et al.*, 1998). As with most virus diseases, the most sustainable means for the control of spraing disease would be the availability of cultivars that combine resistance to virus infection with other desirable traits. From the field/glasshouse trials reported here Record offers a promising source of durable resistance, and our recent finding that segregation for resistance in progeny of the cross Record X Wilja is consistent with its control by a single dominant gene encourages further investigation of the use of this resistance gene in a breeding programme to produce varieties with complete and apparently durable resistance.

The results indicating that a high proportion of some common weeds are TRV positive so early in the season support the view that infection occurs early in the growing season, and that the vector

nematodes are very active during plant - weed and potato/crop - establishment. However, importantly, the results also indicate that the weed roots offer the possibility of a relatively cheap and accurate bioassay that could be used to accurately plot the extent of local TRV infections within a field, allowing growers an opportunity to select how to treat patches and avoid certain areas. Such an assay would also have the advantages of not relying on extensive soil sampling/nematode extraction and could be applied at any time within a rotation.

Conclusions of project

Within the three field trials and parallel glasshouse tests the incidence of spraing symptoms varied considerably where different strains of *Tobacco rattle virus* (TRV) were known to occur, but with a good degree consistency in responses in the varieties studied across the sites. However, there was no evidence that the observed variation reflected differences in the ability of the TRV isolates at the different sites to overcome the inherent resistance to infect the potato varieties, there being little evidence of large interactions in the variety responses to the different TRV strains. Instead, the incidence of spraing is likely to depend on the number of viruliferous nematodes present at a particular site and on environmental factors that affect their activity at critical times during the crop's development. Environmental factors, as well as genotype, also seem to influence whether or not spraing symptoms develop as a result of infection.

The resistance found within Record was found to be durable against the TRV strains at the three sites. This is an important finding as SCRI have identified this resistance as a major gene and will seek to develop its use, as will various potato breeding programmes.

Additional information on the virus presence within various weed species very early in the growing season indicates the importance of weeds as hosts for the virus within sites and also points towards the potential of developing an effective bioassay to allow accurate mapping of TRV on a field scale.

References

Brown DJF and SA MacFarlane. 2001. 'Worms' that transmit viruses. Biologist 48:35-40.

Calvert EC and BD Harrison. 1966. Potato mop-top: A soil-borne virus. Pl Path 15:134-139.

Carlsson H. 1986. Rostringar hos olika potatissorter. Vaxtskyddsnotiser. 50:103-104.

Cooper JI and BD Harrison. 1973. The role of weed hosts and the distribution and activity of vector nematodes in the ecology of tobacco rattle virus. Ann Appl Biol 73:53-66.

Harrison BD and DJ Robinson. 1981. Tobraviruses. *In*: E Kurstak (ed),Handbook of Plant Virus Infection and Comparative Diagnosis. Elsevier / North-Holland Biomedical Press, Amsterdam, pp515-540.

Ploeg AT, DJF Brown and DJ Robinson. 1992. The association between species of *Trichodorus* and *Paratrichodorus* vector nematodes and serotypes of tobacco rattle tobravirus. Ann Appl Biol 121:619-630.

Robinson DJ and BD Harrison. 1989. Tobacco rattle virus. CMI/AAB Descriptions of Plant Viruses No 346,1-7.

Sandgren M. 1995. Potato mop-top virus (PMTV): distribution in Sweden, development of symptoms during storage and cultivar trials in field and glasshouse. Pot Res 38:379-389.

van Hoof HA, 1975. The effect of temperature on the transmission of tobacco rattle virus in tulips by *Trichodorus*, using the “bait-leaf” method. Nematologica 21, 104-8.

van Hoof HA, 1976. The effect of soil moisture content on the activity of trichodorid nematodes. Nematologica 22, 260-4.

Xenophontos S, Robinson DJ, Dale MFB, Brown DJF, 1998 Evidence for persistent, symptomless infection of some potato cultivars with tobacco rattle virus. Potato Research 41, 255-65.

Appendix 1 – Summary of field trial results: Incidence and severity of spraing observed at 3 sites.

Spraing symptom score, % incidence (italic) and combined score (bold) for 15 potato varieties grown at three TRV-affected sites.

	Site 1 Bagthorpe			Site 2 Burrelton			Site 3 Tayport			NIAB Rating
Bintje	9	*0%*	**9**	3	*0.4%*	**9**	3	*2.5%*	**9**	**7**
Claret	3	*12.7%*	**5**	2	*29.4%*	**5**	3	*55.6%*	**5**	**1**
Hermes	9	*0%*	**9**	9	*0%*	**9**	2	*2.8%*	**9**	**8**
K. Edward	4	*1.4%*	**9**	5	*5.6%*	**9**	3	*31.1%*	**7**	**6**
Lady Balfour	2	*11.2%*	**5**	4	*11.1%*	**8**	4	*29.8%*	**7**	**5**
Maris Bard	2	*12.5%*	**4**	1	*52.2%*	**1**	2	*91.2%*	**2**	**2**
Nadine	4	*7.4%*	**7**	5	*12.2%*	**8**	3	*41.2%*	**6**	**6**
Pentland Dell	2	*18.3%*	**2**	1	*43.9%*	**2**	1	*87.3%*	**1**	**1**
Record	9	*0%*	**9**	9	*0%*	**9**	9	*0%*	**9**	**8**
Romano	4	*7.1%*	**7**	5	*0%*	**9**	3	*29.1%*	**7**	**7**
Santé	3	*8.2%*	**6**	5	*11.6%*	**8**	4	*28.8%*	**7**	**6**
Saturna	9	*0%*	**9**	9	*0%*	**9**	4	*6.4%*	**9**	**7**
Saxon	8	*0%*	**9**	5	*0%*	**9**	3	*6.5%*	**9**	**7**
Shepody	4	*2.6%*	**8**	4	*5.9%*	**8**	3	*30.0%*	**3**	**6**
Wilja	4	*8.4%*	**7**	4	*10.7%*	**8**	3	*24.9%*	**3**	**5**

Correlation between combined scores at 3 field sites and NIAB ratings.

	Bagthorpe	*Burrelton*	*Tayport*	*NIAB*
Bagthorpe	1			
Burrelton	0.857519	1		
Tayport	0.798575	0.849889	1	
NIAB	0.87925	0.902271	0.816171	1

Appendix 2 – Complete data from field trials: Incidence, severity of spraing and ELISA results (presence / absence of TRV virus) observed at 3 sites.

Bagthorpe Main TRV Field Trial 2002

PLOT	BLOC	NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
			1	2	3	4	5	6	7	8	9		score	exact	rounded
4	1	BINTJE									30	-	9	9	9
29	2	BINTJE									48	-	9		-
45	3	BINTJE									45	-	9		
61	4	BINTJE									42	-	9		
69	5	BINTJE								1	36	-	9		
97	6	BINTJE									43	-	9		
109	7	BINTJE									40	-	9		
123	8	BINTJE									39	-	9		
17	1	CLARET			1	1	1	4	6	1	8	-	4	2.8	3
31	2	CLARET	1		1		1		3	1	22	-	2		-
42	3	CLARET	2	5	2	1			2	1	16	-	2		
65	4	CLARET		3	2			1		1	25	-	2.4		
73	5	CLARET	1	4			5				14	-	1.8		
100	6	CLARET							1		25	-	8.9		
113	7	CLARET			1	1	2	1			22	-	4.3		
133	8	CLARET		1	2	2	1		1		48	-	3.2		
13	1	HERMES									32	-	9	9	9
30	2	HERMES									18	-	9		-
35	3	HERMES									40	-	9		
60	4	HERMES									28	-	9		
85	5	HERMES									34	-	9		
95	6	HERMES									30	-	9		
119	7	HERMES									31	-	9		
129	8	HERMES									27	-	9		
3	1	K.EDWARD				1	1	2	1	1	43	-	5.3	4	4
34	2	K.EDWARD				1			1		15	-	4		-
40	3	K.EDWARD						1	1		48	-	6.5		
56	4	K.EDWARD					2				35	-	5		
84	5	K.EDWARD				1		1			32	-	5		
99	6	K.EDWARD									44	-	9		
118	7	K.EDWARD		1			1				28	-	2		
130	8	K.EDWARD									35	-	9		
11	1	LADY BALFOUR	1	1	1	1	2			1	16	-	2	2	2
25	2	LADY BALFOUR	1	1			1	2	2		27	-	1.5		-
39	3	LADY BALFOUR	1	2	1	1		1			28	-	2		
66	4	LADY BALFOUR		1			1	1		1	24	-	2		
74	5	LADY BALFOUR	2	2	1	2		4		2	22	-	1.8		
88	6	LADY BALFOUR		1							29	-	2		
114	7	LADY BALFOUR	2		1	2		1	2		29	-	1.7		
134	8	LADY BALFOUR			3	1					35	-	3.3		

Bagthorpe Main TRV Field Trial 2002

PLOT	BLOC	NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
			1	2	3	4	5	6	7	8	9		score	exact	rounded
12	1	M.BARD					1	1			15	-	5.5	2.3	2
27	2	M.BARD		1		1	1	2	1	2	18	-	3		-
46	3	M.BARD	5	2							8	-	1.3		
62	4	M.BARD	1	1		1	1				23	-	1.5		
80	5	M.BARD				1					20	-	4		
93	6	M.BARD	2	1	1		1				15	-	1.7		
112	7	M.BARD	1	1	1						29	-	2		
125	8	M.BARD		1	2			1			22	-	2.7		
14	1	NADINE					4		2	4	16	-	5.7	3.8	4
32	2	NADINE		1		1	3			1	18	-	3		-
37	3	NADINE							2		26	-	8.9		
67	4	NADINE				1	3		4	3	16	-	4.7		
82	5	NADINE		1	2	3	3	2	1	2	29	-	3.3		
101	6	NADINE			2	1		1	2	1	31	-	3.3		
103	7	NADINE		1	1	4	1	1	2	2	29	-	3.5		
135	8	NADINE				1		1	1		26	-	5		
2	1	P.DELL 1						1			9	-	6	2.6	3
19	2	P.DELL 1			2	3	3				2	-	4.1		-
50	3	P.DELL 1			2						18	-	3		
53	4	P.DELL 1		1			2	3		1	22	m	2		
79	5	P.DELL 1	1		1		1				16	-	2		
92	6	P.DELL 1	2	3	2	1	1	1			27	-	2		
117	7	P.DELL 1		1		1					24	-	3		
128	8	P.DELL 1		2				1			23	-	2		
16	1	P.DELL 2		2	1	1	1	3	3	4	5	-	2.7	2.4	2
28	2	P.DELL 2		1				2			8	-	2		-
47	3	P.DELL 2	2	2	3		1	1			29	-	2.1		
58	4	P.DELL 2		2	1	2	2	3	1		17	-	3		
72	5	P.DELL 2	1	1	2	1	5	1	4		10	-	2.3		
86	6	P.DELL 2		1			1		1		27	-	2		
111	7	P.DELL 2		3		3					18	-	3		
124	8	P.DELL 2	1	1	1	1					18	-	2		
7	1	P.DELL 3		5	1	1	1	2	1		1	-	2.4	2.4	2
22	2	P.DELL 3		1		2	4	2		1	10	-	3.3		-
51	3	P.DELL 3		1	3	2		1			16	-	3.2		
68	4	P.DELL 3	1	1			1				11	-	1.5		
81	5	P.DELL 3		1	2		1	1			14	-	2.7		
98	6	P.DELL 3	3	2		1					17	-	1.4		
115	7	P.DELL 3		2	1	1					33	-	2.7		
120	8	P.DELL 3		1							26	-	2		

Bagthorpe Main TRV Field Trial 2002

PLOT	BLOC	NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
			1	2	3	4	5	6	7	8	9		score	exact	rounded
8	1	RECORD									29	-	9	9	9
20	2	RECORD								1	25	-	9		-
44	3	RECORD									33	-	9		
54	4	RECORD									20	m	9		
77	5	RECORD								1	23	-	9		
90	6	RECORD									34	-	9		
107	7	RECORD									34	-	9		
127	8	RECORD									35	-	9		
6	1	ROMANO						1	1	2	18	-	7.3	3.7	4
26	2	ROMANO				3	1	2	3	1	7	-	4.8		-
48	3	ROMANO		1	1	1	1	1	2		20	-	3		
55	4	ROMANO			1			2	1	3	18	-	3		
71	5	ROMANO					1			1	16	-	5		
91	6	ROMANO			2	1	3			1	26	-	4.2		
106	7	ROMANO				1			1		16	-	4		
131	8	ROMANO		1							9	-	2		
9	1	SANTE					8	2	4	8	16	-	5.7	3.1	3
24	2	SANTE	2	1	1		2	1		1	39	-	1.7		-
38	3	SANTE									29	-	9		
59	4	SANTE		1		3	3	1	1	1	26	-	3.5		
76	5	SANTE				1	2				8	-	4.7		
94	6	SANTE									16	-	9		
105	7	SANTE		3	1	1			1		22	-	2.6		
121	8	SANTE		1	2	2	1				21	-	3.2		
10	1	SATURNA									28	-	9	9	9
23	2	SATURNA									32	-	9		-
41	3	SATURNA							1	2	29	-	8.9		
57	4	SATURNA								2	50	-	9		
83	5	SATURNA									37	-	9		
96	6	SATURNA									30	-	9		
104	7	SATURNA									33	-	9		
122	8	SATURNA									28	-	9		
5	1	SAXON						1		1	27	-	7	8.4	8
18	2	SAXON									25	-	9		-
43	3	SAXON									20	-	9		
52	4	SAXON									32	m	9		
78	5	SAXON									30	-	9		
89	6	SAXON									30	-	9		
110	7	SAXON						1	1		28	-	6.5		
132	8	SAXON									28	-	9		

Bagthorpe Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
15	1		SHEPODY							2	2	12	-	8.6	3.6	4
33	2		SHEPODY									36	-	9		-
49	3		SHEPODY			1						31	-	3		
63	4		SHEPODY					1				20	-	5		
75	5		SHEPODY								1	16	-	8.9		
102	6		SHEPODY			2			1			27	-	3		
108	7		SHEPODY			1	1			2	1	18	-	3.5		
126	8		SHEPODY									18	-	9		
1	1		WILJA		1	1	2		2		1	28	-	3.3	3.6	4
21	2		WILJA		1	2	1	1			2	23	-	3		-
36	3		WILJA			2				1		37	-	3		
64	4		WILJA				1	2	1	1	1	22	-	5		
70	5		WILJA		2			1				17	-	2		
87	6		WILJA				5	2				29	-	4.3		
116	7		WILJA			1	1					31	-	3.5		
136	8		WILJA				1		1			26	-	5		

Burrelton Main TRV Field Trial 2002

PLOT	BLOC	NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
			1	2	3	4	5	6	7	8	9		score	exact	rounded
9	1	BINTJE									22	-	9	9	9
30	2	BINTJE									23	-	9		
43	3	BINTJE									46	-	9		
65	4	BINTJE									32	-	9		
75	5	BINTJE			1						23	-	3		
99	6	BINTJE									41	-	9		
118	7	BINTJE									27	-	9		
134	8	BINTJE								1	21	-	9		
14	1	CLARET	2		1	2	1				10	-	1.7	2.3	2
22	2	CLARET		5	3	1					11	-	2.6		
49	3	CLARET	1	1	1	2			2		11	-	2		
59	4	CLARET	2		5	2					7	-	2.4		
81	5	CLARET	2		4						19	-	2.3		
102	6	CLARET			1					2	16	-	3		
109	7	CLARET	1	1	2	2	1				13	-	2.3		
123	8	CLARET	3		2	1					20	-	1.8		
4	1	HERMES									13	-	9	9	9
21	2	HERMES									24	-	9		
45	3	HERMES									8	-	9		
60	4	HERMES									29	-	9		
72	5	HERMES							1		13	-	8.9		
88	6	HERMES								1	21	-	9		
117	7	HERMES								1	14	-	8.9		
127	8	HERMES									10	-	9		
15	1	K.EDWARD				2	6	2	1		21	-	5	4.6	5
25	2	K.EDWARD		1	1	1	4	1			18	-	3		
46	3	K.EDWARD					2	2		1	23	-	5.5		
52	4	K.EDWARD			3	1					19	-	3.3		
83	5	K.EDWARD				1	5			1	30	-	4.8		
87	6	K.EDWARD					1	1	1	2	12	-	6		
110	7	K.EDWARD				1	4	1	1		19	-	5		
125	8	K.EDWARD				1	1				22	-	4.5		
16	1	LADY BALFOUR					1				10	-	5	4	4
18	2	LADY BALFOUR		1	1	2	1	1			18	-	3.3		
41	3	LADY BALFOUR						1			7	-	6		
58	4	LADY BALFOUR		1	2						29	-	2.7		
70	5	LADY BALFOUR			8						5	-	3		
95	6	LADY BALFOUR									10	-	9		
115	7	LADY BALFOUR					1				23	-	5		
135	8	LADY BALFOUR					1				12	-	5		

Burrelton Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
12	1		M.BARD	2	1	1	1	1				3	-	1.7	1.3	1
23	2		M.BARD	8		2						10	-	1.4		
39	3		M.BARD	15								1	-	1		
54	4		M.BARD	3								28	-	1		
73	5		M.BARD	11								5	-	1		
98	6		M.BARD	5	4	2	1	1	3			4	-	1.7		
119	7		M.BARD	6	1	1	1	1	1			4	-	1.4		
128	8		M.BARD	5	1							3	-	1.2		
5	1		NADINE				2	1				10	-	4.3	4.6	5
28	2		NADINE					2	1	1		9	-	5.7		
36	3		NADINE						1			6	-	6		
63	4		NADINE		1		2	4				7	-	3.3		
82	5		NADINE							1	2	14	-	8.8		
92	6		NADINE				1	2				8	-	4.7		
108	7		NADINE				5		1			6	-	4.3		
131	8		NADINE			1	2	1	2		1	20	-	4		
17	1		P.DELL 1	3	2							3	-	1.4	1.4	1
20	2		P.DELL 1	1	1							2	-	1.5		
50	3		P.DELL 1	4	2	1				1		18	-	1.6		
56	4		P.DELL 1	4								4	-	1		
78	5		P.DELL 1	8								3	-	1		
96	6		P.DELL 1	missing									-			
112	7		P.DELL 1	1	2	2						8	-	2.2		
122	8		P.DELL 1	4		1						7	-	1.4		
3	1		P.DELL 2		1	1							-	2.5	1.8	2
24	2		P.DELL 2	2								1	-	1		
47	3		P.DELL 2	1		1	1	1				10	-	2		
64	4		P.DELL 2	1	2				1			12	-	1.7		
74	5		P.DELL 2	1								9	-	1		
86	6		P.DELL 2	missing									-			
114	7		P.DELL 2									8	-	9		
120	8		P.DELL 2		1	1							-	2.5		
10	1		P.DELL 3		3							5	-	2	1.8	2
32	2		P.DELL 3	1								4	-	1		
44	3		P.DELL 3		1							8	-	2		
67	4		P.DELL 3	4		1						8	-	1.4		
69	5		P.DELL 3	6								4	-	1		
101	6		P.DELL 3		2							2	-	2		
107	7		P.DELL 3		1		1					11	-	3		
133	8		P.DELL 3	2		1						2	-	1.7		

Burrelton Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
1	1		RECORD						1	1		18	-	6.5	8.7	9
33	2		RECORD									26	-	9		
37	3		RECORD									11	-	9		
62	4		RECORD									25	-	9		
84	5		RECORD									20	-	9		
89	6		RECORD									19	-	9		
116	7		RECORD									15	-	9		
130	8		RECORD							1	1	17	-	8.8		
13	1		ROMANO									3	-	9	5	5
29	2		ROMANO									7	-	9		
38	3		ROMANO									23	-	9		
53	4		ROMANO									10	-	9		
80	5		ROMANO					3				12	-	5		
91	6		ROMANO					1			2	11	+	5		
104	7		ROMANO								1	20	-	9		
124	8		ROMANO									4	-	9		
2	1		SANTE				1	2	1	1		18	-	5	4.5	5
27	2		SANTE				1					33	-	4		
51	3		SANTE				1	1	1			18	-	5		
66	4		SANTE			1						7	-	3		
71	5		SANTE				4					8	-	4		
90	6		SANTE			4	5	13	2	2	1	3	-	4.4		
111	7		SANTE						1	1		5	-	6.5		
126	8		SANTE					1		1		10	-	6		
5																
7	1		SATURNA									37	-	9	8.6	9
31	2		SATURNA									40	-	9		
40	3		SATURNA									14	-	9		
57	4		SATURNA									28	-	9		
85	5		SATURNA									29	-	9		
93	6		SATURNA						1			46	-	6		
106	7		SATURNA									18	-	9		
132	8		SATURNA									33	-	9		
6	1		SAXON					2				24	-	5	5	5
26	2		SAXON									19	-	9		
42	3		SAXON									23	-	9		
68	4		SAXON									25	-	9		
79	5		SAXON									12	-	9		
100	6		SAXON								2	11	-	8.8		
105	7		SAXON							1	1	4	-	8.5		
121	8		SAXON							1	1	13	-	8.8		

Burrelton Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	Cv score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
11	1		SHEPODY									13	-	9	3.9	4
34	2		SHEPODY									12	-	9		
48	3		SHEPODY		1		1	1				3	-	3		
55	4		SHEPODY									11	-	9		
77	5		SHEPODY			1	1					5	-	3.5		
94	6		SHEPODY									12	-	9		
103	7		SHEPODY					2				14	-	5		
136	8		SHEPODY				1					7	-	4		
8	1		WILJA			2					1	13	-	3	3.7	4
19	2		WILJA				2			2	2	22	-	4		
35	3		WILJA			1			1			7	-	3		
61	4		WILJA		1	2	2					21	-	3.2		
76	5		WILJA			1						4	-	3		
97	6		WILJA			1	1					10	-	3.5		
113	7		WILJA				1	3		1		22	-	4.7		
129	8		WILJA					1				7	-	5		

Tayport Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	CV score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
2	1		BINTJE			2			1			14	-	3	3	3
22	2		BINTJE									27	-	9		
41	3		BINTJE							1		14	+	8.9		
68	4		BINTJE									7	-	9		
78	5		BINTJE									37	-	9		
88	6		BINTJE			2					1	36	-	3		
109	7		BINTJE			1						26	-	3		
134	8		BINTJE									25	-	9		
5	1		CLARET		3	9	9	8	6	2		5	-	3.3	2.9	3
32	2		CLARET		1	3	7		5		4	1	-	3.5		
39	3		CLARET	4	10	7						2	+	2.1		
63	4		CLARET			9		2	5	4	1	7	-	3.4		
73	5		CLARET			2	3	4	6			21	-	4.2		
90	6		CLARET	8	2	12	10	4	3	1	2	1	-	2.2		
105	7		CLARET	1		13	5	2	1	1			+	2.9		
136	8		CLARET	7	5	3	6	4	2			7	-	1.7		
6	1		HERMES	1		1		4	2	4	1	28	-	2	2	2
28	2		HERMES	1			2		2	3		21	-	1		
50	3		HERMES		1							34	+	2		
60	4		HERMES						1		5	19	-	7.7		
82	5		HERMES							2	2	25	-	8.8		
97	6		HERMES			1					11	22	-	3		
112	7		HERMES							1	2	26	-	8.9		
122	8		HERMES									27	-	9		
8	1		K.EDWARD		2	2	5	6	4	2		32	-	3.3	2.9	3
23	2		K.EDWARD	2		7	4	4	3			15	-	2.6		
45	3		K.EDWARD			3				3	1	26	-	3		
66	4		K.EDWARD				1	2	2			27	-	5.2		
83	5		K.EDWARD			5	7	4	5	7	3	22	-	3.9		
94	6		K.EDWARD	6	2	2	1		3	2		11	-	1.6		
104	7		K.EDWARD	6		12	9	2	2	2	3	12	-	2.3		
124	8		K.EDWARD			15	9				3	14	-	3.4		
16	1		LADY BALFOUR			3	1		2		3	7	-	3.3	3.9	4
30	2		LADY BALFOUR			2	2	4				3	-	4.3		
36	3		LADY BALFOUR			4	7	1	1			11	-	3.7		
64	4		LADY BALFOUR				4	4	5	3	2	20	-	5.1		
77	5		LADY BALFOUR		1	1	4	3	2			8	-	3.5		
93	6		LADY BALFOUR			3	6	3	2			9	-	4		
106	7		LADY BALFOUR			5	1	3	5		3	4	-	3.8		
125	8		LADY BALFOUR		1	9	3				2	24	-	3.2		

Tayport Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	CV score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
12	1		M.BARD			2	2						+	3.5	1.7	2
21	2		M.BARD	7	1								-	1.1		
51	3		M.BARD	10	2	2	3					5	+	1.4		
56	4		M.BARD	3	1	5	1					3	m	2.2		
80	5		M.BARD	11	14	4						1	-	1.8		
100	6		M.BARD	12	1	1							-	1.2		
117	7		M.BARD	13	5	1	1	1					-	1.4		
126	8		M.BARD	12								1	-	1		
3	1		NADINE		1	6	6	4	5	2		5	-	3.4	3	3
24	2		NADINE		5	6	2	5	4			6	-	2.8		
44	3		NADINE			6	12	4	1			6	-	3.9		
65	4		NADINE				7	1	5			11	-	4.8		
79	5		NADINE		4	2	5	5	7	2	2	4	-	3.1		
96	6		NADINE			1	3	4	9	5		14	-	4.4		
108	7		NADINE	12		4	4	5	4		6	19	-	1.5		
129	8		NADINE	11		7	3					8	-	1.8		
15	1		P.DELL 1	8	4	3						7	-	1.7	1.5	1
29	2		P.DELL 1	26								4	-	1		
40	3		P.DELL 1	25								3	+	1		
62	4		P.DELL 1	3	2	3							-	2		
71	5		P.DELL 1	5		3	1	3	1			4	-	1.7		
98	6		P.DELL 1	18	2							3	-	1.1		
107	7		P.DELL 1	18		1						1	-	1.1		
135	8		P.DELL 1	1	10	3	1	1				5	-	2.1		
7	1		P.DELL 2	22								2	-	1	1.3	1
18	2		P.DELL 2	25									-	1		
48	3		P.DELL 2	10	3							5	+	1.2		
52	4		P.DELL 2	13	3	1	1					9	+	1.3		
84	5		P.DELL 2	17	8	7	1					7	-	1.7		
89	6		P.DELL 2	8	7	6	3			1		2	+	1.9		
103	7		P.DELL 2	15	1	1						1	-	1.2		
127	8		P.DELL 2	8		3						4	-	1.5		
10	1		P.DELL 3	9	4	6	6					3	-	1.8	1.4	1
31	2		P.DELL 3	25								3	+	1		
43	3		P.DELL 3	4	6	1						2	+	1.7		
58	4		P.DELL 3									3	-	9		
74	5		P.DELL 3	33		3	1					4	-	1.2		
91	6		P.DELL 3	10	1							3	-	1.1		
111	7		P.DELL 3	8		2						1	-	1.4		
120	8		P.DELL 3	6	3	2	1						-	1.6		

Tayport Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	CV score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
17	1		RECORD									11	-	9	8.6	9
25	2		RECORD									27	-	9		
47	3		RECORD									13	-	9		
57	4		RECORD									29	-	9		
69	5		RECORD									24	-	9		
99	6		RECORD						1		7	39	-	7.7		
110	7		RECORD									14	-	9		
132	8		RECORD						4	4	1	32	-	6.7		
14	1		ROMANO			4	3		1	1		16	-	3.4	2.9	3
26	2		ROMANO			2	1					3	-	3.3		
42	3		ROMANO	2	1	4		1				1	-	2.3		
55	4		ROMANO		2	4			4		2	3	-	2.7		
81	5		ROMANO	1		3	4	2		2	8	11	-	2.5		
95	6		ROMANO			7	2				2	23	-	3.2		
113	7		ROMANO			1			1	2		12	-	3		
130	8		ROMANO		1	2		1	1	2	3	5	-	2.7		
9	1		SANTE	4	6	10	8	5	7	1		11	-	2.3	3.8	4
27	2		SANTE			2	8	5	2	1	3	4	-	4.2		
35	3		SANTE				5	7	2	2		10	-	4.8		
67	4		SANTE					8	2			10	-	5.2		
70	5		SANTE						1	1	4	18	-	7.5		
86	6		SANTE		1	1	11	9	5	4	3	6	-	3.8		
118	7		SANTE		1	4	2	4	3	1	1	10	-	3.1		
128	8		SANTE			7					1	22	-	3		
4	1		SATURNA				1	4	3	4		19	-	5.3	3.8	4
34	2		SATURNA			1	2		4	3	1	12	-	3.7		
37	3		SATURNA				3	7				14	-	4.7		
59	4		SATURNA		1			6	5	2	5	42	-	2		
72	5		SATURNA				1		1			44	-	5		
101	6		SATURNA			3	4	1	8	5	1	9	-	3.7		
114	7		SATURNA					4	7	8	2	14	-	6.2		
133	8		SATURNA			1	1		4	1	1	22	-	3.5		
11	1		SAXON			4		1		2		21	-	3.4	3.1	3
20	2		SAXON		1		1	2		1		9	-	3		
38	3		SAXON		1			2			1	30	+	2		
54	4		SAXON								2	4	-	8.7		
76	5		SAXON	1	1	1		1				20	-	2		
92	6		SAXON			3				2		39	-	3		
115	7		SAXON							1	1	23	-	8.9		
131	8		SAXON					1			2	23	-	5		

Tayport Main TRV Field Trial 2002

PLOT	BLOC		NAME	No of tubers in category									ELISA	Plot	Cv score	CV score
				1	2	3	4	5	6	7	8	9		score	exact	rounded
13	1		SHEPODY	missing												
33	2		SHEPODY			1	1			5	3	7	-	3.5	3.1	3
49	3		SHEPODY			3	5					5	-	3.6		
61	4		SHEPODY					1				2	+	5		
75	5		SHEPODY			4	3	1				2	+	3.6		
87	6		SHEPODY		1					2			+	2		
116	7		SHEPODY	1	1							9	-	1.5		
123	8		SHEPODY			1	3	3	2	2		12	-	4.3		
1	1		WILJA			2	3	10	7	7		12	-	4.5	3.5	3
19	2		WILJA			2	5	3		2	2	7	-	4.1		
46	3		WILJA			1	2		2	2	2	2	-	3.7		
53	4		WILJA			1	5				3	8	-	3.8		
85	5		WILJA		1		6	4		7	3	9	+	3.7		
102	6		WILJA			1	9	3	3	1	2	13	-	4.2		
119	7		WILJA	2	1	3	4	5	8	5	3	16	-	2.2		
121	8		WILJA	5	2	2	3	3	2	1	1	23	-	1.7		

Appendix 3 – Summary of 2002 glasshouse tests using soil from 3 sites, includes ELISA TRV positive results

Glasshouse tests 2002

Summary

	Bagthorpe	Burrelton	Tayport
BINTJE	7	9	9
CLARET	4	7	4
HERMES	9	9	9
K.EDWARD	9	9	7
L.BALFOUR	9	4	5+
M.BARD	1	5	2
NADINE	9	5	3+
P.DELL	3	9	2
RECORD	9	9	9
ROMANO	9	9	7
SANTE	6	5	5
SATURNA	9	9	8
SAXON	9	7	8+
SHEPODY	6	9	7+
WILJA	9	9	6+

Correlation between combined scores in 3 glasshouse tests and NIAB ratings.

	Bagthorpe	*Burrelton*	*Tayport*	*NIAB*
Bagthorpe	1			
Burrelton	0.196939	1		
Tayport	0.689709	0.593788	1	
NIAB	0.844567	0.302619	0.842953	1

Appendix 4 – Full data and ELISA results of glasshouse tests 2002 using soil from the three sites

Bagthorpe Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
BAGT	9	1	13	BINTJE	-	9	7
BAGT	29	2	13	BINTJE	-	7	
BAGT	35	3	13	BINTJE	-	9	
BAGT	59	4	13	BINTJE	-	9	
BAGT	73	5	13	BINTJE	-	9	
BAGT	77	6	13	BINTJE	-	6	
BAGT	103	7	13	BINTJE	-	9	
BAGT	106	8	13	BINTJE	-	9	
BAGT	4	1	2	CLARET	-	3	4
BAGT	16	2	2	CLARET	-	9	
BAGT	31	3	2	CLARET	-	9	
BAGT	60	4	2	CLARET	-	7	
BAGT	72	5	2	CLARET	-	6	
BAGT	81	6	2	CLARET	-	8	
BAGT	98	7	2	CLARET	-	9	
BAGT	113	8	2	CLARET	-	5	
BAGT	3	1	14	HERMES	-	9	9
BAGT	18	2	14	HERMES	-	9	
BAGT	39	3	14	HERMES	m	m	
BAGT	57	4	14	HERMES	-	9	
BAGT	71	5	14	HERMES	-	9	
BAGT	83	6	14	HERMES	-	9	
BAGT	104	7	14	HERMES	-	9	
BAGT	116	8	14	HERMES	-	8	
BAGT	12	1	8	K.EDWARD	-	9	9
BAGT	28	2	8	K.EDWARD	-	9	
BAGT	37	3	8	K.EDWARD	-	9	
BAGT	47	4	8	K.EDWARD	-	9	
BAGT	61	5	8	K.EDWARD	-	9	
BAGT	84	6	8	K.EDWARD	-	9	
BAGT	92	7	8	K.EDWARD	-	9	
BAGT	120	8	8	K.EDWARD	-	9	
BAGT	8	1	3	L.BALFOUR	-	9	9
BAGT	20	2	3	L.BALFOUR	-	7	
BAGT	38	3	3	L.BALFOUR	-	9	
BAGT	46	4	3	L.BALFOUR	-	9	
BAGT	75	5	3	L.BALFOUR	-	9	
BAGT	78	6	3	L.BALFOUR	-	9	
BAGT	93	7	3	L.BALFOUR	-	9	
BAGT	107	8	3	L.BALFOUR	-	9	

Bagthorpe Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
BAGT	11	1	4	M.BARD	-	2	1
BAGT	17	2	4	M.BARD	-	9	
BAGT	42	3	4	M.BARD	-	9	
BAGT	58	4	4	M.BARD	-	9	
BAGT	68	5	4	M.BARD	-	1	
BAGT	76	6	4	M.BARD	-	8	
BAGT	100	7	4	M.BARD	-	8	
BAGT	114	8	4	M.BARD	-	9	
BAGT	10	1	6	NADINE	-	9	9
BAGT	19	2	6	NADINE	-	9	
BAGT	45	3	6	NADINE	-	9	
BAGT	49	4	6	NADINE	-	9	
BAGT	62	5	6	NADINE	-	9	
BAGT	82	6	6	NADINE	-	8	
BAGT	96	7	6	NADINE	-	9	
BAGT	108	8	6	NADINE	-	9	
BAGT	13	1	1	P.DELL	-	9	3
BAGT	21	2	1	P.DELL	-	9	
BAGT	41	3	1	P.DELL	-	9	
BAGT	48	4	1	P.DELL	-	9	
BAGT	65	5	1	P.DELL	-	3	
BAGT	89	6	1	P.DELL	-	9	
BAGT	97	7	1	P.DELL	-	9	
BAGT	118	8	1	P.DELL	-	9	
BAGT	7	1	15	RECORD	-	9	9
BAGT	25	2	15	RECORD	-	9	
BAGT	36	3	15	RECORD	-	9	
BAGT	50	4	15	RECORD	-	9	
BAGT	63	5	15	RECORD	-	9	
BAGT	87	6	15	RECORD	-	9	
BAGT	101	7	15	RECORD	-	9	
BAGT	109	8	15	RECORD	-	9	
BAGT	6	1	11	ROMANO	-	9	9
BAGT	23	2	11	ROMANO	-	9	
BAGT	43	3	11	ROMANO	-	9	
BAGT	51	4	11	ROMANO	-	9	
BAGT	66	5	11	ROMANO	-	8	
BAGT	86	6	11	ROMANO	-	9	
BAGT	99	7	11	ROMANO	-	9	
BAGT	115	8	11	ROMANO	-	7	

Bagthorpe Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
BAGT	15	1	7	SANTE	-	6	6
BAGT	30	2	7	SANTE	-	9	
BAGT	33	3	7	SANTE	-	9	
BAGT	54	4	7	SANTE	-	5	
BAGT	67	5	7	SANTE	-	9	
BAGT	80	6	7	SANTE	-	9	
BAGT	95	7	7	SANTE	-	6	
BAGT	117	8	7	SANTE	-	9	
BAGT	1	1	12	SATURNA	-	9	9
BAGT	22	2	12	SATURNA	-	9	
BAGT	40	3	12	SATURNA	-	9	
BAGT	55	4	12	SATURNA	-	9	
BAGT	74	5	12	SATURNA	-	9	
BAGT	79	6	12	SATURNA	-	9	
BAGT	94	7	12	SATURNA	-	9	
BAGT	112	8	12	SATURNA	-	9	
BAGT	14	1	10	SAXON	-	9	9
BAGT	26	2	10	SAXON	-	9	
BAGT	32	3	10	SAXON	-	9	
BAGT	53	4	10	SAXON	-	9	
BAGT	70	5	10	SAXON	-	8	
BAGT	88	6	10	SAXON	-	8	
BAGT	105	7	10	SAXON	-	9	
BAGT	119	8	10	SAXON	-	9	
BAGT	5	1	9	SHEPODY	m	m	6
BAGT	24	2	9	SHEPODY	-	9	
BAGT	34	3	9	SHEPODY	-	9	
BAGT	52	4	9	SHEPODY	-	9	
BAGT	69	5	9	SHEPODY	-	6	
BAGT	90	6	9	SHEPODY	m	m	
BAGT	102	7	9	SHEPODY	-	7	
BAGT	110	8	9	SHEPODY	-	6	
BAGT	2	1	5	WILJA	-	9	9
BAGT	27	2	5	WILJA	-	9	
BAGT	44	3	5	WILJA	-	9	
BAGT	56	4	5	WILJA	-	9	
BAGT	64	5	5	WILJA	-	9	
BAGT	85	6	5	WILJA	-	9	
BAGT	91	7	5	WILJA	-	8	
BAGT	111	8	5	WILJA	-	9	

Burrelton Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
BURR	13	1	13	BINTJE	-	9	9
BURR	23	2	13	BINTJE	-	9	
BURR	33	3	13	BINTJE	-	9	
BURR	50	4	13	BINTJE	-	9	
BURR	66	5	13	BINTJE	-	9	
BURR	80	6	13	BINTJE	-	9	
BURR	94	7	13	BINTJE	-	9	
BURR	107	8	13	BINTJE	-	9	
BURR	10	1	2	CLARET	-	9	7
BURR	27	2	2	CLARET	-	9	
BURR	36	3	2	CLARET	-	6	
BURR	54	4	2	CLARET	-	9	
BURR	72	5	2	CLARET	-	9	
BURR	78	6	2	CLARET	-	9	
BURR	101	7	2	CLARET	-	8	
BURR	109	8	2	CLARET	-	6	
BURR	2	1	14	HERMES	-	9	9
BURR	17	2	14	HERMES	-	9	
BURR	37	3	14	HERMES	-	9	
BURR	60	4	14	HERMES	-	9	
BURR	69	5	14	HERMES	-	9	
BURR	88	6	14	HERMES	-	9	
BURR	91	7	14	HERMES	-	9	
BURR	116	8	14	HERMES	-	9	
BURR	1	1	8	K.EDWARD	-	9	9
BURR	18	2	8	K.EDWARD	-	9	
BURR	35	3	8	K.EDWARD	-	9	
BURR	48	4	8	K.EDWARD	-	9	
BURR	68	5	8	K.EDWARD	-	9	
BURR	82	6	8	K.EDWARD	-	9	
BURR	95	7	8	K.EDWARD	-	9	
BURR	108	8	8	K.EDWARD	-	7	
BURR	14	1	3	L.BALFOUR	-	6	4
BURR	28	2	3	L.BALFOUR	-	9	
BURR	41	3	3	L.BALFOUR	-	9	
BURR	46	4	3	L.BALFOUR	-	9	
BURR	67	5	3	L.BALFOUR	-	9	
BURR	85	6	3	L.BALFOUR	-	3	
BURR	100	7	3	L.BALFOUR	-	9	
BURR	111	8	3	L.BALFOUR	-	5	

Burrelton Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
BURR	4	1	4	M.BARD	-	5	5
BURR	19	2	4	M.BARD	-	9	
BURR	34	3	4	M.BARD	-	4	
BURR	58	4	4	M.BARD	-	9	
BURR	70	5	4	M.BARD	-	9	
BURR	79	6	4	M.BARD	-	9	
BURR	105	7	4	M.BARD	-	9	
BURR	115	8	4	M.BARD	-	9	
BURR	3	1	6	NADINE	-	5	5
BURR	25	2	6	NADINE	-	8	
BURR	44	3	6	NADINE	-	9	
BURR	56	4	6	NADINE	-	9	
BURR	73	5	6	NADINE	-	4	
BURR	86	6	6	NADINE	-	9	
BURR	98	7	6	NADINE	-	9	
BURR	118	8	6	NADINE	-	9	
BURR	12	1	1	P.DELL	-	9	9
BURR	21	2	1	P.DELL	-	9	
BURR	43	3	1	P.DELL	-	9	
BURR	57	4	1	P.DELL	-	9	
BURR	62	5	1	P.DELL	-	9	
BURR	89	6	1	P.DELL	-	8	
BURR	92	7	1	P.DELL	-	8	
BURR	106	8	1	P.DELL	-	9	
BURR	9	1	15	RECORD	-	9	9
BURR	26	2	15	RECORD	-	9	
BURR	38	3	15	RECORD	-	9	
BURR	51	4	15	RECORD	-	9	
BURR	65	5	15	RECORD	-	9	
BURR	83	6	15	RECORD	-	9	
BURR	93	7	15	RECORD	-	9	
BURR	120	8	15	RECORD	-	9	
BURR	5	1	11	ROMANO	-	9	9
BURR	30	2	11	ROMANO	-	9	
BURR	45	3	11	ROMANO	-	7	
BURR	47	4	11	ROMANO	-	8	
BURR	71	5	11	ROMANO	-	9	
BURR	87	6	11	ROMANO	-	9	
BURR	104	7	11	ROMANO	-	9	
BURR	112	8	11	ROMANO	-	9	

Burrelton Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
BURR	15	1	7	SANTE	-	7	5
BURR	20	2	7	SANTE	-	9	
BURR	39	3	7	SANTE	-	5	
BURR	53	4	7	SANTE	-	9	
BURR	64	5	7	SANTE	-	9	
BURR	76	6	7	SANTE	-	9	
BURR	97	7	7	SANTE	-	9	
BURR	113	8	7	SANTE	-	4	
BURR	8	1	12	SATURNA	-	9	9
BURR	22	2	12	SATURNA	-	9	
BURR	40	3	12	SATURNA	-	9	
BURR	55	4	12	SATURNA	-	9	
BURR	61	5	12	SATURNA	-	9	
BURR	84	6	12	SATURNA	-	9	
BURR	96	7	12	SATURNA	-	9	
BURR	110	8	12	SATURNA	-	9	
BURR	11	1	10	SAXON	-	9	7
BURR	29	2	10	SAXON	-	9	
BURR	32	3	10	SAXON	-	9	
BURR	52	4	10	SAXON	-	6	
BURR	75	5	10	SAXON	-	8	
BURR	90	6	10	SAXON	-	9	
BURR	102	7	10	SAXON	-	9	
BURR	114	8	10	SAXON	-	9	
BURR	7	1	9	SHEPODY	-	9	9
BURR	24	2	9	SHEPODY	-	9	
BURR	31	3	9	SHEPODY	-	9	
BURR	59	4	9	SHEPODY	-	9	
BURR	74	5	9	SHEPODY	-	9	
BURR	81	6	9	SHEPODY	-	9	
BURR	99	7	9	SHEPODY	-	9	
BURR	117	8	9	SHEPODY	-	9	
BURR	6	1	5	WILJA	-	9	9
BURR	16	2	5	WILJA	-	8	
BURR	42	3	5	WILJA	-	9	
BURR	49	4	5	WILJA	-	9	
BURR	63	5	5	WILJA	-	9	
BURR	77	6	5	WILJA	-	9	
BURR	103	7	5	WILJA	-	7	
BURR	119	8	5	WILJA	-	9	

Tayport Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
TAYP	13	1	13	BINTJE	-	9	9
TAYP	21	2	13	BINTJE	-	9	
TAYP	39	3	13	BINTJE	-	9	
TAYP	50	4	13	BINTJE	-	9	
TAYP	73	5	13	BINTJE	-	9	
TAYP	84	6	13	BINTJE	-	9	
TAYP	103	7	13	BINTJE	-	9	
TAYP	116	8	13	BINTJE	-	9	
TAYP	14	1	2	CLARET	-	3	4
TAYP	19	2	2	CLARET	-	4	
TAYP	41	3	2	CLARET	-	4	
TAYP	60	4	2	CLARET	-	4	
TAYP	69	5	2	CLARET	-	9	
TAYP	87	6	2	CLARET	-	7	
TAYP	91	7	2	CLARET	-	9	
TAYP	106	8	2	CLARET	-	9	
TAYP	15	1	14	HERMES	-	9	9
TAYP	29	2	14	HERMES	-	9	
TAYP	33	3	14	HERMES	-	9	
TAYP	49	4	14	HERMES	-	9	
TAYP	72	5	14	HERMES	-	9	
TAYP	82	6	14	HERMES	-	7	
TAYP	98	7	14	HERMES	-	9	
TAYP	117	8	14	HERMES	-	9	
TAYP	12	1	8	K.EDWARD	-	9	7
TAYP	28	2	8	K.EDWARD	-	9	
TAYP	34	3	8	K.EDWARD	-	6	
TAYP	51	4	8	K.EDWARD	-	9	
TAYP	65	5	8	K.EDWARD	-	7	
TAYP	83	6	8	K.EDWARD	-	9	
TAYP	95	7	8	K.EDWARD	-	9	
TAYP	115	8	8	K.EDWARD	-	6	
TAYP	8	1	3	L.BALFOUR	-	9	5
TAYP	26	2	3	L.BALFOUR	-	8	
TAYP	32	3	3	L.BALFOUR	+	3	
TAYP	54	4	3	L.BALFOUR	-	9	
TAYP	70	5	3	L.BALFOUR	-	8	
TAYP	90	6	3	L.BALFOUR	-	9	
TAYP	104	7	3	L.BALFOUR	-	3	
TAYP	118	8	3	L.BALFOUR	-	6	

Tayport Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
TAYP	11	1	4	M.BARD	-	2	2
TAYP	22	2	4	M.BARD	-	1	
TAYP	42	3	4	M.BARD	-	4	
TAYP	52	4	4	M.BARD	-	3	
TAYP	68	5	4	M.BARD	-	7	
TAYP	80	6	4	M.BARD	-	7	
TAYP	105	7	4	M.BARD	-	3	
TAYP	110	8	4	M.BARD	-	3	
TAYP	4	1	6	NADINE	-	3	3
TAYP	18	2	6	NADINE	+	7	
TAYP	45	3	6	NADINE	+	4	
TAYP	57	4	6	NADINE	+	4	
TAYP	71	5	6	NADINE	-	8	
TAYP	86	6	6	NADINE	-	9	
TAYP	99	7	6	NADINE	-	9	
TAYP	109	8	6	NADINE	+	2	
TAYP	5	1	1	P.DELL	-	9	2
TAYP	30	2	1	P.DELL	-	9	
TAYP	35	3	1	P.DELL	-	2	
TAYP	56	4	1	P.DELL	-	1	
TAYP	67	5	1	P.DELL	-	4	
TAYP	89	6	1	P.DELL	-	7	
TAYP	97	7	1	P.DELL	-	9	
TAYP	112	8	1	P.DELL	-	4	
TAYP	2	1	15	RECORD	-	8	9
TAYP	27	2	15	RECORD	-	9	
TAYP	40	3	15	RECORD	-	9	
TAYP	59	4	15	RECORD	-	9	
TAYP	74	5	15	RECORD	-	9	
TAYP	78	6	15	RECORD	-	9	
TAYP	102	7	15	RECORD	-	9	
TAYP	120	8	15	RECORD	-	9	
TAYP	3	1	11	ROMANO	-	6	7
TAYP	23	2	11	ROMANO	-	9	
TAYP	37	3	11	ROMANO	-	9	
TAYP	55	4	11	ROMANO	-	5	
TAYP	62	5	11	ROMANO	m		
TAYP	88	6	11	ROMANO	-	9	
TAYP	101	7	11	ROMANO	-	7	
TAYP	114	8	11	ROMANO	-	4	

Tayport Glasshouse tests 2002 -full data

SITE	PLOT	BLOC	ENTRY	NAME	ELISA	SPRAING	CV SCORE
TAYP	10	1	7	SANTE	-	8	5
TAYP	24	2	7	SANTE	-	4	
TAYP	31	3	7	SANTE	-	7	
TAYP	47	4	7	SANTE	-	8	
TAYP	64	5	7	SANTE	-	3	
TAYP	76	6	7	SANTE	-	9	
TAYP	96	7	7	SANTE	-	7	
TAYP	108	8	7	SANTE	-	9	
TAYP	7	1	12	SATURNA	-	9	8
TAYP	25	2	12	SATURNA	-	5	
TAYP	38	3	12	SATURNA	-	9	
TAYP	53	4	12	SATURNA	-	9	
TAYP	75	5	12	SATURNA	-	9	
TAYP	81	6	12	SATURNA	-	9	
TAYP	94	7	12	SATURNA	-	9	
TAYP	107	8	12	SATURNA	-	9	
TAYP	6	1	10	SAXON	-	9	8
TAYP	16	2	10	SAXON	-	9	
TAYP	44	3	10	SAXON	+	8	
TAYP	46	4	10	SAXON	-	7	
TAYP	66	5	10	SAXON	-	7	
TAYP	79	6	10	SAXON	-	9	
TAYP	92	7	10	SAXON	-	9	
TAYP	113	8	10	SAXON	-	9	
TAYP	9	1	9	SHEPODY	+	7	7
TAYP	20	2	9	SHEPODY	-	8	
TAYP	36	3	9	SHEPODY	-	6	
TAYP	48	4	9	SHEPODY	-	9	
TAYP	61	5	9	SHEPODY	-	9	
TAYP	85	6	9	SHEPODY	-	7	
TAYP	93	7	9	SHEPODY	-	7	
TAYP	119	8	9	SHEPODY	-	7	
TAYP	1	1	5	WILJA	-	9	6
TAYP	17	2	5	WILJA	+	1	
TAYP	43	3	5	WILJA	+	9	
TAYP	58	4	5	WILJA	-	9	
TAYP	63	5	5	WILJA	+	4	
TAYP	77	6	5	WILJA	-	9	
TAYP	100	7	5	WILJA	-	9	
TAYP	111	8	5	WILJA	-	9	

Appendix 5 – TRV infection identified in weed species at Tayport site, sampled on 28th April 2003.

Chickweed (Stellaria media)	10 +ve / 11
Fat hen (Chenopodium album)	2 +ve & 1 ?/14
Mayweed (probably Matricaria discoidea)	2 +ve / 3
Groundsel (Senecio vulgaris)	1 +ve / 3
Small nettle (Urtica urens)	0 +ve / 6
Hemp nettle (Galleopsis sp.)	0 +ve / 3

