



Scottish Agricultural Science Agency

# OFFICIAL SEED TESTING STATION FOR SCOTLAND

## Newsletter and Seed Quality Update Autumn/Winter 2001/2002

May we the staff of the OSTs  
wish all our customers a Merry Christmas  
and best wishes for the New Year

**HAPPY XMAS**

### Seed Quality News:

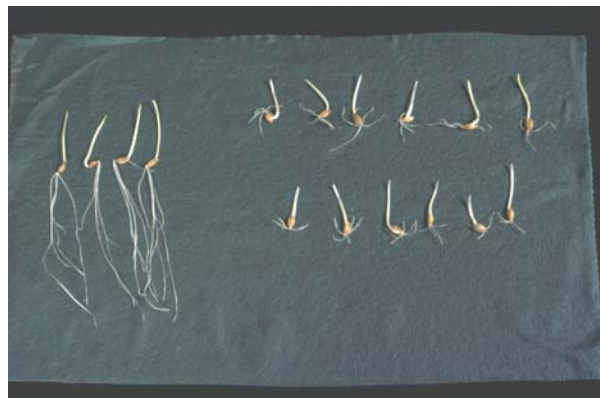
The cereal harvest was earlier and easier this year compared to last year when the wet autumn delayed harvest and prevented the sowing of winter cereals in many areas of the country.

### Germination:

Germination of wheat didn't cause too many problems this year, as disease levels were low. The main problem we had was slow germination, with many wheat samples requiring a test period longer than the 7 days normally needed for wheat. Heat damage and

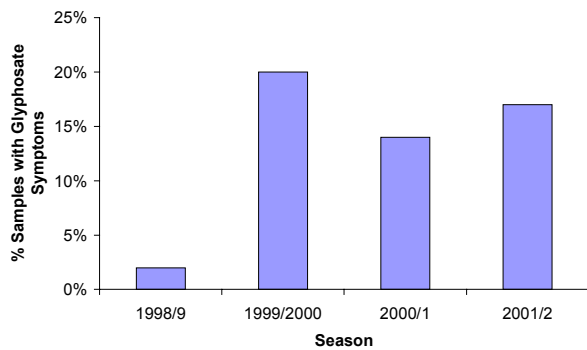
sprouting were the main reasons for low germination.

Although dormancy and slow germination has not been a problem in Barley samples their germinations have been more problematic. The causes of low germination have been related to heat damage, mechanical damage and yet again, the ongoing problem of glyphosate ("Round-up") being sprayed as a preharvest herbicide.



**Plate 1 Barley seedlings with abnormal root growth (splayed roots and roots grow upwards) due to pre-harvest glyphosate application.**

So far this season, 17% of barley samples have shown glyphosate symptoms in germination tests. At this point last season (mid-way through the testing season), 14% of barley samples showed symptoms, so there has been a slight increase this season.



**Percentage of barley samples showing glyphosate symptoms over the last four seasons**

It has been extremely useful for us to know if a sample has been sprayed with glyphosate so that we can initiate a compost test immediately as this allows us to give customers a quicker result. Please continue to provide us with this information on the seed packet.

**Glyphosate Experimental Work**

Ongoing field experiments carried out at our farm at Gogarbank have allowed us to gain a better understanding of the effects of glyphosate. Last year three experiments took place:

- The first examined the effect of planting barley seed, which had previously shown glyphosate symptoms in the germination test and assessing its performance in the field. The relationship between laboratory germination, field emergence and plant establishment is influenced by many factors including variety, but it appears that the field performance of glyphosate affected seed is lower than would be expected in the laboratory germination.
- In the second trial we were also looking to see if there was a residual effect of glyphosate on the next generation of seed. Analysis of our results indicates that there is no residual effect. Seed from crops sown with seed that had reduced germination due to glyphosate did not show any glyphosate symptoms.

- In the third trial, we examined the effect of spraying glyphosate, at different stages of crop maturity, on the germination of the resultant crop. Spraying resulted in decreased levels of germination, which was greatest in paper towelling germination tests. Reductions in seed germination, due to preharvest glyphosate treatments, were related to rainfall experienced in the period after spraying and this masked any effect due to crop maturity.

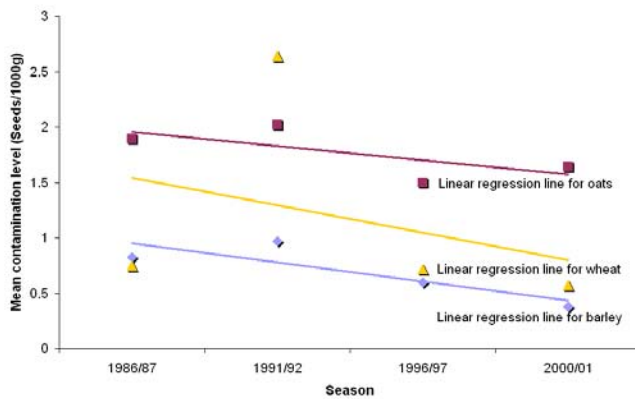
Gillian McLaren, the Analyst in charge of our Germination Laboratory has been responsible for the glyphosate work and will be reporting her findings at next years Crop Protection in Northern Britain conference. **Gillian would be pleased to discuss this work or indeed any aspect of the work of the Germination Laboratory. You can contact her on: 0131 244 8851**

**Purity**

The Seeds Regulations are currently the subject of a major review. To help inform this review Jean Hall, the Analyst in charge of our Purity Laboratory has been collating information regarding the content of other seed in certified cereal seed.

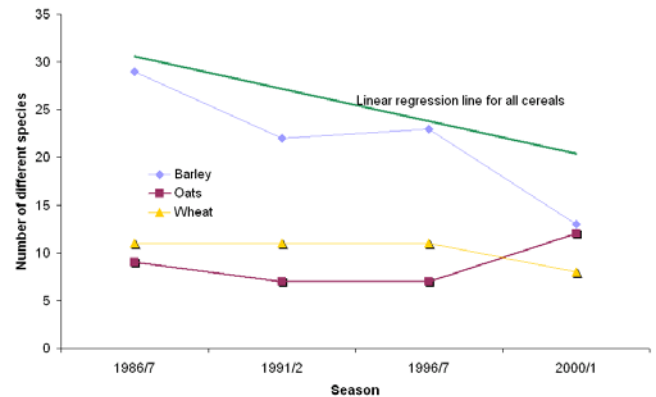
Overall, the level of contamination was very low, with an average of less than one “other seed” found in each sample search of at least 25,000 seed. Oats had the highest proportion of samples with seed of other species (68%), and it had the highest mean contamination level (1.80 seeds per 1000g search). Barley samples had the lowest proportion of samples contaminated (27%) and the lowest mean contamination levels (0.61 seeds per 1000g search). The proportion of wheat samples contaminated (41%) and mean contamination level of wheat samples (1.06 seeds per 1000g search) was intermediate between those of barley and oats.

Since 1986/7 there has been a trend towards less contamination.



**Trends in mean contamination levels in certified cereal seed since 1986/7.**

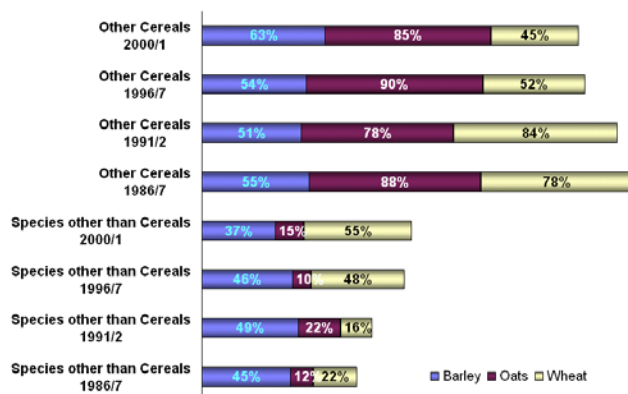
A total of 45 other species were found in the samples of certified cereal seed tested, with the number of species found greatest in spring barley (43) and lowest in wheat (22). The maximum number of different species found in barley, oat and wheat samples in a season was 29, 11 and 12 respectively.



**Trends in number of seeds different species found in certified cereal seed since 1986/7**

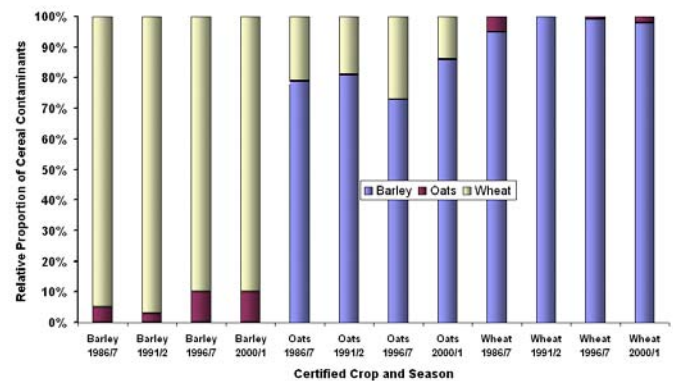
The number of species found varies with the season and there is an overall downward trend since 1986/7, mainly due to the reduction in the number of species found in barley samples.

“Other cereal seed” was the most frequent contaminant particularly in oat samples where in 2000/1 the contribution of cereal contaminants was 85%, and over 70% of oat samples tested were contaminated with seed of other cereal species.



**The proportions of Cereal and Non-Cereal contaminants in samples of certified cereal seed since 1986/7**

It is only in wheat samples from 2000/1 that the proportion of non-cereal contaminants was greater (55%) than that of other cereal contaminants. There also appears to be a trend towards a greater proportion of non-cereal contaminants in wheat samples.



**Relative proportion of cereal seed contaminants in certified cereal seed**

Of the cereal contaminants, barley was the most common in samples of spring oats and wheat, whereas, in barley samples, wheat was the most common contaminant. The level of oat contamination of barley and wheat samples was very low.

Of species other than cereals, *Galium aparine* (Sticky Willie or Cleavers) was by far the most common contaminant in wheat, being present in 14% of all wheat samples. In oat samples, *Elytrigia repens* (Couch grass) was present in 5% of samples and *Polygonum convolvulus* (Bindweed) and *Galium aparine* in around 4% of samples. *Elytrigia repens* was the most common contaminant of barley samples and was present in just over 3% of all samples over the study period.

Whereas certification seed samples were relatively free of seed of other species, the same was not true of samples submitted for analytical

purity testing before seed cleaning and certification (pre-certification samples) where almost 70% are contaminated with seed of other species.

**Jean would be pleased to help you if you would like information on the identification of any contaminant in your seed and you can contact her on: 0131 244 8803**

## Seed Health Testing

The OSTS collates seed-borne disease data from seed samples submitted for testing by growers and producers. This information can be used to help determine the extent of disease incidence and trends that may be associated with changes to agronomic practice and climate in Scotland. Data from seed harvested in 2001 and tested up to 26 November 2001 is summarised below.

## Winter wheat

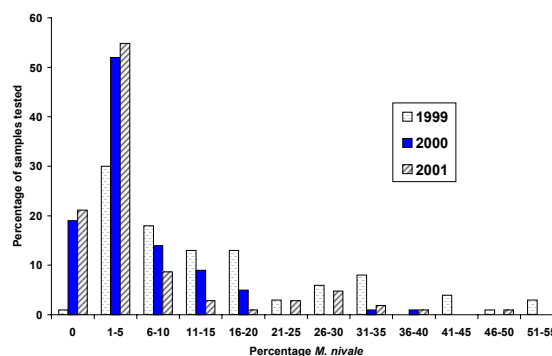
### Bunt (*Tilletia tritici*)

Thirty three percent of samples were contaminated with bunt spores, slightly higher than the previous year where 24% were contaminated. Of those contaminated two samples had more than 1 spore per seed, with a maximum infection of 2 spores per seed.

Seed should be treated with an appropriate fungicide where contamination levels of 1 spore per seed and above are reported in a seed test.

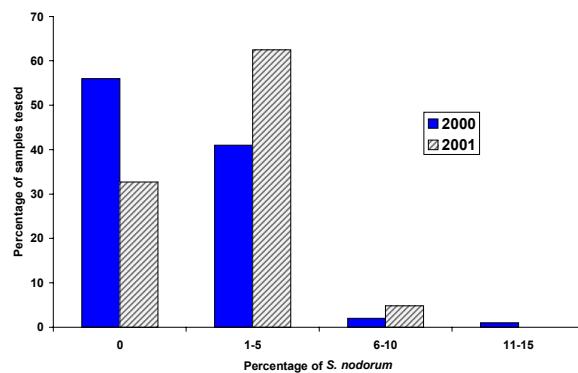
### Seedling blights (*Microdochium nivale* and *Stagonospora (Septoria) nodorum*)

The incidence of *M. nivale* was similar to the previous year with an average infection of 6% compared to an average infection of 5% in 2000. The majority of samples tested (76%) had infection levels below 6%, however there were occasional samples with higher infection levels with a maximum infection recorded of 46%.



Levels of *Microdochium nivale* found in samples from 1999 – 2001 wheat crops.

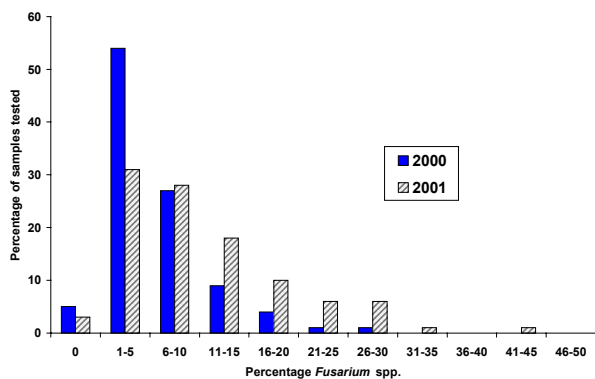
*Stagonospora (Septoria) nodorum* was found in 68% of samples tested compared to 44% the previous year. However, the average infection was 1%, similar to the average infection in 2000 (<1%) and no sample had higher than 10% seed infection.



Levels of *S. nodorum* found in samples of wheat from the 2000 – 2001 crop

### *Fusarium* spp

*Fusarium* spp was present in 97% of samples tested, similar to the levels recorded in 1999 (95%) and 2000 (95%). However, the average infection level of 10% was double the average infection found in 2000 (5%). Sixty-seven percent of samples had more than 5% infection compared to 41% in 2000, with a maximum infection of 45%. The OSTs have no evidence to suggest that the range of *Fusarium* spp. present on Scottish samples affect the germination of these seed lots. *M. nivale* and *S. nodorum* are the primary cause of seedling blight in Scotland.



Levels of *Fusarium* spp. found in samples from the 2000-2001 wheat crop.

## Winter barley

### Loose smut (*Ustilago nuda*)

The incidence of loose smut was higher in 2001 than in 2000, with 20% of samples infected in 2001 compared to only 8% in 2000. The levels of infection were higher in farm-saved seed than certified seed, with 11% of farm-saved samples failing to meet the 0.2% HVS standard seed and

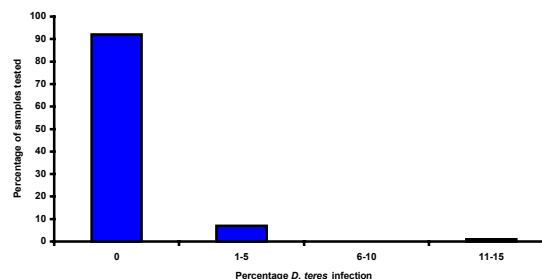
6% failing to meet the 0.5% minimum standard for certification. One sample intended for certification failed to meet 0.2% HVS standard but met the 0.5% minimum standard.

### Leaf stripe

All seed tested (intended for certification and farm saving) were free of this disease.

### Net blotch (*Drechslera teres*)

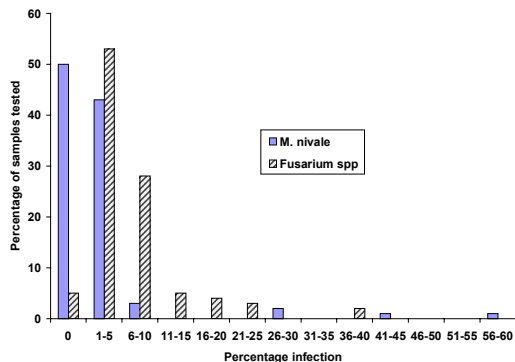
The incidence of net blotch was very low on Scottish winter barley. Only 1% of samples had more than 5% infection, with a maximum infection of 13%.



Levels of Net blotch (*D. teres*) found in samples from the 2001 winter barley harvest

### *Microdochium nivale* and *Fusarium* spp.

As with winter wheat levels of *M. nivale* were low in seed harvested in 2001. Fifty per cent of samples had nil infection, of those with infection 46% had less than 10% infection and 4% had greater than 25% with a maximum infection of 58%.



**Levels of *Microdochium nivale* and *Fusarium* spp. found in samples from the 2001 winter barley harvest**

It should be noted that whereas *Microdochium nivale* affects the germination and emergence of winter wheat, there is no evidence to suggest that it has any effect on winter barley drilled at normal sowing times.

The incidence of *Fusarium* spp. on winter barley, 95%, was higher than in 2000 where 68% of samples were infected. The average infection increased from 2% in 2000 to 6% in 2001. As with wheat the OSTs has no evidence to suggest that the *Fusarium* spp. found on Scottish winter barley affects the germination of the seed.

**Spring barley**

It is still early in the testing season for spring barley and **the information reported is based on a limited number of samples.**

**Loose Smut**

So far the majority of samples tested (96% of farm-saved and 93% of seed intended for

certification) meet the 0.2% standard. However, the incidence of loose smut is high in farm-saved seed with 35% of seed samples infected and 4% of sample exceeding the 0.5% maximum infection for seed certified at the minimum standard. Although the incidence of loose smut is lower in seed intended for certification (11%), the percentage of samples failing to meet the .5% standard is higher at 7% with a maximum infection of 6.6%.

As a number of growers have found out this disease can multiply to unacceptable levels in one season; it is therefore essential that growers intending to sow barley untreated, or use a seed treatment that does not control loose smut or only partially provides control, have their seed tested for this disease.

**Leaf Stripe**

As with winter barley samples, indications are that the majority of spring barley samples are free from this disease. It is however very important to test for this disease if you are considering sowing spring barley seed untreated.

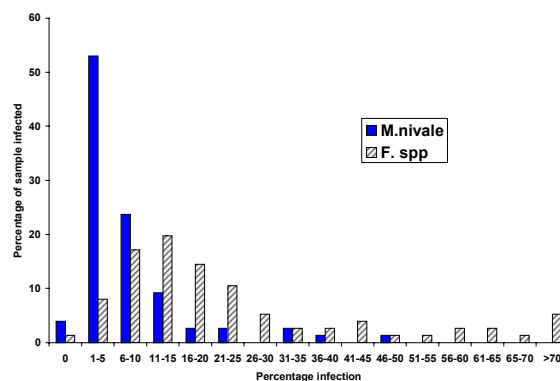
**Net Blotch**

Twelve percent of samples tested have net blotch infection but at low levels. Up to now the average infection recorded is less than 1% and the maximum infection recorded is 20%.

***Microdochium nivale* and *Fusarium* spp.**

Although the incidence of *M. nivale* is high the infection levels are generally below 10%. However infection levels greater than 30% have been recorded. If sown in January or early February when seed bed temperatures are low these infection levels may lead to a reduction in emergence.

There is an increase in the levels of *Fusarium*



spp found in spring barley compared to last year. The average infection recorded so far this year is 23% compared to only 2% in 2000. Data from samples tested with a range *Fusarium* spp. show no effect of high levels of *Fusarium* spp. on the germination of the sample in the laboratory.

#### **UNTREATED SEED**

**WE DO NOT RECOMMEND THE USE OF UNTREATED SEED WHERE SAMPLES HAVE NOT BEEN TESTED FOR GERMINATION OR SEED-BORNE DISEASE.** Growers must ensure that if they intend to use untreated seed that they fully understand how to sample their seed properly to ensure a representative sample and the range of tests they require.

**If you have any questions on the health testing service provided by the OSTs please do not hesitate in contacting Margaret Jacks, the head of our Seed Health Laboratory (0131 244 8882) or Valerie Cockerell our Seed Pathologist (0131 244 8900).**

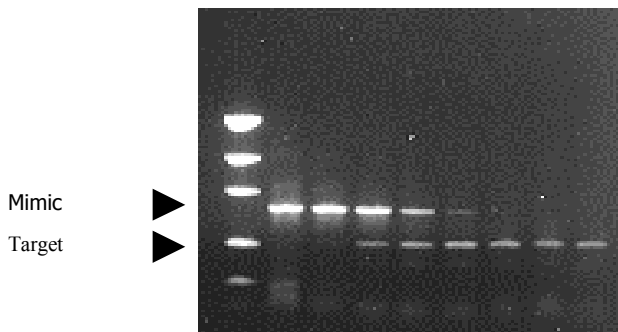
## Development of Molecular tests

Molecular diagnostic methods for the causal agents of seedling blight (*Microdochium nivale*) and bunt (*Tilletia caries*) continue to be developed at SASA in collaboration with ADAS and NIAB by Vincent Mulholland (Diagnostics and Molecular Biology Section) and Marian McEwan (OSTS, Seed Biologist).

This work is being carried out to support and promote better targeting of seed treatments through improved seed testing technology, whilst maintaining a high level of seed health.

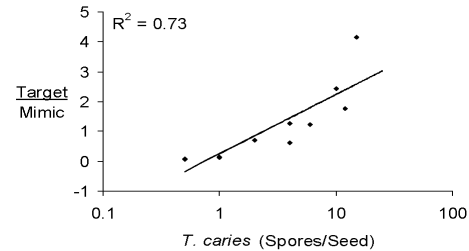
Unlike many other molecular diagnostic tests, the techniques being used in the development of these methods will allow quantification of the amount of fungus present. In other words, the information received by the grower will be equivalent to that reported today by conventional tests rather than just a presence or absence.

Highly sensitive and specific polymerase chain reaction (PCR) protocols, for the detection of *M. nivale* and *T. tritici*, have been established. Results show a good correlation with traditional tests such as, agar plate and microscopic assessment.



Electrophoresis gel showing Competitive assay

In the competitive assay, quantification is based on a ratio produced between 2 DNA fragments specific to a pathogen. The more pathogen present, the higher the ratio obtained. Infection levels are estimated by comparison of this ratio with that of samples of known infection level.



Plot showing relationship between Ratio of intensity of bands produced on gel and the number of spores per seed of *Tilletia caries*.

Another method of quantification is being investigated, real-time PCR. This uses a fluorescent dye (Sybr green) which binds to the DNA product and fluoresces under laser illumination. The fluorescence is measured every few seconds throughout the PCR assay. Quantification of infection levels is possible, as the samples with more infection will produce fluorescence sooner than less infected samples. This method involves no gel electrophoresis and so produces results more quickly.

Work is continuing into assessing, which technique will provide the fastest and most accurate results and which will provide growers with the best value for money.

The main advantage of these methods to the processor and grower will be speed; a result will be available within 48hrs instead of 7 – 10 days. Other advantages include increased throughput and the potential to offer one test for both diseases, instead of two as required at present. Rapid results would enable growers to target seed treatment application more efficiently.

**This work is funded by the HGCA and you can contact Vince or Marian to discuss their work with them on 0131 244 8845.**

## Stem and Bulb Nematode (*Ditylenchus dipsaci*) in Field Beans

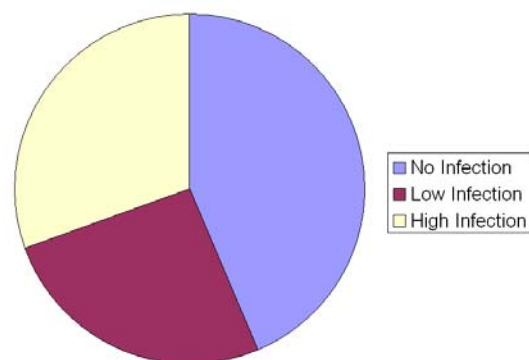
Stem and bulb nematode (*Ditylenchus dipsaci*) is a pest that damages a wide range of crop plants and causes serious yield losses in cereals (including oats, rye); root crops (beet, turnip, carrot and very occasionally potatoes); legumes (field beans, peas, clover); strawberry and bulbs (*Narcissus*, *Allium* spp.). Over 400 host plants have been recorded, including many weed species.

In January 2001, the UKASTA warned that stem and bulb nematode had become a major problem for spring and winter sown field bean crops, responsible for losses of up to 75% of the crop. As well as yield losses the nematodes can be introduced to fields by infested seed. Once established in the soil they can remain viable for many years and place future crops at risk.

The PGRO<sup>1</sup> recommend the planting of nematode-free seed as the best means of protecting clean land, and advocate that purchasers of field bean seed should ensure that their seed has been laboratory tested for stem and bulb nematode. This pest does not appear to have been considered as a serious pest of field beans until recently, and no pesticides have been approved for its control on this crop. Furthermore, there is no requirement for certified field bean seed to satisfy a test to establish freedom from stem and bulb nematode.

In preparation for planting in 2001, tests were carried out at SASA on samples (each comprising 200g of seed) drawn from a total of 23 stocks of field beans. Of these 23 stocks, ten were found to be free of stem and bulb nematode, and the remaining thirteen (57%) were infested. Over 12,000 nematodes were recovered from the sample with the highest level of infestation and over 100 nematodes were recovered from a total of seven samples.

<sup>1</sup> PGRO Processors & Growers Research Organisation



**The incidence of stem and bulb nematode in tests performed by the Virology and Zoology Section at SASA in 2000/2001 (High infestation – over 100 nematodes recovered from 200g of seed)**

An analysis of a further seventeen samples (each comprising 50g of seed) of field beans submitted to the OSTS for which no test for stem and bulb nematode had been requested, revealed infestation in eight (47%) samples.

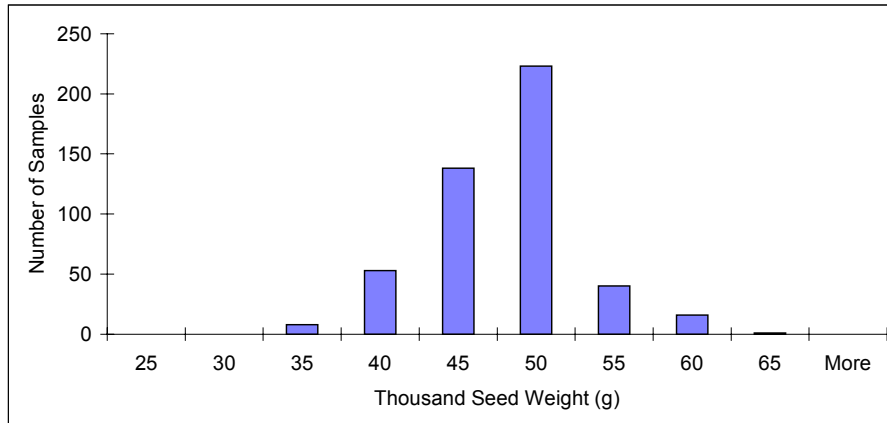
As manufacturers of animal foodstuffs move away from the use of animal proteins as a measure to control the spread of BSE, field beans are becoming an increasingly important source of protein. It is clear that stem and bulb nematode may present a major obstacle to the expansion of this crop. At present, the best method of limiting the risk presented by this nematode is to control its spread. This can be achieved by ensuring that all seed that is sown is free from infestation. The results from these first tests conducted at SASA suggest that as much as 50% of the stocks of field beans may be infested with stem and bulb nematode.

## Thousand Seed Weight Survey

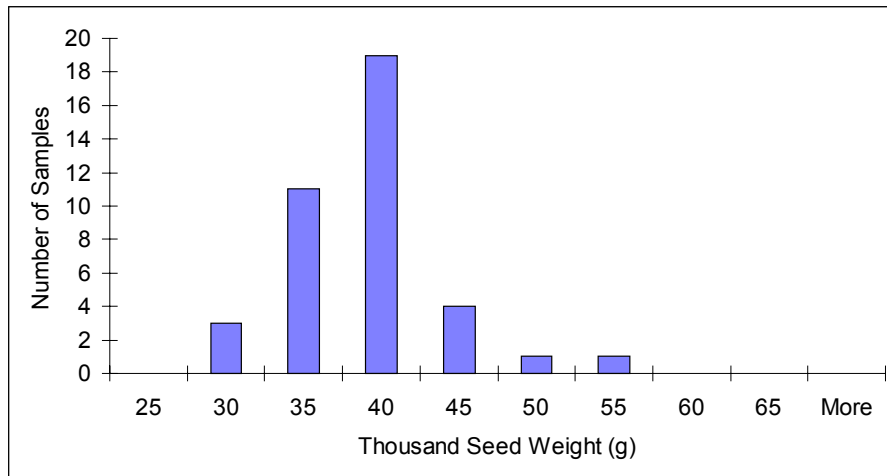
Analysis of the data from this survey has just been completed. In general the thousand seed weights of cereal samples in 2000/2001 were similar to those of 1999/2000. As in previous

surveys, there is a wide range in the thousand seed weights of individual cereal seed samples. This is illustrated in the frequency distribution histograms of thousand seed weights for barley, oats and wheat samples shown below:

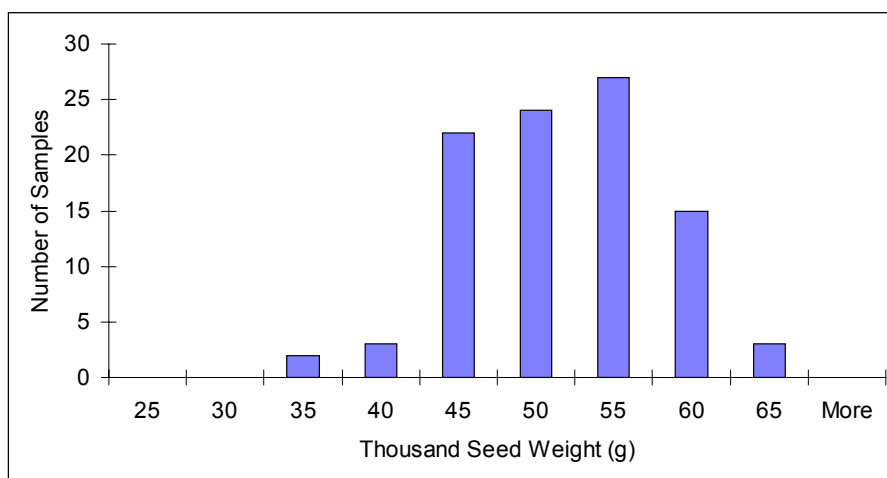
### a) Barley



### (b) Oats



### (c) Wheat



**Thousand Seed Weights of (a) Barley, (b) Oat and (c) Wheat samples tested at the OSTs in 2000/2001**

**These results emphasise the importance of thousand seed weight as a quality factor. In some cases there is a difference of almost 100% between highest and lowest thousand seed weights.** Growers must use the results of thousand seed weight determinations in conjunction with germination tests results when they calculate the seed rate required to give recommended seedling populations<sup>Φ</sup>.

Even within individual varieties there were significant differences in the thousand seed weights of different seedlots as can be seen in Table 1.

**Table 1 Summary of thousand seed weight data from individual varieties of (a) Barley, (b) Oats and (c) Wheat\***

**(a) Barley**

Variety	All Samples	Angela	Chalice	Chariot	Decanter	Delibes	Manitou	Muscat
Maximum	64.0	50.3	51.6	47.3	49.0	47.6	55.8	40.1
Minimum	31.5	37.3	39.0	35.1	35.1	37.4	39.9	32.9
Range	32.5	13.0	12.6	12.2	13.9	10.2	15.9	7.2
Average	45.6	46.2	46.8	42.7	44.0	43.4	46.5	38.2

Variety	Optic	Pastoral	Prisma	Regina	Riviera	Rounder	Tyne
Maximum	55.9	54.4	49.9	56.3	53.3	42.9	42.4
Minimum	32.3	42.6	35.8	41.4	36.6	36.6	34.3
Range	23.6	11.8	14.1	14.9	16.7	6.3	8.1
Average	45.7	48.4	45.6	50.4	49.6	40.5	36.2

**(b) Oats**

Variety	All Samples	Dula
Maximum	52.6	39.6

<sup>Φ</sup> The Scottish Agricultural College's advisors will be pleased to provide advice on how you should use your germination and thousand seed weight results to calculate required seed rates.

\* Data is presented for varieties for which more than 10 seedlots were tested

Minimum	27.3	28.8
Range	25.3	10.8
Average	36.5	34.8

**(c) Wheat**

Variety	All Samples	Claire	Consort	Riband
Maximum	60.4	49.6	55.3	60.4
Minimum	30.3	40.0	39.8	45.1
Range	30.1	9.6	15.5	15.3
Average	49.3	45.6	48.9	54.4

Preliminary analysis of the data available so far for 2001/2002 indicates that thousand seed weights are higher in this year's crop.

## Quality Assurance:



To ensure that all results sent to you the customer are accurate and traceable we are continuing to work under the UKAS and International Seed Testing Association quality assurance schemes. In October this year we underwent our annual surveillance by external UKAS assessors and in November ISTA carried out its triennial re-accreditation audit. I am pleased to report that we have retained our accreditations.

## Visitors

We are pleased to extend an open invitation to our customers who as an individual, or as part of a group, would like us to arrange a visit to the OSTs. Caroline Cadger, our Laboratory Manager would be pleased to organise this for you.

### **You can contact Caroline by phone, FAX or E-Mail**

**Phone:** 0131 244 8908  
**FAX:** 0131 244 8971  
**E-Mail:** [Caroline.Cadger@sasa.gsi.gov.uk](mailto:Caroline.Cadger@sasa.gsi.gov.uk)

Caroline would also be pleased to answer any seed testing questions you may have.