

# **Grower Summary**

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## **FV 365**

The incidence of Turnip yellows virus (TuYV) in overwintered cauliflower and Brussels sprout and the effect of the virus on yield, quality and storage

Final 2011

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HDC is a division of the Agriculture and Horticulture Development Board.

**Project Number:** FV 365

**Project Title:** The incidence of Turnip yellows virus (TuYV) in overwintered cauliflower and Brussels sprout and the effect of the virus on yield, quality and storage

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**Previous report/(s):** None

**Start Date:** 1 April 2010

**End Date:** 17 May 2011

**Project Cost:** £ 49,077.00

## Headline

- Despite low aphid numbers, TuYV incidences of 55-60% were found in cauliflower and sprout crops in the 2010/11 season.
- Growers could double their yields / profits by growing the least affected Brussels sprout variety, rather than the most susceptible ones, in years where aphid numbers are at average or high levels.

## Background

Turnip yellows virus (TuYV, previously known as Beet western yellows virus) is widespread in the UK and we have found very high incidences in some years (100% of plants infected in some crops we have sampled). TuYV is transmitted by aphids and infects a number of weeds and most Brassica crops, including oilseed rape, which acts as a very large overwintering reservoir / host for the virus and its aphid vectors. We have found oilseed rape crops with 100% TuYV infection in recent years.

Our previous research has shown that this virus can reduce the yields of cabbage by 16-36% depending on the variety. But little is known about the effect of the virus on other vegetable Brassicas.

In order to investigate how widespread the virus is in winter cauliflower and Brussels sprout crops in the UK, sampling and testing was carried out.

Commercial cauliflower crops were sampled in Lincolnshire, Kent, Cornwall and the Isle of Wight in the winter of 2010/11 and tested for the presence of Turnip yellows virus. Commercial Brussels sprout crops were sampled in Lincolnshire, Lancashire, Yorkshire and Scotland in the winter of 2010/11 and tested for the presence of Turnip yellows virus.

In order to determine the effect of Turnip yellows virus on different cauliflower and Brussels sprout varieties, fully replicated controlled experiments were carried out.

## **Summary of the project and main conclusions**

- Despite low aphid numbers in 2010, Turnip yellows virus incidences of up to 60% were found in cauliflower crops and 55% in Brussels sprout crops.
- These results clearly indicate that in years when there are average, or high aphid numbers, vegetable Brassica crops in many regions (particularly the main Brassica growing regions) are likely to suffer 100% infection by Turnip yellow virus.
- Controlled experiments in gauzehouses, showed that Turnip yellows virus induced very little in terms of leaf symptoms in Brussels sprout or cauliflower plants. Only by growing infected Brussels sprout plants side by side with uninfected plants, was it clear to the eye that Turnip yellows virus infection stunted plant growth in all seven varieties tested (by 7-16%) .
- These results confirm that growers would not be aware that their crops were infected by the virus, unless they had them tested for the presence of the virus.
- Turnip yellows virus reduced the marketable yield of seven Brussels sprout varieties by up to 65%. The variety that showed the lowest marketable yield reduction had its yield reduced by 22%.
- The highest marketable yield achieved for virus-infected plants was from the variety Speedia which produced double the yield of virus-infected plants of two other varieties and almost three times the yield of another variety.
- These results clearly indicate that in years when there is high aphid activity and a lot of Turnip yellows virus infection, growers could double their profits by growing the least affected Brussels sprout variety rather than the most susceptible ones.
- Even the highest yielding Brussels sprout variety had its marketable yield reduced 30% by Turnip yellows virus.
- This result and the higher marketable yield reductions in other varieties (up to 65%) clearly demonstrate the need for further research on the control of Turnip yellows virus in vegetable Brassicas.
- Turnip yellows virus significantly reduced the shelf life of two of the seven sprout varieties tested.

### ***Incidence of Turnip yellows virus in cauliflower and Brussels sprouts***

High levels of Turnip yellows virus (TuYV) infection were found in cauliflower crops in England (up to 60% of plants infected in particular crops) in 2010/11 despite low levels of

aphids in 2010. The infection levels detected varied between 0% and 60% and are indicated in Table 1.

**Table 1:** The incidence of Turnip yellows virus in cauliflower crops

<b>Region</b>	<b>Field / grid reference</b>	<b>Turnip yellows virus incidence (= % infection) in cauliflower crops</b>
Lincolnshire	Butterwick	20%
Lincolnshire	Fosdyke	5%
Lincolnshire	Frieston Shore	0%
Lincolnshire	Frieston	25%
Lincolnshire	Holbeach St Marks	20%
Lincolnshire	TF096453	10%
Lincolnshire	TF096453	60%
Lincolnshire	TF093457	5%
Kent	Crumps	15%
Kent	Front field	25%
Kent	Cottington	55%
Cornwall	Perranuthnoe Marazion	40%
Cornwall	Rose Goonhaven	50%
Cornwall	Strawberry Lane Hayle	30%
Isle of Wight	Field 1	0%
Isle of Wight	Field 2	10%
Isle of Wight	Field 3	10%

High levels of Turnip yellows virus infection were also found in Brussels sprouts crops in the UK (up to 55% of plants infected in particular crops) in 2010/11. The infection levels detected varied between 0% and 55% and are indicated below.

**Table 2:** The incidence of Turnip yellows virus in Brussels sprout crops.

<b>Region</b>	<b>Field / grid reference</b>	<b>Turnip yellows virus incidence (= % infection) in Brussels sprout crops</b>
Lincolnshire	Butterwick	10%
Lincolnshire	Swinesherd	40%
Lincolnshire	Friskney	55%
Lancashire	Cropper's Lane	20%
Lancashire	Poppy Lane	5%
Lancashire	Scarith Hill	10%
Lancashire	Edge Hill	15%
Yorkshire	Colnabs Field	25%
Yorkshire	Mansions Field	25%
Yorkshire	Chris' field	10%
Scotland	Rankeiar	0%
Scotland	Kenly Green	5%
Scotland	Ravensby	0%

***The effect of Turnip yellows virus on the yield and storage***

Cauliflower varieties Alpen, CAU820, Cendis, Jerome, Medallion, Trewint and Triumphant were grown in two gauzehouses at Wellesbourne in a fully replicated experiment where half of the plants of each cultivar were infected with Turnip yellows virus and the other half were left uninfected.



**Figure 1.** Gauzehouse with cauliflower growing.

Very cold temperatures of  $< -14^{\circ}\text{C}$  were experienced on site and the experiment was affected. Although there were small, but significant differences in the amount of virus detected in the different cultivars and differences in the yields of the cultivars, the adverse effects of the cold temperatures on the cauliflowers does not give us confidence in this data.

The experiment on the effect of Turnip yellows virus on Brussels sprout varieties Dominator, Doric, Genius, Maximus, NZ16-4391, Petrus and Speedia went well. The virus caused large (30 - 65%) and statistically significant reductions in marketable yield of six of the seven varieties and the virus caused a 22% reduction in the marketable yield of the cultivar where there wasn't a 'statistically significant' effect (Table 3).

**Table 3:** The effect of Turnip yellows virus on the marketable yield of Brussels sprout plants.



Variety	Mean marketable weight (g) of sprouts from uninfected plants	Mean marketable weight (g) of sprouts from infected plants	% reduction in yield caused by TuYV
Doric	969	761	22
Speedia	1482	1039*	30
Petrus	1045	717*	31
Maximus	879	580*	34
Genius	1282	730*	43
Dominator	1287	499*	61
NZ16-4391	1008	354*	65

\*Weight of sprouts from infected plants significantly less than weight from uninfected plants of the same variety. Least significant difference (L.S.D.) between two means for the difference to be significant at 5% is 281.

Turnip yellows virus reduced the height of plants for all seven varieties significantly, by 7-16%. Turnip yellows virus significantly reduced the shelf life of two of seven sprout varieties.



**Figure 2:** The effect of Turnip yellows virus on Brussels sprouts. An uninfected sprout plant of cultivar Genius is shown (top) and a virus-infected Genius plant (bottom).

There were significant differences in the amount of Turnip yellows virus detected in the seven different sprout varieties, however, the amount of virus detected did not appear to be clearly related to the yield reductions of all varieties, or effect on shelf life caused by the virus.

## **Financial Benefits**

An estimate of the mean incidence of Turnip yellows virus in sprouts in the U.K. in 2010/11 based on the fields we sampled was 16.9%.

The provisional area of Brussels sprouts grown in the UK in 2010/11 was 3,041 hectares (<http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/bhs/>) so this equates to 513.9 hectares infected by Turnip yellows virus.

The provisional value of the Brussels sprout crop in the UK in 2010/11 was £38.756 million (<http://www.defra.gov.uk/statistics/foodfarm/landuselivestock/bhs/>), based on the provisional area of 3,041 hectares, this gives a value of £12,744.5 / hectare.

So the area affected by Turnip yellows virus (513.9 hectares) had a value £6.55 million. If we take the minimum marketable yield reduction for infected plants of 22% from our trials, this would equate to losses in 2010/11 of £1.44 million.

If we take the maximum marketable yield reduction of a current cultivar of 61% from our trials, this would equate to yield losses of £4 million, giving a range of £1.44 - £4 million for losses due to Turnip yellows virus in 2010/11.

Without details of the area of each cultivar grown, it is difficult to predict the financial benefit that could have been achieved by growing the most tolerant variety. The calculations suggest that significant benefits could be achieved (even in years where there are few aphids and relatively low virus incidences) by growing the more virus-tolerant variety.

In years like 2011 when much higher Turnip yellow virus incidences are being detected in crops, benefits from growing a tolerant variety could be in the £10s of millions.

## Action points for growers

- The results from this first phase of the project emphasise the importance of developing control measures for Turnip yellows virus in vegetable Brassica crops, particularly those that are in the field during aphid peak flight periods.
- The time of infection of Brussels sprouts and winter cauliflower by Turnip yellows virus and the efficacy of a range of insecticidal treatments in controlling the virus are being investigated in the second phase of this project (FV 365a).
- Until the results of Phase 2 of the project are available, during the growing season, growers should go to the Rothamsted Insect Survey Aphid bulletin (<http://www.rothamsted.bbsrc.ac.uk/insect-survey/STAphidBulletin.php>), locate their closest trap site, and monitor bulletins weekly.
- When the presence of the major vectors of Turnip yellows virus, *Myzus persicae* gp start to be caught in their local trap, they should consider treating their crops with an approved aphicide.