

1981

## 1981 Plant viruses

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DEPARTMENT OF AGRICULTURE

EXPERIMENTAL SUMMARY

1981

PLANT VIRUSES

1. Clover viruses  
G.D. McLean  
J. Sandow
  
2. Barley yellow dwarf virus  
G.D. McLean  
T.N. Khan  
P.A. Portmann  
R. McLean  
M. Grimm

## 1. CLOVER VIRUSES

G.D. McLean and J. Sandow

### EXPERIMENTS:

81HA6, 81MA9, 81BR14, 81BY12, 81BH5, 81AL38, 81ES39

### OBJECTIVES:

To determine the extent of the 'Dinninup virus' problem (sub. clover mottle)  
To further assess the incidence of red leaf virus  
To determine the incidence of bean yellow mosaic virus  
To note the incidence of sub. clover stunt virus

### RESULTS:

The 'Dinninup virus' is now known as subterranean clover mottle. Reports of this work were presented at the Fifth International Congress of Virology and the International Workshop on Legume Viruses at Versailles.

Sub. clover mottle was detected at two more locations; Perup in the Manjimup district and at Cowaramup. The Perup planting was severely affected and the paddock will probably be resown in the near future.

### Beet western yellows virus

A sub. clover sample was Capel with 'red leaf' symptoms was shown by Dr G.R. Johnstone to be infected with beet western yellow virus (BWYV). This virus causes stunting and chlorosis of a wide range of dicotyledonous species, including sugar beet, red beet, spinach, lettuce, broccoli, cauliflower, radish, turnip and flax. In Tasmania it has been found to infect potatoes, sugar beet, lettuce and pea. BWYV is transmitted by several aphid species, the most important of which is Myzus persicae. Seed transmission is not known to occur.

This is the first record of beet western yellows virus in the State. It has very similar symptoms to red leaf virus disease. Red leaf virus is transmitted by the aphid Aulacorthum solani. In Tasmania Dr Johnstone has noted dual infections of beet western yellows virus and sub. clover red leaf virus in sub. clover.

### Alfalfa mosaic virus

This virus has been detected from both lucerne at Bullsbrook and white clover at Harvey. It was detected by sap transmission to beans. This virus is transmitted in a non-persistent manner by at least 13 aphid species including the blue-green alfalfa aphid, Acyrtosipon solani Kondoi. It is also seed transmitted.

### Bean yellow mosaic

This virus was detected on a Meteora sample from Narrikup. The mosaic was very severe.

## A. BYDV: SURVEY OF INCIDENCE

G.D. McLean and T.N. Khan

### OBJECTIVE:

To survey the incidence of barley yellow dwarf virus (BYDV)

### EXPERIMENTAL:

In an area of 0.01 ha the following cereal varieties were space planted using 0.5 m and 0.25 m as row and within row spacings, respectively.

Algeribee oats, BYDV indicator,	210 plants
Shannon barley, BYDV resistant,	210 plants
Proctor barley, BYDV susceptible,	210 plants
West oats, BYDV susceptible,	105 plants
Egret wheat, BYDV susceptible,	105 plants

Shannon and Proctor are 'near' isogenic lines. Proctor is susceptible to BYDV, Shannon is resistant.

Abundant nitrogen was supplied as two top dressings to avoid any redening of the leaves due to nitrogen deficiency.

Virus symptoms were observed on Algeribee oats. Symptoms of BYDV were recorded at various stages on a scale 0 to 4 where 0 = no disease, 1 = doubtful, 2 = definite redening, 3 = severe and 4 = very severe (no grain produced and severely dwarfed).

The significance of differences between means is denoted by an \* =  $p < 0.05$ , \*\* =  $p < 0.01$ , \*\*\* =  $p < 0.001$  and NS = not significant.

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Table 1. BYDV incidence trials 1981. Yield and 100 seed net for Shannon and Proctor barley (2)

District	Trial	BYDV incidence on Algeribee oats	100 seed weight (g)			Yield per plant		
			Shannon (S)	Proctor (P)	<u>S-P</u> S	Shannon (S)	Proctor (P)	<u>S-P</u> S
Busselton	81BU1	2.2	4.41	3.27	26***	18.29	4.91	73***
Busselton	81BU2	2.3	4.55	2.70	41***	9.55	2.67	73***
Bridgetown	81BR11	0.3	4.76	3.49	27***	26.11	8.94	66***
Bridgetown(1)	81BR12	0.4	-	-	-	-	-	-
Manjimup(1)	81MA6	2.4	-	-	-	-	-	-
Manjimup(1)	81MA7	-	-	-	-	-	-	-
Albany (1)	81AL31	0.9	-	-	-	-	-	-
Albany	81AL32	1.9	3.87	3.14	19***	7.52	2.32	69***
Jerramungup(1)	81JE14	0	-	-	-	-	-	-
Jerramungup(1)	81JE15	0.08	-	-	-	-	-	-
Katanning	81KA21	1.4	4.34	3.23	26***	28.43	8.42	70***
Katanning	81KA22	0.1	3.68	3.24	12***	8.54	6.54	23**
Narrogin	81NA28	0	4.35	3.47	20***	15.38	8.71	43***
Northam	81NO31	0	4.31	3.92	9***	17.39	12.50	28**
Esperance	81ES38	0.01	4.70	4.24	10***	32.36	14.85	54***
Esperance	81E26	0.01	3.85	3.71	4 NS	16.58	13.09	21*

(1) These trials were not harvested principally due to kangaroo or rabbit damage and poor germination or samples mixed

(2) All assessments are the mean of 50 Shannon and 50 Proctor plants

Table 2. BYDV incidence trials 1981. Number of heads and number of seeds/head for Shannon and Proctor barley(2)

District	Trial	BYDV incidence on Algeribee oats	Number of heads			Number of seeds/head		
			Shannon (S)	Proctor (P)	S-P S	Shannon (S)	Proctor (P)	S-P S
Busselton	81BU1	2.2	15.16	7.42	51***	24.77	16.32	34***
Busselton	81BU2	2.3	7.48	4.86	35***	25.32	13.80	45***
Bridgetown	81BR11	0.3	20.36	14.48	29***	26.52	16.72	37***
Bridgetown(1)	81BR12	0.4	-	-	-	-	-	-
Manjimup(1)	81MA6	2.4	-	-	-	-	-	-
Manjimup(1)	81MA7	-	-	-	-	-	-	-
Albany(1)	81AL31	0.9	-	-	-	-	-	-
Albany	81AL32	1.9	11.18	9.36	16 NS	16.04	5.84	64***
Jerramungup(1)	81JE14	0	-	-	-	-	-	-
Jerramungup(1)	81JE15	0.08	-	-	-	-	-	-
Katanning	81KA21	1.4	26.32	17.48	34***	24.08	14.20	41***
Katanning	81KA22	0.1	13.44	12.94	4***	17.08	14.80	13**
Narrogin	81NA28	0	13.63	14.76	-8 NS	24.87	15.64	37***
Northam	81NO31	0	16.53	17.84	-8 NS	25.04	17.02	32***
Esperance	81ES38	0.01	32.92	25.42	23***	20.06	13.83	31***
Esperance	81E26	0.01	21.16	22.26	-5 NS	20.16	15.22	24***

(1) These trials were not harvested principally due to kangaroo or rabbit damage and poor germination or samples mixed

(2) All assessments are the mean of 50 Shannon and 50 Proctor plants

Effect of BYDV on the yield of West oats

At the 81BU1 and 81BU2 sites the West oat plants were rated for BYDV infection. Plants were harvested and assessed for yield, seed per head and 100 seed weight.

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Table 3. Effect of BYDV on West oats (grain yield, seed per head and 100 seed weight)

Health category	81BU1				81BU2			
	Number of plants	Yield (g)	Seed per head	100 seed weight (g)	Number of plants	Yield (g)	Seeds per head	100 seed weight (g)
0	7	7.4	31	1.9	28	8.3	44	3.4
1	5	7.7	31	2.0	4	7.9	54	3.6
2	41	8.2	45	2.4	26	6.9	56	3.1
3	15	1.6	22	1.8	10	3.4	34	3.2
4	3	1.4	24.0	1.9	15	1.7	13	1.7

COMMENTS:

1. The levels of apparent infection were low in 1981 and infection was detected later in the season than 1980. Trials with infection levels above 1.4 showed differences in Shannon and Proctor yields ranging from 66 to 73 per cent. In trials with low infection levels (< 0.1) it ranged from 21 to 54, and in trials with no infection from 28 to 43 per cent. If 54 per cent yield difference is taken as being inherited, difference between Shannon and Proctor, the losses ranging from 11 to 19 per cent could be attributed to BYDV infection. Although the data clearly shows a gross effect of BYDV on yield at high levels of infection, the magnitudes of these losses are difficult to quantify due to anomalies in data from the low infection sites.
2. Amongst yield components, grain yield losses appear to be associated with number of heads. Number of seeds/plant and 100 seed weight show less consistent association.
3. An examination of West oats in two trials shows considerable "tolerance" to BYDV infection. In both trials grain yield loss occurred only in plants showing infection rating of three or more.

B. BYDV: GENOTYPE X INSECTICIDE STUDIES

- i) 81MN14 - Manjimup Research Station  
G.D. McLean, T.N. Khan and J. Sandow
- ii) 81MT29 - Mt Barker Research Station  
G.D. McLean, T.N. Khan and J. Sandow
- iii) 81E28 - Esperance Downs Research Station  
M. Grimm, T.N. Khan and G.D. McLean

These three trials each had the main plot as spray vs. no spray with sub-plot genotypes.

- (i) 81MN14  
Genotypes: Shannon - BYDV resistant  
Proctor - BYDV susceptible  
West - BYDV susceptible  
Egret - BYDV susceptible  
Algeribee - BYDV indicator  
Plot size: 3 x 1.25 m
- (ii) 81MT29  
As for 81MN14  
plus the five genotypes with the insecticide treatment surrounded by a sprayed 10 m border (reference plot)
- (iii) 81E28  
Genotypes: Shannon, Proctor, West, Egret  
Adjoined 81E26 (BYDV Survey of Incidence 10 m x 5 m plots)

Table 4. BYDV - genotype x insecticide studies - Mt Barker Research Station  
81MT29A

Genotype	100 seed weight (g)		Yield/plot (g)	
	Insecticide	No insecticide	Insecticide	No insecticide
Shannon barley	4.057	3.918	890	866
Proctor barley	3.639	3.505	842	1150
West oats	3.663	3.673	1501	1482
Algeribee oats	3.478	3.232	1036	991
Egret wheat	3.472	3.405	1045	921

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81MT29B: Reference plot - insecticide only

Genotype	100 seed weight (g)	Yield/plot (g)
Shannon barley	3.465b	466ab
Proctor barley	2.875a	418a
West oats	3.808c	757c
Algeribee oats	3.298b	637bc
Egret oats	2.803a	360a

\* Because of rain, no insecticide spraying was carried out from July 20 to September 15

Table 5. Genotype x insecticide studies - Manjimup Research Station 81MN14

Genotype	No. of seeds per head		100 seed weight (g)		Yield/plant (g)			Yield/plot (g)		
	I*	0*	I	0	I	0	I-0x100	I	0	I-0x100
Shannon barley	22.80	20.40	3.860	3.768	3.81	2.50	34	388	246	37
Proctor barley	19.20	17.60	3.232	2.990	2.19	1.46	33	263	182	31
West oats	31.80	35.00	3.790	3.782	2.52	2.72	-8	245	266	9
Egret wheat	28.80	21.80	3.450	3.084	2.05	1.13	45	275	164	40

\* I = insecticide, 0 = no insecticide

Table 6. Genotype x insecticide studies - Esperance 81E28

Genotype	100 seed weight (g)		Yield/plot (g)	
	Insecticide	No insecticide	Insecticide	No insecticide
Shannon barley	2.994	3.026	2566	2644
Proctor barley	2.764	2.696	2923	3515
West oats	2.928	2.956	3142	3231
Egret wheat	3.384	3.352	3868	3655

COMMENTS:

81MT29

1. No apparent BYDV infection was detected in the main plot of 81MT29. In the reference plot 12 per cent of the plants showed some infection.

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2. Neither insecticide vs. no insecticide nor interactions were found to be significantly different. The remarkable result was a 37 per cent greater yield of the susceptible barley variety Proctor in the no insecticide treatment. However, due to waterlogging and weed infestation, little significance can be attached to these results.
3. In reference plots Shannon out-yielded Proctor by 10 per cent with 17 per cent ( $P = 0.05$ ) greater seed weight. However, these differences are within the range of inherent differences between the two varieties indicated in the 1980/81 season.
4. The differences between insecticide vs. no insecticide and interactions genotypes x insecticide treatments were not significant. Shannon showed no response to the insecticide treatments but in Proctor unexpectedly, yield in 'no insecticide' treatment was 20 per cent greater.

81MN14

1. Infection with BYDV was high as seen in the indicator plots of the Algeribee oats. The difference between no insecticide and insecticide treatment was nine per cent.

BYDV infected plants - October 9

No insecticide	56%
Insecticide	47%

2. Although yield loss of 27 per cent was seen in the no insecticide treatment, it was not significant. Neither were the interactions between genotype and insecticide.
3. Proctor and Shannon barley exhibited similar losses in yield and related characters in 'no insecticide' treatment, indicating little advantage of the resistance of Shannon to the BYDV in this instance.

81E28

1. No apparent BYDV infection was seen in this trial. An observation plot close to this trial showed negligible infection in Algeribee oats.

C. BYDV: DIFFERENCES AMONGST BARLEY GENOTYPES

G.D. McLean, T.N. Khan, P. Portmann and R. McLean

81C19 - Chapman Research Station  
81WH31 - Wongan Hills Research Station  
81BA30 - Badgingarra Research Station

OBJECTIVE:

To study inherent differences in yield in Proctor and Shannon barley due to barley yellow dwarf virus.

MAIN PLOTS:

Genotypes

Proctor barley: BYDV susceptible  
Shannon barley: BYDV resistant  
Clipper barley: BYDV resistant  
Algeribee oats: BYDV indicator

(The trial at Chapman was discarded due to an error in sowing.)

Table 7. Yield per plot and 100 seed weight, Badgingarra and Wongan Hills in isogenic lines, Shannon and Proctor

	Yield per plot		100 seed weight	
	81BA30	81WH31	81BA30	81WH31
Proctor	462.6a	577.8b	4.04b	2.72b
Shannon	385.7a	531.2b	4.29a	3.33a

Means with the same letter are not significantly different at  $p = 0.05$

COMMENT:

Proctor outyielded Shannon at both Badgingarra and Wongan Hills. Yield superiority of Shannon over Proctor observed in the cooler and high rainfall areas of the South may be due to specific adaptation of Shannon and in some cases due to resistance to the BYDV.

D. BYDV: RESISTANCE AND YIELD IN CV. SHANNON AND CV. PROCTOR

G.D. McLean, T.N. Khan, P. Portmann, R. McLean

81BR13 - Bridgetown  
81MA8 - Manjimup  
81AL36 - Albany  
81JE17 - Bremer Bay

OBJECTIVE:

To study the resistance and yield of Shannon barley in high rainfall areas.

MAIN PLOTS:

Genotypes

Shannon barley (BYDV resistant)  
Proctor barley (BYDV susceptible)  
Clipper barley (BYDV susceptible)  
Algeribee oats (BYDV indicator)

81JE17

Main plots: Shannon, 23 replications  
Proctor, 23 replications  
Algeribee, 1 replication  
West, 1 replication

Table 8. Yield per plot and 100 seed weight - Bokerup 81MA8

	Yield per plot (g)	100 seed weight (g)
Proctor	265.10a	3.42a
Shannon	393.19b	4.10b

Means with the same letter are not significantly different at P = 0.05

Table 9. Yield per plot and 100 seed weight, Bremer Bay, 81JE17

	Yield per plot (g)	100 seed weight (g)
Proctor	127.52	3.50
Shannon	163.22	3.53

LSD = 41.75; LSD = 0.11

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Table 10. Yield per plot and 100 seed weight - Albany 81AL36

	Yield per plot (g)	100 seed weight (g)
Proctor	251*	3.20*
Shannon	280*	3.74*

\* These are the means of five replications

Table 11. Yield per plot and 100 seed weight - Bridgetown 81BR13

	Yield per plot (g)	100 seed weight (g)
Proctor	151	3.46
Shannon	224	3.19

These are the means of three replications

COMMENTS:

1. 81BR13 Bridgetown: This trial was a poor one since two replications suffered from poor germination and two from heavy weeds. Only four replications were harvested.
2. 81MA8 Manjimup-Bokerup: An excellent trial, however no virus infection was observed on the Algeribee oats.
3. 81AL36 Albany: Very heavy weed infestation. Only four replications harvested. No BYDV symptom observed on the Algeribee oats.
4. 81JE17 Bremer Bay: No BYDV infection
5. Magnitude of differences in Shannon and Proctor's yields at 81MA8 and 81JE17 fall within the inherited differences seen in sites with no BYDV infection. It was consistent with the fact that BYDV infection was very low at both the above sites.

E. BYDV: SCREENING FOR RESISTANCE

81MN13 - MANJIMUP RESEARCH STATION

T.N. Khan and G.D. McLean

AIM:

A plot study to screen for barley yellow dwarf resistance in CVT lines

The following varieties were space planted in two rows (21 plants each).

Algeribee oats, BYDV indicator  
Five BYDV resistant lines barley  
Five stage 4 lines oats  
Five stage 4 lines wheat  
Five stage 4 lines barley

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Table 12. Infection of BYDV in cereal genotypes at Manjimup (81MN13)

No.	Genotype	% infection at September 9, 1981	% infection at October 9, 1981	Value as source of resistance
1	Algeribee - oats	42.00	93.00	
2	65Q/119 - oats	30.00	73.50	
3	West - oats	38.00	91.00	
4	Swan - oats	35.00	75.00	
5	Moore - oats	29.00	58.50	*
6	65Q/102 - oats	37.00	83.00	
7	CI668 - barley	2.50	32.00	*
8	CI938 - barley	15.50	28.50	*
9	CI1113 - barley	6.50	21.00	*
10	CI1231 - barley	3.50	9.50	*
11	Forrest - barley	22.50	62.00	*
12	Beecher - barley	79.50	100.00	
13	Clipper - barley	0.00 <sup>+</sup>	62.00 <sup>+</sup>	
14	Galleon - barley	11.50	63.50	*
15	Stirling - barley	8.00	46.50	*
16	Dampier - barley	3.00	58.00	*
17	Miling - wheat	31.00	82.00	
18	Warimba - wheat	27.50	59.50	
19	RAC359 - wheat	52.50	80.00	
20	Egret - wheat	26.50	79.00	
21	Jacup - wheat	32.00	74.00	
	LSD (0.05P)	27.68	31.44	*

\* Oat variety showing significantly less infection than Algeribee; barley variety showing significantly less infection than Beecher; and wheat variety showing significantly less infection than Miling.

<sup>+</sup> One replication only. Data not included in the statistical analysis.

COMMENTS:

1. Although high correlation between early records and late records ( $r = 0.80^{***}$ ) may suggest early records as a good indication of resistance, late records may be more reliable due to lower coefficient of variation.
2. Several barley cultivars show useful degree of resistance. On the other hand, only one wheat and one oat variety can be classified as moderately resistant.

3. It suggested that value of a resistance score which will take into account severity of infection on a plant as well as per cent incidence in the plot be studied to obtain a more appropriate discrimination between varieties.