Brucedale Plant Health

GRDC Grains Research & Development Corporation

Coolamaine Economic Research

Estimating the Current and Potential Costs from Diseases of Oilseed Crops in Australia

Gordon Murray and John Brennan

Project objectives

- Assess value of disease losses to Australian oilseed crops to reflect the current situation
  - present losses with current controls
  - potential losses if current controls not applied
  - value of control
- Estimates are the **average annual values**
- Current pesticide use for disease control
- Fully transparent to provide benchmark at 2010 and allow future comparable assessments

Crop disease losses

- GRDC have used 1998 estimates of wheat disease losses when deciding on funding priorities
- They asked us to update the wheat estimates because:
  - Changes to wheat area and production
  - Changes in disease incidence and severity
    - Management
    - New pathogens and races
    - Climate change
- Method fully transparent so that it can be updated when required

Coolamaine
Economic Research

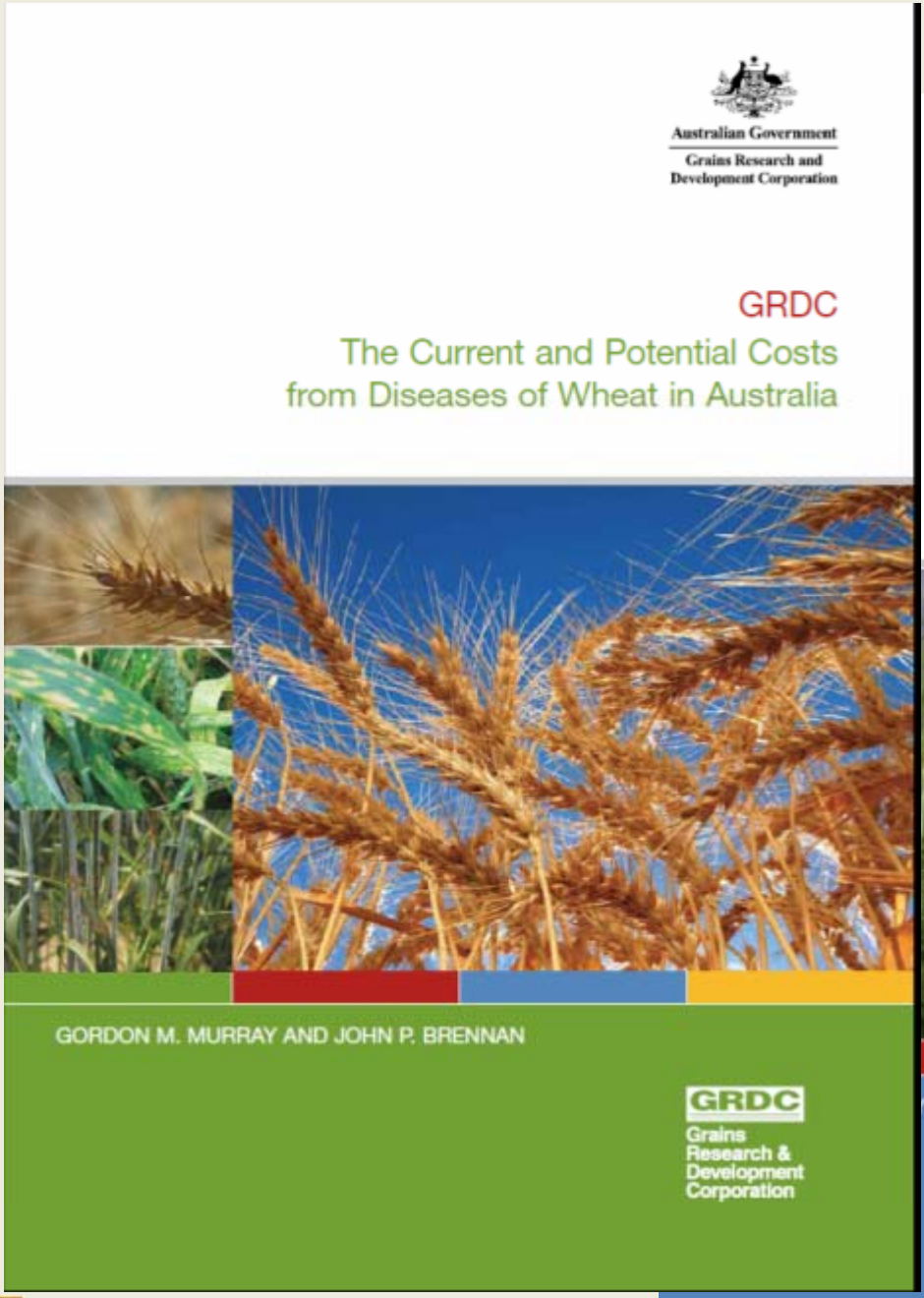
Why value disease losses?

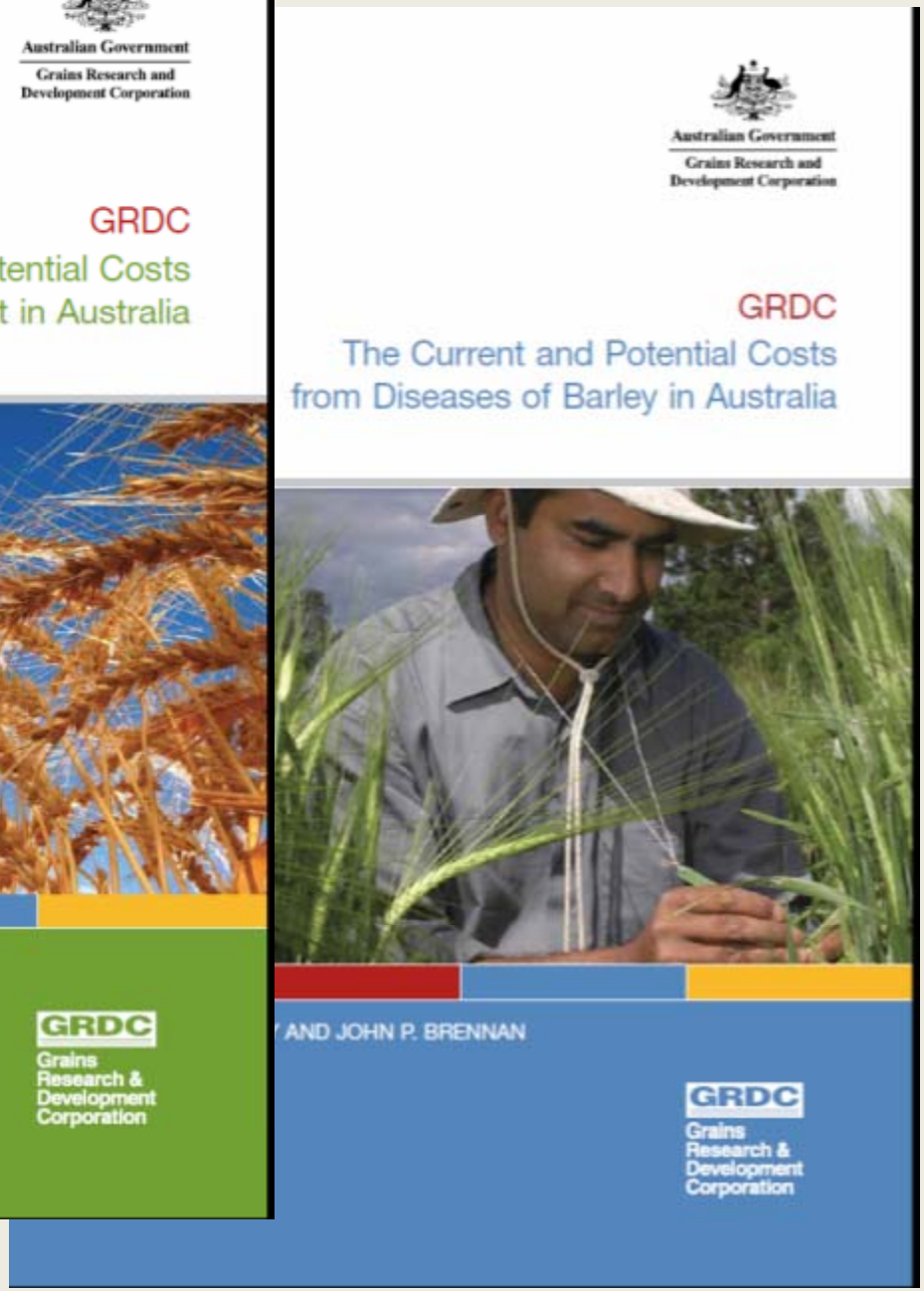
Lyman (1918):

> "How can we expect practical men to be properly impressed with the importance of our work and to vote large sums of money for its support when in place of facts we have only vague guesses to give them and we do not take the trouble to make careful estimates."

2008-09 study

- Estimated current and potential losses in wheat and barley as average annual losses
- Provided estimates of fungicide use on these crops
- Delivered methodology in electronic form to GRDC
- Reported as two GRDC bulletins and as refereed papers





GRDC

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2009-10 studies

- Estimate current and potential losses from diseases of:

Pulses

Oilseeds

Coolamaine
Economic Research

Yield losses from crop diseases

Crop	Production ($ million)	Present loss ($ million)	Present loss (%)
heat	4680	913	20
rley	1289	252	20

These are average annual values

Yield losses from crop diseases

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ckpeas	83	13	16

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ld peas	165	40	24
ckpeas	83	13	16
oins	207	0.1	0.05

These are average annual values

Methodology

- The diseases are those known to occur in Australia, and which have caused loss or have attracted attention in one or more areas
- These data collected on an agro-ecological zone basis
  - incidence and severity of each disease with and without control
  - crop production, area and value
  - fungicide use

Pathogens and diseases of canola

	Disease
eaf fungi	
sicae	Alternaria brassicae blight
sicicola	Alternaria brassicicola blight
ani	Alternaria raphani blight
a capsellae	white leaf spot
rassicae	light leaf spot
otiorum	Sclerotinia stem rot
fungi	
a	white rust
arasitica	downy mildew
erarum	powdery mildew
n fungi	
	Fusarium damping off and root rot
maculans	blackleg
megasperma	Phytophthora root rot
a brassicae	club root
	Pythium damping off and root rot
or	Sclerotinia crown rot
liae	Verticillium wilt
o.	Rhizoctonia damping off and root r
ani	hypocotyl rot

Nematodes	
Helicotylenchus sp.	spiral nematode
Hemicriconemoides cocophillus	sheath nematode
Pratylenchus neglectus	root lesion nematode neglectus
Ditylenchus dipsaci	stem nematode
Heterodera cruciferae	cyst nematode
Heterodera schachtii	sugar beet cyst nematode
Pratylenchus thornei	root lesion nematode thornei
Bacteria	
Pseudomonas syringae pv. *maculicola*	bacterial leaf spot
Xanthomonas campestris	black rot
Viruses	
Beet western yellow virus	beet western yellows
Cauliflower mosaic virus	cauliflower mosaic
Turnip mosaic virus	turnip mosaic
Phytoplasmas	

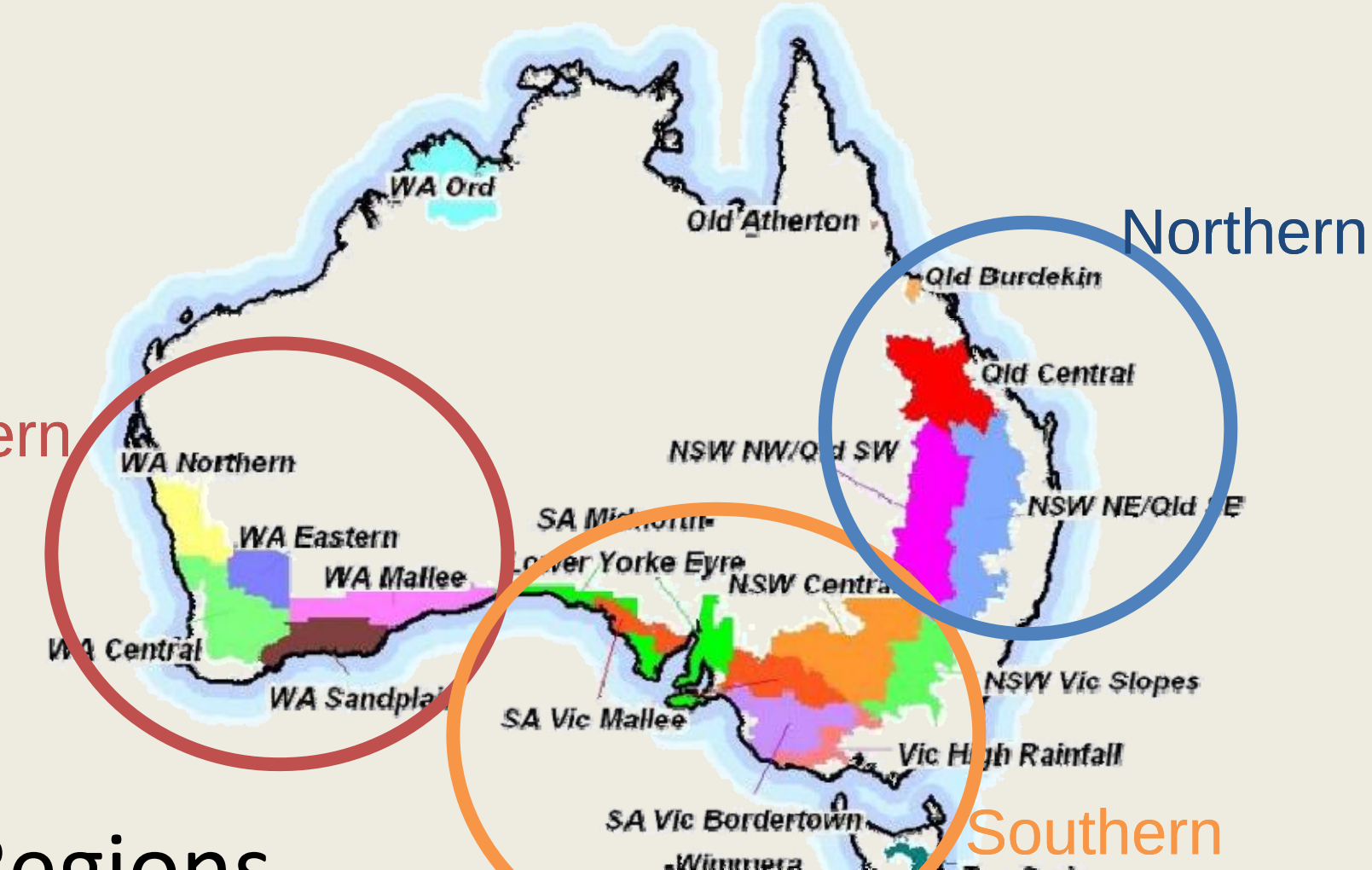
Estimating loss (%)

Loss = incidence X severity

Incidence per crop area per year
= (incidence per year) X (area affected)

Severity = loss in area affected when disease occurs

Agro ecological Zones



ern

Northern

Southern

egions

Oilseed crops, pathogens and diseases

Crops	Pathogens/diseases	Agroecological zones
Canola	30	13
Soybean	34	12
Sunflower	31	9
Linseed		
Safflower		

Pathogen and Disease Data

upplied by crop pathologists and agronomists familiar with the crop
iseases in each zone

Assessment of Pathogens in Australian peanuts

Zone:	**Terra Australis Incognita**
Assessor:	**Gordon Murray**
Date:	**1-Sep**

			Incidence		Severity		Contribution to control (%)		
	Disease	Present in zone	% of years	% area affected	No controls % loss	Controls % loss	Breeding	Cultural	Pesticide
af fungi									
hidicola	early leaf spot	Y	50	40	65	5	95	0	5

dence is the frequency with which disease caused by a

verity is the proportion of yield loss caused by a pathogen
years that are favourable for its development

tribution to control
f disease is controlled, the proportion of control that is

Crop production data

Average for recent multiple year period that gives a reliable view of current production, for each agro-ecological zone

- area (hectares)
- yield (t/ha)
- production (tonnes)
- gross value ($)

Used 10-year period for wheat and barley

Used 5-year period for pulses

Estimating disease loss

ncidence

- % of years
- % of area in those years
  - = % incidence/year

Severity

- Potential (%)
- Present (%)

% yield loss/year = Incidence x Severity

(average per year)

Calculating yield loss

Current yield = $Yield_{without\ disease}$ x (1- relative loss)

Yield losses

Loss $/ha = %loss x Yield (t/ha) x price ($/t)

Quality losses

– severity determines grade, grade determines value

Total loss = Yield loss + Quality loss

Loss per ha x Zone crop area = Loss $ for zone

Quality Losses

As severity increases, the disease may affect seed appearance, size and other factors affecting marketing quality

We need to identify those diseases with potential to affect quality and develop relationship between severity and quality for oilseeds

e.g. Quality losses in wheat

thogen		Severity range					
		0	>0–0.2%	>0.2–1%	>1–5%	>5–20%	>20%
purpurea	grade	ASW	ASW	GP	Farm	Farm	Farm
	discount	0.00	0.00	8.22	63.66	63.66	63.66
graminearum	grade	ASW	ASW	GP	Feed	Farm	Farm
	discount	0.00	0.00	8.22	33.34	63.66	63.66

Fungicide treatments: Wheat

	Northern	Southern	Western	Australia
a treated (%)				
treatment	**63**	**90**	**58**	**73**
rrow application	**1**	**12**	**13**	**10**
r application	**53**	**29**	**43**	**39**
ungicide	**19**	**0**	**16**	**9**

Fungicide costs ($million)

Region	Wheat	Barley
Northern	30	2
Southern	62	16
Western	62	15
Australia	**154**	**33**

Completing the data sheets

	A	B	C
1	**Assessor:**	**Gordon Murray**	*enter your name here - it will be transferred to each zone sheet*
2	**Date:**	**27-Sep-09**	*enter date here*
3	Canola		
4		**Instructions for Canola Survey**	*print this sheet for reference when completing the zone sheet(s)*
5	**Cells**	**Description**	
6	**Pathogen / disease list**		
7	Columns A, B	If there are additional pathogens in the zone that are not on the list and you wish to enter data for these, do so in row 54 and following (insert extra rows if required).	
8	Column C	For each pathogen and disease, indicate in column C: Y = present in zone; N = not recorded in zone; U = uncertain / unknown status If Y, then complete table for that pathogen; if N or U, do not complete the rest of the table for that pathogen. We seek data for only those pathogens that are present in the zone.	
9			
10	**Quantitative estimations of incidence and severity**		
11	Column D	*Incidence (*% of years*).* Consider recent years. Enter the percentage of years that the disease developed significantly in the zone.	
12	Column E	Incidence (% of area). Enter the percentage of the cropping area affected by the disease in the years when it developed significantly	
13	Columns F, G	Severity (control and no control). Consider the damage done in those seasons that favoured development of the disease. Enter the yield loss as a percentage when the disease was not controlled (column F) or would cause if controlled (Column G).	
14	**Control methods**		
15	Columns H : J	These columns seek your best estimation of the proportion of control made by breeding (resistance), cultural methods (tillage, rotation, stubble management), and pesticides. For example, in that zone a certain pathogen might have 75% control by breeding and 25% by pesticide (fungicide) while another has 25% by breeding and 75% by cultural and a third has 30% by breeding, 40% by cultural and 30% by fungicide. The total of H to J is 100%.	
16	**Pesticide use**		
	Table at end of pathogen listings	The pesticide treatments descriptions are broad. It seeks information on the proportion of the crop that receives some form of pesticide treatment in the zone and the approximate per hectare cost of the treatment (product plus application). Precise data	

GRDC Agro-Ecological Zones - Canola

	Zone	Abbreviation	Region	Included for this crop
1	Qld Burdekin	Qld Bur	N	
2	Qld Atherton	Qld Ath	N	
3	Queensland Central	Qld Cen	N	Yes
4	NSW North-East/Queensland South-East	NNEQSE	N	Yes
5	NSW North-West/Queensland South-We	NNWQSW	N	Yes
6	NSW Central	N Cen	S	Yes
7	NSW-Victoria Slopes	NV Slp	S	Yes
8	Victoria High Rainfall	Vic HR	S	Yes
9	SA-Victoria Mallee	SV Mall	S	Yes
10	SA-Victoria Border-Wimmera	SV BWim	S	Yes
11	SA Mid-North/Lower Yorke, Eyre	SMNLYE	S	Yes
12	TAS Grain Growing	Tas	S	Yes
13	WA Northern	WA N	W	Yes
14	WA Central	W Cen	W	Yes
15	WA Eastern	WA E	W	Yes
16	WA Sandplain-Mallee	W SandM	W	Yes
17	WA Ord	WA Ord	W	Yes
18	NT Central (Katherine)	NT Kath	W	

Assessment of Pathogens in Australian Canola

Zone: 3. Queensland Central

3

Assessor: Gordon Murray

Date: 27-Sep

	Disease	Present in zone	Incidence		Severity		Contribution to control (%)		
			% of years	% area affected	No controls % loss	Controls % loss	Breeding	Cultural	Pesticide
eaf fungi									
sicae	Alternaria brassicae blight	Y	60	30	10	10	0	0	0
sicicola	Alternaria brassicicola blight	U							
ani	Alternaria raphani blight	U							
a capsellae	white leaf spot	U							
rassicae	light leaf spot	N							
otiorum	Sclerotinia stem rot	Y	25	20	60	30	10	70	20
fungi									
a	white rust								
arasitica	downy mildew								
rarum	powdery mildew								
n fungi									
	Fusarium damping off and root rot								
maculans	blackleg	Y	50	50	75	10	50	25	25
megasperma	Phytophthora root rot								
a brassicae	club root								
	Pythium damping off and root rot								
or	Sclerotinia crown rot								
liae	Verticillium wilt								
p.	Rhizoctonia damping off and root rot								
ani	hypocotyl rot								

Alternaria present but species uncertain

Alternaria present but species uncertain

Pathogens/diseases not on list

A	B	C	D	E	F	G	H	I	J
Assessment of Pathogens in Australian Canola									
Zone:	**3. Queensland Central**								3
Assessor:	**Gordon Murray**			**Date:**	**27-Sep**				
			Incidence		**Severity**		**Contribution to control (%)**		
		Present in zone	**% of years**	**% area affected**	**No controls % loss**	**Controls % loss**	**Breeding**	**Cultural**	**Pesticide**
	Disease								
yellow virus	beet western yellows								
osaic virus	cauliflower mosaic								
virus	turnip mosaic								
phytoplasma	aster yellows								
thogens/diseases									

Effects on quality

Does anyone have any information on effects of diseases on canola quality?

- Appearance
- Seed size
- Oil content
- Toxins
- other

Estimating pesticide use

A	B	C	D	E	F	G	H	I	J	K
	Assessment of Pathogens in Australian Canola									
Zone:	3. Queensland Central								3	
Assessor:	Gordon Murray			Date:	27-Sep					
			Incidence		Severity		Contribution to control (%)			
	Disease	Present in zone	% of years	% area affected	No controls % loss	Controls % loss	Breeding	Cultural	Pesticide	

se for Canola		Cost	
crops receiving following pesticide applications (%)		($/ha)	Comment
Seed (low cost fungicide)			
eed (high cost fungicide)			
Seed (insecticide)			
(fungicide + insecticide)			
In-furrow fungicide			
In-furrow insecticide			
Foliar fungicide spray(s)			
Foliar insecticide			
Other (specify)			

Estimating pesticide use

A	B	C	D	E	F	G	H	I	J
Assessment of Pathogens in Australian Canola									
Zone:	**12. TAS Grain Growing**								12
Assessor:	**Brian field**			**Date:**	**15-Feb**				
			Incidence		Severity		Contribution to control (%)		
	Disease	Present in zone	% of years	% area affected	No controls % loss	Controls % loss	Breeding	Cultural	Pesticide
Use for Canola		Cost ($/ha)	Comment						
f crops receiving following pesticide applications (%)									
Seed (low cost fungicide)	20	?							
eed (high cost fungicide)	10	?							
Seed (insecticide)									
(fungicide + insecticide)	70	?							
In-furrow fungicide									
In-furrow insecticide									
Foliar fungicide spray(s)									
Foliar insecticide	30	?							
Other (specify)