Gross margin analyses of crop rotation data sets from the Riversdale site for 2007 to 2011



Report by: JA Strauss, Institute for Plant Production, Western Cape Department of Agriculture (June 2012)

Contents

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Introduction

This report summarises income and expenditure data, and provides a basic economic analyses to the Gross Margin level, for each crop sequence being tested in the crop rotation trial located on the farm Uitkyk in the Riversdale "vlaktes" for the period 2007 to 2011.

The aim of the research at this site is to determine the effects of selected **long-rotation** crop/pasture production systems on crop yields and the economy of pasture/crop rotation systems in the Southern Cape. It must be noted that, due to practical constraints, the trial design allowed for the comparison of only five crop-sequences (each replicated 3 times) following five years of lucerne pasture. **In this design the effect of season on individual crop responses within the different crop sequences is lost. The effect of fluctuating prices of agricultural commodities is also not accounted for in the design.** However, the design allows for economic comparison of rotation "systems" within the same sequences of seasons - long-term result; and, in the short-term (annually), comparison among systems of the effects of that stage of the system on economic returns, weed dynamics, soil-borne disease complexes, nitrogen mineralization rates, soil organic carbon dynamics etc. In this way the results obtained are of great and of immediate value to the farming community, despite not being in a position to determine the effects of season and commodity prices on crop response variables.

This 2nd phase of the trial started in 2007. The five crop sequences being tested are shown in Table 1. Crop management is based on conservation farming practices.

Table 1 Crop sequences tested (following lucerne) at the Riversdale site. W = wheat, B = barley, Tr = Triticale, C = canola, L = lupin. The sequences represent crops in year 1 (2007) to year 5 (2011)

Region	System	Crop sequence
Riversdale	1	W-L-W-C-W
	2	W-C-W-L-Tr(Replaced with *Wheat* in final year)
	3	W-B-C-W-Tr(Replaced with *Barley* in final year)
	4	C-Tr-L-W-W
	5	C-W-L-W-C

Note that system 2 and 3 were changed in 2011 to replace Triticale with wheat and barley, respectively. This was done because of two reasons. Firstly, because the frequency of planting triticale has decreased in the area over the last 4 years and more importantly the next phase of the trial is to look at pure cash crop rotations without the animal factor. It was therefore decided by the technical committee to replace the triticale in these two systems.

Experimental Procedure: a summary

Each crop was managed according to the research protocols that were presented in the original project proposal and in the annual funding application documentation. Details of annual management inputs for each crop and crop sequence are presented in the annual reports. A summary of procedures and results relevant to the economic analyses of trial data is presented below.

Plot size

Each treatment plot is 0.5ha in extent. This plot size allows for the use of standard farm implements and machinery. In case of this (Riversdale) trial site, new or relatively new, tractors, planters (AUSPLOW), harvesters (e.g. Lexion) and boom sprayers are used.

Soils

The soils at the site were tested and macro- and trace elements were corrected to above threshold levels at the start (January/February 2007) of this the 2nd 5-year phase of the trial, to ensure that soil fertility would not limit crop production. Soil compaction layers were removed during land preparation at each trial site. In March 2011 the area was limed to ensure adequate levels of phosphorus in the soil since the original plan was to re-establish lucerne on the trial site.

Crop management

Protocols for the management of each crop are developed to ensure consistent application of the best available information on the production requirements of each crop over time. It must be stressed however that these protocols are updated, annually if necessary, as new technology becomes available regarding management requirements of each crop. A no-till, conservation farming approach has been adopted within the management system, implying that the soils are disturbed only during the planting action. Whilst the crop residues are retained following harvesting they are grazed during the summer months.

Crops are planted, protected against weeds, diseases and insect pests, and harvested using standard farm implements. Weed, insect and disease control measures are implemented by field staff in collaboration with the specialist associated with that crop.

The appropriate cultivar for each crop is used each year and managed according to the management protocols referred to above.

The crops are harvested using a combine harvester. The total yield of each treatment plot was bagged and weighed. Grain quality was determined at the SSK silo from composite samples that were taken from the yield of each treatment plot.

Detailed records of all real-time costs and income are maintained for each treatment plot.

Summary of management inputs 2007 to 2011

Land preparation

Before the planting season commenced the whole site was sprayed twice with Glyphosate (450 a.i.) (September 2006 and February 2007). A Trash fieldspan was used on two occasions (October and March) to scarify the soils to a depth of 150mm. The herbicide and scarifying was done to get rid of the old lucerne pasture and weeds before planting. Lime was differentially applied in January 2007 as indicated from a detailed grid sampling of the site.

Crop management

2007 (refer to Appendix 1 for greater detail):

The crops (wheat and canola) were planted using an AUSPLOW (300mm row width).

Fertilizer (N & P) was applied in liquid form during planting. Cyperphos and slug pellets (canola) were applied during planting.

Post emergence crop protection measures were necessary with strategic applications of Lomex (broad-leaf weeds), Duet (disease control) and cyperphos (aphids and bollworm) during the season.

Nitrogen topdressings were applied to the canola plots only.

The wheat and canola were swathed in early October (10th and 8th respectively) and harvested with a pickup at the end of October.

2008 (refer to Appendix 2 for greater detail):

The whole site was sprayed twice with Gramoxone (on the 10th and 24th April 2008) before planting commenced. The main management activities (inputs) are presented in Appendix 2.

The crops (wheat, barley, triticale, lupin and canola) were planted into undisturbed soil using an AUSPLOW (300mm row width).

Liquid fertilizer was applied during planting. Cyperphos (all crops) and slug pellets (canola) were also applied during planting to prevent insect damage to emerging seedlings.

Post emergence crop protection measures were necessary with strategic applications of herbicides, insecticides and fungicides being applied during the season (Appendix 2).

Nitrogen topdressings were only done in the canola on the 10th of June.

The canola, lupin and barley were swathed on 13 October and harvested with a pickup at the end of October. Wheat and triticale were harvested directly on 13 October.

2009 (refer to Appendix 3 for greater detail):

The whole site was sprayed once with Gramoxone for the control of summer weeds in January 2009. The main management activities (inputs) are presented in Appendix 3.

The crops (wheat, lupin and canola) were planted into undisturbed soil using an AUSPLOW (300mm row width).

Fertilizer was applied in liquid form and was sprayed in the planting furrow between the closing tool and the press-wheel. Cyperphos (all crops) and slug pellets (canola) were applied during planting to prevent insect and slug damage to emerging seedlings.

Post emergence crop protection measures were necessary with strategic applications of herbicides, insecticides and fungicides being applied during the season (Appendix 3).

Nitrogen topdressings were not applied to any crops during the season.

The lupin and wheat were swathed on 16 October and harvested with a pickup at the end of October.

No data are available from the canola plots as the crop in these plots had been accidentally killed off through the use of an incorrect herbicide. This occurred during June when it was considered to be too late to replant the crop.

2010 (refer to Appendix 4 for greater detail):

The whole site was sprayed once with Gramoxone for the control of summer weeds in March 2010. The main management activities (inputs) are presented in Appendix 4.

The crops (wheat, lupin and canola) were planted into undisturbed soil using an AUSPLOW (300mm row width).

Fertilizer was applied in liquid form and was sprayed in the planting furrow between the closing tool and the press-wheel. Cyperphos (canola and lupin) and slug pellets (canola) were applied during planting to prevent insect and slug damage to emerging seedlings.

Post emergence crop protection measures were necessary with strategic applications of herbicides, insecticides and fungicides being applied during the season (Appendix 3).

Nitrogen topdressing was applied canola during the season.

The lupin and canola were swathed on in October, while wheat was swathed in November. All crops were harvested with a pickup in November.

Yields on in the lupin plots were below 1ton/ha due to incorrect use of Metribuzin on the cultivar Tanjil and an acute attack of powdery mildew.

2011 (refer to Appendix 5 for greater detail):

The main management activities (inputs) are presented in Appendix 5.

The crops (wheat, lupin and barley) were planted into undisturbed soil using an AUSPLOW (300mm row width).

Post emergence crop protection measures were necessary with strategic applications of herbicides, insecticides and fungicides being applied during the season (Appendix 3).

Nitrogen topdressing was applied to the canola crop during the season.

All crops were swathed in October and harvested with a pickup in November.

Economic analysis: approach

Gross margin analysis of costs and income associated with each treatment plot of each research site was based on the following:

Gross income: Yield per ha x product price at the date when delivered to the silo (during harvest). Quality was taken into account.
Price per ton after silo and marketing costs

Directly allocatable variable costs

Actual price of products and services (e.g. contractors) at the date the product or service was supplied **for that research site** –these prices may vary from site to site depending on date supplied, supplier, amounts purchased etc.

In-directly allocatable variable costs

Fuel price = average (coastal) price per litre (diesel) for the period April to October as supplied by the AA for a specific year.

Fuel-use is based on calculations presented in the "Guide to Machinery Costs" for a specific year for the **actual machinery and implements used at each site.** The Guide calculates fuel use as: 0.14, 0.158 and 0.18 litres per kWhr for low, medium and high power out-put respectively.

Repairs and maintenance costs were also based on the replacement costs of machinery and implements provided in the Guide to Machinery Costs for a specific year for the **actual machinery and implements used at each site**

Refer to Appendix 6 for detail on "prices and costs" of replacement value of all machinery and implements, as well as the costs of all inputs used in each year.

Note that costs such as fuel and maintenance costs of transporting machinery, seed for planting, water for spraying etc to the trial site, from the farm "opstal" were not allocated to any of the treatments. Only expenditure that could be directly allocated to each treatment plot was included in the analyses.

Gross margin analyses of the Riversdale site data for 2007 to 2011: a summary

Land preparation

The direct and indirect allocatable variable costs associated with land preparation (scarifying) and liming for the research site in late 2006/early 2007, are presented in Table 2.

Table 2 Costs associated with land preparation for the Riversdale site including the cost of lime (late 2006/early 2007).

Site	Direct allocatable variable costs (R/ha)	In-direct allocatable variable costs (R/ha)	Total allocatable variable costs (R/ha)
Riversdale	406	99	505

Gross margin analysis for each crop produced in 2007 to 2011

It must be noted that the soils and local climate of the Riversdale research site provide the site with an above-average yield potential relative to the Riversdale production region and all crop production management inputs should be viewed in this context.

While direct and indirect allocatable variable costs per ha such as fuel usage and maintenance and repair costs of machinery and implements, may differ from farm to farm and region to region, the "prices and costs" used in the Gross Margin analyses of the different crop sequences allow for direct comparison between systems. The direct and indirect allocatable variable costs per ha used in these analyses are, however, considered to be very similar to those costs and prices experienced on farm (**but apply only to the activities directly attributable to that ha**).

Summary data showing the average direct and indirect allocatable variable costs, average Gross Income and Gross Margin per crop for each crop sequence in each of the five years, are presented in Tables 3a and 3b.

Table 3a Riversdale research site average direct and in-direct variable costs, average gross income and average gross margin per crop - 2007 to 2009

	2007	2007	2008	2008	2008	2008	2008	2009	2009	2009
	Wheat after lucerne	Canola after lucerne	Lupin after wheat	Canola after wheat	Barley after wheat	Triticale after canola	Wheat after canola	Wheat after lupin	Wheat after canola	Lupin after wheat
Fertlizer	235	473	508	957	576	625	625	532	657	523
Weed control	106	80	300	252	157	249	249	146	146	141
Pest Control	43	161	70	204	162	162	162	80	80	194
Fungicide	93	93	178	0	99	99	99	126	126	252
Fuel	99	106	189	200	189	170	170	106	106	134
Lime	0	0	0	0	0	0	0	0	0	0
seed	179	147	378	110	252	192	319	320	320	607
contractors	164	185	101	91	135	181	180	181	170	100
Rep and maint	105	111	132	138	132	121	121	129	129	161
Total variable cos	1023	1355	1857	1953	1702	1800	1926	1620	1734	2113
Yield (tons)	1.967	2.293	2.253	2.032	2.993	4.033	4.003	4.015	3.779	2.195
Quality	B4 & UT				Feed	Feed	B1	B2	B2	
Price (Rands)	1700/2075	3500	2345	3500	1545	1500	2084	1633	1633	1955
Gross income	3686	8026	5283	7111	4625	6049	8342	6556	6171	4291
Gross margin	2663	6670	3425	5158	2923	4249	6416	4936	4437	2178

Table 3b Riversdale research site average direct and in-direct variable costs, average gross income and average gross margin per crop – 2010 to 2011

	2010 Canola after wheat	2010 Lupin after wheat	2010 Wheat after canola	2010 Wheat after lupin	2011 Wheat after canola	2011 Wheat after lupin	2011 Barley after wheat	2011 Wheat after wheat	2011 Canola after wheat
Fertlizer	1006	494	552	552	549	549	515	549	701
Weed control	158	96	165	165	378	378	0	378	235
Pest Control	113	6	29	29	30	30	30	30	0
Fungicide	0	140	0	0	110	110	360	110	0
Fuel	162	158	158	158	164	164	159	164	169
Lime	0	0	0	0	279	279	279	279	279
seed	165	362	271	271	307	307	186	307	236
contractors	99	37	136	130	346	344	477	343	172
Rep and maint	164	158	158	158	146	146	140	146	152
Total variable costs	1866	1450	1468	1463	2309	2308	2147	2306	1943
Yield (tons)	2.07	0.77	2.84	2.74	3.75	3.73	4.57	3.69	2.1
Quality			B1	B1	B2	B2 & B3	Malt	B2	
Price (Rands)	3450	2000	2290	2290	2160	2160/2045	2360	2160	3700
Gross income	7153	1540	6511	6263	8107	7919	10793	7978	7770
Gross margin	5287	90	5043	4800	5798	5610	8646	5671	5827

Direct and indirect allocatable variable costs

The direct and indirect allocatable variable cost data given in Table 3a and 3b are shown in greater detail in Figures 1 (a to f) and Figures 2 (a to j). Note that the data shown in Figure 1c for canola that was planted in 2009 should be ignored as these are only partial costs due to the fact that the crop was lost at an early stage of growth due to the incorrect herbicide being applied. Figure 1d is presented for the same crop sequence (System 3) without the canola data.

Fertilizer makes the greater contribution to total costs than the other inputs. It is closely followed by the cost of seed and weed control. It is interesting to note the highest fertiliser input costs in all systems was for canola (Fig 2a), this is due to the fact that a top dressings was applied to the canola plots. The dramatic increases in fertilizer prices experienced in 2008, and that was carried through to 2009, are also apparent (Table 3 and Figure 2a).

The lowest directly allocatable variable costs across all crops and years tended to be those used for insect (pest) control (Table 3 and Figure 2).

Fuel cost increased dramatically in 2008 reflecting the approximate 70% increase in the diesel price when compared to 2007 and 2009.

The highest total input (direct and indirect allocatable) costs per ha were for the 2011 production year (Table 3 & Figure 2j). The production cost was higher because of the application of lime across all plots, added contractor costs of spraying for diseases and insects by plane as well as higher transport costs due to the high yields obtained. While the high costs for lupin production are surprising the costs should be seen in the context of the high P requirement of lupins and the price of P from 2007 until 2011, as well as the higher costs of fungicide applications and seed inputs for lupins relative to the other crops.

Gross income

Gross income of canola after lucerne was more than twice the gross income of wheat

after lucerne in 2007 (Table 3a and Figure 3). It should be borne in mind that the wheat was severely infected with the disease "take-all" and produced on average only about 2 tons per ha of the lowest quality grain (UT and B4). This should be compared to the average production of canola of about 2.3 tons per ha together with the high market value of canola in 2007. Average wheat yields on neighbouring camps that were not infected with take-all were in excess of 3 tons, which is to be expected as canola produces between 50 and 60% of the yield of wheat when grown under the same climatic conditions. Since the total input costs were only slightly higher for the canola than the wheat in 2007, the gross margins for the canola were also about 2.5 times the gross margins obtained for the wheat.

Following excellent yields for all crops in 2008, wheat showed the highest gross income followed (in descending order) by the canola, triticale, lupin and barley crops. Gross margins recorded by these crops followed the same pattern.

A slightly higher input cost for wheat after canola compared to wheat after lupin in 2009 (due to the additional N applied at planting for the wheat after canola) and an increased yield for the wheat after lupin resulted in a higher gross income and gross margin for the wheat after lupin than the wheat after canola (Table 3a and Figure 3). With the highest input costs, lowest yield and product price, the lupins had the lowest gross income and gross margin in the 2009 season. Note that the canola crop is not discussed here for reasons mentioned above.

Wheat following canola showed a higher gross income in 2010 than wheat following lupin (Table 3b). The gross income for lupin was the lowest; this was due to very poor yields. The poor yields were the result of applying the wrong herbicide (Metribuzin) on the cultivar Tanjil.

The highest gross income was realised in the 2011 season. Barley recorded the highest average gross margin. It was R2686 more than wheat following canola. The average gross income for wheat following lupin was the lowest, which is understandable because of the poor yields of the lupin planted in 2010.

Average annual costs, income and gross margin

Average annual costs, income and gross margins per system over the five years under discussion are presented in Figures 4 a, b & c.

Average annual (total) allocatable variable costs over the five years tended to be higher for systems where both lupins and canola were produced in those years (Figure 4a).

Average annual gross income (Fig 4b) were the lowest for systems 2 and 3 which included the failed canola (system 3) and poor lupin (system 2) discussed previously.

System 5 which included 2 years of canola crops and a lupin crop showed the highest gross income as well as the highest margin per ha. It must also be remembered that the 3 systems that included wheat in the first of the five crop production years was affected by "take-all", which lowered the gross income of these systems.

The land preparation costs must also be taken into consideration i.e. the R505/ha land preparation cost must be allocated to all treatments. This could be done by adding those costs to the costs for the first year of the cropping phase or spread over the five years of the cropping phase.

Conclusions

It is clear that the direct and indirect allocatable variable cost data, together with crop management data for each crop sequence being tested, provide useful guidelines for producers regarding the management and economic implications of applying crop rotations in the Riversdale "vlaktes" production region.

From the data of the five production years it is clear that any of the five systems tested could be used in a long rotation sequence with lucerne pastures. The performance of system 5 which included two canola crops, two wheat crops and lupin proved to be a revelation and underlines the effect that canola following lucerne is a viable option (if weed control was done properly in the pasture phase).

Acknowledgements

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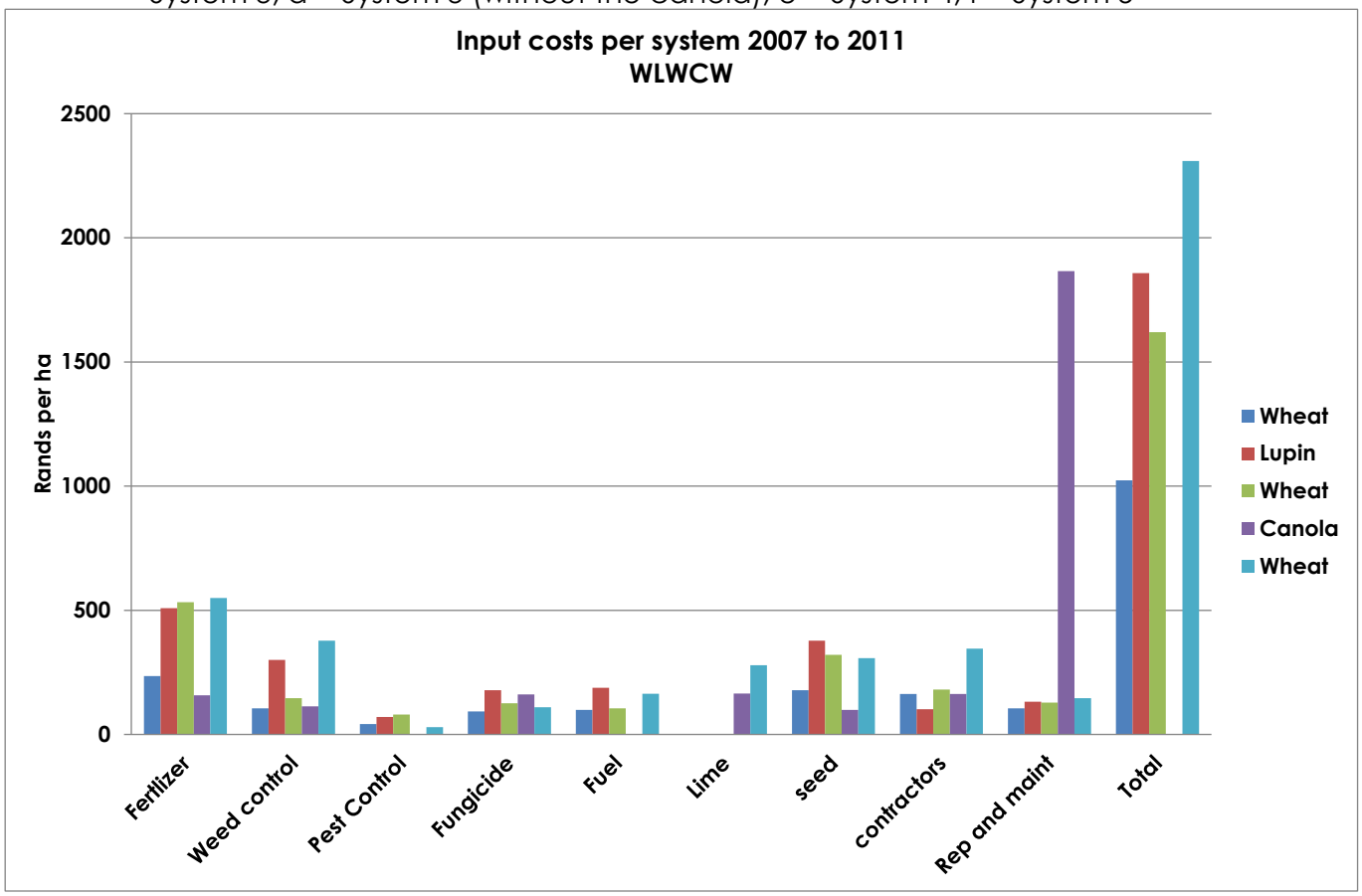
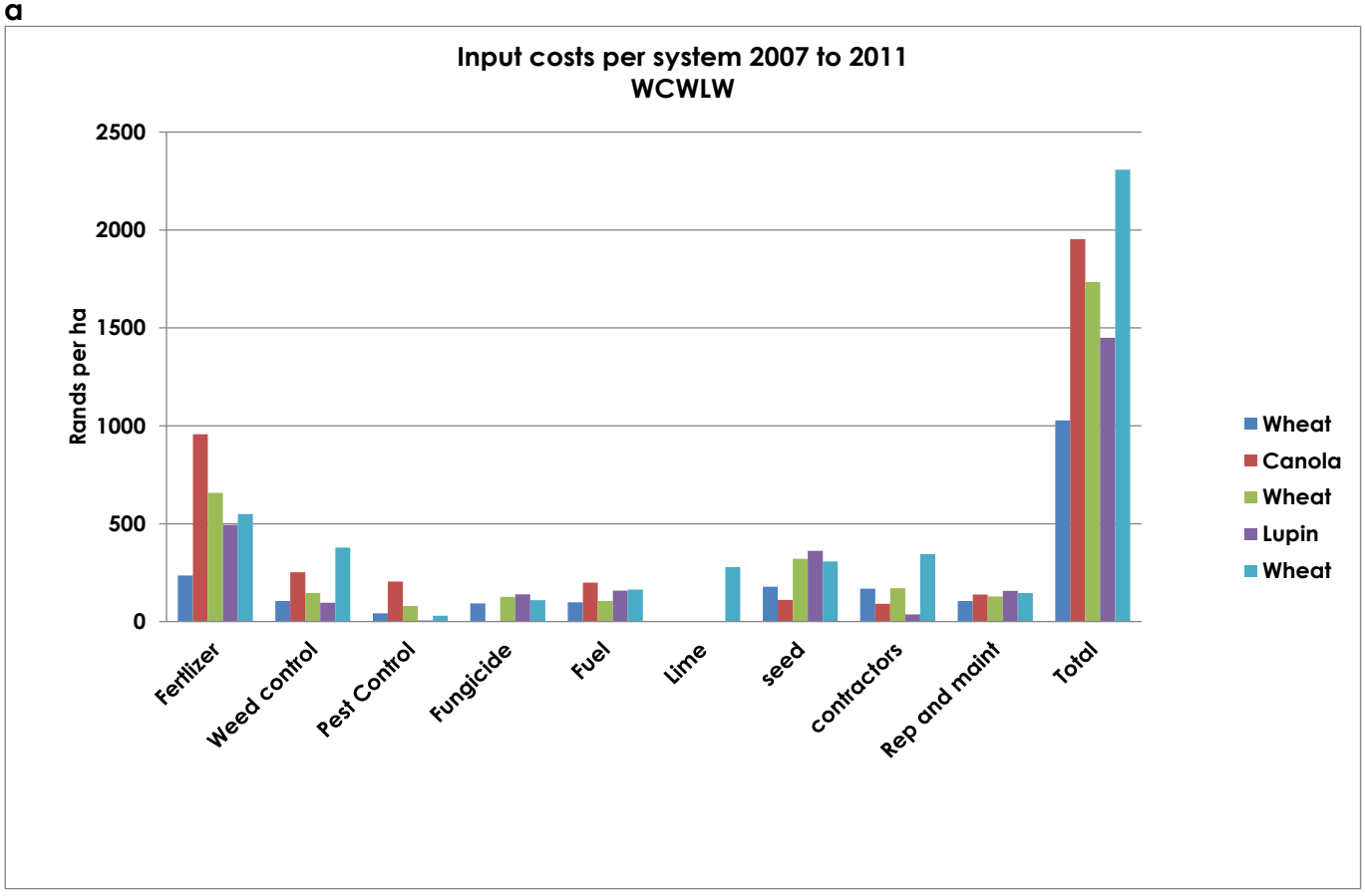
Figure 1 Direct and indirect allocatable variable costs per system - a = System 1; b = System 2; c = System 3; d = System 3 (without the canola); e = System 4; f = System 5



a



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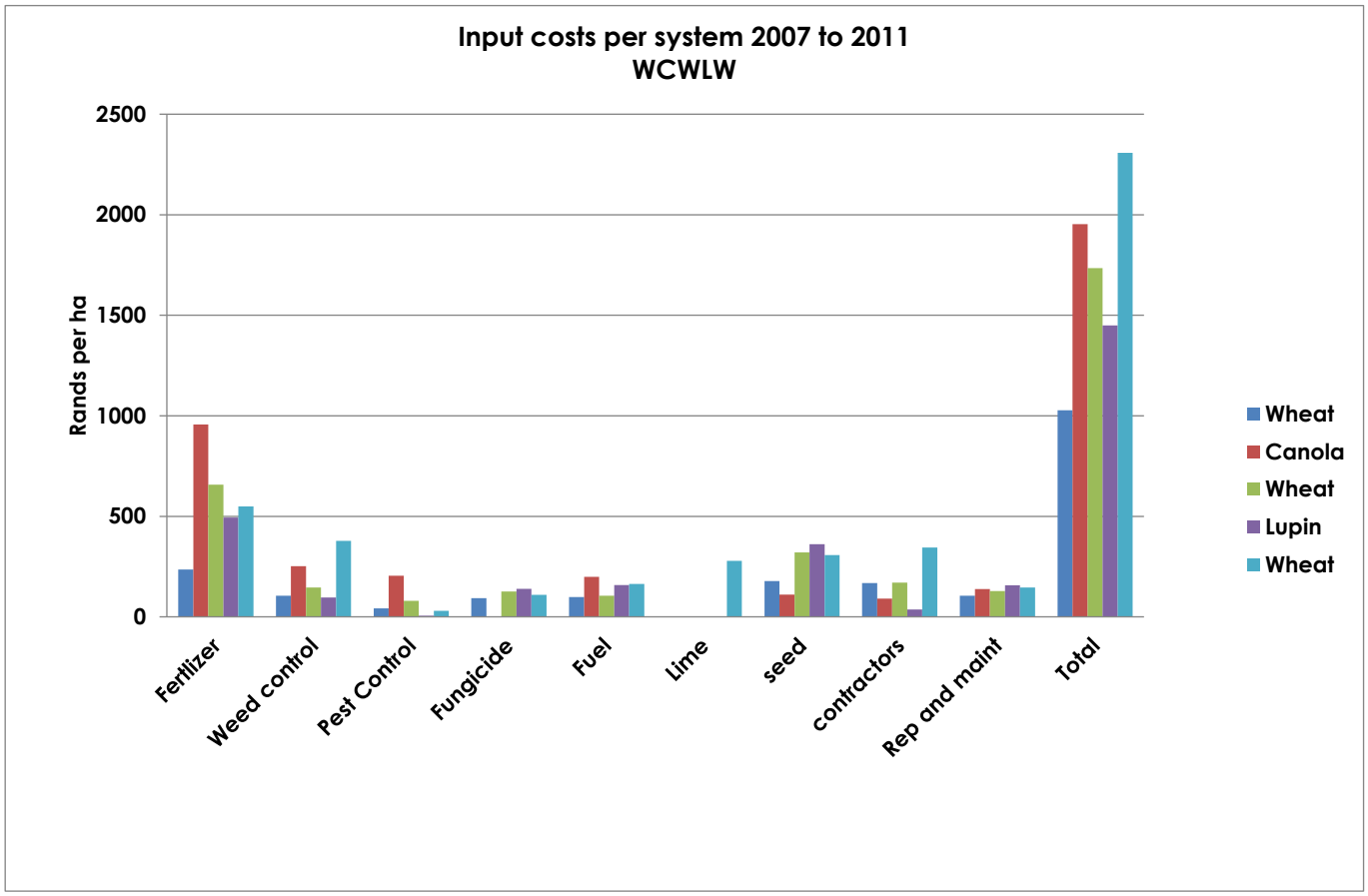
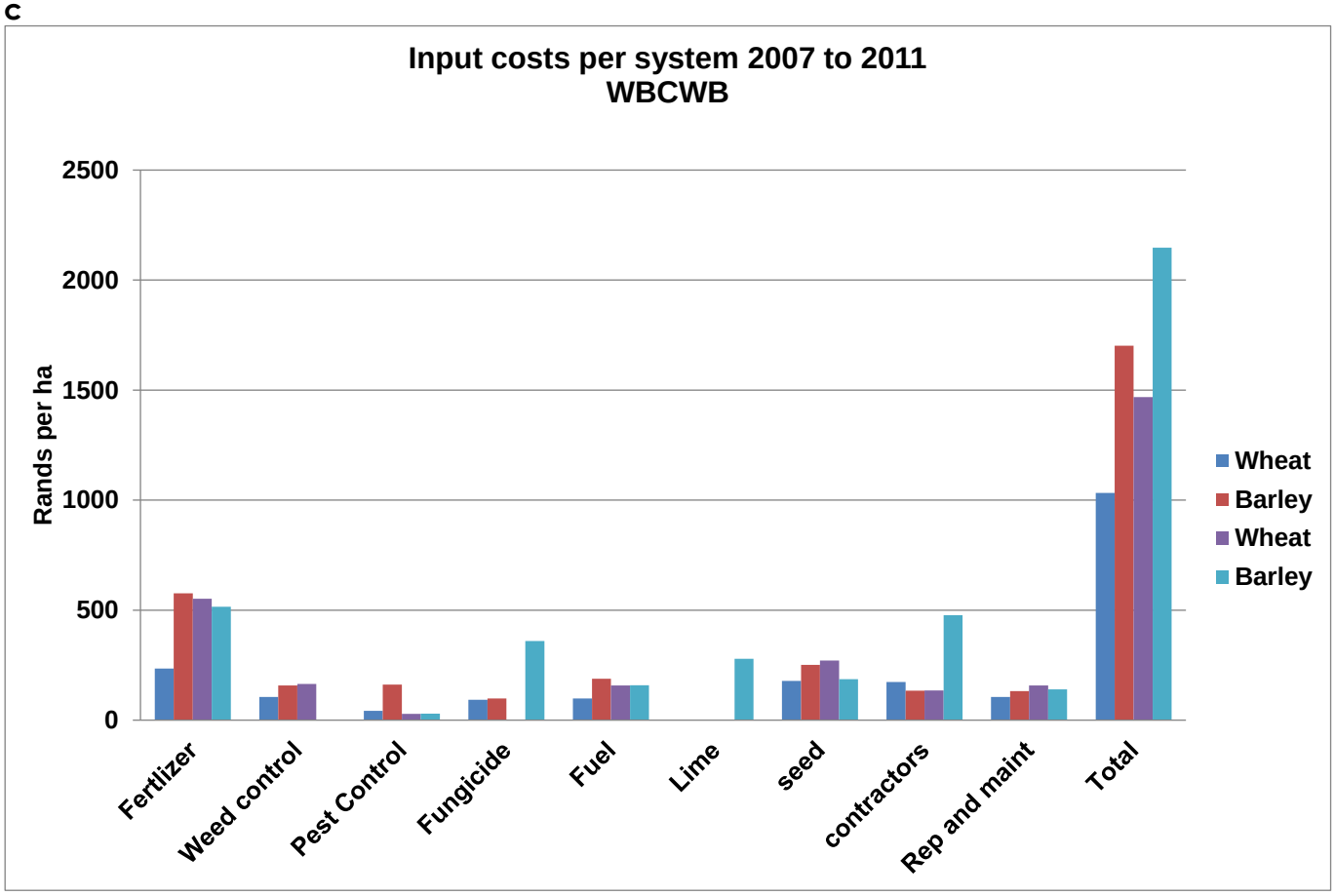
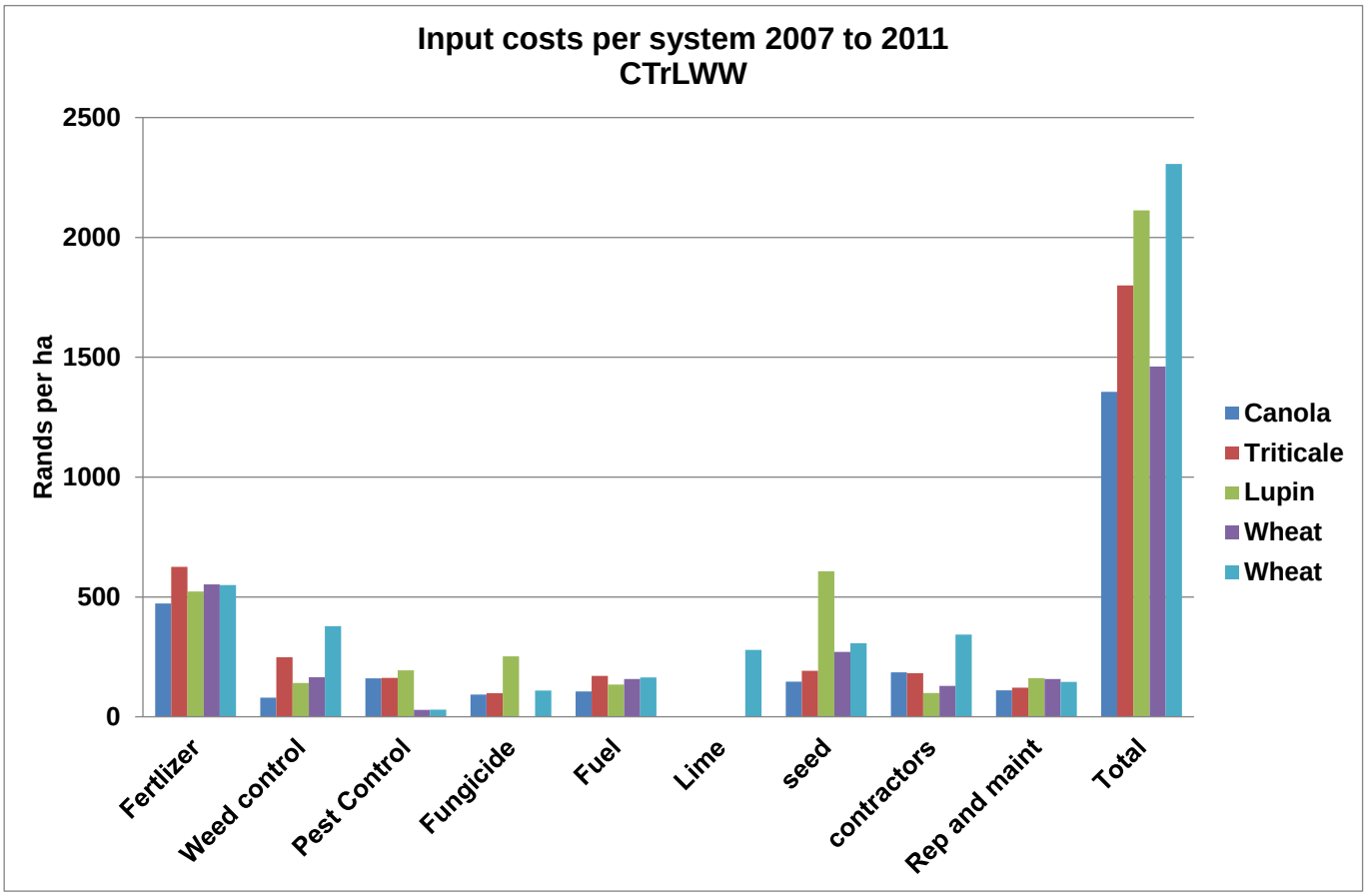

Input costs per system 2007 to 2011
WCWLW
Rands per ha
2500
2000
1500
1000
500
0
Fertlizer
Weed control
Pest Control
Fungicide
Fuel
Lime
seed
contractors
Rep and maint
Total
Wheat
Canola
Wheat
Lupin
Wheat

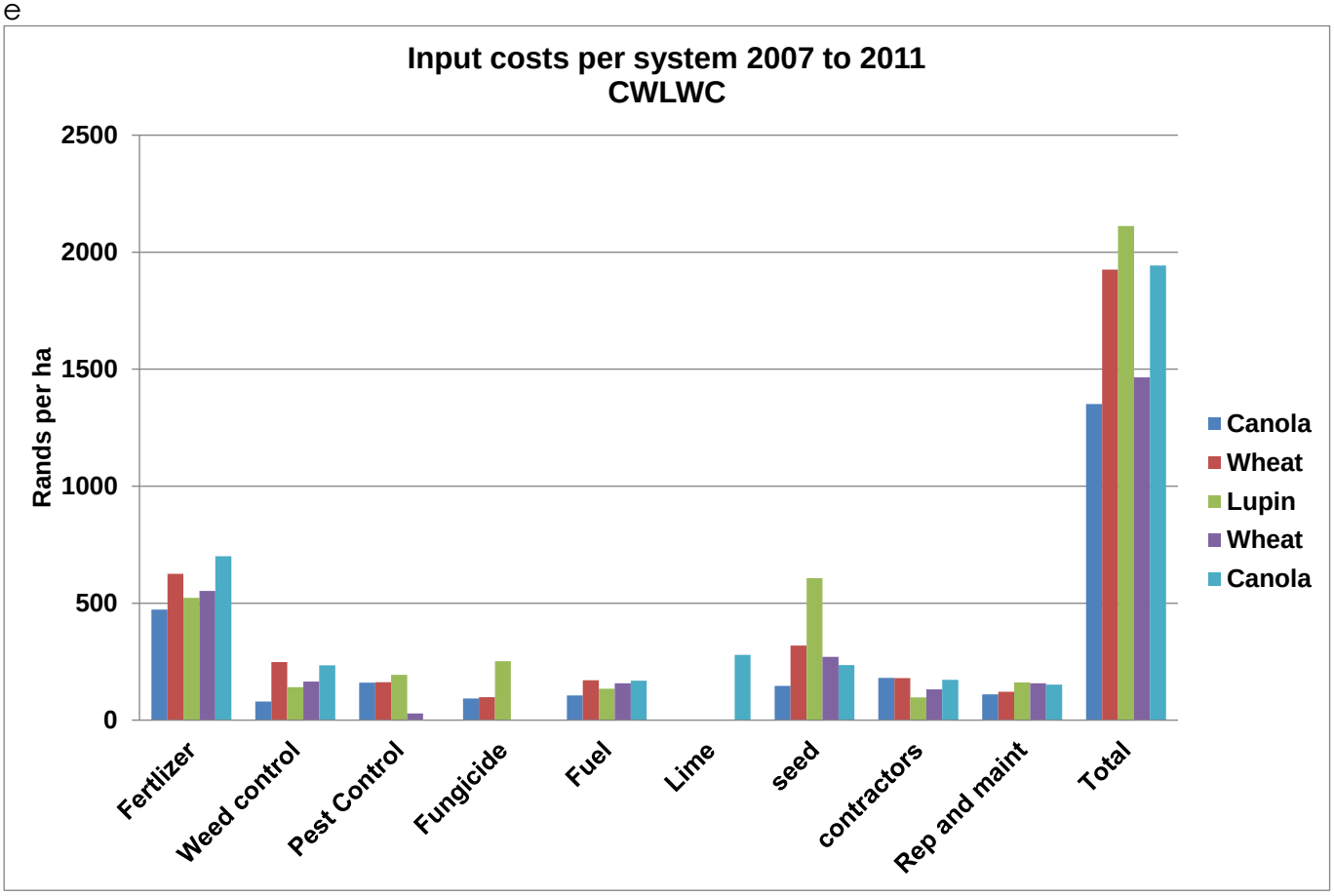
c


Input costs per system 2007 to 2011
WBCWB
Rands per ha
2500
2000
1500
1000
500
0
Fertlizer
Weed control
Pest Control
Fungicide
Fuel
Lime
seed
contractors
Rep and maint
Total
Wheat
Barley
Wheat
Barley

d

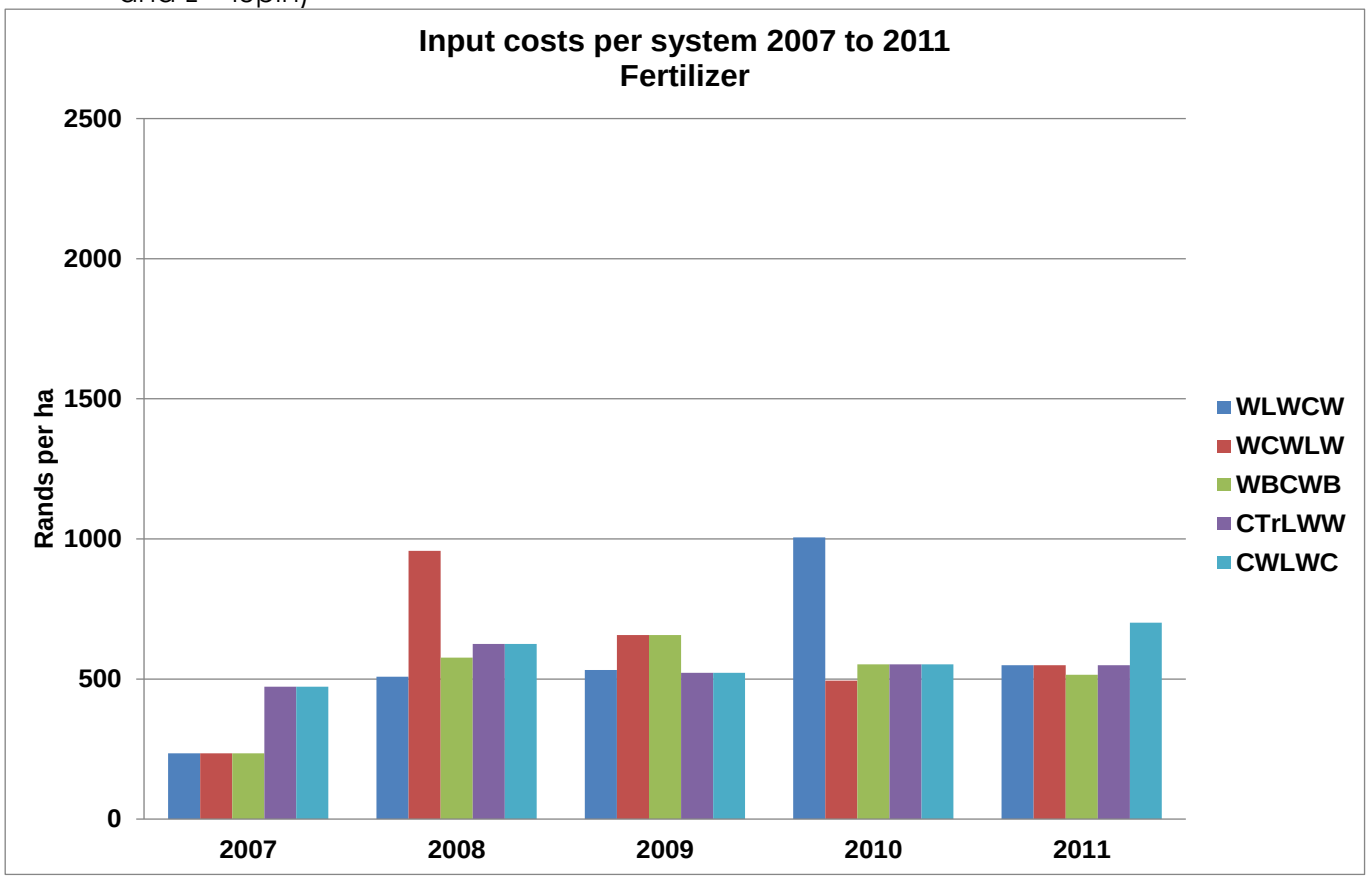

Input costs per system 2007 to 2011
CTrLWW
Rands per ha
2500
2000
1500
1000
500
0
Fertlizer
Weed control
Pest Control
Fungicide
Fuel
Lime
seed
contractors
Rep and maint
Total
Canola
Triticale
Lupin
Wheat
Wheat

e


Input costs per system 2007 to 2011
CWLWC
Rands per ha
2500
2000
1500
1000
500
0
Fertlizer
Weed control
Pest Control
Fungicide
Fuel
Lime
seed
contractors
Rep and maint
Total
Canola
Wheat
Lupin
Wheat
Canola

f

Figure 2 Direct and indirect allocatable variable costs per year for each crop in a system. The first column of letters in the ledgend are the crops planted in 2007; 2nd column = crops in 2008, the 3rd column = crops in 2009 (W = wheat, C = canola, B = barley, Tr = triticale and L = lupin)



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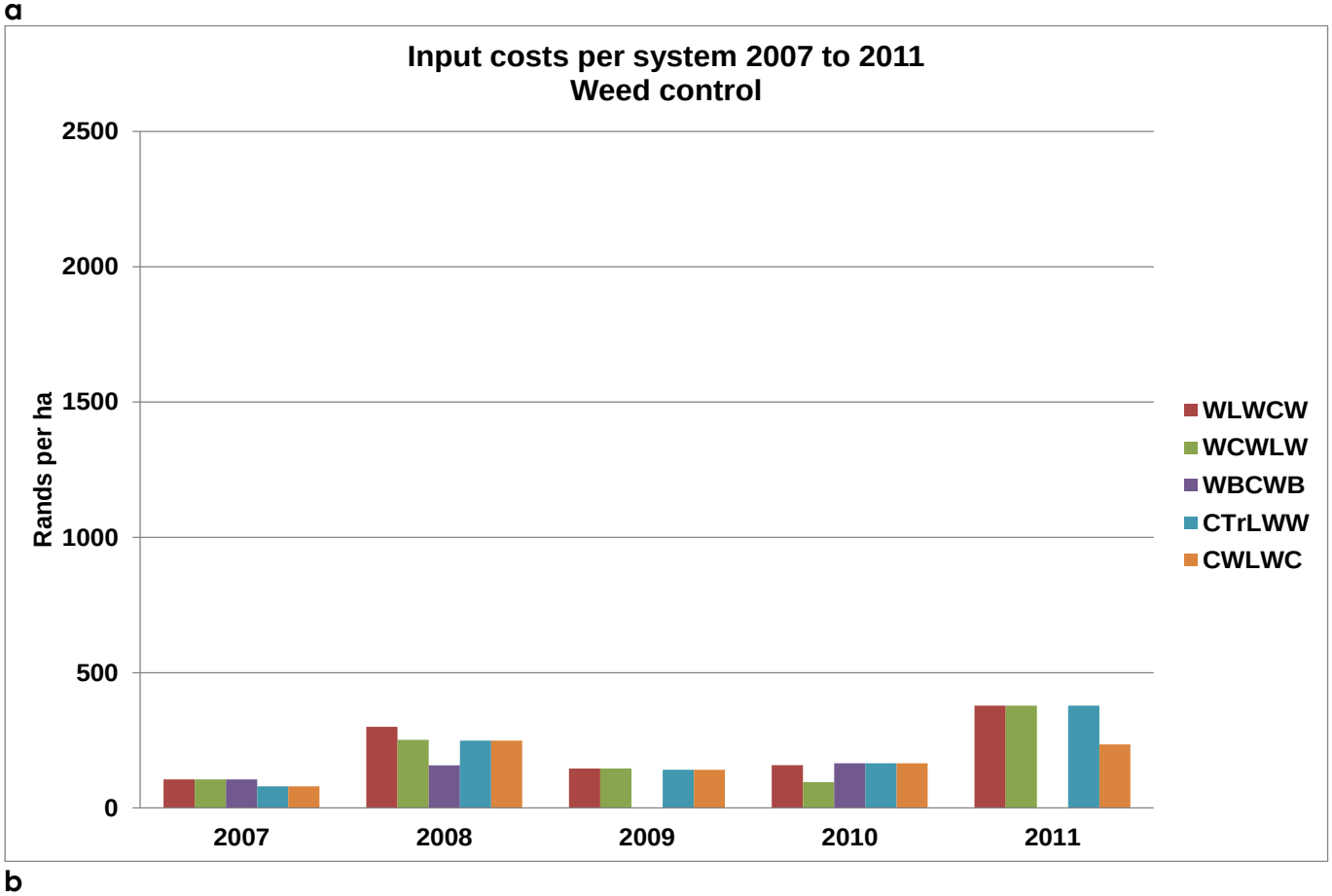

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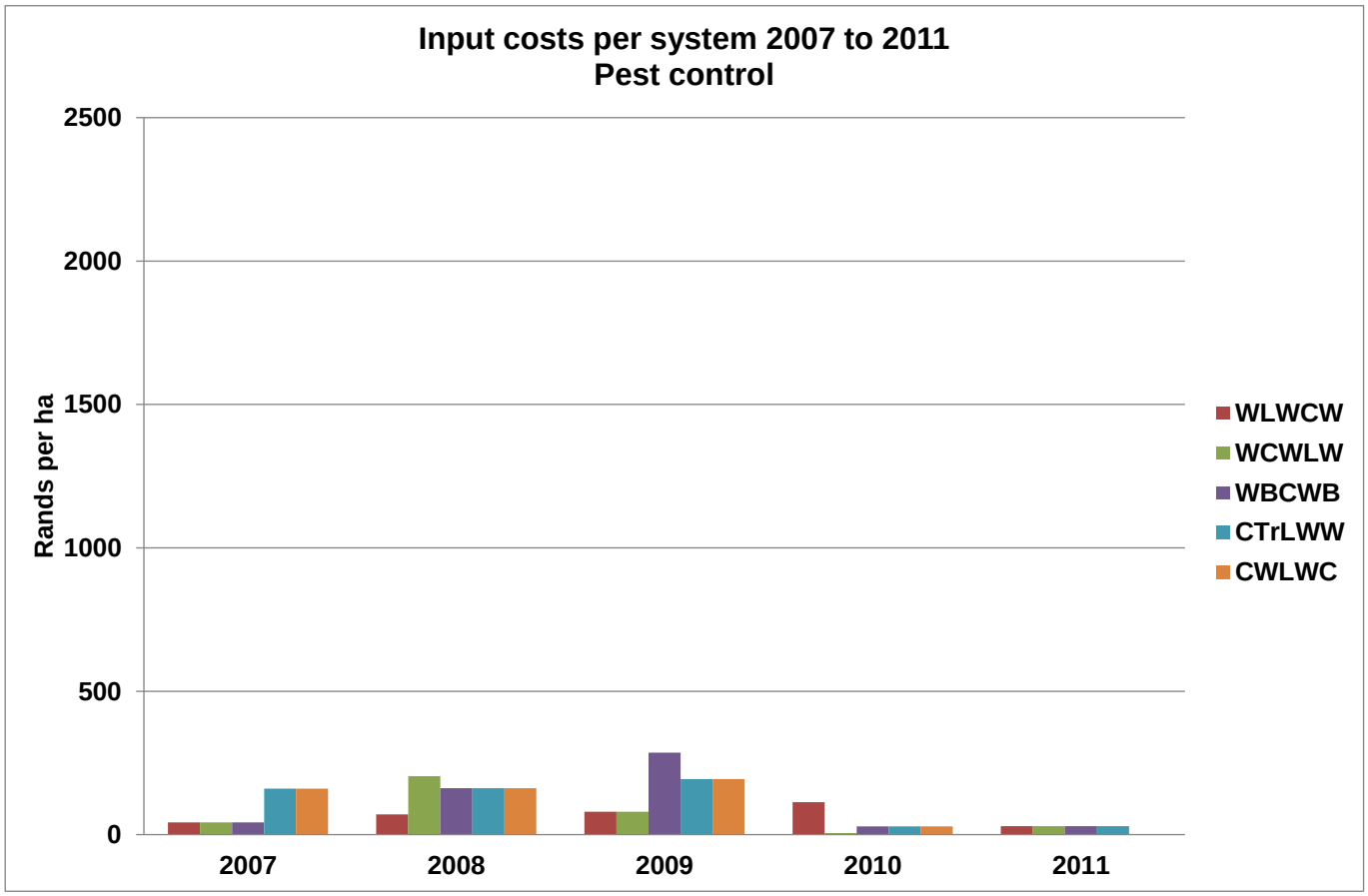
Input costs per system 2007 to 2011
Pest control
Rands per ha
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
WLWCW
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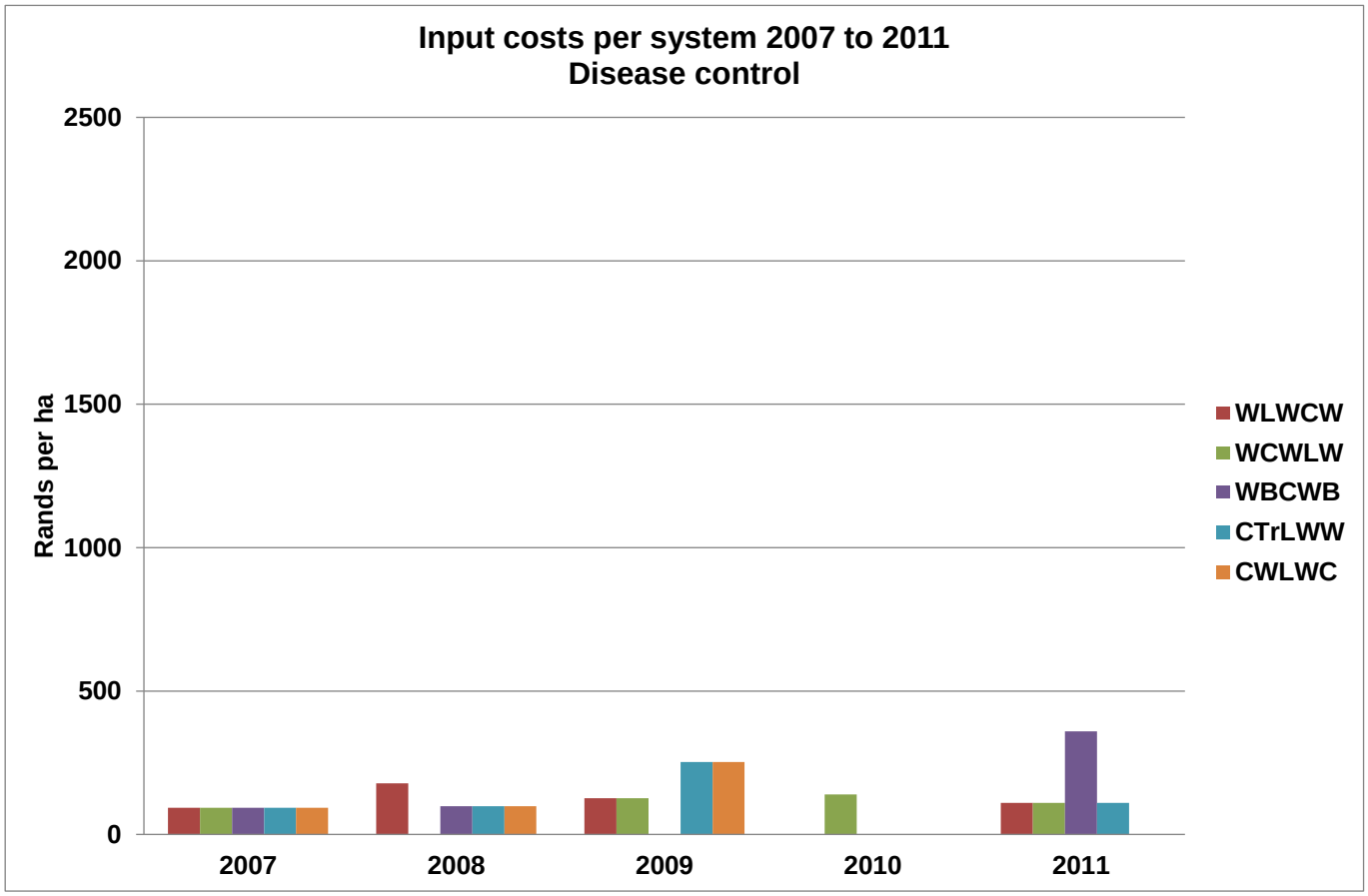
WBCWB
CTrLWW
CWLWC

c


Input costs per system 2007 to 2011
Disease control
Rands per ha
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2000
1500
1000
500
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2007
2008
2009
2010
2011
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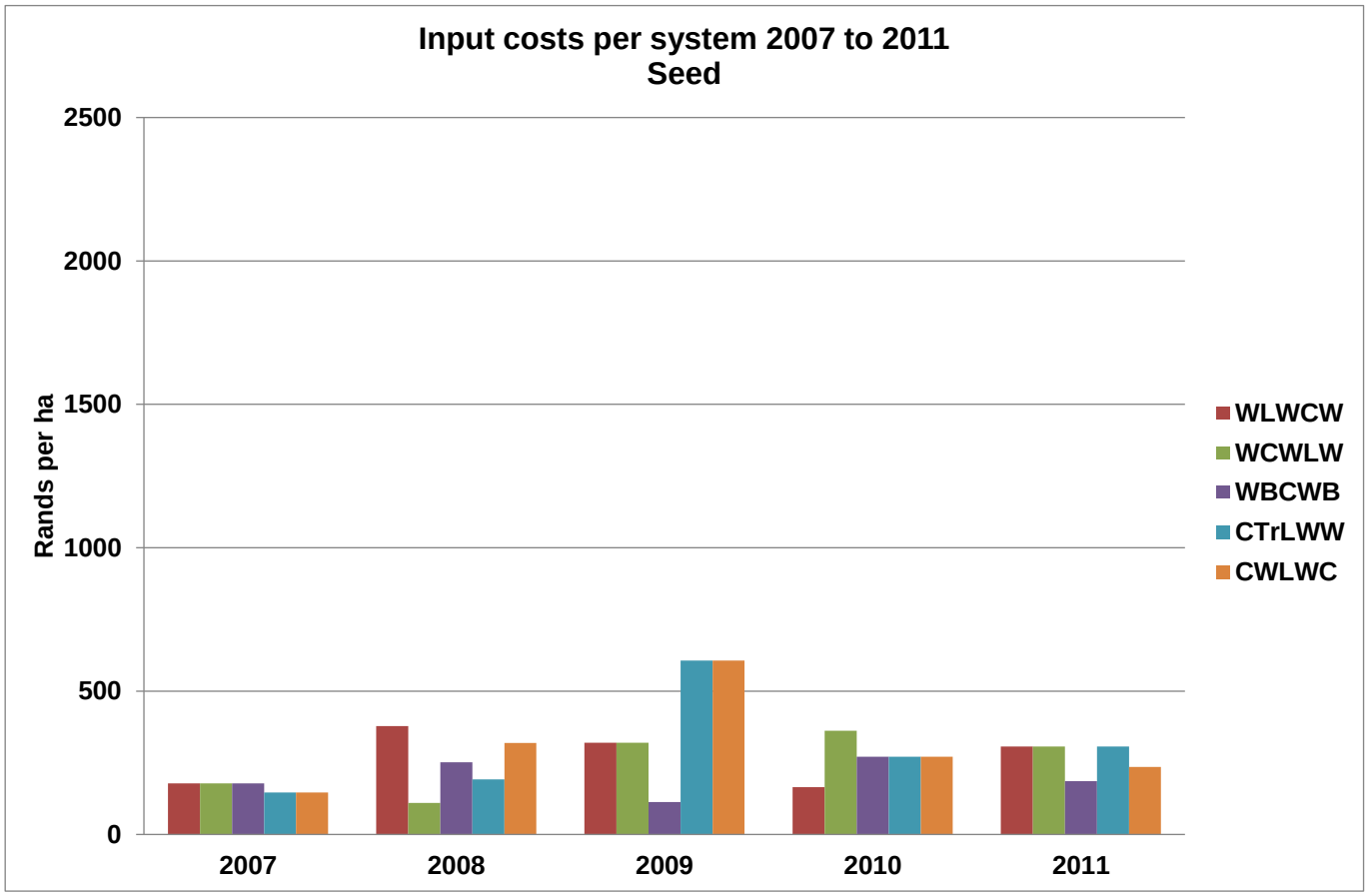
WBCWB
CTrLWW
CWLWC

d


Input costs per system 2007 to 2011
Seed
Rands per ha
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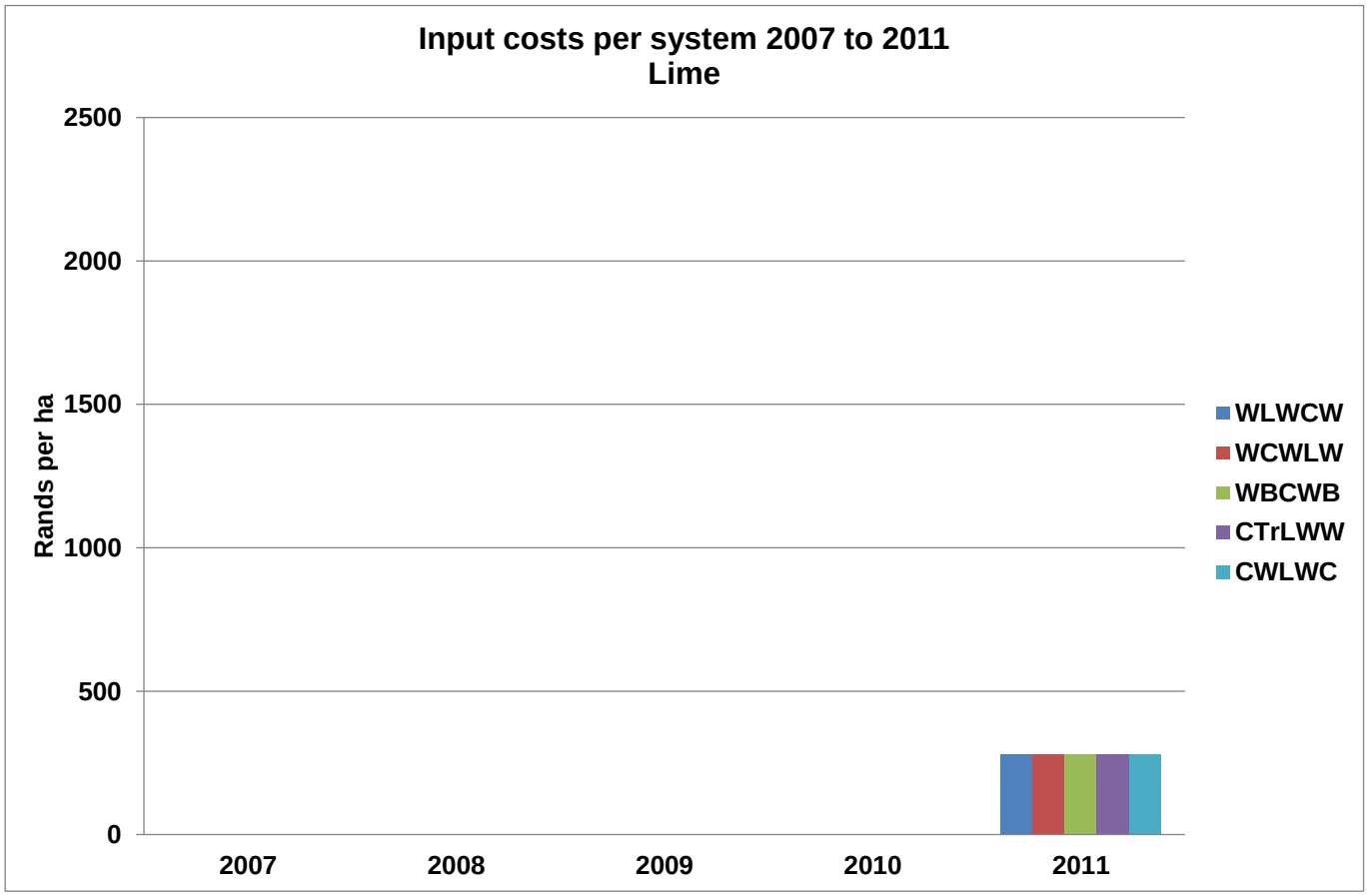
2000
1500
1000
500
0
2007
2008
2009
2010
2011
WLWCW
WCWLW
WBCWB
CTrLWW
CWLWC

e


Input costs per system 2007 to 2011
Lime
Rands per ha
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
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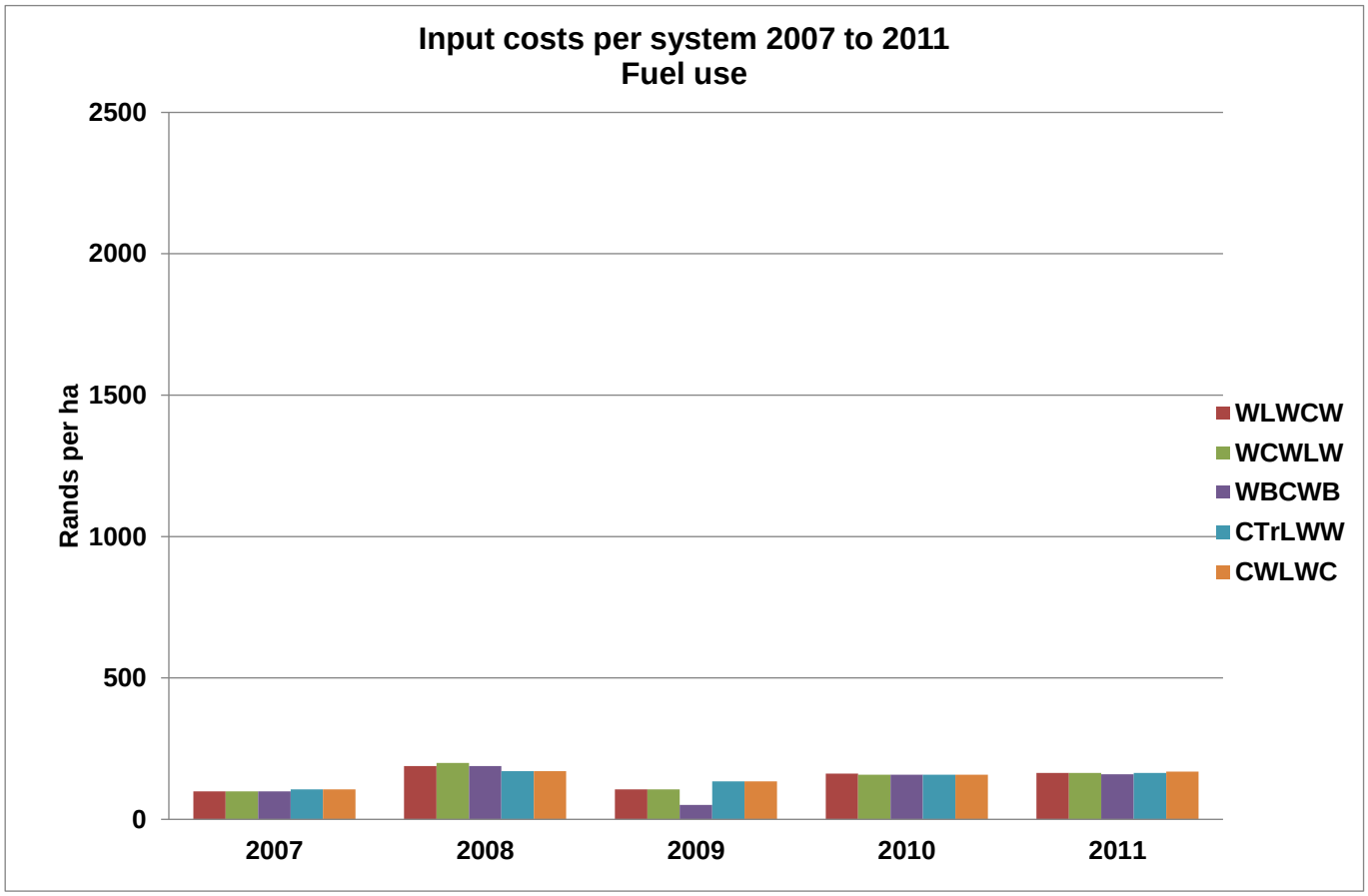
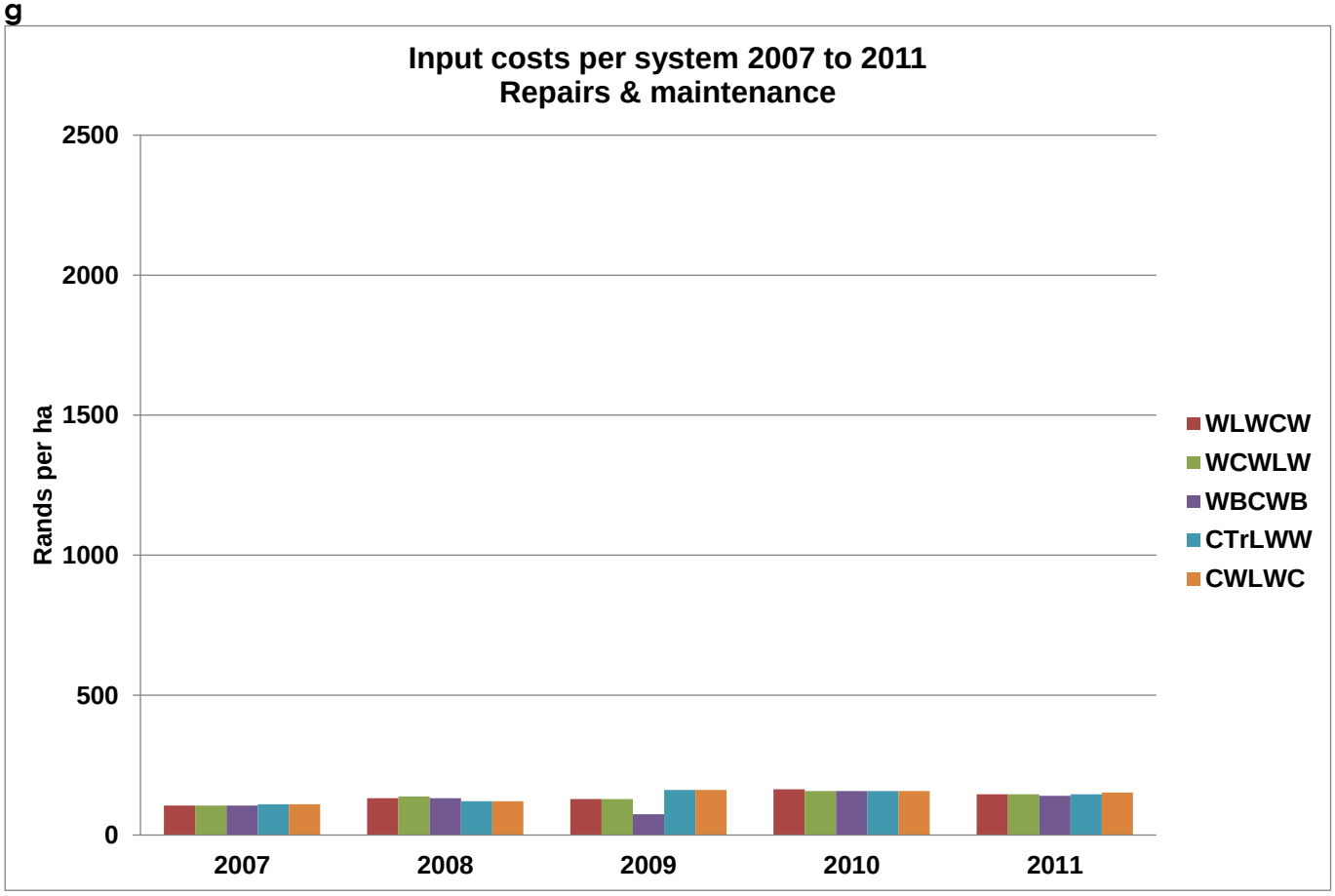
WCWLW
WBCWB
CTrLWW
CWLWC

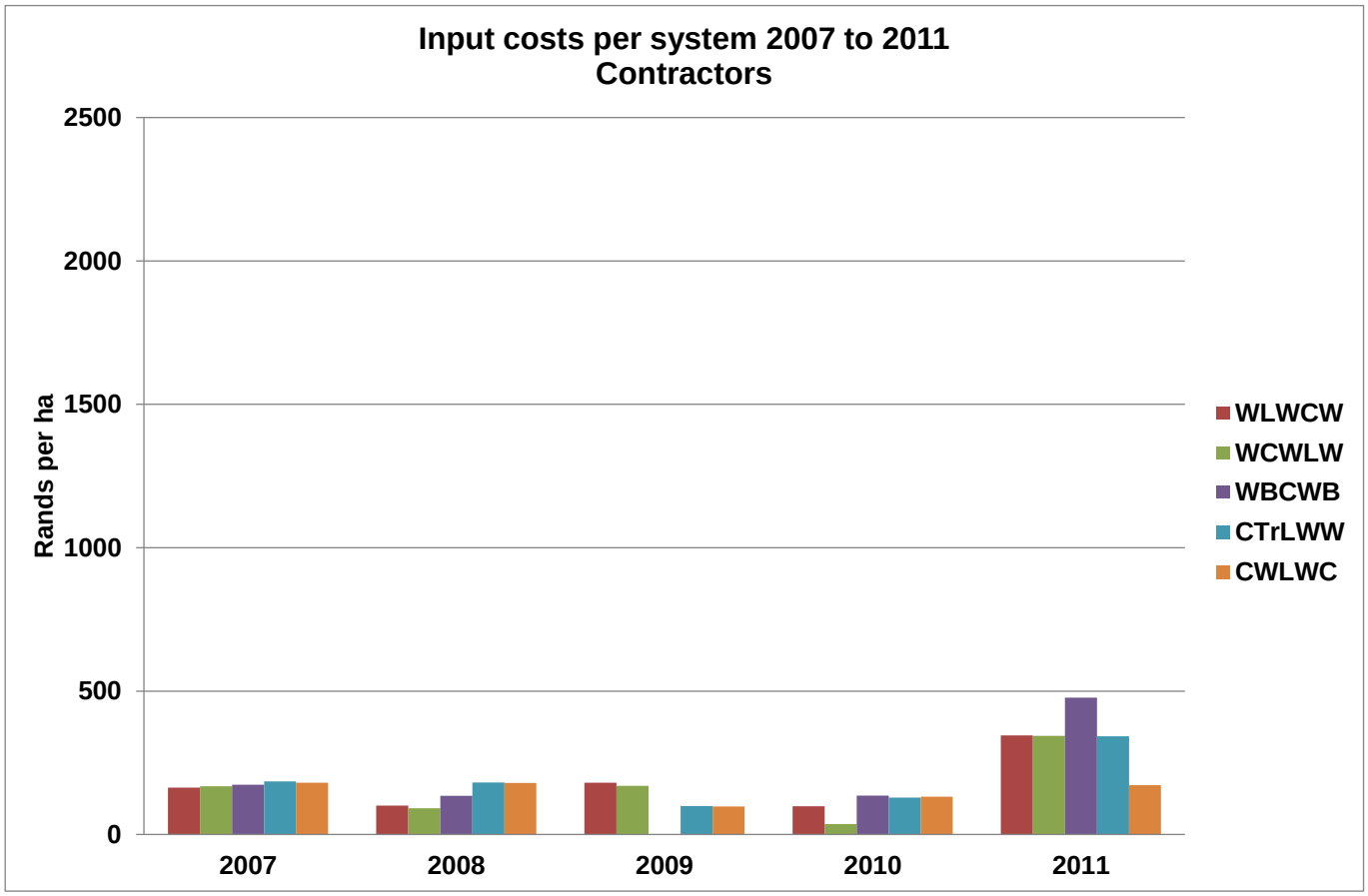
f


Input costs per system 2007 to 2011
Fuel use
Rands per ha
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
WLWCW
WCWLW
WBCWB
CTrLWW
CWLWC

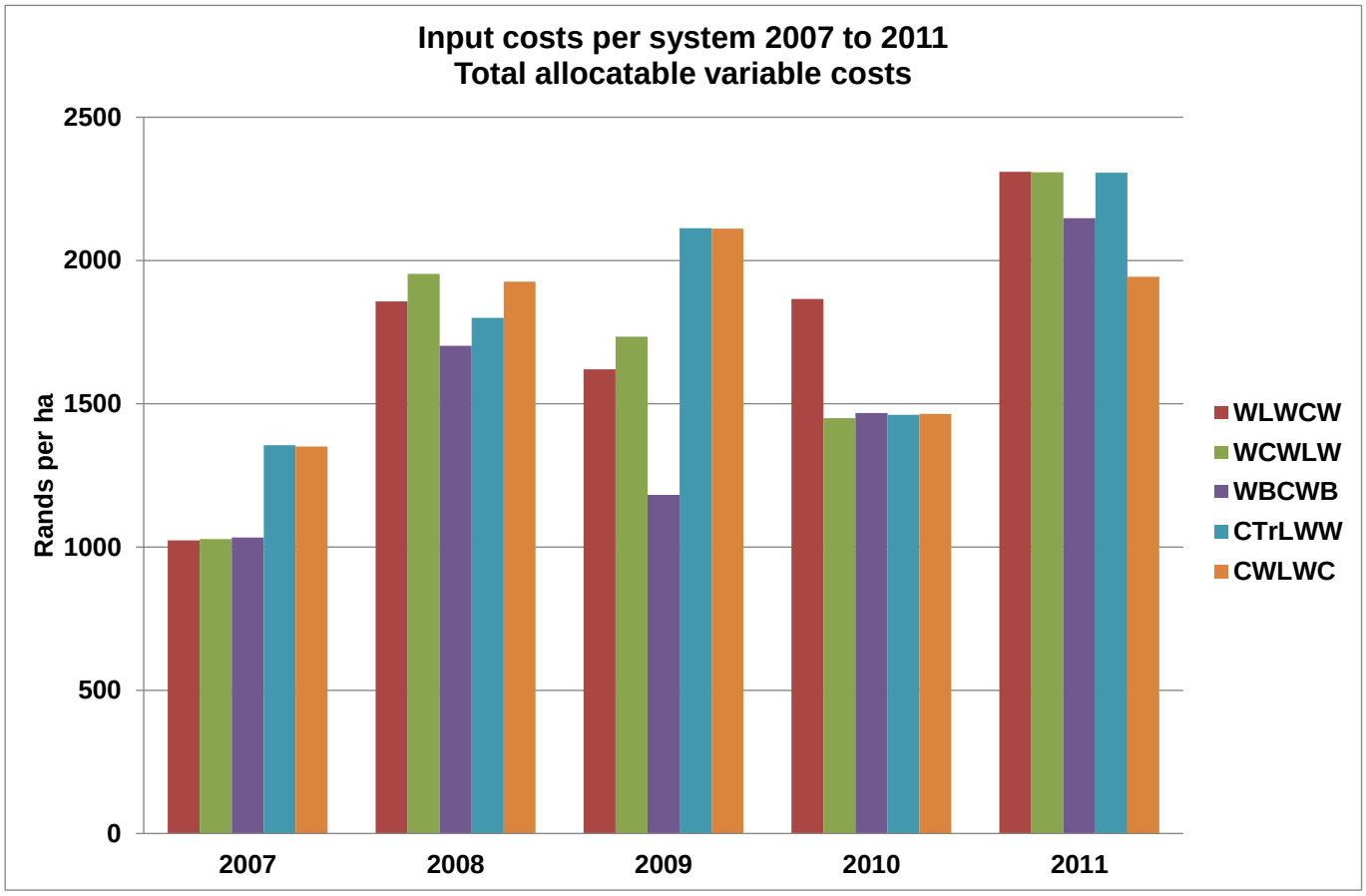
g


Input costs per system 2007 to 2011
Repairs & maintenance
Rands per ha
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
WLWCW
WCWLW
WBCWB
CTrLWW
CWLWC

h

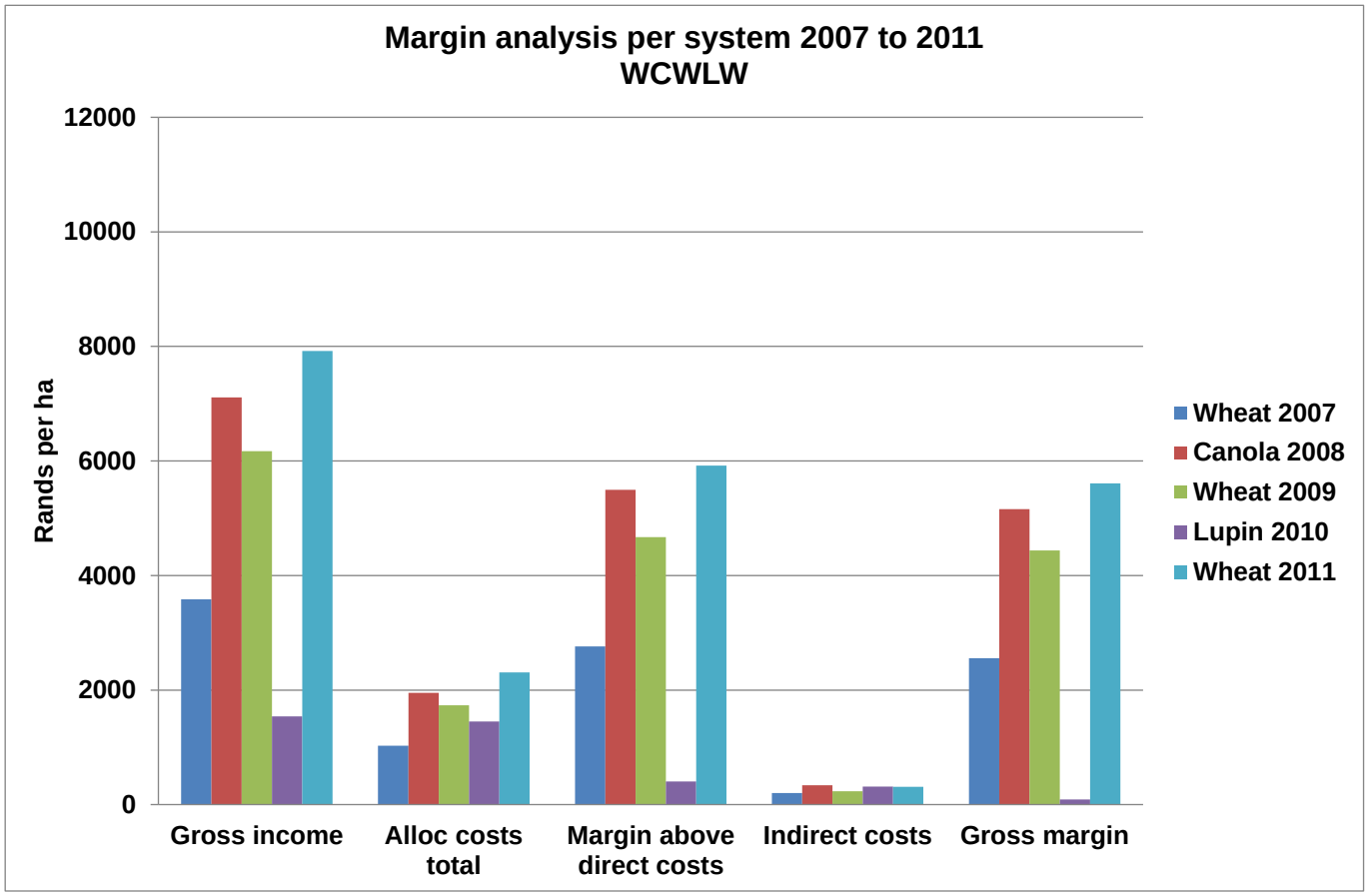

Input costs per system 2007 to 2011
Contractors
Rands per ha
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
WLWCW
WCWLW
WBCWB
CTrLWW
CWLWC

i

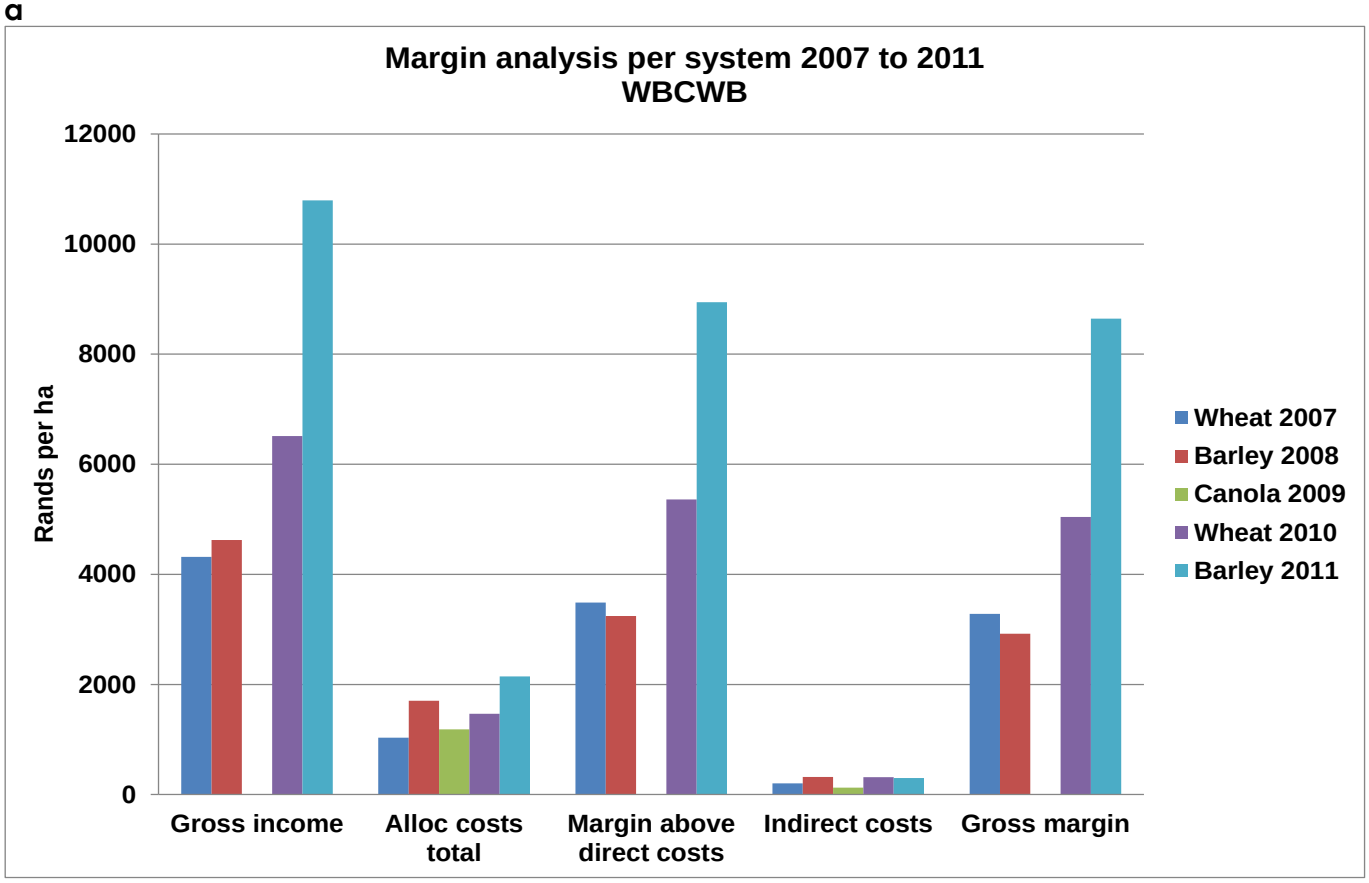

Input costs per system 2007 to 2011
Total allocatable variable costs
Rands per ha
2500
2000
1500
1000
500
0
2007
2008
2009
2010
2011
WLWCW
WCWLW
WBCWB
CTrLWW
CWLWC

j

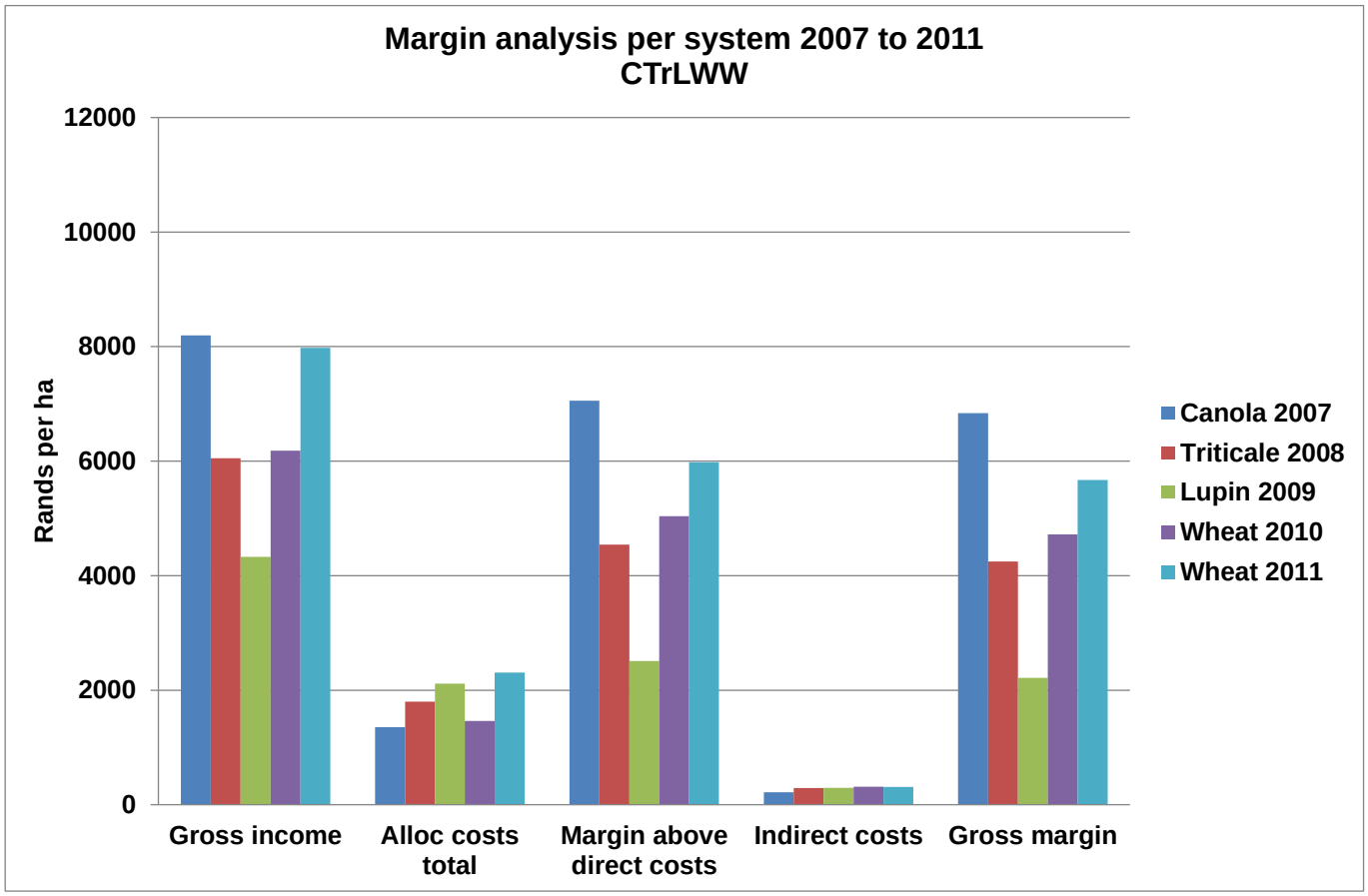
Figure 3 Gross margin analysis of the first three years of each crop sequence. a = System 1; b = System 2; c = System 3; d = System 4; e = System 5



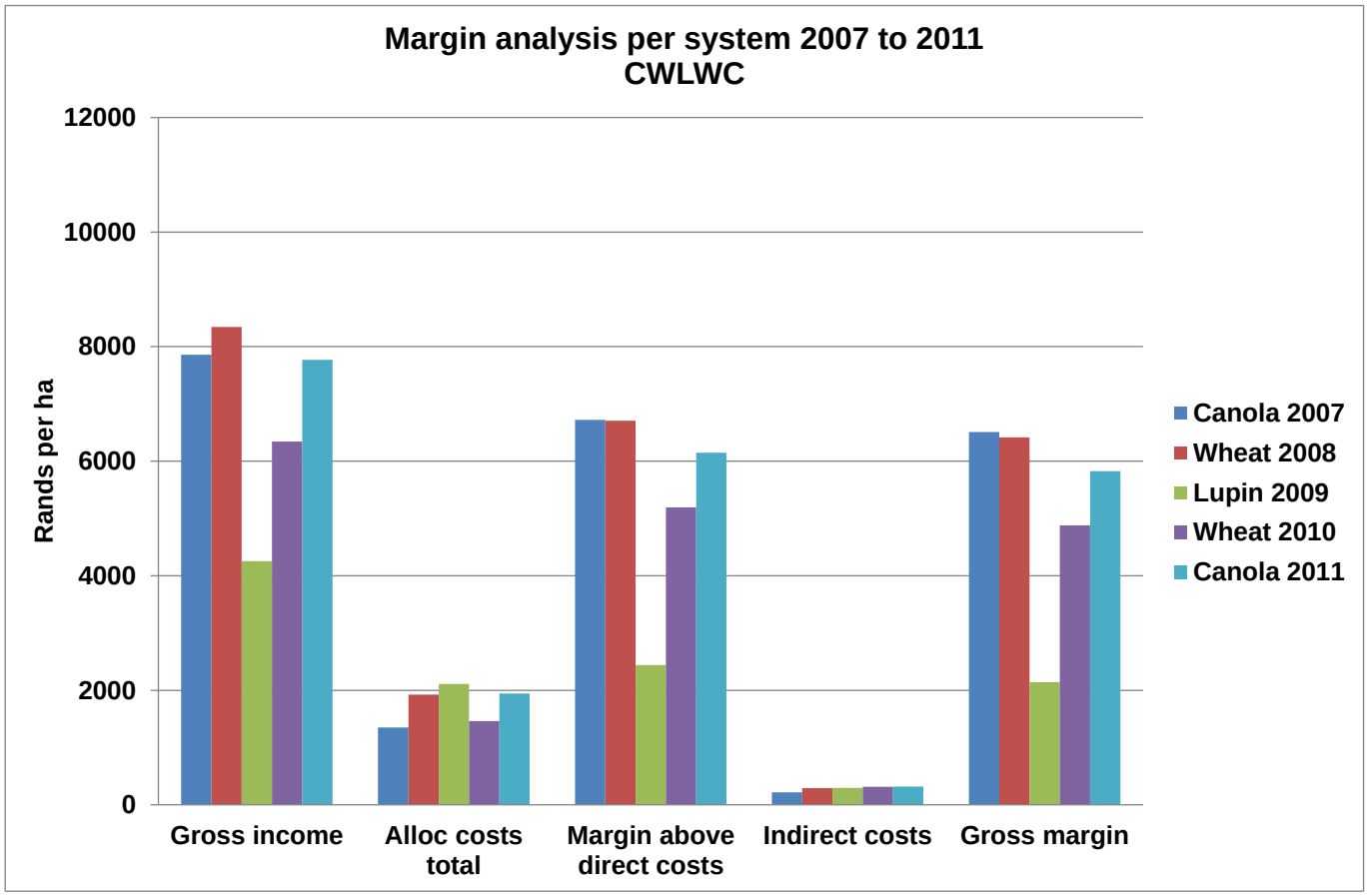
a



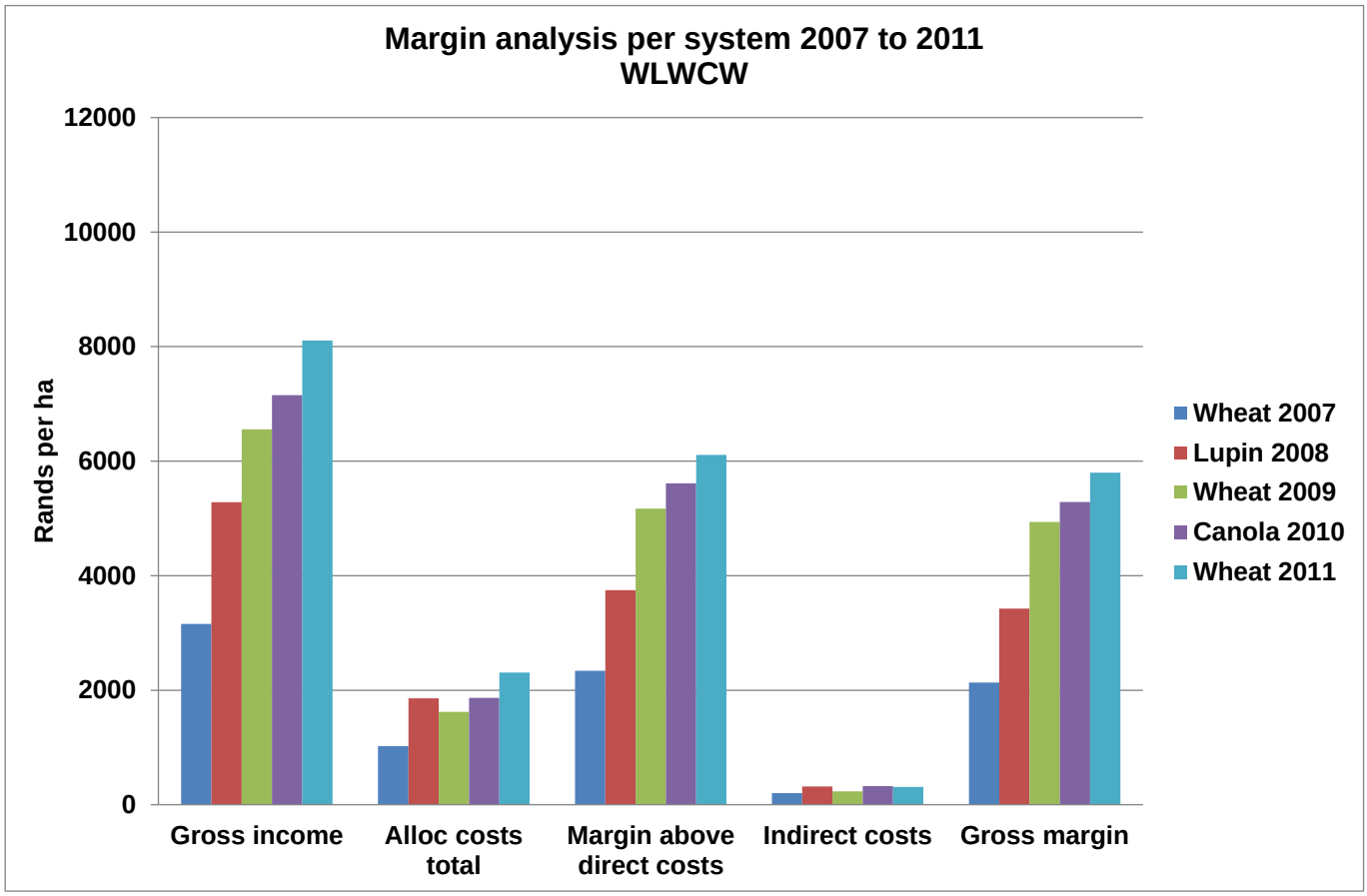
b


Margin analysis per system 2007 to 2011
CTrLWW
Rands per ha
12000
10000
8000
6000
4000
2000
0
Gross income
Alloc costs total
Margin above direct costs
Indirect costs
Gross margin
Canola 2007
Triticale 2008
Lupin 2009
Wheat 2010
Wheat 2011

c

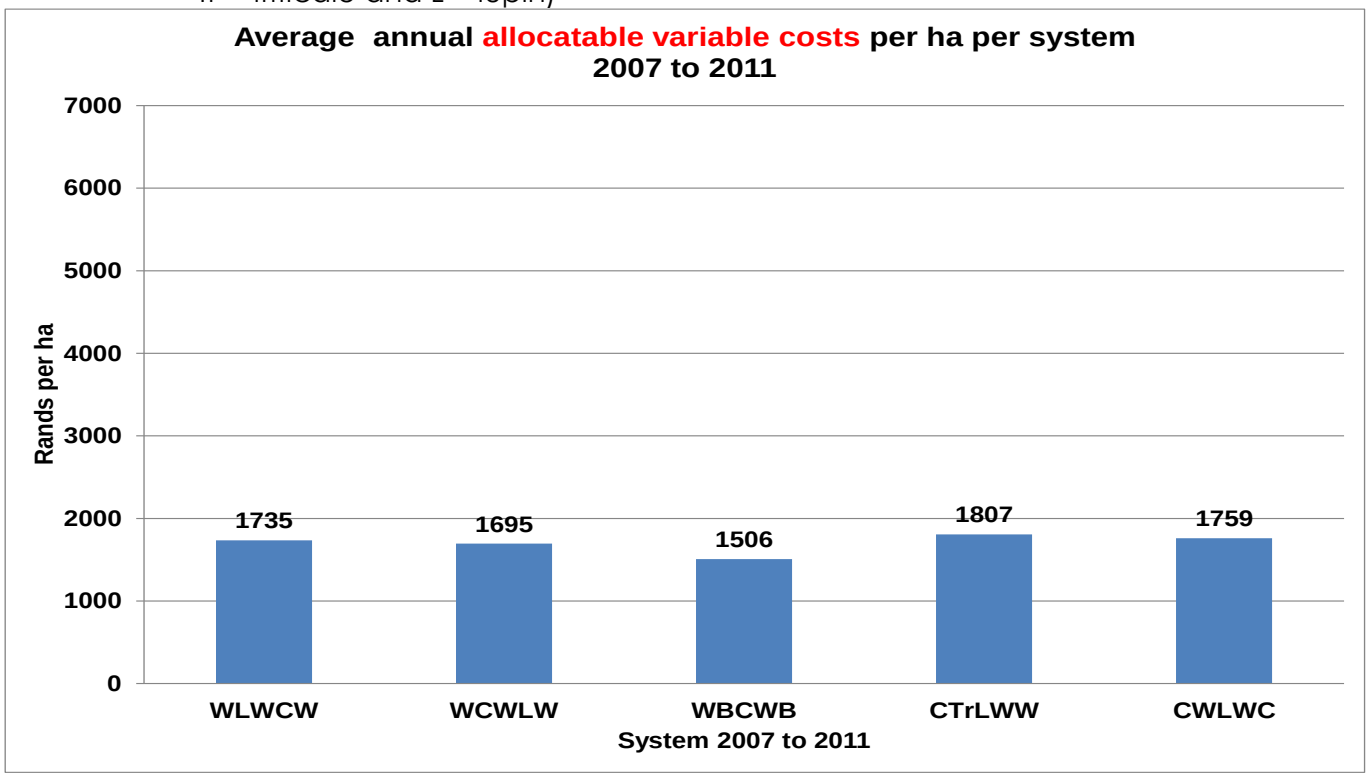

Margin analysis per system 2007 to 2011
CWLWC
Rands per ha
12000
10000
8000
6000
4000
2000
0
Gross income
Alloc costs total
Margin above direct costs
Indirect costs
Gross margin
Canola 2007
Wheat 2008
Lupin 2009
Wheat 2010
Canola 2011

d

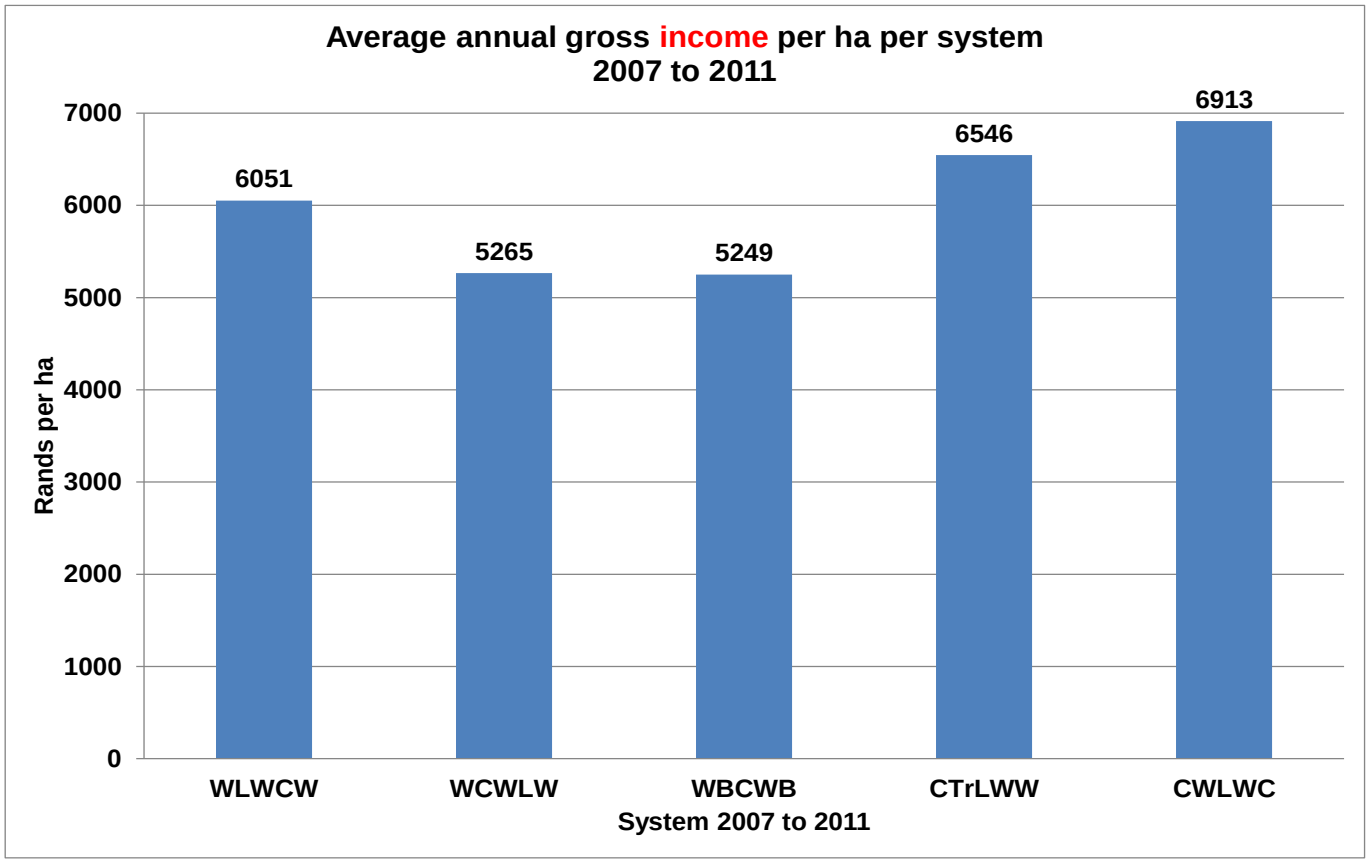

Margin analysis per system 2007 to 2011
WLWCW
Rands per ha
12000
10000
8000
6000
4000
2000
0
Gross income
Alloc costs total
Margin above direct costs
Indirect costs
Gross margin
Wheat 2007
Lupin 2008
Wheat 2009
Canola 2010
Wheat 2011

e

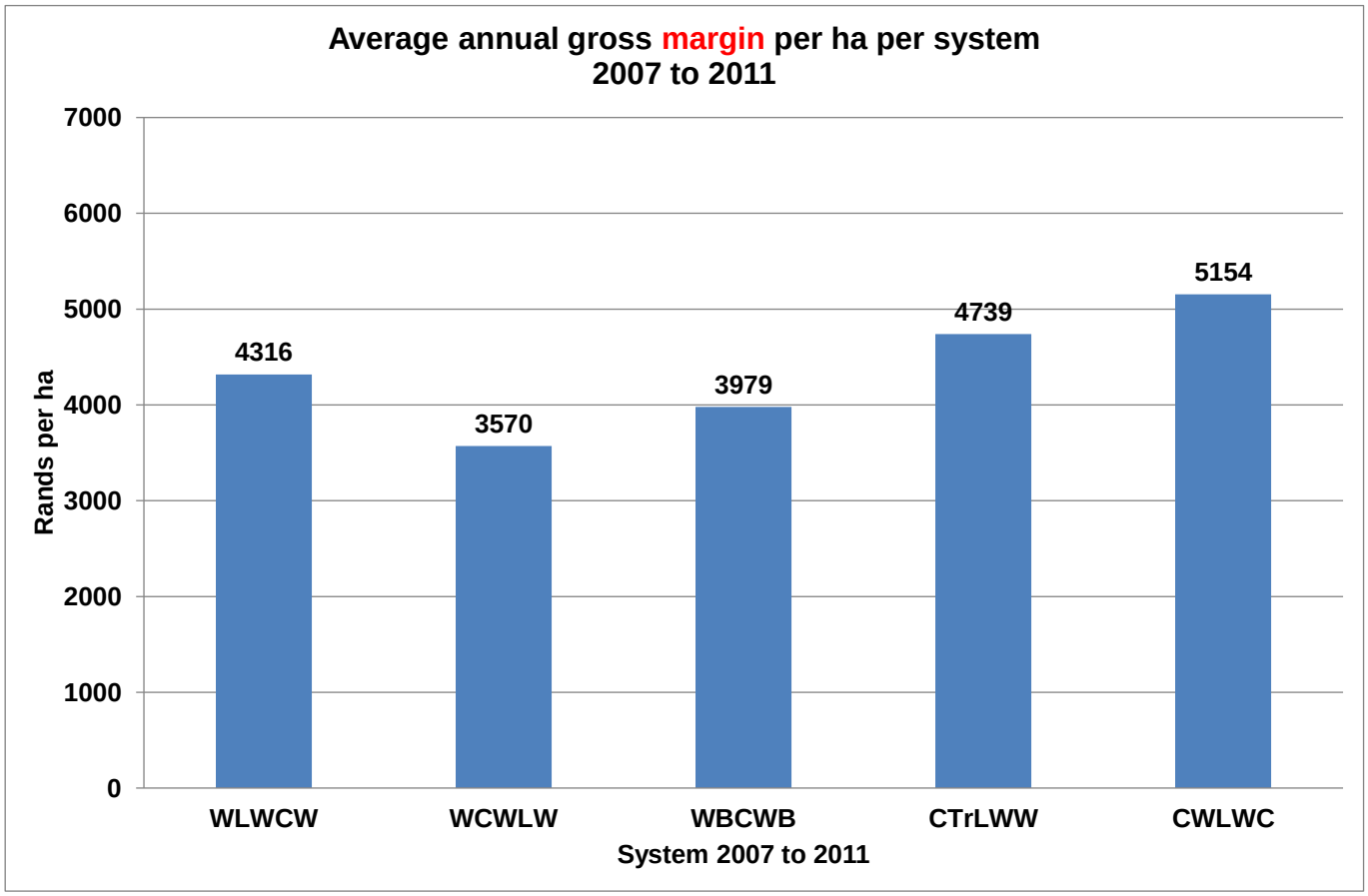
Figure 4 Average annual costs, income and gross margins per system from 2007 to 2009. a = average total allocatable costs; b = average gross income; c = average gross margin. Note that the x-axis shows the crop sequence for 2007 to 2011 while the data are for the 1st 3 years of each sequence. (W = wheat, C = canola, B = barley, Tr = triticale and L = lupin)



a



b


Average annual gross margin per ha per system
2007 to 2011
Rands per ha
7000
6000
5000
4000
3000
2000
1000
0
4316
3570
3979
4739
5154
WLWCW
WCWLW
WBCWB
CTrLWW
CWLWC
System 2007 to 2011

c

Appendix 1. Management inputs for crops planted during 2007 at the Riversdale site

Crop	Cultivar	Planting date	Seeding rate (kg/ha)	Fertilization rate at planting (kg/ha)	Top dressing (kg/ha)	Crop protection Products throughout season
Wheat	SST 027	10/05	58	14N + 14P + S + Cu	Nil	Glyphosate Logran Cyperphos Duet
Canola	Commet	20/04	3.0	15N + 14P + S + Cu	24N	Cyperphos Slug pellets Lomex Duet

Appendix 2. Management inputs for crops planted during 2008 at the Riversdale site

Crop	Cultivar	Planting date	Seeding rate (kg/ha)	Fertilization rate at planting (kg/ha)	Top dressing (kg/ha)	Crop protection Products throughout season
Wheat	SST 027	24/04	70	24N + 15P + S	Nil	Paraquat Logran Cyperphos Brominex Duet Mospilan
Barley	SSG 564	24/04	65	20N + 15P + S	Nil	Paraquat Cyperphos Brominex Duet Mospilan
Triticale	Ibus	24/04	62	24N + 15P + S	Nil	Paraquat Logran Cyperphos Brominex Duet Mospilan
Lupin	Quilinock	24/04	100	5N + 15P + S	Nil	Paraquat Simazol Cyperphos Capitan Duet Tralate
Canola	Spectrum	24/04	3.0	24N + 20P + S	24N	Cyperphos Slug pellets Gallant Duet

Appendix 3. Management inputs for crops planted during 2009 at the Riversdale site

Crop	Cultivar	Plant date	Seeding rate (kg/ha)	Fertilization rate at planting (kg/ha)	Top dressing (kg/ha)	Crop protection Products throughout season
Wheat following Canola	SST 027	01/05	60	25N + 15P + S	Nil	Gramoxone Logran Cyperphos MCPA Duett
Wheat following Lupin	SST 027	01/05	60	15N + 15P + S	Nil	Gramoxone Logran Cyperphos MCPA Duett
Lupin	Mandelup	01/05	105	5N + 20P + S	Nil	Gramoxone Cyperphos Metribuzin Brushoff Mospilan Duett
Canola	Jade	01/05	2.5	25N + 15P + S	Nil	Gramoxone Cyperphos Slug pellets

Appendix 4. Management inputs for crops planted during 2010 at the Riversdale site

Crop	Cultivar	Plant date	Seeding rate (kg/ha)	Fertilization rate at planting (kg/ha)	Top dressing (kg/ha)	Crop protection Products throughout season
Wheat	SST027	10/05	60	20N + 15P + S	Nil	Logran Ally Glean Methomax
Lupin	Tanjil	10/05	95	10N + 20P + S	Nil	Cyperphos Metribuzin Duett
Canola	AGAMax	10/05	3	20N + 15P + S	38N	Cyperphos Molloxide Lomex Cyperphos

Appendix 5. Management inputs for crops planted during 2011 at the Riversdale site

Crop	Cultivar	Plant date	Seeding rate (kg/ha)	Fertilization rate at planting (kg/ha)	Top dressing (kg/ha)	Crop protection Products throughout season
Wheat	SST027	16/05	60	20N + 15P + S	Nil	Pallas Trend MCPA Prosaro Mospilan
Barley	Erica	16/05	47	20N + 15P + S	Nil	Abacus Prosaro Mospilan
Canola	AGAMax	16/05	3.1	20N + 15P + S	38N	Aramo Dash

Appendix 6. "Prices and costs" of replacement value of all machinery and implements, as well as the costs of all inputs used in each year

					2007	2008	2009	2010	2011
Mechanization									
Tractors	62 kW				308000	361020	397000	373813	393930
	92 kW				544400	677940	746000	704193	610476
	230 kW				1683800	1800850	2050000	2214000	2196064
Harvestors	177 kW				1642293	1861721			
	290 kW						3124000	3311440	35101264
Implements									
Boomsprayer, trailed: 28m; 3200l					400000	440000			
Planter, DBS: 13.2m; 0.18 hr/ha					1353000	1488300	1637000	1637000	1839333
Swather (platsnyer): 8m					147468	162215	178400		
Swather (platsnyer): 5m							140000		
Swather (platsnyer): 9.2m self-propelled								1500000	1278721
Spreader fertilizer D/disc 3t: 28m; 0.05 hr/ha					80000	79300			
Trash Field span: 7.4m					96095				
Boomsprayer, trailed: 30m; 4200l							460000	804500	804500
Product prices:	unit				R/unit	R/unit	R/unit		
Wheat: B1	ton					2084	1728	2290	2275
Wheat: B2	ton						1633	2190	2160
Wheat: B3	ton						1508	2090	2045
Wheat: B4	ton				2075				
Wheat: UT	ton				1700				
Wheat: Class other	ton				1700				
Barley (mout)	ton						2150		2360
Barley (feed grade)	ton					1545	1550		
Canola	ton				3500	3500	2900	3450	3700
Lupins	ton					2345	1955	2000	
Triticale (feed)	ton					1500			

Appendix 6 (continued). "Prices and costs" of replacement value of all machinery and implements, as well as the costs of all inputs used in each year

Product prices:	unit				R/unit	R/unit	R/unit		
Wheat: B1	ton					2084	1728	2290	2275
Wheat: B2	ton						1633	2190	2160
Wheat: B3	ton						1508	2090	2045
Wheat: B4	ton				2075				
Wheat: UT	ton				1700				
Wheat: Class other	ton				1700				
Barley (mout)	ton						2150		2360
Barley (feed grade)	ton					1545	1550		
Canola	ton				3500	3500	2900	3450	3700
Lupins	ton					2345	1955	2000	
Triticale (feed)	ton					1500			
Seed prices:	Unit								
SST 027	kg				3.08	4.56	5.34	4.52	5.12
Spectrum	kg					36.8			
Commet	kg				49.00				
Jade	kg						45.33		
Garnett	kg							55.00	
AGAMax	kg								76.00
SSG 564	kg					3.5			
Erica	kg								3.96
Quilinock	kg					3.78			
Mandilup	kg						5.78		
Tanjil	kg								3.81
Ibus	kg					3.00			

Appendix 6 (continued). "Prices and costs" of replacement value of all machinery and implements, as well as the costs of all inputs used in each year

Herbicides	Unit								
Glifosaat WSG 500	liter				29.50				
Gramoxone	liter					37.50	50.00	34.00	
Simazol	liter					48.17			
Logran	g					2.43		2.07	
Gallant	liter					226.00			
Bromoxinex	liter					74.94			
Logran	g				2.26		2.04		
Lomex	g				2.66			3.00	
Metribuzin	liter						160.00	111.80	
MCPA	liter						39.00		32.50
Alley	g							1.62	
Glean	g							1.62	
Aramo	liter								117.50
Dash	liter								117.50
Pallas	liter								806.00
Trend	liter								81.23
Brushoff	g						1.20		
Erase	kg						45.50		
Fungicides:	Unit								
Abacus	liter								250.00
Prosaro	liter								275.00
Capitan	liter					227.00			
Duett	liter				116.25	123.64	140.55	140.00	

Appendix 6 (continued). "Prices and costs" of replacement value of all machinery and implements, as well as the costs of all inputs used in each year

Insecticides:	Unit					
Mospilan	gram		0.80	0.68		0.60
Cyperfos 500EC	liter	53.20	69.36	100.00	70.00	
Tralate	liter		100.00			
Slug pellets (combat)	kg		12.61			
Methomex	liter				140.00	
Mollxide	kg	25.25		42.00		
Aero spray:	R/ha	80.00				90.00
Transport:	R/ton	45.00	45.00	45.00	47.70	50.56
Lime spreading:	R/ton	105				66.00
Intrest rate:	Notes: Gemiddelde rente op Kapitaal vir jaar	14%	14%	14%	14%	14%
Diesel (R/litre)	AA website gemiddelde prys vir April - November	6.24	10.16	6.54	7.41	9.20
Regular labour cost: R/dag	Minimum dagloon: Plaasarbeid	54.00	54.00	54	54	54