



Department of
Agriculture and Food



Research Library

Experimental Summaries - Plant Research

Research Publications

1987

Plot Size Trial (Wheat)

G. J. Lewis

Department of Agriculture, W.A.

Follow this and additional works at: <https://researchlibrary.agric.wa.gov.au/rqmsplant>



Part of the [Agronomy and Crop Sciences Commons](#), and the [Soil Science Commons](#)

Recommended Citation

Lewis, G J. (1987), *Plot Size Trial (Wheat)*. Department of Agriculture and Food, Western Australia, Perth. Article.

This article is brought to you for free and open access by the Research Publications at Research Library. It has been accepted for inclusion in Experimental Summaries - Plant Research by an authorized administrator of Research Library. For more information, please contact jennifer.heathcote@agric.wa.gov.au, sandra.papenfus@agric.wa.gov.au, paul.orange@dpird.wa.gov.au.

IMPORTANT DISCLAIMER

This document has been obtained from DAFWA's research library website (researchlibrary.agric.wa.gov.au) which hosts DAFWA's archival research publications. Although reasonable care was taken to make the information in the document accurate at the time it was first published, DAFWA does not make any representations or warranties about its accuracy, reliability, currency, completeness or suitability for any particular purpose. It may be out of date, inaccurate or misleading or conflict with current laws, policies or practices. DAFWA has not reviewed or revised the information before making the document available from its research library website. Before using the information, you should carefully evaluate its accuracy, currency, completeness and relevance for your purposes. We recommend you also search for more recent information on DAFWA's research library website, DAFWA's main website (<https://www.agric.wa.gov.au>) and other appropriate websites and sources.

Information in, or referred to in, documents on DAFWA's research library website is not tailored to the circumstances of individual farms, people or businesses, and does not constitute legal, business, scientific, agricultural or farm management advice. We recommend before making any significant decisions, you obtain advice from appropriate professionals who have taken into account your individual circumstances and objectives.

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia and their employees and agents (collectively and individually referred to below as DAFWA) accept no liability whatsoever, by reason of negligence or otherwise, arising from any use or release of information in, or referred to in, this document, or any error, inaccuracy or omission in the information.

EXPERIMENTAL RESULT SUMMARY (1987)

Western Australian Department of Agriculture
Plant Industry
Crop Science Section

G.J. Lewis
Research Officer
Plant Industry

Title: Plot Size Trial (Wheat)

Experiment Number: 87BA20, 87N20, 87WH36

Aims:

1) To determine if plot size (length or width) x cultivar or seeding machine x cultivar interactions exist within a set of wheat cultivars.

2) To examine the relationship between the relative yield of wheat cultivars grown in experiments and in similarly treated bulk areas at the same site.

Location: Badgingarra Research Station - New Land Block
Newdegate Research Station
Wongan Hills Research Station

Treatments: Treatments consisted of ten cultivars (Aroona, Canna, Egret, Eradu, Gamenya, Gutha, Halberd, Jacup, Kulin and Millewa) two types of seeding equipment (cone seeder - 8 run, combine drill¹ - 12 run) and two plot lengths (22.5 m, 50.0 m). Plot length treatments were imposed on the experiment by cutting the original 50.0 m plots into two sections with a harvester or mower. A block of 0.25 ha areas of six cultivars (Aroona, Gamenya, Gutha, Halberd, Kulin and Millewa) was sown adjacent to the experiment with a commercial 24 run drill².

Layout: Each experiment had a split plot design with three replications. Plot length treatments constituted main plots and seeding machinery x cultivar formed sub plots. Machine x cultivar treatments were randomly allocated within each replicate.

A block of 0.25 ha areas of six of the cultivars was situated on both sides of the experiment. Cultivars were randomly allocated within each block.

- 1 12 run cone seeder was used at Badgingarra.
2 12 run drill at Wongan Hills.

Results and Statistical Analysis:

Grain yield and depth of sowing were measured at all three sites. Some yield components were measured at Wongan Hills and Newdegate but only head number per metre row at Wongan Hills is reported in this summary.

Table 1. Depth of sowing (cm) of plots sown with 3 types of seeding equipment

Seeding equipment	Badgingarra	Newdegate	Wongan Hills ¹
Cone seeder (8 run)	2.2	5.2	3.6
Cone seeder (12 run)	2.2	5.7	3.9
Combine (drill) (24 run)	3.0	6.5	3.9

Table 2. Plant density of selected cultivars (plants/m²) (approximately one month after sowing)

Cultivar seeding machine	Site								
	Badgingarra			Newdegate			Wongan Hills		
	8 run CN	12 run CN	24 run DR	8 run CN	12 run CN	24 run DR	8 run CN	12 run CN	24 run ¹ DR
Aroona	110.8	121.8	128.2	81.3	75.6	80.1	89.8	75.2	75.2
Gamenya	149.3	140.0	139.5	84.2	109.4	93.1	97.7	110.1	110.1
Gutha	123.7	136.1	139.5	93.1	115.0	-	94.2	105.4	105.4

LSD _{0.05}	Badgingarra	Newdegate	Wongan Hills
	39.1	16.8	18.9

CN - cone seeder
 DR - combine (drill)
 1 - 12 run combine

Table 3. Grain yield (kg/ha) of 10 wheat cultivars grown in plots of various length (25, 50 m) sown with 2 types of seeding equipment (8 run cone seeder, 12 run cone seeder)

A: Badgingarra

Plot length (m)	Seeding equipment (width)			
	8 run	12 run	24 run	24 run ¹
22.5	195	175	175	175
50.0	134	154	154	154
SED	26	11	11	11

Cultivar/	Cultivar x width (machine)			
	Cone seeder (8 run)	Cone seeder (12 run)	x	Combine (24 run)
Aroona	209	182	196	214
Canna	185	141	163	-
Egret	232	222	227	-
Eradu	141	121	131	-
Gamenya	141	142	142	129
Gutha	158	152	155	123
Halberd	240	202	221	188
Jacup	218	168	193	-
Kulin	57	75	66	41
Millewa	168	137	152	144
SED	35			

Table 3 continued ...

B: Newdegate

Plot length (m)		Seeding equipment (width)	
24.0 m	2,730	Cone seeder	2,723
50.0 m	2,630	Combine	2,636
SED	280	SED	31

Variety/	Cultivar x seeding equipment (width)			Combine (24 run)
	Cone seeder (8 run)	Combine (12 run)	x	
Aroona	2,623	2,672	2,647	2,234
Canna	2,816	2,611	2,713	-
Egret	2,427	2,411	2,419	-
Eradu	2,672	2,575	2,601	-
Gamenya	2,627	2,575	2,601	1,946
Gutha	2,736	2,501	2,618	2,324
Halberd	2,893	2,791	2,842	2,074
Jacup	2,556	2,369	2,462	-
Kulin	2,942	2,797	2,869	2,513
Millewa	2,935	2,803	2,869	2,563
SED	97			

C: Wongan Hills

Plot length (m)		Seeding equipment (width)	
22.5	1,941	Cone seeder	1,986
50.0	2,013	Combine	1,968
SED	67	SED	29

Variety/	seeding machine (width)			Cultivar x Combine (12 run)
	Cone seeder (8 run)	Combine (12 run)	x	
Aroona	2,001	2,008	2,004	1,766
Canna	2,001	2,008	2,004	-
Egret	1,852	1,848	1,850	-
Eradu	2,146	2,139	2,143	-
Gamenya	1,977	1,945	1,961	1,711
Gutha	2,073	2,039	2,056	1,907
Halberd	1,963	1,904	1,933	1,702
Jacup	1,772	1,765	1,768	-
Kulin	2,147	2,077	2,112	1,972
Millewa	1,925	1,945	1,935	1,786
SED	93			

Table 4. Summary of analysis of variance tables for grain yield (kg/plot)¹

Source of variation	Site		
	Badgingarra	Newdegate	Wongan Hills
	Variance ratio		
Reps stratum			
Reps * length stratum			
Length	5.642	0.348	1.152
Residual			
Total			
Reps * length * cultivar stratum * machine/width			
Cultivar	9.609***	10.476***	6.209***
Width (machine)	4.499*	7.647**	0.375
Length * cultivar	3.140***	0.681	1.453
Length * width (machine)	0.473	1.499	0.042
Cultivar * width (machine)	0.496	1.560	0.106
Residual			
Total			
Grand Total			

*** Sig P ≤ 0.005
 ** Sig P ≤ 0.01
 * Sig P ≤ 0.05

Table 5. Correlation (r) between grain yield of six¹ cultivar in 'experimental' plots of various sizes and their yield in bulk areas

Plot size	Badgingarra	Newdegate	Wongan Hills
25 m x 8 row CN	0.8821**	0.8929*	0.6543
50 m x 8 row CN	0.9086**	0.6575	0.7891*
25 m x 12 row CN	0.9732***	0.7654	0.7601*
50 m x 12 row CN	0.6350	0.5603	0.7676*

CN = cone seeder
 DR = combine (drill)

* Correlation significant p < 0.05
 ** Correlation significant p < 0.01
 *** Correlation significant p < 0.005

¹ Halberd excluded at Newdegate as the same seed source was not used throughout the experiment.

Table 6. Rank correlation (R) between performance of six¹ cultivars in 'experimental' plots of various sizes and in bulk areas

Plot size	Badgingarra	Newdegate	Wongan Hills
25 m x 8 row CN	0.7143	0.8000	0.6000
50 m x 8 row CN	0.7714*	0.8000	0.8860**
25 m x 12 row CN	0.8857**	0.8660*	0.7611*
50 m x 12 row CN	0.2857	0.7000	0.6000

CN = cone seeder

- * Correlation significant $p < 0.05$
- ** Correlation significant $p < 0.01$
- *** Correlation significant $p < 0.005$
- ¹Halberd excluded at Newdegate

Table 7. Effect of row position on number of heads/m row in plots of various wheat cultivars sown with two different seeding machines

Seeding machine	Cultivar	Wongan Hills								
		Row number								
		1	2	3	4	5*	6*	7*	8*	\bar{x}
Cone seeder	Aroona	42.7	35.7	37.7	31.7	41.7	37.0	32.0	35.7	36.1
	Canna	36.7	30.0	24.3	24.7	22.0	14.0	28.3	31.3	27.0
	Egret	39.7	28.3	26.7	25.7	29.7	22.7	33.3	41.0	30.9
	Eradu	37.7	31.7	34.0	33.0	36.7	34.0	36.7	41.0	35.6
	Gamenya	43.0	39.0	30.7	39.3	32.7	33.3	36.3	52.7	38.4
	Gutha	50.0	25.7	38.3	27.7	30.7	34.3	35.3	41.3	35.4
	Halberd	45.3	41.7	38.7	30.0	32.7	35.0	43.3	48.7	40.7
	Jacup	44.7	27.0	28.3	26.7	29.7	27.3	30.0	36.3	31.2
	Kulin	34.3	28.7	28.7	32.3	29.7	26.0	28.3	32.3	30.0
	Millewa	40.3	30.3	44.3	31.7	35.7	33.7	36.7	39.3	36.5
	\bar{x}		41.4	31.8	33.2	31.3	32.1	30.2	34.0	40.0
Combine	Aroona	37.0	32.0	30.0	40.0	39.0	31.7	27.0	33.0	33.7
	Canna	28.3	33.7	23.7	27.7	37.0	27.0	26.7	30.0	29.2
	Egret	33.3	27.0	28.3	30.7	28.7	28.3	27.7	31.0	29.4
	Eradu	42.7	32.0	31.7	27.7	38.3	38.7	35.0	36.7	35.3
	Gamenya	41.0	39.7	32.0	35.0	37.7	29.7	42.7	46.0	38.0
	Gutha	40.7	30.3	31.0	23.7	36.0	25.3	32.0	38.7	32.2
	Halberd	52.3	28.3	34.3	29.0	35.0	27.0	32.0	37.0	34.4
	Jacup	30.0	27.7	24.7	25.0	20.7	30.7	26.7	30.7	27.0
	Kulin	28.0	32.0	28.3	20.7	31.7	14.3	26.0	21.7	25.3
	Millewa	40.3	34.0	34.7	27.0	36.7	34.0	36.0	37.3	35.0
	\bar{x}		37.4	31.7	29.9	28.6	34.1	28.7	31.2	34.2
Grand mean		39.4	31.7	31.5	29.9	33.1	29.4	32.6	37.1	

* Row 5-8 of plots sown with the combine are in fact Row 9 - Row 12.

Table 8. Analysis of variance table for number of heads/m row

Source of variation	d.f.	VR	Probability level
Machine	1	2.394	0.262
Variety	9	4.413	< 0.001***
Row	7	14.703	< 0.001***
Machine * variety	9	0.439	0.904
Machine * row	7	1.763	0.095
Variety * row	63	1.197	0.166
Machine * variety * row	63	0.880	0.724
Row			
Linear	1	1.641	0.201
Quadratic	1	75.878	< 0.001***
Cubic	1	1.120	0.291
Quartic	1	13.947	< 0.001***
Deviation	3	3.446	0.017*

Discussion:

At each site there were large differences in grain yield between cultivars. However no evidence of plot width x cultivar or machine x cultivar interactions was found at any of the sites. Therefore the use of 8 row plots sown with the cone seeder does not systematically bias against any cultivar or group of cultivars. The plot length x cultivar interaction at Badgingarra is not important because of the low mean yield of this site and the likelihood that plot length is confounded with differences in soil fertility between different sections of the site. There is no logical basis for this interaction as the shorter plots were obtained by dividing the longer plots into two sections immediately prior to harvest and adding the yield of both sections together for the purposes of statistical analysis.

Grain yields were higher in narrow plots than in wide plots planted with either a combine or cone seeder. This plot width effect was statistically significant at two of the three sites. As six rows were harvested from both the narrow and wide plots any edge effects, which penetrated more than one row into the plot, were completely removed from the wider plots but not from the narrow plots.

Plant counts on selected varieties approximately 1 month after sowing show that use of the cone seeder did not reduce the germination and emergence of wheat seedlings.

The yield of varieties in experiments with small plots was consistent with their performance in similarly managed bulk areas. The yield of varieties grown in standard 25 m cone seeded plots was significantly correlated with their yield in bulk areas at two of the three sites. At the third site significant correlations were obtained with both longer and wider experimental plots. Rank correlations were not significant for 25 m cone seeded plots at all three sites but good correlation was found with 12 row 25 m plots.

Conclusion:

1. There is no evidence of plot width x cultivar interactions.
2. Variety performance in experimental plots is the same as in similarly treated bulk areas.
3. Some improvement in this correlation can be obtained by increasing the plot width.

Title: Plot Size Trial (Wheat)

Experiment Number: 87M80

Aims: To examine the relationship between the relative yield of wheat cultivars grown in experiments and in similarly treated bulk areas at the same site.

Location: Merredin Research Station

Site Description:

Aspect: South
 Soil type: Sandy loam
 Vegetation: Mallee, gimlet

Agronomic Management:

Date of sowing: 23/6/1987
 Seed rate: 48 kg/ha
 Fertilizer: Agras 150 kg/ha

Treatments:

Treatments consisted of six cultivars (Aroona, Gamenya, Gutha, Malberd, Kulin and Millewa) sown with two types of seeding equipment (8 run cone seeder, 12 run cone seeder).

Layout:

Two variety trials were sown adjacent to each other, one to 25 m plots with the 8 run cone seeder and the other was sown to 50 m plots with the 12 run cone seeder.

A block of 0.25 ha areas of each cultivar was sown on either sides of these variety trials.

Results:

Table 1. Grain yield of six cultivars sown into plots of different width sown with different seeding equipment

Cultivar/Plot width (seeding equipment)	Cone seeder (8 run, 1.4 m)	Cone seeder (12 run, 2.1 m)	Combine (12 run, 2.1 m)
Aroona	1,204	1,434	1,432
Gamenya	1,133	1,338	1,400
Gutha	1,261	1,419	1,368
Halberd	978	1,261	1,259
Kulin	1,312	1,465	1,496
Millewa	1,144	1,364	1,279
x	1,172	1,380	1,372
C.V. (%)	5.0	4.6	-

Statistical Analysis:

Table 2. Correlation (r) and rank correlation (R) between grain yield of six cultivars in 'experimental' plots of various sizes and their yield in bulk areas, 0.25 ha in size

Plot size	r	R
24.3 m x 8 row	0.7957*	0.7143
49.3 m x 12 row	0.8068*	0.6865

* Correlation significant $P < 0.05$

Conclusion:

There is a good correlation between yield performance of cultivars in experimental plots and their performance in similarly treated bulk areas regardless of what plot type or seeding equipment is used. Because of the narrow range of yield performance between cultivars within this experiment any small differences in soil fertility or in grain loss during harvest was sufficient to cause a substantial impact to rank correlation.