

VIABILITY OF FARMING IN THE NORTH EAST AGRICULTURAL REGION



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Introduction

In February 2008 the Dept of Agriculture WA commissioned Planfarm Pty Ltd to look at the viability of the NE Agricultural Region.

Thus this report deals with what is referred to throughout as the North East Agricultural Region (NEAR). By definition this area covers the less than 325mm average annual rainfall zone in the shires of Chapman Valley, Mullewa, Morawa and Perenjori.

Farmers in the NEAR have again endured a very poor growing season in 2007. For most this is the fifth dry year since 1999 with the other two years (2003 and 2005) being only average for most although above average for the area south of Morawa.

For many farm business owners this run of seasons has seen equity eroded, farm debt escalate and confidence decline to an all time low. Add to this large rises in input costs such as fertilizer and fuel along with public concern that, due to climate change, these dry seasons may be more frequent in the future. Certainly times are tough in the NEAR.

With the above in mind the immediate challenge for farm businesses is to survive and hopefully reduce debt in the coming 1 – 3 years. This approach clearly relies on receipt of adequate rainfall which climate projections tell us is less likely to occur as we move into the future.

This report looks at the current status of a sample of farm businesses in the NEAR and in particular looks at viability based on their current position and what they can expect, with regards rainfall, in the future. Several possible business / system structures are examined and the key success factors for farming in such a low rainfall environment contemplated.

Key Findings

1. A detailed survey of 27 Planfarm Clients located in the NEAR shows that the majority are still viable assuming adequate rainfall in the future although all have an elevated level of debt. Within the survey group there is a very wide range with the strongest businesses remaining very strong and the weakest being in a position of extreme difficulty.
2. A farming system designed around growing wheat at 1.0 t/ha looks likely to be profitable provided the price of wheat stays at \$250/t or higher and costs, both operating and fixed, reflect the low yielding nature of the system.
3. From 2002 – 2007 (a very poor period by any standards) average wheat yield is 1.12 t/ha with the top performing 25% achieving 1.30 t/ha. This suggests that, even in a drying and warming climate, the 1.0 t/ha target is achievable in the majority of years.
4. Farm managers in the NEAR have made many changes to the way they operate since the dry run of seasons began in 2000. Many of these changes are deemed appropriate for the environment and the need to reduce seasonal risk.
5. Farm managers need to implement every available strategy that helps to minimize losses in extreme drought years. Management in these years is critical with respect to long term profitability in this low rainfall area.
6. Livestock on cropping dominant farms should be reconsidered in light of likely negative cropping impacts as well as the environmental risks involved.
7. Strategic use of fallow (mostly chemical) appears to be an appropriate method of managing weeds as well as helping to insure against severe drought in this environment. Understanding of soil type, likely yield response and a range of management issues will be required though to implement successfully.
8. Further research is required into issues related to many of the above key findings.

Research recommendations

1. Further research is required into the role of fallow. Specifically this research should be focused on four areas;
 - a. Trial work to better understand issues such as how to fallow, is it appropriate to seed a cover crop, herbicide management, weed seed bank impact, etc, etc, etc?
 - b. Crop simulation modeling using APSIM to gain a better understanding of likely yield responses on the range of relevant soil types.

- c. Detailed economic analysis of the role of fallow in the system.
 - d. Collate and document the experiences of growers in the NEAR who have been using various forms of fallow over a period of time.
2. The impacts of livestock on following crop yield should be better explored and defined.
3. Plant breeders should be encouraged to develop a range of very short season wheat varieties which better suit this environment. Such varieties would play a significant role in achieving the year-in-year-out wheat yield objective of a minimum of 1.0 t/ha.

Current Business Status

To best understand the position of farm businesses in the NEAR Planfarm has gathered together data from 27 clients located in the NEAR. All farms included in the survey come from the approximately <325mm rainfall zone in the shires of Chapman Valley, Mullewa, Morawa and Perenjori.

The survey data does not provide us with a recipe for success rather an understanding of what is happening in a typical farm business as well as those in the top and bottom performing groups.

Table 1: Current status of Planfarm clients in the NEAR. The data has been sorted on a % business equity basis (highest to lowest).

2007/08 PLANFARM NE WHEATBELT FARM BUSINESS ANALYSIS			
Low Rainfall NE wheatbelt	TOP 25%	GROUP AVE.	BOTTOM 25%
Effective Area (ha)	5684	4801	4165
<i>Owned and leased.</i>			
ASSETS			
Land & Improvements	\$4,211,173	\$2,889,997	\$1,836,981
Livestock	\$76,421	\$61,793	\$81,483
Plant	\$1,116,795	\$917,700	\$686,707
Produce, Chem/Fert	\$526,894	\$336,364	\$144,868
Pools, Tolls, Credits	\$376,702	\$185,383	\$92,342
Cash Accounts	\$299,736	\$121,890	\$9,570
Total Farm Assets	\$6,607,722	\$4,513,125	\$2,851,952
Farm Assets \$/Effective Ha	\$1,098	\$923	\$789
LIABILITIES			
Total Farm Debt	\$1,195,146	\$1,269,633	\$1,310,534
Hire Purchase Debt	\$183,756	\$152,612	\$161,717
Farm Debts \$/Eff Ha	\$213	\$285	\$382
Hire Purchase Debt \$/Eff Ha	\$32	\$32	\$39
Net Off Farm Assets	\$2,209,251	\$1,065,748	\$168,097
EQUITY			
Net Business Equity	\$7,621,827	\$4,309,399	\$1,709,515
Net Farm Equity	\$5,412,576	\$3,243,492	\$1,541,418
Business Equity %	84%	70%	51%
Farm Equity %	81%	68%	52%
OTHER			
Debt to Income Ratio (2008 budget)	0.79	1.25	1.90
Ave Plant Value \$/Eff. Ha	\$196	\$191	\$165
6 Yr Average Wheat Yield*	1.30 t/ha	1.12 t/ha	0.96 t/ha
6 Yr Average GSR (mm)*	156	159	147
Sheep No	1,497	1,332	1,222
FIXED COSTS (2007)			
Finance Costs \$/Eff Ha**	\$16.56	\$24.25	\$36.03
Personal Costs \$/Eff Ha	\$20.30	\$17.34	\$12.44
Repayments (HP) \$/Eff Ha	\$19.11	\$20.13	\$19.75

Note:

* Only those clients for whom we have 6 years of wheat yield and growing season rainfall information were included in these two analysis.

** Finance costs include interest and bank fees on term and overdraft debt.

Of the data presented in table 1 there are several critical observations that can be made. These include;

1. Top 25% are in good shape. Equity is greater than 80% and debt to income ratio is well less than 1:1 (based on 2008 budget figures).
2. In contrast the bottom 25%, are in a position of great difficulty. With equity at 51% and debt to income at 1.9:1 this is clear!
3. Specifically 15 of the sample group have equity >75%, 6 have equity between 60 – 74% and 6 have equity < 60%. This allows us to conclude, based on equity, that 56% of the sample group are in an adequate to strong position with the remainder being either vulnerable (60 – 74%) to in dire trouble!
4. The top 25% have a 6 year average wheat yield of 0.18 t/ha greater than the average (at \$250/t this is more than \$120,000 pa for the average crop area). The group has an average wheat yield of 0.34 t/ha more than the bottom 25%.
5. This extra yield has been achieved with the same growing season rainfall as the group average (156mm – 159mm).
6. Finance costs in 2007 were manageable for the top 25% (\$16.56 / eff ha or \$94,127) but were out of control for the bottom 25% (\$36.03 / eff ha or \$150,065).
7. Farms in the top 25% have more effective area at their disposal than the group average and certainly more than the bottom 25%. This allows this group to spread fixed costs over more ha.

2007 Farm Business Performance

Planfarm assess annual business performance by calculating a notional annual profit for each business. This is done by using raw cashflow data and correcting for changes in stock, fertilizer, chemical and seed on hand. Grain income is determined by valuing all grain production (less seed) at year end prices or actual sale prices (if sold at harvest). This approach matches income with expenses incurred to produce that income and thus provides a true result for the budget year. It also avoids distortions which can appear in cashflows due to timing of grain sales and input purchases.

If comparing some of the figures with those in table 1 (such as % equity, details of assets and liabilities, etc) it needs to be understood that those in table 2 have been calculated based on 'opening' position whereas those in table 1 have been calculated on 'closing' position.

Table 2: Farm business survey results for the 2007 season sorted into top 25%, average and bottom 25% based on operating surplus. Operating surplus has been calculated from the Planfarm 'Profit Analysis' as opposed to the 'cash' result.

2007 PLANFARM NE WHEATBELT FARM BUSINESS ANALYSIS

Low Rainfall NE	TOP 25%	GROUP AVE.	BOTTOM 25%
Effective Area (ha)	5012	4801	4330
Grow Season Rainfall (mm)	129	122	116
Gross Farm Income \$/ha	\$120.07	\$95.52	\$68.42
Farm Operating Costs \$/ha	\$78.49	\$91.93	\$124.36
Farm Operating Surplus \$/ha	\$41.58	\$3.59	-\$55.93
Op. Costs as % of Gross Inc.	65%	96%	182%
ASSETS			
Land & Improvements	\$2,449,045.00	\$2,900,875	\$2,941,926
Livestock	\$84,179.17	\$73,797	\$69,120
Plant	\$777,592.71	\$968,686	\$1,173,846
Produce, Chem/Fert	\$188,355.67	\$250,442	\$281,168
Pools, Tolls, Credits	\$269,534.67	\$216,716	\$125,715
Cash Accounts	\$142,730.17	\$94,244	\$16,646
Opening Farm Assets	\$3,911,437.38	\$4,504,760	\$4,608,422
Net Off Farm Assets	\$870,948.17	\$1,051,164	\$478,366
Opening Farm Debt	\$833,306	\$1,069,143	\$1,135,309
Net Business Equity	\$3,949,079	\$4,486,781	\$3,951,478
Equity %	73%	75%	72%
Debt to Income Ratio	1.63	2.95	5.08
Return on Capital %	2.00%	-3.46%	-9.41%
Ave Plant Value \$/Eff. Ha	\$155	\$202	\$271
Ave Plant Value \$/Crop Ha	\$262	\$354	\$552
Ave Plant Value/Crop Income	1.51	2.92	6.35
Total Crop Area ha	2967	2735	2126
% Crop	60%	55%	49%
Legumes (% of crop area)	6%	5%	0%
Wheat Area ha	2521	2311	1946
Lupin Area ha	239	302	0
Barley Area ha	297	286	300
Wheat Yield t/ha	0.55	0.47	0.45
Lupin Yield t/ha	0.43	0.31	0.00
Barley Yield t/ha	0.59	0.40	0.32
Wheat kg/mm ave	6.41	6.65	7.49
N use kg/ha cereal	7.84	11.38	16.00
P use kg/effective ha	4.13	4.43	4.94
Herbicide \$/ha Crop	\$19.30	\$22.10	\$33.59
Fuel \$/ha Crop	\$22.27	\$22.33	\$26.55
Opening Sheep No's (hd)	2156	1790	1730
Closing Sheep No's (hd)	1784	1396	937
Lambs per Winter Grazed Ha	0.32	0.39	0.34
Wool Production (kg)	7967	7564	8246
Wool per Winter Grazed Ha	2.83	4.22	3.63
Wool Price \$/kg greasy	\$4.50	\$4.42	\$3.50
Stocking Rate DSE/WGHa	0.49	0.76	0.75

2007 PLANFARM NE WHEATBELT FARM BUSINESS ANALYSIS

Receipts			
Grain Sales	\$102.82	\$69.09	\$42.67
Wool Sales	\$5.70	\$9.11	\$12.25
Sheep Sales	\$4.81	\$6.53	\$6.00
Other Livestock Sales	\$0.00	\$4.56	\$2.00
Fuel Rebate	\$1.94	\$2.25	\$1.42
Other Rebate & Sundry	\$4.80	\$3.98	\$4.08
TOTAL FARM INCOME	\$120.07	\$95.52	\$68.42
% Income From Crop	86%	72%	62%
% Income From Livestock	9%	21%	30%
Expenses			
Wages	\$7.46	\$7.02	\$11.73
Contract	\$0.86	\$3.55	\$10.92
Rates/Licences/Water	\$3.60	\$4.57	\$5.80
Administration	\$3.95	\$5.15	\$6.16
Elec/Gas & Sundry	\$1.42	\$1.61	\$2.18
Freight	\$3.54	\$2.30	\$2.07
Insurance	\$3.58	\$3.82	\$4.32
Fertiliser	\$15.90	\$16.70	\$21.32
Seeds & Grading	\$1.07	\$1.17	\$1.21
Fuel & Oil	\$13.18	\$12.72	\$13.03
Weeds & Pests	\$11.42	\$12.59	\$16.49
Plant Repairs	\$7.01	\$7.77	\$10.68
Bld/Fen/Water Repairs	\$2.06	\$2.48	\$3.30
Fodder/Agistment	\$0.25	\$3.55	\$6.25
Livestock Expenses	\$0.45	\$0.64	\$1.07
Shearing/Crutch/Packs	\$1.27	\$1.86	\$2.50
Ram Purchases	\$0.35	\$0.38	\$0.00
Other Stock Purchases	\$0.32	\$2.69	\$5.00
Other Payments	\$0.80	\$1.37	\$0.33
TOTAL OPERATING COSTS	\$78.49	\$91.93	\$124.36
OPERATING SURPLUS	\$41.58	\$3.59	-\$55.93
Finance Costs	\$20.39	\$24.08	\$37.07
Personal Costs	\$17.19	\$16.50	\$15.72
Repayments	\$21.43	\$21.16	\$24.94
LABOUR EFFICIENCY			
Permanent Labour	2.0	2.0	2.0
Casual Labour (man wks)	5.5	6.4	1.3
Eff. Area/Perm. Labour Unit	2508	2554	1989
Inc./Perm. Labour Unit	\$60	\$47	\$34
Op Surpl/Perm. Lab unit	\$104,196	\$8,434	-\$121,087

Observations;

1. The best performing businesses in 2007 spent the least on operating costs (\$13.44/eff ha less than the average and a whopping \$45.87/eff ha less than the bottom 25%). This is to be expected in a drought year, where the most frugal approach pays off.
2. Of the operating cost items those where the bottom 25% particularly spent more than the average included;
 - a. Contract
 - b. Fertiliser (Nitrogen - 16kg/ha cereal v 7.8kg/ha cereal)
 - c. Weeds & pests (\$33.59/ha crop v \$19.30/ha crop)
 - d. Plant repairs
 - e. Fodder / agistment
 - f. Other livestock expenses
3. The bottom performing group also ran a stocking rate higher than the top 25% group, the same as the average but they spent far more achieving this and ended up finishing with numbers almost 50% of where they started the year. This meant the livestock operation for this group was high cost and they still did not manage to carry the numbers into 2008!
4. The top performing group planted the most crop (60%) and achieved higher yields than the remainder. The high wheat price outcome enhanced the value of this strategy.
5. Wheat yield for the top performing group was 17% more than the average and this was achieved with only 7mm more rain during the growing season (GSR).
6. Fixed costs;
 - a. The bottom performing group also had to pay the highest finance cost / eff ha (\$37.07 compared with \$24.08 / eff ha as an average).
 - b. All groups paid themselves similar amounts per eff ha (\$15.72 - \$17.19)

How have things changed?

The survey results presented above show us the current status of farm businesses in the NEAR. They also show us how businesses fared in 2007 in terms of income and expenditure, production, etc.

What the results do not show us is how things have changed in recent years. Given the dry run of seasons it would be reasonable to assume that many businesses have adapted to the circumstances somewhat.

It is also reasonable to assume that they have been weakened significantly!

In 2002 Andrew Sandison of Planfarm conducted a similar benchmarking study of farm businesses in much the same part of the region. It is interesting to compare the 2007/08 results with those from the 2002 survey. The 2002 report collated data from 32 clients in the NEAR v 27 in this report.

Table 3: Comparison of 1996-2001 with 2007.

	Average 2001	Average 2007
Effective ha farmed	3,943 ha	4,801 ha
% Equity (farm)	86%	68%
Farm debt per eff ha	\$119	\$285
Plant value per eff ha	\$171	\$191
% ha sown to crop (6 yr av)	76%	55%*
% ha sown to legumes (6 yr av)	25%	5%
Wheat Yield (6 year average)	1.68 t/ha	1.12 t/ha
Nitrogen / ha crop (6 yr av)	40.3 kg/ha	11.4 kg/ha
Phosphorous / eff ha (6 yr av)	9.0 kg/ha	4.4 kg/ha
Closing sheep number	2,406	1,332

*Note – The area sown to crop in 2007 was reduced due to the very late start to the season!

Observations

- It should be pointed out that although both surveys include common clients the sample businesses are not identical in both groups.
- Effective area farmed has increased significantly.
- Average % equity has decreased by 18%.
- Reflecting this observation is farm debt per effective ha blowing out from \$119 / eff ha to \$285 / eff ha. At 10% interest applied over the average size farm operation, this equates to \$46,921 compared to \$139,678 in 2007!
- The value of plant per eff ha has not changed significantly. This is not surprising if one assumes the majority of farmers in the area would have held plant longer than originally intended due to the poor seasons and their weakened financial positions.
- % area sown to crop is misleading. In 2005 the % area sown to crop in the Low Rainfall North (Planfarm Client Survey) was 72%. Going into 2008 farmers in the area were planning on their largest ever cropping programs depending on the start to the season. This would have seen crop area at >76%.
- % area sown to legumes has declined significantly. This decline would have been partly due to the poor season but mostly due to the poor legume results achieved since 1999. In 2005 (a good season in the area) the Planfarm LRN client survey showed % crop sown to legumes was 11%.
- 6 year average wheat yield has declined from 1.68 t/ha to 1.12 t/ha. Clearly the 2002, 2006 and 2007 droughts have impacted here, and the 96-01 period was wetter than average.
- Nitrogen usage was 40 kg/ha averaged across the 1996 – 2001 period. When one considers that the average wheat yield was 1.68 t/ha it is clear that this is far too much nitrogen. Such an N rate would need to see wheat average close to 2.0 – 2.2 t/ha to be justified. At average yields in the range of 1.12 – 1.3 t/ha (average to top 25% from table 1) no nitrogen would need to be applied.

- Phosphorous rate per effective ha (as opposed to cropped ha) has slipped from 9.0 kg to 4.4 kg. The reduced crop area in 2007 plus very late start certainly saw this figure reduced. In 2005 P rate per effective ha from the Planfarm LRN Client Survey was 9.1 kg/eff/ha.
- Sheep numbers have been reduced significantly from 2,406 to 1,332 (55%).

It is clear, from the above highlighted changes, that farmers have already made many of the necessary alterations to the way they do business. Whilst these have mostly been forced on them due to the poor run of seasons they have encountered, it is reasonable to assume that they are now farming in a more appropriate fashion given the environment and the projection of the environment both drying and warming due to climate change.

Looking forward what should a NEAR farm business look like?

Most NEAR farms appear to be viable!

The above survey data shows that, based on equity and debt to income ratio, the average farm in the area of interest is still viable – albeit that they have a significant level of debt on average. Not only though are many viable, they are still strong (certainly the top 25%)!

What about those that don't seem viable?

Unfortunately there are some businesses that are probably going to be best off selling at a reasonable price and pursuing other life and career options. It is of course possible that these businesses get an excellent run of years and reduce debt to manageable levels! However history says that the non-rainfall related circumstances (soil types, management, labour etc) which have contributed to their current positions will remain with them therefore any gains are quite likely to be eroded in the future, no matter what the rainfall.

For those who decide to sell up the obvious question is who will buy the properties? Currently not many local businesses are in a position to buy land but a single good season will change this to some degree.

The need to demonstrate viability

The data presented here demonstrates that a substantial number of NEAR farm businesses are viable, despite the recent run of dry seasons. If there is a formula for this success, that can be applied more widely across the region, this would result in a more robust financial performance overall. Demonstrating and extending this success will over time lead to investor interest in the NEAR.

With farm viability in mind the questions are two fold;

1. Is the average NEAR farm viable at present? and
2. What changes need to be made to enhance viability?

The Planfarm survey results suggest that the average farm is viable but, due to reduced crop yield and now increased debt, there is a need to improve performance and enhance viability.

When considering enhancing viability and making changes to the way farm businesses operate in the NEAR the task is made difficult by several significant variables including;

1. How much rainfall can be expected? What impact climate change?
2. The price of wheat shifted dramatically in 2007. What prices can be budgeted on in the future?
3. Operating costs have risen dramatically in the past 6 months alone! Fertiliser has doubled, fuel is \$1.75/L as I write, wages are up, Glyphosate has doubled in price! Where will prices settle in years to come?
4. Can we expect significantly better wheat varieties to be released (i.e. very short season, improved drought tolerance)?
5. At a specific farm level what is the exact nature of the farm under consideration (i.e. soil type).

However, even without the answers to the above we have learnt one thing in recent drought years that cannot be simply captured in typical Year-in-Year-out budgeting efforts. Wipeouts or years when farm income is significantly reduced (i.e. nil tonnes of wheat delivered) are what create the real difficulty. The large losses associated with these events, lead to higher debts which increase financial, personal and management pressures in following years.

Cropping, livestock and risk

Given that, due to the environment, a farm business needs to be able to cope with severe droughts the level of risk taken on by the business needs to be as low as possible.

The lowest risk farming operations have typically been livestock focused ones (because the input costs are lower and plant requirement far less) but history says that businesses in the low rainfall environment are limited with regards livestock production capacity and therefore are likely to manage only small returns if entirely focused on livestock. As well, livestock are difficult to manage in and through drought periods with numbers typically ending up being reduced when seasons take a turn for the better limiting the opportunity to capitalize (the typical Murchison pastoral conundrum).

Farm businesses in the NEAR are typically geared up to grow large crop areas as can be seen in table 1 where average plant value is \$917,000 or \$191/eff/ha.

However as input costs such as fertilizer, fuel, chemical, labour, etc increase along with interest rates so does the level of risk associated with cropping. These cost increases of essential inputs mean that more is invested in growing a crop every season and even if grain price increases keep terms of trade neutral or even positive there is no escaping the increased risk which results from the higher level of operating cost exposure and possible crop failure.

Crop type

If it is assumed that growing crops is the best option for the NEAR, as is proposed here, then the question arises, which crop types are most suitable?. The last 8 years (2000 – 2007) has proven to most in the NEAR that crops such as lupins, canola and chickpeas are too risky. They are mostly not well adapted crops to the environment and in particular do not cope well with moisture and heat stress. There are exceptions to this, particularly on the ideal soils and in western parts but for most, cereals are the most reliable, lowest cost and most profitable.

Specifically wheat has proven to be the most reliable crop of choice and is also the most likely to be profitable. After many years of experience it is also the enterprise of which farmers in the NEAR have by far the most experience.

Thus the remainder of this report focuses on wheat as the 'staple' enterprise.

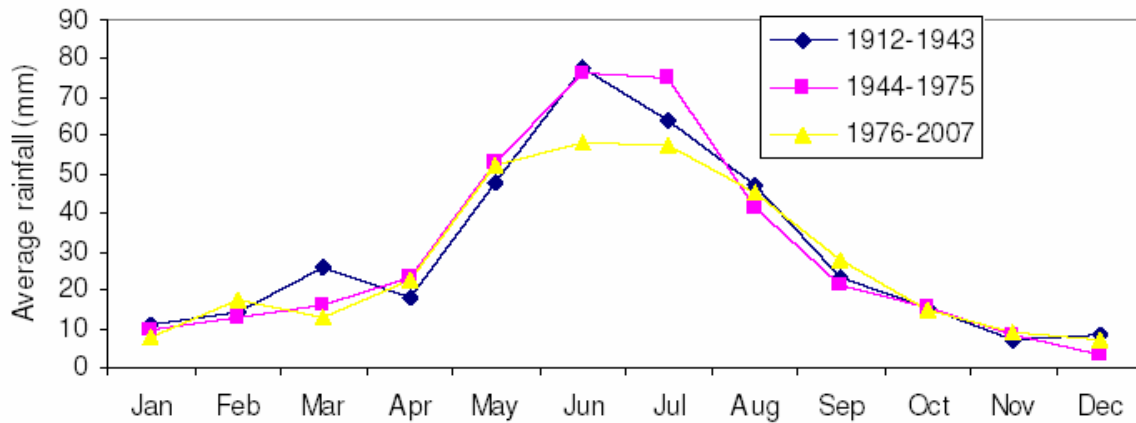
Rainfall in the future – what can we expect?

Assuming good management, rainfall then determines the result for a broad-acre farm business. The big question is, what can be expected with regards rainfall as we peer into the future?

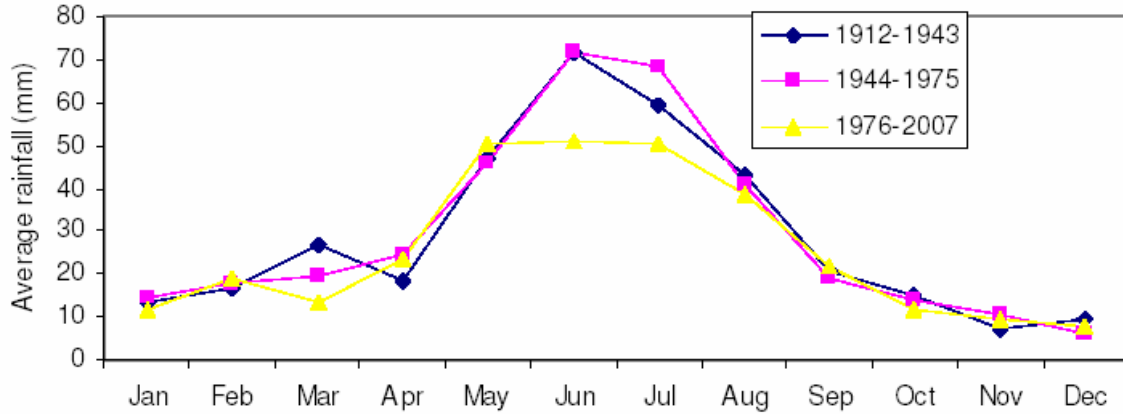
Climate experts suggest that the NEAR will suffer at the hands of climate change and in fact has already done so to some extent - this can be seen in the charts below. Even though we cannot be sure what rainfall will be in the future it is certainly worth understanding what history says is possible and in particular recent history.

The charts below show clearly that, since 1976, rainfall in the key growing season months of June, July and to a lesser extent August, has decreased. On average across the locations of Yuna, Mullewa and Morawa there has been a loss of growing season rainfall in the order of 40mm. At 10 kg/mm/ha this is 400kg/ha.

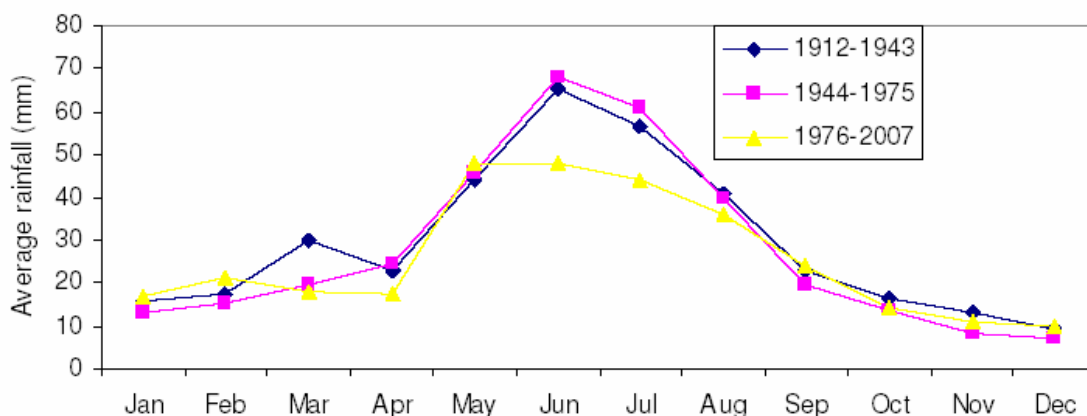
Graph 1: Yuna historical average monthly rainfall



Graph 2: Mullewa historical average monthly rainfall



Graph 3: Morawa historical average monthly rainfall



From a rainfall budgeting perspective, focusing on the 1976 – 2007 period, provides us with a sensible average amount to be working on. Using data for the same period (1976 – 2007) we can also gain an appreciation of the likely spread and probability of achieving a certain amount of rainfall in the growing season.

Table 3: Different rainfall deciles for the growing season (April – Sept) for 4 NEAR locations for the period 1976 – 2007

	Decile 1	Decile 3	Decile 5	Decile 7	Decile 9
Yuna	174	201	250	288	341
Mullewa	132	174	231	259	290
Morawa	123	161	202	250	282
Perenjori	109	154	195	251	279

The range of crop yields given the above rainfall data

In designing a farming approach in this low rainfall area it is essential to understand what rainfall is likely and then estimate probable crop yield from here.

A very crude but useful way of doing this is to use the following formula.

Growing season rainfall (mm) * 2/3 (to allow for evaporation) * 10 kg/mm/ha (this is approximately the long term whole farm average WUE for Planfarm clients in the LRN).

For example decile 1 for Mullewa = 132mm * 2/3 = 88mm * 10kg/mm/ha = 880kg/ha or 0.88 t/ha.

As mentioned this is crude because it does not take into account when the rain actually falls but at least it provides a guide as to what is possible. In this simplified case it also does not take into account summer rainfall – which can be significant.

With this formula and the above rainfall data in mind the hypothesis that we (Planfarm) put forward is that if a business can grow 1.0 t/ha in decile 1-2 type years, and sets input levels accordingly, then it will make a profit more often than not.

The 1.0 t/ha figure seems logical to us as recent history says that, including the horrible droughts encountered recently, a farm in the NEAR will more often than not get more rain than is required to achieve this in the growing season (not even counting valuable summer rainfall which is reasonably common in the area).

Note: Water Use Efficiency (WUE) varies significantly from year to year. Good sands and loams in particular can commonly return results in the 15kg/mm/ha range!

So what needs to change?

When looking at some of the changes that come out of the 2002 and 2007 survey data in Table 3 it is apparent that most farmers have made some significant changes to how they operate in the NEAR. Clearly inputs have been reduced (N and P) and risky legume crops have been largely removed from the system in response to the dry run of seasons. Arguably this is the way it should stay!

The average farm is almost entirely focused on cereals (wheat with some barley) and runs only a nominal flock of sheep or cattle.

Once again a look at the 2007 Client Survey (Table 2) highlights the difference in operating expenditure between the top 25% group and the bottom 25% group. This result shows very clearly the difference between those who, for one reason or another, spend more per effective ha and those who don't. Consider such a difference over a long period of time and the end result is obvious!

The next sections in this report consider this question of change.

The future – how should a typical farm business in the NEAR operate?

With the above rainfall charts in mind along with the significant increases in input costs and subsequent need to avoid disastrous results so common in drought years consideration is given here to the farming system and business structure required to be profitable in the dry and quite probably drying climate of the NEAR.

The hypothesis being put to the test is that;

“A low input business designed around an expected minimum wheat yield of 1.0t/ha will be profitable in 90% of years and therefore profitable in the long term. Not only this – the 10% loss years will be smaller losses”.

With this hypothesis in mind and based on the survey data and also an estimate of ‘reasonable’ wheat, fertilizer, fuel and chemical prices various year-in-year-out (YIYO) budgets have been prepared. These budgets have been prepared based on a ‘mock’ farming system with typical operating and fixed costs as derived from the Planfarm survey data. An important assumption is that all effective ha are cropable! This will not be the case on all farms.

The ‘mock’ farming system

The ‘mock’ farming system is one that many in the area aspire to but, given current debt levels, have great difficulty achieving – it is one with a significant level of fallow each year. Specifically the analysis is based on wheat, wheat, wheat, fallow or 25% fallow each year!

This system / rotation has been chosen as it allows wheat area to be dominant with the fallow component providing essential weed seed bank management along with some benefit to the following crop through soil moisture preservation but in a low cost fashion.

These budgets suggest that a low yielding wheat dominant farm can be profitable provided costs are kept under control and that the price of wheat can remain at or above \$250 farm gate (i.e. net of ALL costs). Certainly if costs can be controlled as described and wheat yield of 1.3 t/ha or more achieved then excellent returns are possible.

Term debt

Term debt has not been included in the analysis. It is assumed that anyone can look at the analysis and calculate what level of debt they can support. The level of term debt also varies significantly from farm to farm.

It is important to realise that individuals need to factor the required level of term debt into their own analysis when determining their own farm viability at a particular point in time!

The price of wheat

In 2007 the price of wheat moved to a never seen before level (see graph below). In early 2008 it actually peaked even higher at close to \$12.50/bu USD.

Given major changes in the world wide supply and demand situation it is a widely held view that wheat will remain at a new level when compared to historical prices. What this level is - is unknown but grain experts spoken to (Farmarco, Planfarm Marketing, Plumgrove) seem comfortable that somewhere around \$300/t FOB is a sensible figure for mid-term budgeting purposes.

Graph 4: Historical CBOT nearby futures from 1966 – 2008.



Table 4: Year-in-Year-out (YIYO) budget for a typical farm in the NE Wheatbelt. Rotation - wheat : wheat : wheat : fallow.

Effective area		4801	ha						
Value		244	arable acre	\$2,893,467					
Income									
Wheat	50%	2400.5	ha	1.0	t/ha	\$	250	/t on farm	\$ 600,125
Wheat on fallow	25%	1200.25	ha	1.3	t/ha	\$	250	/t on farm	\$ 390,081
Fallow	25%	1200.25	ha						
Total arable	100%	48001	ha	1.1	Based on farm gate prices				\$ 990,206
Expenses									
		Area		Units		Unit Price (\$)			Total
Operating									
Fertiliser - Wheat	DAP	3600.75	ha	35	kg	\$	1,200.00	/t includes freight	\$ 151,232
		3600.75	ha	0	kg	\$	-	/t includes freight	\$ -
Lime		500	ha	750	kg	\$	24.00	/t on farm	\$ 9,000
Seed	Wheat	3600.75	ha	60	kg	\$	280.00	/t includes dressing	\$ 60,493
Weed / Pest Control	Wheat	3600.75	ha	1		\$	35.00	/ha	\$ 126,026
	Fallow	1200.25	ha	3		\$	10.00	/ha	\$ 36,008
Fuel - crop (net of rebate)		3600.75	ha	1		\$	22.00	/ha	\$ 79,217
Fuel - fallow (net of rebate)		1200.25	ha	1		\$	9.00	/ha	\$ 10,802
Fuel - general									\$ 10,000
Wages		4801	ha			\$	14.00	/ha	\$ 67,214
Contract		4801	ha			\$	3.55	/ha	\$ 17,044
Rates/licences/water		4801	ha			\$	4.57	/ha	\$ 21,941
Admin (inc phone, professional)		4801	ha			\$	5.15	/ha	\$ 24,725
Elec/gas/sundry		4801	ha			\$	1.61	/ha	\$ 7,730
Insurance - general		4801	ha			\$	3.75	/ha	\$ 18,004
Insurance - crop							0.9%	Crop value	\$ 8,912
Plant repairs		4801	ha			\$	13.00	/ha	\$ 62,413
Bld/fen/water repairs		4801	ha			\$	4.00	/ha	\$ 19,204
Other payments		4801	ha			\$	2.00	/ha	\$ 9,602
TOTAL							\$154.04		\$ 739,564
Operating Profit									
Finance seasonal							\$479,389	Rate 9.5%	\$ 45,542
Repayments (HP)		4801	ha				\$21.16	/ha	\$ 101,589
Personal costs		4801	ha				\$16.50	/ha	\$ 79,217
Farm improvements		4801	ha				\$8.00	/ha	\$ 38,408
Profit before tax									
Return on asset (land)									
		-0.13%							

Observations

- Fertilizer rate (DAP at 35kg/ha) is low but should be more than adequate for the targeted low yields.
- There is a good allowance for wages in the budget
- Plant repairs have been contained to a reasonable level. There are many who do spend much more than this allowance.
- The result indicates that 1.0t/ha of wheat (1.3t/ha on the fallowed land) with costs kept well under control and wheat at \$250/t net farm gate is close to breakeven assuming no term debt.

Sensitivity analysis based on the above budget

Clearly there are many variables in the above budget analysis. Assumptions need to be made and these have been based on the survey data, reasonable price estimates, agronomic knowledge and best bet outlooks at the time of writing. However significant changes in many key areas (i.e. yield, crop area, price, etc) will have a significant impact on the outcome. This section explores many of these variables and looks at the potential financial impact.

What about 100% wheat?

Table 5: 100% wheat over the average farm affective area (4,801ha) at various yields.

Yield	0.9 t/ha	1.0 t/ha	1.1 t/ha
Income	\$1,080,225	\$1,200,250	\$1,320,275
Profit before tax	-\$21,501	\$97,392	\$216,286
Return on asset	-0.7%	3.4%	7.5%

Given that wheat is the enterprise that the majority of farms in the area are based upon (wheat is also the best suited and most drought tolerant crop we have) it is important to maximize wheat area.

The concept of 100% wheat looks fine on paper but there is little doubt that many managers struggle to achieve it due to weeds (particularly grass weeds). It is also likely that a percentage of the farm is not suited to cropping in most years thus reducing the wheat area.

Never-the-less the W,W,W,F system needs to be compared with 100% wheat. Table 5 does this and highlights that, if wheat yield can be maintained at 1.0 t/ha or better (remembering we are comparing with 1.1 t/ha wheat yield averaged across wheat on wheat and wheat on fallow) then the higher wheat % returns a healthy profit (3.4%).

Is fallow appropriate?

The issue with the fallow based system is that the fallowed hectares return a loss in the order of \$45/ha using the example figures each year. This is opposed to a crop, which hopefully delivers an operating profit.

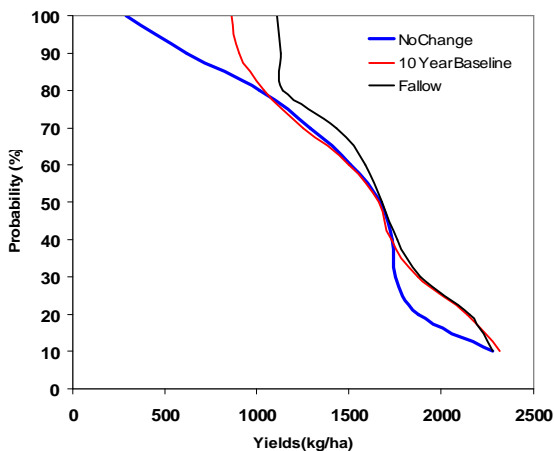
Thus the yield advantage derived from the fallow phase needs to be significant to justify the operation. Significant yield impacts are most likely on soils with better 'plant available water capacity' (PAWC) – thus the stronger the soil the more likely a good yield response (dependant on rainfall of course).

In order to appropriately evaluate fallow potential yield gains need to be considered. In the analysis thus far the yield advantage has been deemed to be 0.3t/ha averaged over time. This figure has been arrived at with the assumption that it is better to be conservative until proven otherwise. It also seems like a realistic 'average' figure across the range of seasons encountered and soil types that need to be dealt with.

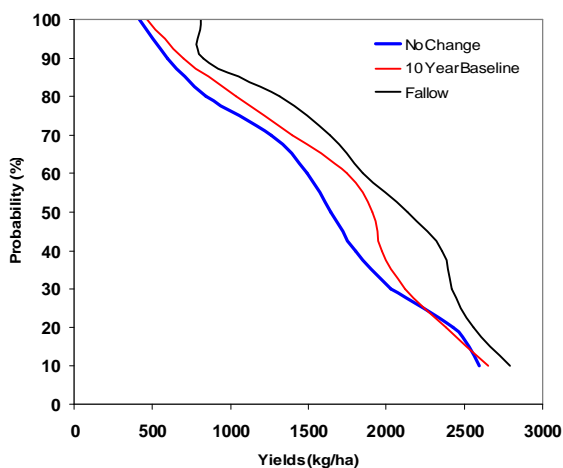
Some crop simulation modeling work carried out recently by CSIRO for three locations across the NEAR highlight the potential for fallow across seasons and soil type.

This modeling has taken place using APSIM (agricultural production simulator) which is widely proven in Western Australia.

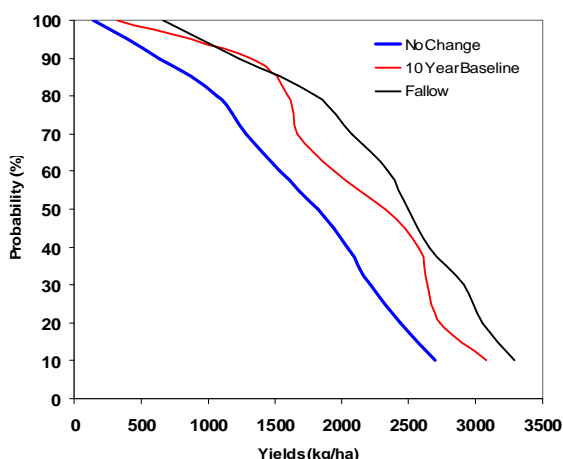
Figure 1: Probability of exceedance curves for yield (kg/ha) at Yuna (sandplain), Mullewa (red loam) and Morawa (deep red loam) for the period 1998 – 2007 ('baseline'), compared to simulated wheat yields in warmer and drier conditions without changing management ('no change') and for wheat grown on 'fallow' (W,W,F rotation). Source: S.Crimp, A.Laing, Y.Oliver (CSIRO), A.Gartman and J.Odgers (BCG) – 'Farm based analyses of adaptation options: NEAR WA'.



1. Yuna – yellow sand



2. Mullewa – red loam



3. Morawa – deep red loam

The three charts highlight the difference in likely yield advantage following fallow between soil types. Essentially those which can store significant amounts of water will produce the best responses (i.e. loam – clay soils).

Interestingly there is a significant yield advantage expected in the poorer 20% of years only on the sandy soil (helping to ensure a 1.0t/ha result) but a yield advantage of between 250kg/ha and 500kg/ha on the red loam site at Mullewa across all years.

The best soil with regards PAWC, the Morawa deep red loam, has provided by far the best response to fallow. This is to be expected because of its superior ability to store water for the wheat crop.

For a farm business wishing to get the most out of crop fallow efforts it is clear that a very good understanding of soil type and responsiveness is required.

So what response is required to justify fallow? The following sensitivity analysis provides some insight.

Table 6: Profit / loss before tax for a range of responses to fallow in t/ha at various 'wheat on wheat' yields (i.e. base-line yield) in a 75% wheat / 25% fallow system

Crop Yield ã	0.4 t/ha	0.7 t/ha	1.0 t/ha	1.3 t/ha
0.2 t/ha advantage	-\$578,857	-\$311,347	-\$43,837	\$223,673
0.3 t/ha advantage	-\$549,134	-\$281,624	-\$14,113	\$253,397
0.4 t/ha advantage	-\$519,411	-\$251,900	\$15,610	\$283,120
0.5 t/ha advantage	-\$489,687	-\$222,177	\$45,333	\$312,844
0.6 t/ha advantage	-\$459,964	-\$192,454	\$75,057	\$342,567

Table 7: Profit / loss before tax for a range of yields where 100% wheat is sown

Wheat yield	0.4 t/ha	0.7 t/ha	1.0 t/ha	1.3 t/ha
Profit / loss	-\$615,968	-\$259,288	\$97,392	\$454,073

Assumptions: As per table 4. No adjustments have been made to expense items per ha from 0.4 t/ha to 1.3 t/ha. Thus it has been assumed that personal expenditure, etc is not cut back due to the poor season!

Tables 6 and 7 highlight that fallow, particularly at the higher yield response levels (0.4 – 0.6 t/ha), improves the profit result, or more to the point decreases the size of the loss, at lower yield levels (less than 1.0 t/ha) when compared with 100% wheat.

Given that the high yield responses are most likely in the poor years, on all soil types too, fallow looks likely to assist with the critical objective of 'lessening the damage' in poor years.

When considering this the critical question is obviously 'what crop yield is achievable in a continuous wheat on wheat rotation'?

Fallow issues for consideration

A couple of other critical fallow related issues (on top of soil type, area and yield response) that need to be considered before a reasonably fixed rotation based on fallow could be established include;

1. Chemical v mechanical. Mechanical fallow (i.e. off set ploughs) destroys furrows, which are important even when not in crop to harvest water. Mechanical fallow also increases erosion risk and damages soil structure. The reduced cover also increases evaporation unless this is carried out in specific circumstances in which the opposite can happen (i.e. bare soil).
2. Glyphosate resistance if chemical fallowing. Glyphosate needs to be preserved as a priority, particularly in this environment and in such a system. In a chemical fallow system glyphosate will need to be rotated with Sprayseed, etc to minimize such a risk. Managers need to consider the likelihood of Glyphosate resistant GM crops in the future and whether or not they wish to push the glyphosate resistance risk in the mean time?
3. Sowing something to ensure paddock cover – managers who currently fallow with regularity in the NEAR typically report that preserving ground cover is a high priority to reduce erosion risk and reduce evaporation. Competition with weeds can also reduce the need for early knockdown spraying reducing spraying costs.

With this in mind one wonders whether seeding a very cheap crop of some sort, i.e. low seed rate, no fertilizer, wide row, lupin or oat crop is not justified. It is possible that in certain years such efforts could lead to worthwhile crop income whilst still getting good weed seed set control (crop topping, cutting for hay) as well as other benefits such as fixation of nitrogen by lupins (typically 7

– 20 kg/ha??). Trouble is this strategy could see extra water used reducing some of the benefit to the following crop!

This strategy is more along the ‘cover cropping’ theory currently being tested by WANTFA than just straight fallow.

4. Timing of fallow – full fallow v late Spring?
5. Management of subsoil constraints – clearly fallow response is related to plant available water capacity or in simple terms the ‘size of the bucket’. Thus any constraint that limits plant rooting depth will limit potential fallow response. Thus subsoil acidity, hard pans, traffic pans, etc will all need to be managed to see maximum benefit from fallow.

What about the price of wheat?

Table 8: Profit before tax and return on asset (land) at various wheat prices (net farm gate).

Price	\$200/t	\$250/t	\$300/t
Profit before tax	-\$198,972	-\$14,113	\$170,754
Return on asset	-7.9%	-0.49%	5.9%

Clearly – based on the assumptions on input prices, the result is very sensitive to the price of wheat. \$200/t farm gate is an average price historically but before prices jumped to a high of over \$380/t net farm gate in 2007. The analysis shows that, with high input prices and the low wheat yields being factored in, something in the order of \$250/t is required for such a business to be viable.

What about yield?

Table 9: Profit before tax and return on asset (land) at various wheat yields (remembering that this is an average of wheat on wheat and wheat on fallow).

Yield (t/ha)	1.0	1.1	1.3	1.5	1.7
Profit before tax	-\$103,284	-\$14,113	\$164,227	\$342,567	\$520,907
Return on asset (land)	-3.6%	-0.49%	5.68%	11.84%	18.00%

In these analyses it has been assumed that the various wheat yields can be achieved with no increase in fertilizer rates (remembering a low rate of 35kg DAP has been budgeted). Whilst this is likely to be the case up to 1.45 t/ha achieving 1.65 t/ha might be more difficult. Certainly if a farm found itself averaging closer to 1.7 t/ha some extra phosphorous is likely to be required and possibly even nitrogen to optimize profit.

The rate of P in particular will need to take into account soil type and historical P applications.

This table shows that small improvements in yield can lead to very significant profit results. Remember that in the survey data (table 1) the difference between the top 25% and the average was 0.18 t/ha.

What about input price increases?

Table 10: Profit before tax at various operating costs and prices and at average wheat yield of 1.1 t/ha.

	\$200/t	\$250/t	\$300/t
Operating costs -10%	-\$122,821	\$63,356	\$249,533
Nil change	-\$198,972	-\$14,113	\$170,754
Operating cost +10%	-\$275,123	-\$91,583	\$91,958
Operating costs +20%	-\$351,274	-\$169,052	\$13,170

This table shows clearly that substantial rises in fertilizer, fuel, etc can have a significant impact of profit if not offset by better grain prices and or yield. Certainly managers need to be very prudent with expenditure as they deal with such substantial price increases as we have seen in the last 6 months!

What about reducing fixed costs?

Table 11: Profit before tax at various fixed costs and prices and at average wheat yield of 1.1 t/ha.

	\$200/t	\$250/t	\$300/t
Fixed costs -20%	-\$153,047	\$31,812	\$216,671
Fixed costs -10%	-\$176,010	\$8,849	\$193,708
Nil change	-\$198,972	-\$14,113	\$170,754

Note: Fixed costs include personal or drawings, repayments (HP) and farm improvements / capital costs.

When a farm business is doing it tough or a budget is too tight for comfort it is usually the operating costs which are taken to by management. Fixed costs though are important and as the above table shows have an impact on the level of profit possible.

Making changes to fixed costs often involves difficult decisions and by their nature they cannot be quickly reduced (they are fixed). Eg reducing family labour units, reducing drawings, reducing HP commitments.

What about livestock!

The system analysed above has no livestock. The non cropped area (25%) is fallowed with 3 applications of chemical budgeted. The obvious question is 'wouldn't some income off the non cropped area rather than just expenditure make sense'? On the face of it yes – but I believe the answer is no in most cases!

Some simple calculations (see tables 12 to 15) using average gross margins per head of livestock highlight why.

Table 12: Dry sheep equivalents (DSE) per winter grazed ha (wgaha). The assumption is that all fallowed ha are instead grazed.

Stocking rate (DSE/wgaha)	2	2.5	3
Area (ha)	1,200	1,200	1,200
DSE total (no)	2,400	3,000	3,600

Table 13: Gross margin / DSE (\$/ha) at various total DSE's.

Gross Margin	\$15/hd	\$20/hd	\$25/hd
2,400 sheep	\$36,000	\$48,000	\$60,000
3,000 sheep	\$45,000	\$60,000	\$75,000
3,600 sheep	\$54,000	\$72,000	\$90,000

Table 14: Total improvement in position including reduced herbicide and application cost with removal of fallow operation (\$/ha) at various total DSE's.

Gross Margin	\$15/hd	\$20/hd	\$25/hd
2,400 sheep	\$67,200	\$79,200	\$91,200
3,000 sheep	\$76,200	\$91,200	\$106,200
4,600 sheep	\$85,200	\$103,200	\$121,200

Table 15: Yield loss due to no fallow / impact of grazing efforts

Yield (t/ha)	0.1	0.2	0.3	0.4
Grain price (\$/t)	250	250	250	250
Area (ha)	1,200	1,200	1,200	1,200
Cost (\$)	\$30,000	\$60,000	\$90,000	\$120,000

At a stocking rate of 2.5 DSE/wgha and a gross margin of \$20/hd income of \$60,000 is generated. Add to this the reduced spraying costs due to no fallow of approx \$31,200 and the total improvement in position is some \$91,200. At \$250/t for wheat this equates to approx 0.3 t/ha over the non cropped area. Thus grazing only has to cause 0.3 t/ha of yield loss (i.e. in the year following grazing) for the grazing efforts to be worthless.

I suggest that this is most often the case through moisture loss (less ground cover and no furrows), impact on timing of the crop operation, erosion (wind and water), soil compaction and reduced ability to sow crop dry or into marginal moisture because of reduced ground cover (erosion – furrow fill, herbicide efficacy, sandblasting of the crop, etc). Client experience also suggests that weeds are less in systems with no livestock.

The impact on the following crop (fallow v annual pasture) is very difficult to quantify – but because this is the case farm managers should not underestimate the impact of livestock on following crop production.

Of course there are non arable ha on most farms in the NEAR (salt flats, very shallow soils, etc). Such country can clearly be grazed but it comes down to the individual as to whether the effort is worthwhile. A farm with significant noncropable area will likely have the greatest justification for livestock.

The other opportunity that arises when cropping only is that of off farm income. Cropping typically involves 4 - 5 months of work allowing farming partners and staff to work elsewhere or operate another business during the remaining months. Livestock reduce this opportunity significantly due to the requirement to constantly be at the farm.

There is also the added expense of maintaining infrastructure such as fences, shearing sheds, watering systems, etc.

It should be noted that any system that can lift carrying capacity significantly (say 4-6 dse/wgha) will alter the above calculations and assumptions. Very few people have managed to do this in the low rainfall zone and even if it could be done, the low risk nature of livestock is replaced with a higher degree of risk (in the case of drought particularly).

How bad can the result get in the case of a severe drought?

This is a very difficult question to answer as there are many and varied lead in scenarios to a drought. The worst type of drought is one where the crop is fully sown at a good time of sowing and then dies during the season. This commits the farmer to the full costs of seeding a crop only to have nil income returned.

Realistically though the majority of droughts come when the break to the season is late and there are signals from early in the piece that a poor result is likely. 2007 was the classic example of this with no subsoil moisture in most of the NEAR and a sowing date which got later and later until decent rains came on the 22nd June.

Thus the YIYO budget in table 4 has been adjusted to reflect this type of outcome.

Table 16: Result in a drought situation based on 0.4t/ha wheat and 0.8t/ha wheat on fallowed country at various wheat prices.

Wheat price (\$/t)	250	275	300
Operating Loss (\$)	-151,173	-119,091	-87,008
Profit Result (\$)	-374,910	-343,013	-311,117

Assumptions:

- All wheat on fallow sown, 50% of remaining wheat sown (i.e. 2/3 of planned wheat area)
- Fertiliser rate reduced from 35kg/ha – 30kg/ha

- Wages reduced by 50%
- All other operating costs reduced as was deemed reasonable and appropriate for a drought
- Fixed costs have remained the same except for farm improvements reduced to \$2.00/eff/ha

What about doing nothing?

Whilst this is a possible outcome it is typically very unlikely. However it is interesting to contemplate such a result. The beauty of the 'do nothing' result is that nothing (extra) is put at risk. Overhead, sunk and fixed costs are those that remain and essentially make up the net loss.

Assuming all area is fallowed (i.e. sprayed 3 times inc. one summer spray) and that costs are reduced as much as possible the result is;

- Operating loss of -\$375,260
- Profit result of -\$592,537

Crop Yield in bad droughts – thinking outside the square!

Given that disastrous years do occur any system clearly needs to seek some income in these years (assuming the income covers the variable costs of production). History says that these severe droughts which lead to nil or nearly nil grain income, are what really set a business back, leading to significant term debt which adds unwanted finance costs to the business. Thus, if various crop management strategies can be developed for differing starts to the season, surely the chances of a wipeout can be minimized?

Some of the opportunities or methods that can increase the chances of at least some crop production in droughts include;

- Sowing some wheat very early (i.e. early April) if the chance arises to ensure at least some % of the crop emerges. Adequate subsoil moisture is integral to this strategy. A small amount of farmer experience plus some CSIRO crop simulation modelling suggest that this strategy would have paid off handsomely in 2006!
- Dry sowing a portion of the crop (better soils) by a certain date maximizing the chances of germination
- Make the most of any wet sowing opportunity after;
 - 10th April when have subsoil moisture >30mm plant available
 - 25th April when no or only limited subsoil moisture
- Conserve moisture at all times (inc retaining stubbles, minimum tillage, no sheep, control summer weeds, possibly some fallow)
- Fallow heavier soils in late seasons (i.e. when chance of profit is reduced for soil type) – this enhances their chances in the following year.
- Have seeding equipment which can sow effectively (and quickly) onto moisture and form appropriate furrows
- Understand crop breakeven yield and be prepared to sow crop cereals until a predetermined date if it rains (remembering that some operating profit per ha is better than none!). To do this a good understanding of performance on various soil types is needed.
- Stick to wheat, especially when late sowing.
- Have enough short season wheat variety(s) to sow whole program if needed
- Implement set cost crop management – eg commit only \$120/ha (or \$150/ha) – allocating \$ to most profitable/lowest risk inputs.
- *Breed a wheat variety that matures in record time (3 months?)*

Of course it will also be very important to be able to identify those soil types which should certainly not be sown in certain seasons. Figuring out when the 'odds are stacked against you' will always be an essential low rainfall skill!

Critical success factors for low rainfall business

Experience tells us that there are several critical success factors that are tried and tested in the low rainfall regions of WA such as the NEAR. These factors will be even more critical in the future if we assume that rainfall will decline further.

1. Focus on cereal cropping – do not get distracted by other crops and livestock. Wheat in particular is where the money is so don't do anything which compromises efforts in this area.

If running livestock on cropable area consider not just the income received per ha but the potential crop yield lost due to poor timing, lost moisture, erosion, nutrient loss, destruction of furrows, etc.

2. Water use efficiency – it is essential that maximum yield can be gained per mm of rainfall received. This will include varietal selection, TOS, fallow, weed control, soil type selection along with those factors mentioned in the section on wheat yield in bad droughts.

The Planfarm data highlights that the top performing businesses somehow extract extra yield per mm of GSR received.

3. Scale of farmed area – needs to be adequate so that fixed costs are reduced on a per ha basis, plant investment per ha is reduced, etc.

It is important to remember that scale of the farming operation can be achieved without necessarily purchasing the extra land required. Leasing is less costly (approx 50% of the interest rate of the time) and does not commit the landholder to the area permanently. It can also free up capital for off farm investment purposes.

Sharefarming is another viable alternative, particularly now that there are dedicated companies, such as AACL, providing professionally managed sharefarming opportunities. The beauty of sharefarming is that risk is shared between the parties involved.

4. Scale of plant – needs to be sufficient so that seeding can be carried out in a very timely fashion. It is important though, not to have too much capacity and capital tied up in plant that it is not utilized (too much cost/ha).
5. Excellent cost control – good financial systems, will power to keep costs under control. The difference between the top 25% of businesses and the bottom 25% in this area is staggering!
6. Minimization of crop wipeouts in bad droughts! Related to WUE but specifically about different and possibly new strategies to reduce the risk of a no crop income result!
7. Low debt level (term debt). When the wheel turns and times are good again managers need to remember that decisions to take on more debt in these times frequently come back to bite when times are tough! Discipline in good times is essential in all rainfall zones but particularly so in the drier areas.
8. Sound financial resources – need to be able to weather bad years when they appear. As per the above point managers need to retain some of the profits to assist in the tough times.
9. Low risk – no point chasing optimum crop yield when it is more likely that 'the rain will not come!' Low input based on conservative wheat yield expectations is the key.
10. Management of seasonal variability – to maximize returns there is likely to be years (say 2 in 10?) where at seeding there is a strong enough signal that the season is likely to be above average to warrant a higher input approach (i.e. when seeding in early May on very good levels of soil moisture).

Likewise there will be certain seasons, like those where the break is very late and there is no subsoil moisture, where likely crop yield is deemed such that an operating loss is most likely. In these years it is important to recognize this and reduce crop area.

Water Use Efficiency

Clearly, in an environment which is already dry for grain production and looking likely to dry further, it is paramount that every mm of rainfall is made to count. To do this the best possible agronomic practice is required. The agronomic factors that need to be made a priority for all businesses include;

- Time of sowing – it is vital that sowing opportunities between approx 15th April and 15th June are realized (arguably earlier – see next section on crop yield in bad droughts). This means sufficient seeding capacity is required. As a guide less than 250ha per m of bar width is adequate – certainly the ability to sow 200ha per day is needed. Dry sowing should be part of any crop program (depending on the date) – dry sowing takes the seeding pressure off after rain is received and also gives the crop the chance to germinate on lesser amounts of rainfall. Better / more reliable soils should be the focus.

Minimum to no tillage seeding is a must. The days of working country (apart from fallow type operations) should be gone!

Good managers always seem to get the crop out of the ground at the earliest possible opportunity. Along with the above this takes excellent organisation. A disorganized operation at the end of April is a recipe for missed opportunity. It is surprising how many managers are still disorganized at the start of seeding. This should NEVER be the case.

- Soil type selection – managers need to know their soil types well and particularly how they are likely to yield given various times of sowing. Certainly knowing which to cull when a season gets late is vital. To realise yield potential in good years (sown on time and with subsoil moisture) a manager also needs to know which are most likely to yield well given the conditions. This may see an increase in inputs as deemed necessary based on 'likely' crop yield.
- Varietal selection – short season varieties should form the basis of any program although there is a need to have up to three different season length varieties to insure against frost risk and also to provide some flexibility when sowing in April – early May.

In the ideal world a variety which matures in 60 – 90 days would be available even if it was not possible to yield as well as other varieties in better seasons. Late breaks and insurance against early finishes to a season would be the target.

- Moisture conservation – simple strategy really. Includes maintaining stubble cover, minimal soil disturbance, maintaining formed furrows in non cropped paddocks, etc. Probably should see the exclusion of sheep from cropping focused paddocks on a permanent basis!

Moisture conservation is linked directly to water use efficiency.

- Fallow – a system such as that included in the analysis in Table 4 allows a manager to keep weeds under control, manage soil based nematodes / diseases and most importantly conserve moisture from one season to the next to boost likely crop yield in the following crop. It is reasonable to expect that 10kg/mm of plant available water (PAW) conserved will be the yield benefit (i.e. 300 kg/ha for 30mm of PAW).

The problem with fallow is that target paddocks run at a loss for the year in fallow – as much as \$40 - \$45/ha in the examples referred to above. It is most likely that a system based on a % of fallow will be developed but where the area varies from year to year depending circumstances, type of season encountered, etc.

- Row spacing – certain soil types (shallow) have responded very well to increased row spacing in trial work carried out by the Dept of Agriculture WA. Whilst this work needs to be continued to accurately define the area of application it appears to have merit when trying to manage the use of water by crops on soils that almost always come under drought stress (i.e. shallow and acidic soils).
- Fertiliser inputs – managers need to ensure fertilizer inputs are tailored to likely crop yield. This is from both an economic perspective and also to manage early crop vigour on soils unlikely to finish well in the majority of seasons.

Better use of soil tests is needed by many. Good agronomic advice (i.e. that where there is also a good understanding of farming economics) is vital.

Management of seasonal variability

The ability to manage seasonal variability is critical in gaining the best possible result and also in minimizing risk in any given season.

To do this effectively a farm manager needs to understand two critical factors;

1. What does history say is possible on my farm in terms of rainfall?
2. What are my chances of achieving a certain yield at critical times during the season (i.e. seeding and when considering post emergent expenditure)

If a farmer can reasonably understand 'likely' crop yield rather than 'potential' crop yield and then make crop management decisions accordingly he is going to match appropriate inputs to crop yield more often than not. This is a skill that some managers have but plenty do not!

Clearly the great difficulty in calculating likely crop yield is the fact that we can never tell how much rain will fall looking forward but with the right approach and an understanding of historical rainfall a good estimate is possible.

The key components to estimating likely crop yield at seeding, and in order of importance are;

1. Crop emergence date – is it optimal (i.e. May)?
2. Soil moisture – roughly how much plant available moisture do I have?
3. Historical rainfall – what chance at my location getting a certain amount of rain?
4. Growing season outlook – is it extremely good or extremely poor? If neither (i.e. somewhere around average) then ignore!

Note: Sowing date followed by subsoil moisture are the best indicators a farm manager has at seeding about likely crop yield. Even though we would all like the skill in seasonal forecasting to be better than it is, the fact is that it will always be difficult and there will never be any guarantees. Certainly at present the outlooks available to us (i.e. DAFWA, BoM, etc) do not have sufficient skill from which to base crop management decisions. They can be factored into decision making but should sit below sowing date and soil moisture level in order of importance.

Once the season is underway the task of calculating likely crop yield gets somewhat simpler because the information presented above is added to by the chance to visually assess crop performance (i.e. how is it traveling)? Most farmers and agronomists are good at this.

Remember though that soil moisture at the time of yield assessment always needs to be considered. Soil moisture level determines how much reliance there is on rain to come (i.e. a good finish). Moisture in the ground is akin to money in the bank!

Crop simulation models / tools

Available to farmers are crop simulation methods and calculators that can assist with understanding the chances of achieving a certain yield.

The Yield Prophet, developed by CSIRO and the Birchip Cropping Group (BCG) is a web based tool which, when provided with key soil, crop and historical weather information, can reasonably simulate likely crop yield.

To check out the Yield Prophet go to www.yieldprophet.com.au.

Alternatively water use efficiency based calculations can be used to estimate likely crop yield. DAFWA has a tool called PYCAL (potential yield calculator) which can assist with such WUE based calculations.

Both of these approaches / methods always need checking against visual assessments when used during the season.

New enterprises?

New enterprises and opportunities should not be ignored by managers however they should adopt with caution. An example is the widespread adoption of legumes in the latter part of the 1990's (chickpeas and lupins). Planfarm data shows that between 1996 and 2001 the average farm in the low rainfall north zone sowed 25% of effective area to such crops (peaking at 30% between 1996–1999). Since 1999 these crops have mostly caused nothing but economic loss for farmers!

Looking forward carbon trading appears to show promise with oil mallees likely to underpin initial efforts. It is highly unlikely though that, such opportunities will be a 'silver bullet'. They, at best, will add value to an existing system.

Until something other than wheat is proven managers should look at new enterprises as value add opportunities but do so with caution and ensure that the new enterprises does not compromise 'core business'!

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