LIMITED WATER STRATEGIES IN IRRIGATED COTTON

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As a farmer geared for the production of irrigated cotton, the prospect of little or no irrigation water adds a new dimension to risk management. Since the 1980's and 90's have been relatively dry, we have learned to manage with less than full supply; however the last two years in the Gwydir have been extremely dry.

For the 1993 cotton crop, there was only a five percent allocation of irrigation water, and for the 1994 crop, the allocation was zero. Furthermore, there was no beneficial rainfall and only insignificant surplus flows in the rivers. In our case, there was a small carry over from the previous year.

As a consequence of the drought, 1994 cotton production in the Gwydir Valley is down by a disastrous 80 percent, and the prospects for 1995 don't seem to be much better. Managing under these circumstances becomes a matter of survival. It is a matter of adopting effective strategies to reduce the risk of disastrous crop failure.

The first process in facing up to a season without water is to set some rules and make certain assumptions. Assumptions can be based on previous experience, fact or fiction and can incorporate any degree of risk. In essence, its a question of looking at the known e.g. available land, water currently available from the dam and on farm storage, then taking a position in respect of future outcomes. For example, expected average rainfall, (more or less) and the likelihood of future irrigation water from storage and surplus flows. Then, you need to provide enough flexibility in the system to take advantage of changed circumstances and opportunities.

Auscott's approach to growing cotton with limited water was as follows:

- We had the benefit of experience gained in the 1981-83 drought.
- Prepare more land than we had water for as economically as possible, e.g. no nitrogen.
- Use management strategies based on rain fed cotton production including skip row.

- Spread the water over a larger area rather than concentrate on small area for maximum yield. The logic here was twofold. Spread fixed farm costs and reduce water storage evaporation losses. (We have experienced 50% losses from on farm storage.)
- Plan for a break-even on profit as a worst case scenario.
- We were prepared to convert solid plant to skip in late November.

The key element in the strategy was to use skip row in a two in one out configuration.

Why grow skip row?

- Reduce risk.
- Buy time to get rainfall or irrigations and spread irrigation intervals.
- Reduce break even profit level.
- Utilise rainfall, ie use irrigation to supplement rainfall.

What assumptions were made?

Because the soil profile was full of water at planting time and stands were established without irrigation, it was assumed that 2 irrigations on solid plant and 1 irrigation on skip row would get us up to break even point.

Based on long term weather forecasts, the expectation was for average summer rainfall that would be beneficial to the crop and equivalent to one crop irrigation.

We gambled on a 10% allocation from Copeton Dam

Actual plantings and irrigation turned out as follows. Of the total area planted, 20% was solid with two irrigations, 30% skip row with 1 irrigation and 50% skip row dry. So in total, 80% of the area was skip row.

In order to back up the management strategy, trials were carried out. The theory was put to the test. A summary of the results follows.

Irrigation Versus Row Configuration Trial. (Field 57 Windmill)

Solid plant (Irrigated 1-3 times) **Vs Skip row** (Irrigations 1 and 2).
Field: Fallow following wheat, variety L23 planted 9/10/93 solid. Trial areas were skipped on 2/11/93. Established stand 9.94 plants/m.
Nitrogen: All applied post plant, 55 kgs/ha side dress and 30 kgs/ha water run.
Trial: 2 replicates each of 6 plots 32ms wide, 3 solid, 3 skip row.

Trial Plan and Irrigation Dates

Replicate 1						Replicate 2					
Solid			Skip			Solid			Skip		
20/12	20/12	20/12	20/12	20/12	20/12	20/12	20/12	20/12	20/12	20/12	20/12
4/1	4/1		15/1	15/1		4/1	4/1		17/1	17/1	
15/1						15/1					

Rainfall: **Date/ (mms)**

	Oct	Nov	Dec	Jan	Feb	March
	5/14	1/2	8/40	13/5	3/5	1/8.5
	15/16	13/6		19/8	9/3	5/12
	17/1.5	14/5			14/3	8/11
	22/2.5				17/31	11/10
	25/6				20/54	
Month Total	40	13	40	13	123	41.5

Evaporation Totals - see F49*

Harvest: Trial havested by stripper on 22/4/94.

Yields Summary

	Lint O/T	Rep1 B/Ha	Rep2 B/Ha	Avg B/Ha	Avg B/Ac
Solid I Irr	34.33	1.224	1.048	1.136	0.46
Solid 2 Irr	34.33	1.866	1.802	1.834	0.74
Solid 3 Irr	33.07	2.972	3.114	3.043	1.23
Skip 2:1 1 Irr	33.47	1.616	1.347	1.482	0.60
Skip 2:1 2 Irr	33.11	2.510	2.721	2.615	1.06

Quality Summary

	Grade	Length	Avg Strength	Avg Mic
Solid I Irr	SLM	29/32"	24.5	4.2
Solid 2 Irr	SLM	15/16"	25.1	4.4
Solid 3 Irr	SLM	1-3/32"	26.9	4.3
Skip l Irr	SLM	1"	27.7	4.8
Skip 2 Irr	SLM	1-3/32"	29.5	4.7

Irrigation Versus Row Configuration Trial (Field 40 Top Box)

Solid Plant (Irrigated 1-3 times) **Vs Skip row** (Irrigations 1 & 2).
Field: The field was long fallowed, variety was CS50. Planted on 2/10/93 solid.
Trial areas were skipped on 4/11/93. Established stand averaged 10-12 plants/m.
Nitrogen: Pre plant 80 kgs/ha with 25 kgs/ha water run post plant.
Trial: Consisted of 2 replicates each of 6 plots 16ms wide, 3 solid 3 skip row.

Trial Plan and Irrigation Dates

Replicate 1						Replicate 2					
Solid			Skip*			Solid			Skip		
24/12	24/12	24/12	24/12	24/12	24/12	24/12	24/12	24/12	24/12	24/12	24/12
7/1	7/1		24/1	24/1		7/1	7/1		13/1	13/1	
24/1						24/1					

*2nd irrigation on skip row in replicate 1 delayed 11 days from refill point.

Rainfall: **Date/ (mms)**

	Oct	Nov	Dec	Jan	Feb	March
	4/12	13/10	8/49	13/7	3/3	1/10
	15/18		16/14	19/14	14/52	5/30
	16/31		22/8		17/40	8/3
	24/2				20/50	11/10
	25/8					
Month Total	71	10	71	21	145	53

Harvest: Trial was spindle picked on 3/5/94.

Yields Summary

	Lint O/T	Rep1 B/Ha	Rep2 B/Ha	Avg B/Ha	Avg B/Ac
Solid I Irr	34.75	2.07	2.27	2.17	0.88
Solid 2 Irr	35.82	3.66	3.06	3.36	1.36
Solid 3 Irr	35.72	4.87	4.82	4.85	1.96
Skip 2:1 1 Irr	35.40	2.46	2.52	2.49	1.01
Skip 2:1 2 Irr	35.73	2.82	2.60	2.71	1.10
Skip* 2 Irr	36.78	3.41	3.47	3.44	1.39.

HVI Fibre Characteristics (from a hand gin)

	Avg Length	Avg Strength	Avg Mic
Solid I Irr	1.09	29.2	4.6
Solid 2 Irr	1.09	28.4	4.4
Solid 3 Irr	1.17	30.0	4.5
Skip 1 Irr	1.07	29.1	4.4
Skip 2 Irr	1.17	31.4	4.4
Skip*2irr	1.17	31.2	4.7

Block Comparisons of Row Configuration in Commercial Fields

Solid Vs Skip 2:1 with 1 crop irrigation.

Field 55 Windmill.

Planted on 13/10/93 to L23, established stand averaged 9.44 plants/m. The field was planted solid and skipped on 26/11/93 with the exception of the trial block (48 ms).

Irrigation: 16/12/93 including 25 kgs/ha (N) as Urea. No pre plant fertiliser was applied.

Rainfall: Data is the same as for Field 57.

Harvest: Trial areas were harvested by stripper on 19/4/94.

Yield Summary

	B/Ha	B/Ac
Solid	0.881	0.36
Skip	1.229	0.50

Solid plant (With 1 and 2 irrigations) **Vs Skip Row** (Irrigated once).

Field 49 Top Box.

Planted: 8/10/93 to CS50 solid. Established stand averaged 9.24 plants/m trial area skip rowed on 2/12/93.

Nitrogen: All applied post plant, 30 kgs/ha side dress and 25 kgs/ha water run.

Trial Plan and Irrigation Dates

Solid	Solid	Skip Row
27/12 & 13/1	27/12	27/12

Rainfall: Data is the same as for field 40.

Harvest: Trial areas were spindle picked on 14/4/94

Yields & Quality

	Lint O/T	B/Ha	B/Ac	Avg Grade
Skip 1 Irr	38.86	3.33	1.35	Mid 1-1/16" 3.8-4.9
Solid 1 Irr	38.75	3.48	1.41	Mid 1" 3.8-4.9
Solid 2 Irr	38.61	5.28	2.14	Mis 1-1/16" 3.8-4.9

Total Monthly Evaporation (mm) For Moree (Urban) 93/94 Season

Oct	Nov	Dec	Jan	Feb	March	Total
179.0	255.8	278.8	355.8	183.2	161.4	1,414mm

CONCLUSIONS:

What did the trials show? As usual in this business, there are no clear cut answers.

In the first place, the season did not go according to plan. There was no beneficial rain.

The February rains came too late. There was no irrigation allocation and the small surplus

flows came too late. Furthermore, there was a heat wave at the end of January inflicting severe stress on the plants. The crop did however, get off to a terrific start.

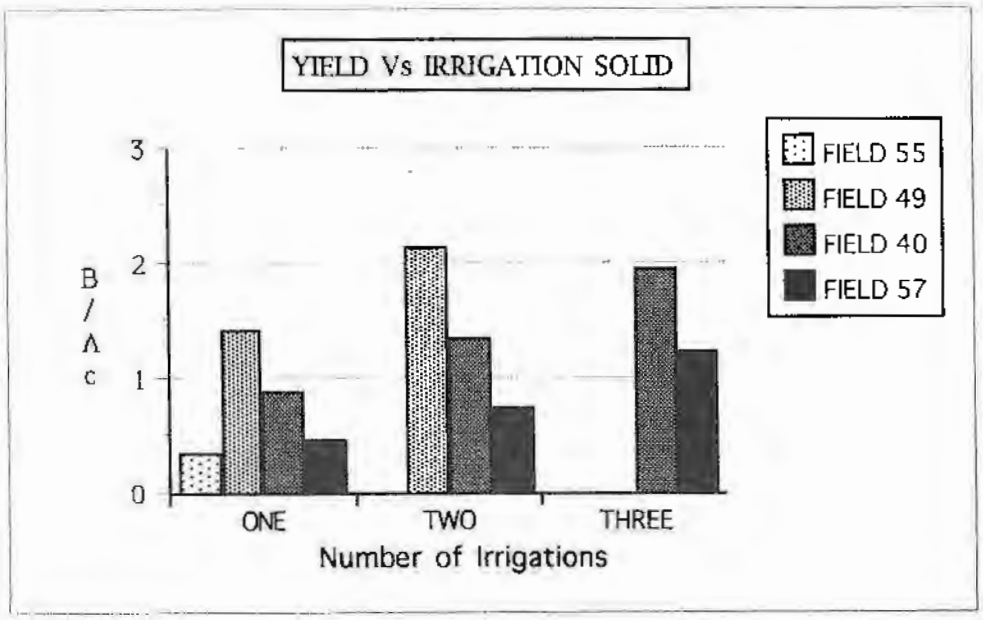
Key Points Arising from the Trials:

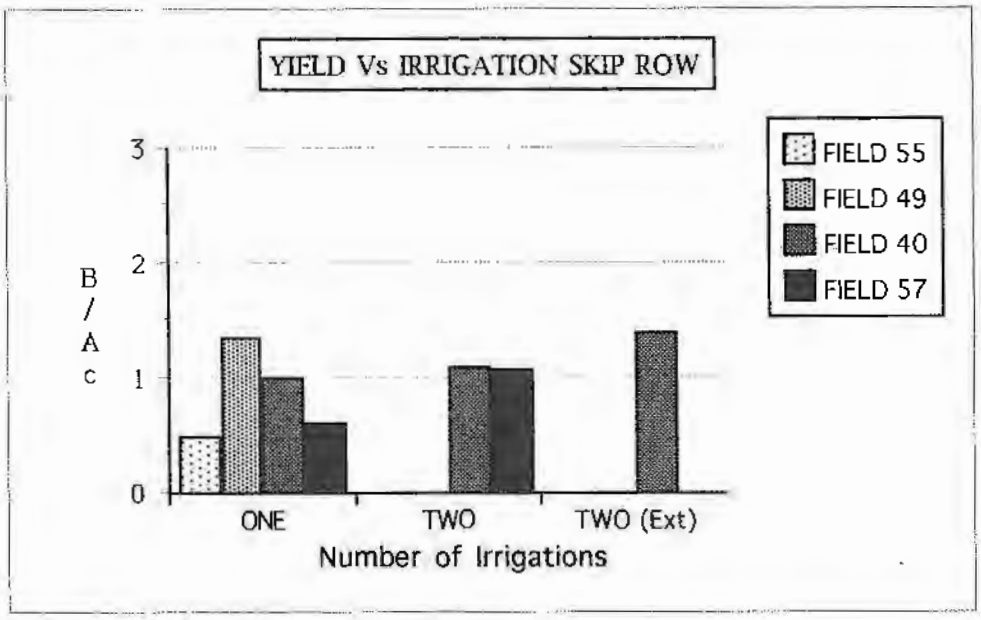
- Skip row is not always beneficial except in a nil irrigation situation.
- Soil type, its structure and plant available water capacity is critical if restricting the number of irrigations. This factor alone, had a bigger influence on the results than anything else.
- Skip row can reduce production costs. Savings can be made on seed, harvest, insecticide and irrigation. Weed control is more expensive.
- Skip row will buy you time, up to 3 weeks.
- Skip will reduce the risk of total crop failure.
- Our experience suggests that in a dry summer like last season, to produce a profit, solid plant needs a full profile to start plus 3 crop irrigations and skip, a full profile plus 2 crop irrigations.

How does this fit in with Brian Hearne's production from irrigation model?

I agree with its conclusions, however, it fails to take into account evaporation loss if water has to be stored on farm. Losses from on farm storages in the past two years have been around 50% to carry the water through a summer for irrigation. That means you would need more that 10 megalitres per hectare for 4 irrigations. Reducing area has impact on production costs. Fixed cost per hectare becomes greater as the area reduces significantly increasing break even yield level.

Many questions remain. Skip row has a place with limited water but with some reservations. In the end, it depends on the individual farmer and how he wants to manage.


YIELD Vs IRRIGATION SOLID
B / Ac
3
2
1
0
ONE
TWO
THREE
Number of Irrigations
FIELD 55
FIELD 49
FIELD 40
FIELD 57


YIELD Vs IRRIGATION SKIP ROW
B / Ac
3
2
1
0
ONE
TWO
TWO (Ext)
Number of Irrigations
FIELD 55
FIELD 49
FIELD 40
FIELD 57