TOPIC: WATER USE EFFICIENCY OF CROPPING SYSTEMS

Group: *Morawa 2010*

ABSTRACT

Our aim in this project is to explore whether cropping strategies using higher inputs are more water use efficient than lower input systems and to what extent this affects profit. It is based on the "Practice for Profit" trials that were run in the past but is designed to capture multi-year effects. Three multi-year trials have been established at Morawa, Mingenew and Buntine. The treatments reflected the high and low ends of input levels that might typically occur in each area and were applied to either wheat-on-wheat sequences or wheat rotated with various break crop options. The specific sequences and inputs varied between the trials based on input from each grower group, staff members and agronomists.

The trial at Morawa compared a canola-wheat sequence to a wheat-on-wheat sequence with either high or low input levels. Low input had lower fertiliser, lower seed density and cheaper herbicide options. We also incorporated a comparison of a very early wheat cultivar (Zippy) to a medium maturity cultivar (Wyalkatchem). We wanted to see whether, by avoiding late season drought, zippy might give more stable yields from year to year. The trial has run for three years. Here we present the water use efficiency results for three treatments in 2009 and 2010. We also present the cumulative gross margin for the three years so far.

Water use by the crop was estimated from the sum of the in-season rainfall and the change in soil water between sowing and harvest. By estimating the amount of soil evaporation as one third of in-season rainfall, we determined the amount of water used by the plant as transpiration. The ratio of crop yield to transpiration is the transpiration efficiency of the crop which has a potential of around 20-22 mm/kg/ha.

In 2009, the transpiration efficiency of Wyalkatchem was very good, being 16.7 kg/ha/mm in the low input treatment and 18.7 kg/ha/mm with high inputs. Zippy was unable to respond to rainfall later in the season. As a result, its transpiration was only 10.2. In the 2010 season, all the crops had low transpiration efficiency because of a poor rainfall distribution during the growing season.

The yield of Zippy was more stable than that of Wyalkatchem, but the earlier maturity resulted in a substantial yield penalty. Zippy yielded around 2 t/ha each year whereas Wyalkatchem responded more in better years. The yield penalty associated with the earlier maturing variety was not offset by the higher input level. Higher input actually increased the variability in annual gross margins.

So far Wyalkatchem has a substantially greater cumulative gross margin than Zippy and there is little difference between the high and low input strategies.

The experiment is planned to run for another two years. This will provide two full cycles of the rotation as well as allowing time for longer term trends to develop.

TRIAL DETAILS

Property	Gary and Debbie Collins, Morawa
Soil type	Red loamy sand with shallow gravel
Crop & Varieties	Wheat: Wyalkatchem and Zippy
Replicates:	Four, randomised complete blocks

Treatment strategies. Actual inputs used varied slightly between years.

TREATMENT	Zippy High input	Wyalkatchem High Input	Wyalkatchem Low Input
Seeding rate	80	80	50
Nitrogen	High	High	Low
Trace elements	Yes	Yes	No
Herbicide	Full	Full	Low cost

RESULTS

Crop water use and water use efficiency in 2009.

TREATMENT	Zippy High input	Wyalkatchem High Input	Wyalkatchem Low Input
Rainfall (mm)	224.4	224.4	224.4
Soil water depletion (mm)	34.7	56.2	55.5
Total water use (mm)	257.3	278.8	278.1
Yield (kg/ha)	1.9	4.0	3.5
Transpiration Efficiency (kg/ha/mm)	10.2	18.7	16.7

Crop water use and water use efficiency in 2010.

TREATMENT	Zippy High input	Wyalkatchem High Input	Wyalkatchem Low Input
Rainfall (mm)	141.2	141.2	141.2
Soil water depletion (mm)	62.6	44.7	48.1
Total water use (mm)	203.8	185.9	189.3
Yield (kg/ha)	2.0	1.8	1.7
Transpiration Efficiency (kg/ha/mm)	12.6	12.2	11.9

Cumulative gross margin 2008-2010 ($/ha).

Year	Sowing date	Rainfall (mm)	Zippy High input	Wyalkatchem High Input	Wyalkatchem Low Input
2008	31/05/2008	199	524.52	669.02	710.89
2009	31/05/2008	224	161.00	481.00	473.10
2010	14/06/2010	141	342.40	342.40	360.28
Cumulative GM			1027.92	1492.42	1544.27

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Dr Steve Milroy *Improving Crop Production and Quality* Sub Program Leader, CSIRO Perth

NB: OTHER INTERESTING WORK ON THE SHORT SEASON VARIETY "ZIPPY" AND LATE BREAKS

You may also be interested to follow up a trial conducted by Christine Zaicou-Kunesch of the Department of Agriculture and Food in Geraldton. In 2010 she conducted a trial on short season wheat at Mullewa Research Annexe, and also at Mingenew. A late break was simulated using tarps. Varieties included Zippy, Westonia, Wyalkatchem, Magenta, and Yagan Barley. This trial was reported under the heading :Varietal Options for a Late Break" in the Summer 2010-11 edition of "Ag in Focus", a publication of the Kondinin Group in partnership with DAFWA. See p12 at http://issuu.com/kondiningroup/docs/agif_summer_2010-11_lr