"Summer Crops and Residual Soil Moisture 2012 Results"

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Key Outcomes:

- Summer crops grown on high levels of stored soil moisture produced commercially viable yields
- Summer Fallow did not store significant amounts of water for the following crop
- Wheat yields following summer legumes were better than the summer fallow treatment and summer grasses

Trial Objectives: To determine the effect of different summer crops on plant available water for the following wheat crop

Trial Duration: 2011-2012

Location: Navan **Farmer Co-operators**: Pat & Mary Connell

Soil Type: Black Cracking Clay

Paddock History: 2010 Oats Hay
2011 (Winter) Chemical Fallow
2011/12 (Spring/Summer) – Summer Crops

Monthly Rainfall:

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
18	11	55	16	42.5	76.5	38	46.5	29	21.5	4.5	10

Yield Limiting Factors: Dry Spring

Type of Trial: Replicated small plot trial

Trial Design: Randomised Complete Block Design

Treatments:

Following a winter chemical fallow in 2011, 27 different summer crops (+1 fallow treatment) were sown in either mid October or November 1st depending on the soil temperature requirement. The varieties (where known) and species are shown below in **Table 1**. All plots received 100 kg/ha N as Sulphate of Ammonia after sowing to ensure that N was not

limiting. This was also to rule out legume nodulation as a factor determining yield, as it was difficult to source the required inoculant groups for all the legumes in the trial.

Table 1: Summer Crops included in 2011 Summer Crop Trial, MNHRZ

Tmt	Variety	Tmt	Variety
1	Chemical Fallow	**15**	Sunbird 7 Sunflower
2	Red Caloona Cowpea	**16**	Genesis 079 Chickpea
3	A6785 Soybean	**17**	Cowpea (Commercial)
4	Pidgeon Pea	**18**	Borlotti bean (Commercial)
5	Rongai Lab Lab	**19**	Sironaria Safflower
6	Highworth Lab Lab	**20**	White French Millet
7	Navybean (Commercial)	**21**	PAC2434 Grain Sorghum
8	Red Kidney Bean (Commercial)	**22**	Speed Feed 2 Forage Sorghum
9	Cannellini Bean (Commercial)	**23**	84G22 Grain Sorghum
10	Mungbean (Commercial)	**24**	36Y84 Corn
11	Borlotti Bean (Commercial)	**25**	38F70 Corn
12	Mungbean (Old seed)	**26**	Sprint Forage Sorghum
13	Genesis 090 Chickpea	**27**	BettaGraze Forage Sorghum
14	Genesis 114 Chickpea	**28**	Rocket BMR Forage Sorghum

All treatments that produced viable grain & forage yields were hand harvested in March 2012. Following harvest, all plots were desiccated with glyphosate to minimise further water use. Selected plots were tested for residual soil moisture to 1m prior to sowing in 2012.

In May 2012 Cobra wheat was sown over the summer crop plots at 200 seeds/m2 with 80 kg/ha of triple superphosphate. 100 kg N/ha was applied to the wheat during the season to ensure that nitrogen was not a yield limiting factor. All wheat plots were harvested and weighed for yield, with sub-samples taken for protein testing.

Results:

Table 2: Summer Crop Grain Yield, MNHRZ March 2012

2011 Crop	Yield (kg/ha)
PAC2434 Grain Sorghum	4904.6
84G22 Grain Sorghum	3534.0
Sunbird 7 Sunflower	3302.5
Genesis 079 Chickpea	2207.5
Genesis 090 Chickpea	2056.8
Cowpea	1628.7

Genesis 114 Chickpea	1586.5
Mungbean New seed	1259.4
Mungbean Oldb seed	936.1
LSD 0.05	***1263.5***

NB: Varieties not listed in this Table did not produce a commercially viable grain yield

Table 3: Total Summer Crop Dry Matter Production, MNRHZ March 2012

Crop	**Yield (kg/ha DM)**
Rocket BMR Forage Sorghum	10297.9
Sprint Forage Sorghum	9896.3
BettaGraze Forage Sorghum	9374.0
38F70 Corn	8887.1
84G22 Grain Sorghum	8818.9
Speed Feed 2 Forage Sorghum	8650.9
36Y84 Corn	7664.0
PAC2434 Grain Sorghum	7444.9
White French Millet	3551.2
A6785 Soybean	1443.6
Rongai Lab Lab	1047.2
Pigeon Pea	986.9
Highworth Lab Lab	829.4
LSD (0.05)	***3619.5***

Table 4: Pre-Sowing Plant Available Water (for Wheat) following selected summer crops, MNHRZ April 2012

Summer Crop	**Available Soil Water**
Grain Sorghum	- 85mm
Forage Sorghum	- 83mm
Sunflower	- 81mm
Corn	- 70mm
Safflower	- 70mm
Millet	- 70mm
Chickpea	- 65mm
Summer Legumes	- 65mm
Fallow	- 31mm

NB: PAW Results have been averaged for multiple varieties e.g. Forage Sorghum

Table 5: Wheat Yield (kg/ha) following summer crops, MNHRZ 2012

2011 Summer Crop	2012 Wheat Yield	2012 Wheat Protein (%)	2012 Wheat N Removal (kg N/ha
Genesis 090 Chickpea	6557.6	12.1	138.8
Cannellini Bean (McKenzie)	6494.0	11.8	134.0
Genesis 114 Chickpea	6449.8	11.6	131.3
Bartolli bean (McKenzie)	6378.9	11.4	128.0
Mungbean (Old Seed)	6348.8	11.3	125.8
Red Kidneybean (Omega)	6341.3	11.6	128.9
Cowpea (Omega)	6289.4	11.9	130.9
Mungbean (Omega)	6219.0	12.0	130.2
Genesis 079 Chickpea	6212.2	11.7	127.8
Chemical Fallow	5920.3	10.3	106.8
Highworth Lab Lab	5913.8	11.2	116.9
A6785 Soybean	5869.1	11.4	117.8
Red Caloona Cowpea	5852.9	12.4	125.9
Navybean (Omega)	5820.5	11.9	121.2
Bartolli Bean (Omega)	5792.8	12.3	124.4
Sunbird 7 Sunflower	5783.5	11.9	120.1
Pigeon Pea	5750.6	11.9	120.3
38F70 Corn	5469.2	11.4	108.3
Sironaria Safflower	5465.9	12.9	124.0
Rongai Lab Lab	5423.2	11.8	112.4
36Y84 Corn	5395.4	11.5	109.1
84G22 Grain Sorghum	5277.2	11.2	103.2
White French Millet	5214.0	12.3	111.6
PAC2434 Grain Sorghum	5021.8	11.1	98.1
Rocket BMR Forage Sorghum	4922.2	12.1	104.4
Speed Feed 2 Forage Sorghum	4769.4	11.5	95.6
Sprint Forage Sorghum	4754.0	11.9	98.2
BettaGraze Forage Sorghum	4525.4	12.0	95.4
LSD (0.05)	***900.38***	***NS***	***17.35***

Comments:

Summer crop grain (Table 2) and forage yields were exceptional considering in crop rainfall was less than 50mm. High levels of PAW at sowing and a soil type that enabled moisture to be stored to depth and then released back to the crop during the growing season were the reasons for this. Interestingly, a smaller summer crop trial was sown in the same paddock

on a red clay loam soil and the plots were not harvested due to very poor productivity and no grain production. Choosing a soil type with good potential rooting depth (i.e. lack of subsoil constraints to root growth) appears to be paramount when deciding to sow a summer crop.

Plant Available Water (PAW) levels following the various summer crop species varied greatly due to previous crop type (See **Table 4**). Summer grasses and sunflowers used more soil water compared to the other species tested in the trial. The real surprise treatment was the chemical fallow, which effectively did not grow a crop for 15 months, yet failed to store any water above the crop lower limit. This is most likely due to the extensive cracking experienced by this soil type over the summer months, causing evaporation to depth.

It may be better to opportunistically grow summer species on soils that store water but crack open during the summer months, as opposed to losing the water to evaporation as the soil cracks.

Wheat yield following summers crops in **Table 5** varied considerably, but do not completely correspond with PAW levels measured prior to sowing. Generally, the wheat yield following the summer legumes was highest, but not significantly different from the wheat following chemical fallow or sunflower plots. Wheat yield following the summer forage grasses was significantly worse than the summer fallow and many of the summer legume treatments. This result is supported by farmer observations of wheat yields following sorghum in broadacre situations. Unfortunately, the soil testing equipment was unable to test soil moisture below 1m, which may have been useful in this instance to extract significant differences in soil moisture between the treatments.

Conclusion and into the paddock

Summer cropping may be a commercially viable option on soil types that can store moisture to depth. Stored moisture may be a result of left over in season rainfall (e.g. following beans, peas, oats hay etc) or significant late spring/summer rainfall events. The benefit of growing summer crops on soils that crack during summer is that the moisture can be utilised to grow a crop as opposed to letting it evaporate. Even on soils that do not crack and evaporate significant moisture over summer, residual soil moisture may be utilised with an opportunistic summer crop providing 1) the soil type is suited and 2) the yield reduction of the following wheat crop is part of the decision making process. In this trial, wheat yield was reduced by approximately 33% by growing a sorghum summer crop.

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