Impact of summer cropping on subsequent wheat crops

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Key points

- Adequate crop nutrition following summer crops is essential for optimised winter grain yield.
- Soil moisture was not limiting this season; therefore wheat yield responses were driven by crop nutrition.

Location: Pine Lodge, East Shepparton, VIC

Rainfall:
Annual: 863mm
GSR: 583mm

Soil:
Type: Sandy clay loam — clay loam
pH (H_20): 4.9–6.8 (0–20cm)

Paddock history:
2009–10 — summer cropping trial
2008 — wheat
2007 — canola

Plot size: 27m^2

Replicates: 9

Aims

To investigate the impacts of summer cropping on subsequent winter crop (wheat) yield.

To determine nitrogen (N) response of wheat following summer crops.

Method

Five summer crops (millet, lablab, mung beans, sunflower and safflower) were planted in 1.2ha plots during the 2009–10 summer and compared against a chemical fallow for soil moisture. These summer crop blocks were replicated three times.

During 2010 a wheat crop was sown across the entire trial area (see Table 1).

Six fertiliser treatments were applied parallel to the previous year's summer cropping treatments at two different growth stages — first node development (GS31) and flag leaf emergence (GS39–49) (see Table 2 and Figure 1).

Emergence counts, tiller counts, ear numbers, biomass measurements were carried out at first node development (GS31) and flowering (GS65).

Soil tests, including deep nitrogen testing (DSN) were carried out in the different summer crop blocks before sowing and will be carried out after harvest.

Soil moisture sensors recorded soil moisture, temperature and electrical conductivity (EC).

TABLE 1 Sowing details of 2010 wheat crop at Pine Lodge

Sowing date	19 May 2010
Variety	Lincoln
Sowing rate	52kg/ha
Fertiliser at sowing	80kg/ha MESZ

TABLE 2 Fertiliser treatments applied to wheat crop at Pine Lodge

Nitrogen treatment	Fertiliser rate applied at GS31 (kg/ha)	Fertiliser rate applied at GS39–49 (kg/ha)
1	0	0
2	40	0
3	80	0
4	120	0
5	40	40
6	60	60

FIGURE 1 Trial layout

Results to date

2009–10 summer crop

Summer crops generally performed well, however millet was the most successful crop producing a substantial grain yield and biomass (see Table 3). This indicates its potential as a summer grain and fodder crop.

Wheat crop performance before first nitrogen application

Wheat seedling emergence in plots previously under safflower, mung beans and fallow was higher than the other plots. The target population was 150 plants/m^2, so lablab and sunflowers were the only two plots significantly below target population.

Growth assessment data indicated that millet impacted negatively on wheat growth. For example, tiller counts taken 82 days after sowing (DAS) were significantly lower in plots previously under millet (see Table 4).

Given the growing season's cool and wet conditions, this negative effect could not be attributed to reduced soil moisture storage after millet. Subsequent observations indicated soil nitrogen levels in plots previously under millet and lablab were markedly lower than the other plots (see Figure 2).

The millet block showed visible signs of nitrogen deficiency, indicating that millet might have depleted more soil nitrogen than other summer crops. This highlights the importance of understanding the impacts of summer cropping on nitrogen availability in addition to the impacts of soil, water and soil-water interactions.

Wheat yield

Unfortunately the wheat crop could not be harvested due to rainfall-induced lodging and significant sprouting. The effect of nitrogen levels on grain yield was not evaluated as final yield results were not available.

However, the number of ears per square metre, recorded on 8 November 2010 at milk development (GS75), was used to estimate potential yield. The results indicate that both nitrogen and summer crop type significantly affected potential yields (see Figure 3).

TABLE 3 Harvested grain and dry matter yield for summer crops at Pine Lodge 2009–10

Summer crop	Grain yield (t/ha)	Dry matter yield (t/ha)	Notes
Lablab	n/a	6.34	Quadrat samples cut on 31 March 2010
Mung beans	0.51		Harvested on 17 April 2010
Millet	2.35	9.66	Grain harvested 17 April 2010; dry matter cut 31 March 2010
Safflower	0.51		Harvested 2 March 2010
Sunflower	0.17		Harvested 20 April 2010 — significant seed loss due to late-season bird damage and harvest losses as sunflower trays not used on header

TABLE 4 Rates of seedling emergence (61 DAS) and tillering (82 DAS) of wheat under various cropping treatments at Pine Lodge 2010

Previous summer crop	Emergence (plants/m^2)	Tillers/m^2	Difference in tiller numbers compared with fallow (%)
Fallow	151	431	n/a
Lablab	137	441	2
French millet	145	384	-11
Mung beans	150	511	19
Safflower	158	484	12
Sunflower	131	511	19

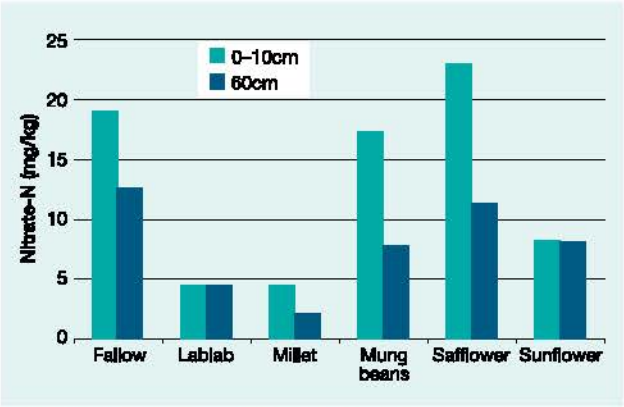

FIGURE 2 Soil nitrogen levels before wheat crop was sown at Pine Lodge 2010

Observations and comments

Summer cropping has the potential to spread risk by increasing the number of crops within the rotation. The reduction in wheat yield following a millet crop, and the differential response of wheat to different nitrogen applications, shows the importance of adequate winter crop nutrition following summer crop production.

Unfortunately record rainfall during 2009–11 meant this project was unable to determine whether summer cropping impedes wheat growth as a result of depleting soil moisture reserves.

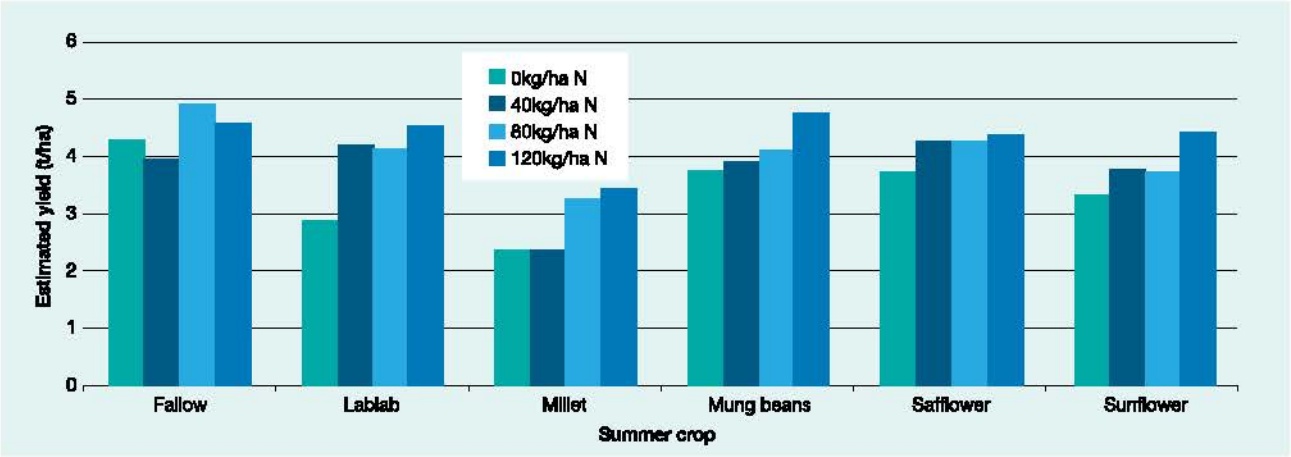

FIGURE 3 Estimated wheat yield as affected by previous summer crop and nitrogen levels at Pine Lodge 2010

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