Polymers

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Aim

To demonstrate if summer crops and wheat can be grown successfully when sown in winter and covered in biodegradable polymer films.

Take home messages

- *Biodegradable polymer films retain soil moisture and increase soil temperature*
- *Polymers allow crops to be grown out of season and expand the planting window*
- *Sorghum and millet successfully germinated under the film failed to germinate in the absence of the film.*

Method

Three strips of six different crops were sown at Curyo (Table 1). Each strip was 2.4m wide by 28m long. Two of the strips for each crop were covered with biodegradable thin films (polymers), one with polymer 484 (clear) and the other with polymer 485 (white). The polymer was applied immediately after sowing using a specially designed layer. Both polymers have different degradability characteristics and are designed to degrade in-crop after establishment.

Table 1. List of treatments and sowing rates used in this demonstration.

Crop	Variety	Sowing rate kg/ha	Polymer
Wheat	Young	67	Control
Wheat	Young	67	Polymer 484
Wheat	Young	67	Polymer 485
Sunflower	Sunbird7	5	Control
Sunflower	Sunbird7	5	Polymer 484
Sunflower	SunBird7	5	Polymer 485
Mungbean	White French	20	Control
Mungbean	White French	20	Polymer 484
Mungbean	White French	20	Polymer 485
Cowpea	Red Caloona	15	Control
Cowpea	Red Caloona	15	Polymer 484
Sorghum	n/a	5	Control
Sorghum	n/a	5	Polymer 484
Millet	Crystal	10	Control
Millet	Crystal	10	Polymer 484

Location: Curyo

Replicates: 1 (Demonstration)

Sowing date: 26 June

Crop type: Wheat, sorghum, sunflower, cowpea, millet, mungbean

Seeding equipment: Smale bar, no-till (narrow points, presswheels, 30cm row spacing), Trimble Auto-Pilot RTK (2cm) guidance

Random slits (up to 10cm long) were cut in the film using a sharp knife on the wheat plots only. This was designed to speed the breakdown process when the wheat plants growing under the film looked stressed.

On the 22 January 2009, total biomass was measured for sorghum, millet and sunflower (including grain). Sorghum and millet biomass production was determined by cutting a 1m row of crop at ground level and oven drying at 60°C. Three individual cuts were taken and weighed separately in each plot to get a representative value for the each treatment. The sunflower plants were relatively sparse within the plots and cuts were made using a quadrat. The sunflower biomass was taken at maturity and included the weight of the grain. The sunflower heads were hand-threshed to ascertain grain yield.

Results

Polymer 485 degraded faster than polymer 484. A trial inspection on 10 August found that polymer 485 was totally degraded.

Polymer 484 withstood the wind events during the winter months until the 12 September, when wind speed exceeded 40km/hr for three days. On 23 August 2008, the wheat plot covered with polymer 484 was showing signs of stress and the film was slit accordingly.

Crop vigour was visually better at early growth stages under both films than crop grown in control conditions.

Wheat was harvested on 28 November. Yields were recorded but as this was only a demonstration, it cannot be said if there were significant differences between treatments (Table 2).

Table 2. Wheat yields at Curyo.

Crop	Treatment	Yield t/ha
Wheat	Control	1.10
Wheat	Polymer 484	1.10
Wheat	Polymer 485	0.70

Of the summer-growing crops, sunflower germinated in all plots but visually was better under the films (Figure 2). Millet and sorghum also germinated but only under the polymer 484 (clear). Mungbean and cowpea plants did not germinate.

Figure 1. Laying the polymers at sowing.

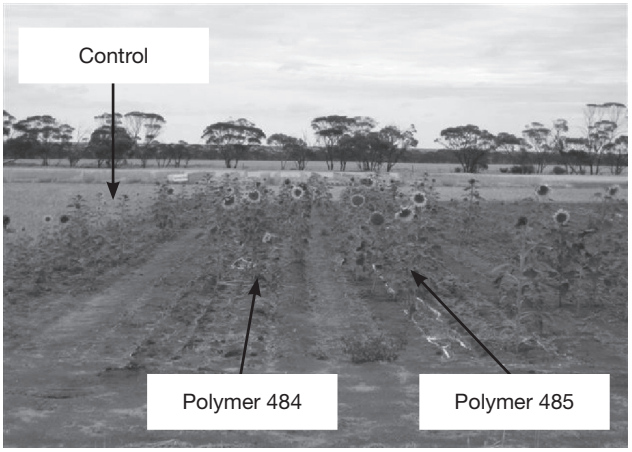

Figure 2. Sunflower plots 168 days after sowing.

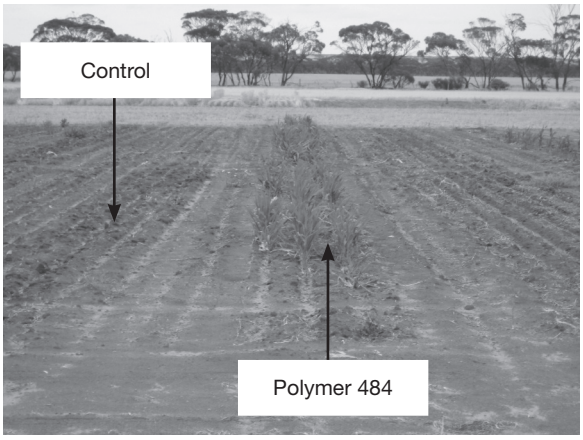

Figure 3. Millet under polymer 484.

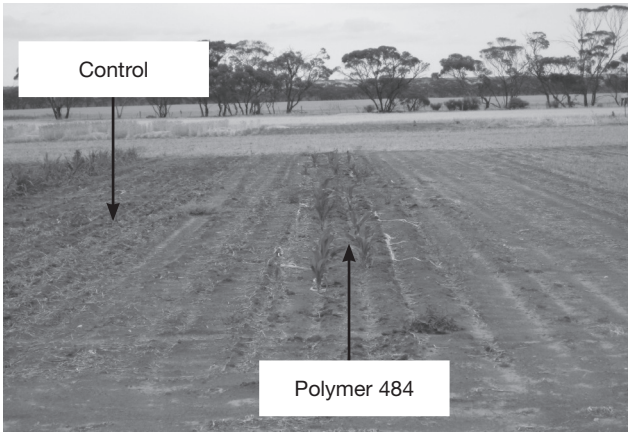

Figure 4. Sorghum under polymer 484.

Biomass production for sunflower increased when either polymer film was applied. Sunflower, millet and sorghum all germinated better under the film than without. In the case of sorghum and millet, there was no germination in the absence of the film.

In terms of grain yield, the addition of film increased sunflower yield, with sunflower under both polymers yielding similarly (Table 3). Yield data for the millet and sorghum could not be obtained at the time of writing this article. It is important to keep in mind that this is a demonstration only and yield results are not taken from replicated trial work.

Table3. Biomass production and grain yield of sunflower, millet and sorghum.

Crop	Biomass t/ha	Grain yield t/ha
Sunflower (control)	2.89	0.31
Sunflower (polymer 484)	5.05	0.89
Sunflower (polymer 485)	5.77	1.07
Millet (control)	0	n/a
Millet (polymer 484)	3.7	n/a
Sorghum (control)	0	n/a
Sorghum (polymer 484)	2.1	n/a

Interpretation

With no replication, it is difficult to conclude that the results found in this demonstration would be consistent in other years. Visual differences in early wheat growth did not translate into an increase in grain yield, which is consistent with previous BCG work.

Germination and biomass production of sunflower, millet and sorghum was increased under the polymers. Emergence of mungbean and cowpea was not improved as a result of the film.

Application

Given the cost of the films is likely to be around $200/ha, advances in technology such as this really need to justify the expenditure (at least 1t/ha yield increase for wheat). Small increases in grain yield have occurred under film in previous BCG trials but the increases have not justified the cost, at least for wheat.

This demonstration proved that there is a possibility that summer-growing crops such as sunflower, millet and sorghum may be productive in the Mallee, even when sown in winter (June). This research needs to be investigated more closely in a replicated trial to conclude that results found in this trial will be consistent in future years.

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