PROJECT SUMMARY

RURAL INDUSTRIES
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Agronomic evaluation of teff in Tasmania

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Background

Teff (*Eragrostis tef*) is a self-pollinated C4 grass and is grown as an annual warm season cereal crop. It has been cultivated for thousands of years, and continues to play a significant role in the traditional diets of some African countries, particularly Ethiopia and Eritrea.[1, 2]

The positive nutritional attributes of teff grains encourages nutritionists to classify it as a 'whole food' because of its protein content; it is an excellent source of essential amino acids, particularly lysine, which is often deficient in grain foods. Its nutritional composition is reported as 11% protein, 80% complex carbohydrates and 2–3% crude fat.[3]

Although teff is a minor cereal crop worldwide, its beneficial effect on human health cannot be underestimated due to the fact that it is naturally gluten-free.[4] This makes it a viable alternative to wheat, rye and barley for people who are suffering from celiac disease due to gluten intolerance.[5]

There is evidence that teff can grow under diverse agro-ecological conditions.[6] Temperature has a significant effect on growth and development of the crop, and a temperature range from 15 °C to 25 °C with an average of 120 frost-free days is suggested as optimum in teff production regions.[7]

The growing situation found in south-east Tasmania would seem to offer ideal conditions, under irrigation for teff production.[8] It is expected that due to climate change, rainfall is likely to decrease over the next 20–50 years throughout south-east Australia and this will result in even more favourable conditions for teff in Tasmania.[9]

Research

An initial trial looked at two varieties of teff (white, brown), under two sowing rates (3 kg/ha, 6 kg/ha) and three times of sowing (early, mid and late November) with four replications to determine the suitability of these varieties for Tasmania. The trial was conducted near Brighton in southern Tasmania as this area showed a low incidence of frost from October to April.

Unfortunately, only one of four replicates was able to be watered. By visual inspection, the main limitation of the crop was late ripening and hence late harvesting (late April/early May). The 6 kg/ha sowing rate was better than the 3 kg/ha rate and there was very little difference in maturity between teff varieties.

Using this information, a second trial was conducted at the University of Tasmania Farm near Richmond which is in a similar area, with low chance of frost. Four replicates of white teff were sown at a rate of 6 kg/ha at five different sowing times (Table 1).

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As the main limitation was late harvesting, it was decided to try earlier sowing to see if this would result in earlier harvesting.

All trial sites were sown with a Kimseed Cone Seeder with plots 1.6 m x 10 m. Fertiliser (150 kg/ha, 9–14–17, NPK was applied at sowing by broadcasting. All plots were sprayed with 1.5 L/ha MCPA 750 and 300 mL/ha Dicamba 200 herbicides. The area was watered as and when required.

The first three sowings (T1, T2, T3) were cut and windrowed with a sickle mower when the majority of seeds had turned from green to brown and left for 19 days before pick up and the entire crop (including straw) still had to be dried. The last two sowings (T4, T5) were left 31 days in May/June and also needed drying.

Outcomes

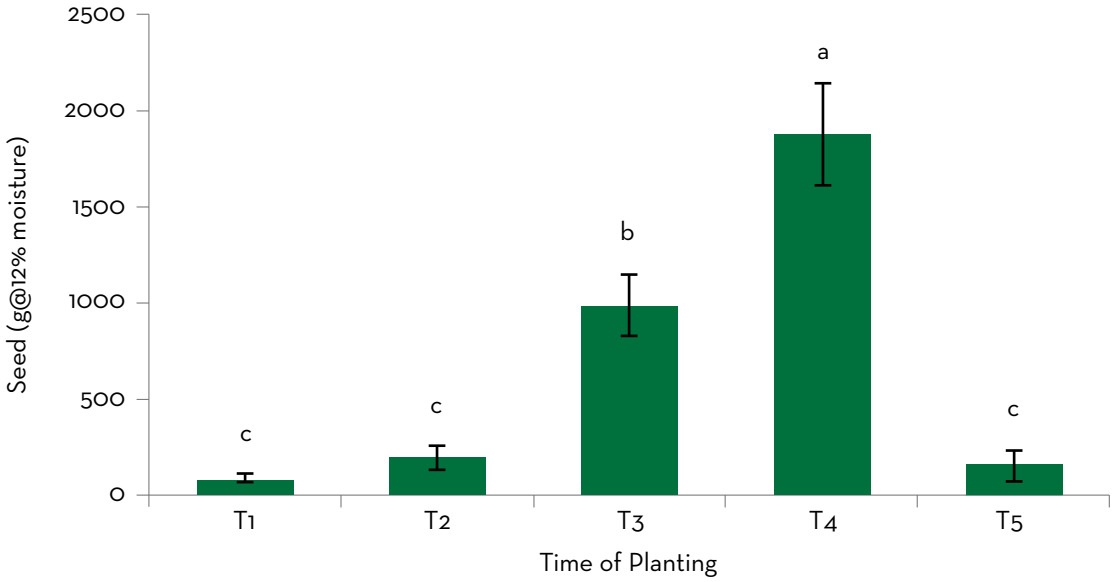
From the data (Table 1 and Figure 1) it is clear that the optimum time of sowing is mid-late November with severe penalties in terms of yield for planting in October or December. The highest yield was from the 22 November (T4) sowing, corresponding to an average 1.7 T/ha seed yield and 11.3 T/ha straw yield. This would potentially make the crop commercially viable.

The limitation, however, is whether the crop could be harvested in late April/May in the Tasmanian environment. Although the area is relatively dry, at this time of year it is cool with heavy dews and, hence, would be highly risky to harvest commercially. Even if the seed could be dried it would be difficult to put through a header.

Table 1 Summary of conditions and results of five different teff plots, showing dates for sowing and harvesting, and means and standard error (SE) for seed and straw

Plot	Sowing date	Crop cut/ windrow date	Crop pick up date	Mean seed (g@12% moisture/ plot)	Seed SE	Mean straw (kg dry matter/plot)	Straw SE
T1	12 Oct	20 Apr	9 May	86	16.0	5	0.2
T2	25 Oct	20 Apr	9 May	191	52.4	6	0.4
T3	11 Nov	20 Apr	9 May	976	155.1	11	0.9
T4	22 Nov	9 May	9 June	1869	264.4	19	0.4
T5	7 Dec	9 May	9 June	151	81.2	4	1.1

Programs used: IBM SPSS 22 and Microsoft Office Excel 2007



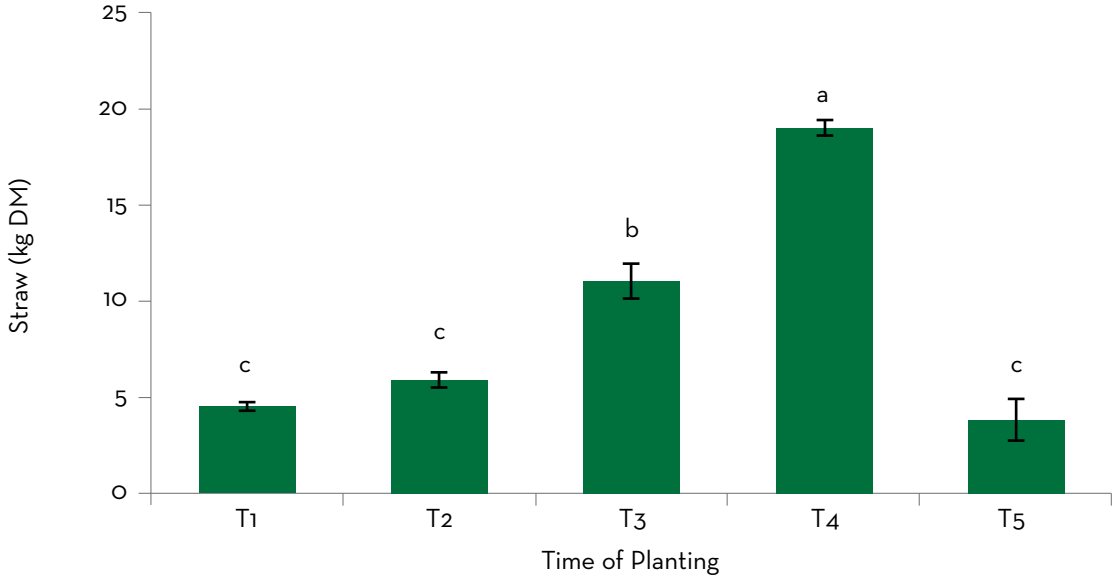


Figure 1 Comparison of means from five different times of planting and their effect on seed and straw yield with standard error represented in the error bars. The mean seed and straw yield of plots T1, T2, and T5 are not significantly different from each other; the mean seed and straw yield of plot T3 is significantly different to all other plots; and the plot T4 is significantly different to all other plots. The plot T4 statistically has the highest mean seed and straw yield.

Implications

With the current genetic material, harvesting the crop appears to be the main limitation to growing teff in Tasmania as windrowing the crop would be highly risky. Direct harvesting could be an option, however, this would need to occur in May when the seeds would be fully ripe. Desiccation in late April could be an option, however, under the trial conditions the crop did lodge quite severely and hence would still be difficult to harvest. *(continues overleaf)*

(from previous)

As harvesting appears to be the only real impediment to commercially growing teff in Tasmania, finding earlier flowering and maturing genetic material would be the most likely way to overcome the problems with harvesting. Over the last five years, Tasglobal has assembled a collection of 35 accessions of *Eragrostis tef*. Ongoing evaluation has concentrated on identifying material that is both early flowering and high yielding and two accessions (one from the USA and one from South Africa) seem to offer further possibilities for selection. Tasglobal is also conducting a breeding program with the aim of developing a cultivar that is well adapted to the Tasmanian climate.

In the course of our studies (using the CSIRO Climex program) it is worth noting that two other regional sites would also seem well suited to teff production, namely Tamworth in northern New South Wales and Killarney in southern Queensland.

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For more information

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