Summary

This project is the culmination of two previous projects focusing on the feasibility of breeding common millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*).

Advanced F5 lines of panicum of satisfactory yield have been yield tested and breeding investigations carried out on flowering time, height, drought resistance (osmoregulating capacity), spike size, shattering, etc.

Problems have been encountered in the creation of new segregating populations of millet. Seven F1 seeds were produced but these all died as seedlings at the three leaf stage.

The commercial White French millet variety has been reselected and supplied to the industry.

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Conclusions
Recent market investigations have indicated that the trend in production of millet in many countries appears to be downwards. There are possible uses for the grain in human nutrition and for purposes other than birdseed.

However, it would appear that millet will continue to only be opportunity crops in Australia.

From the investigations carried out, it has been concluded that the primary concerns expressed by primary producers relating to poor seedling establishment in millet do occur but this is not related to yielding ability, as long as weeds are controlled.

Outcomes
This project sought to use the findings and resources of two previous projects to establish a millet breeding program (Project UQ61 examined future market demand for millet and panicum products and Project UQ102 identified appropriate breeding objectives).

All millet seed distributed by Queensland Agricultural Merchants Inc. has been improved selections from this breeding program.

Advanced lines of millet showing promise have also been generated by this program.

The breeding objectives for millet breeding for Australia have also been established and demonstrated to be useful.

Two major problems were encountered with the current project.

Segregating populations of foxtail millet had been previously generated from initial crosses and were advanced to the F5 generation in this project, despite the difficult drought conditions prevailing, especially in 2002-3.

However, the seven F1 plants generated from several thousands of attempted crosses in common millet died as seedlings. The difficulties achieving hybrids and the death of the millet seedlings suggest that the lines selected as parents may differ in chromosome number (there is variation in chromosome number among the Panicum spp.).

Effort was therefore focused on a further screening of the reselected millet (P. miliaceum var. White French) on behalf of the millet industry.

The F5 regional field trial was lost prior to harvest in 2002-3, due to the difficult conditions. As a result of this, a replicated yield trial of 242 of the best advanced F5 selections from all foxtail millet crosses was established in the 2003-4 season at Irvingdale. At harvest, two of the 242 advanced lines were significantly higher yielding than the highest control, 040 SS, and all but nine of the other lines were yielding at the level of the control, 040 SS. This control had been withdrawn from release
due to variation in its seed supply.

A report describing all the experience gained from the three successive millet projects has been prepared.

**Achievements/Benefits**

Common millet and foxtail millet are viewed as opportunity crops by those who grow them. These crops have very low variable costs and, especially in the case of the former crop, a relatively short growing season.

The grain harvested can also be readily stored for years, awaiting a good price. This has become evident from the constant trade in millet over the past four years, even though the severe 2002-3 drought curtailed their plantings severely. Despite this, Australia’s production of all millets is currently quoted by the Food and Agriculture Organization of the UN (FAO) as the highest it has been for at least the past 40 years.

Estimates of the worldwide production of millet over the past 45 years indicate that production has fallen but average yields have risen. Analysis of the performances of individual countries has revealed that the USA, Hungary, Myanmar, Bangladesh and possibly Bulgaria or the Czech Republic have been improving in terms of average yield but all other countries seem to be reducing both the areas planted and the quantity harvested.

Less than 2% of the international production of all millets actually enters international trade. Australia, Argentina and Hungary export a large proportion of their millet production. Several European countries, especially the Netherlands, are also large exporters of millet but are not millet producers themselves.

The term millet, when used internationally, refers to several other small grain cereals as well as *P. miliaceum* and *S. italica*. The term often refers to pearl millet which is the predominant and usually the only millet grown throughout Africa. The biggest producers of millet appear to be the USSR (and its separate states since 1991) and China (in terms of *P. miliaceum*) and possibly Argentina (especially in terms of the latter crop).

Hence, this project has sought to use the resources and the information available to establish a millet and panicum breeding program.

The principal problems identified by the Australian millet industry a decade ago when these millet projects commenced were poor seedling emergence, especially among the *S. italica* varieties and poor grain quality in the current *P. miliaceum* variety.

Field trials over six seasons in the millet growing areas of south-east Queensland demonstrated very poor seedling establishment among the birdseed millet varieties currently grown in Australia but there was a wider range of seedling establishment available within a large collection of imported lines. However, there was no evidence in any yield trials of a relationship between seedling establishment and subsequent yield. Yields from both species of millet were able to compensate for differing plant populations.

The quality problem with the commercial variety of *P. miliaceum*, var. White French, has been reduced significantly through reselection of the original line and comparative testing involving several hundred original lines. All seed of White French millet sold by the Queensland Agricultural Merchants Inc. since the release of the first reselection of White French has been sourced originally from this project. A more recent reselection has also been carried out and supplied to the merchants.

Likely objectives for a breeding program to improve *P. miliaceum* in south-east QLD would include grain yield, grain quality, an absence of lodging, an optimum 50% flowering time of approximately 41 days after sowing and resistance to *Acidovorax avenae* subsp. *avenae*.

Objectives for *S. italica* would include grain yield, grain quality, thick stems, longer flag leaves, an absence of lodging and shattering and an optimum 50% flowering time of approximately 49 days after sowing.

Advanced lines of *S. italica* to the F5 generation have been selected and these have achieved the yield levels of the highest yielding controls.

Gross margin analyses have shown that millet at the current yield and price levels do not have an economic advantage over...
their competitor crops.

A report describing the experience gained with millet in south-east QLD has been prepared.

**Intellectual property summary**

All seed of the released variety of White French millet has been supplied to the millet industry through the Queensland Agricultural Merchants Inc.

**Additional information**