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EARLY SOWING of CEREAL CROPS in LOW RAINFALL AREAS

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One of the objectives of the Department of Agriculture's crop research in the low rainfall, northern wheatbelt is to develop crop varieties and management practices that will make best use of stored water on both sandplain and fine textured soils. Sowing a crop early will improve its water use efficiency and yield in low rainfall areas.

Low rainfall areas

A short growing season, as well as low average annual rainfall (less than 325 mm), characterize Western Australia's low rainfall cropping zone. During spring, crop growth is squeezed between both rapidly declining rainfall and rising evaporative demand.

The critical importance of evaporative demand in September in northern low rainfall areas is illustrated by comparing Mullewa with Moora. At Mullewa (low September rainfall, high evaporative demand and low water use efficiency) crop yield potential from September rain is relatively low. At Moora, 250 km south of Mullewa, with more favourable spring growing conditions, the potential yield from September rain is about three times that of Mullewa.

Early sowing is not a new concept, and many farmers will remember sowing varieties such as Bencubbin as early as April. However, there have been significant changes in the types of weeds (grass weeds are now a particular problem), soil conditions and tillage practices, crop varieties, fertilizer inputs, and farm economics. Cropping methods must be carefully managed to exploit every growing season whilst minimizing the risks of crop failure caused by a 'false break', weeds, frost or leaf disease.

Advantages of sowing early

Sowing cereal crops early has the following advantages:

- Warmer May soil temperatures hasten seedling emergence, early growth and expansion of leaf area.
- Rapid expansion of leaf area reduces wasteful water evaporation directly from the soil surface.
- Strong early growth means that the crop will produce more growth from June to August when it is most efficient in terms of water use.
- The crop will flower early, and its yield potential will be realized because adequate soil moisture usually remains to ensure grain filling.

We have been applying these principles to the following general cropping situations.

Sandplain soils

Sandplain soils have a low water holding capacity of about 40 to 70 mm per one metre depth. They may lose water from deep drainage during peak winter rainfall, and yet store insufficient moisture in the rooting zone (0 to 2 m deep) to support grain filling in spring.

Solution: Sow a vigorous crop such as barley early to use the stored soil moisture. This will reduce drainage and leaching of nitrogen, and when combined with early maturity, will avoid the problem of inadequate soil moisture.

Heavy soils

Heavy soils are fertile and promote strong vegetative growth, however, they may be prone to excessive evaporation. Their shallow depth of stored moisture increases the risk of the crop haying off.
Figure 1. Effect of sowing date on yield of barley and wheat varieties sown at East Chapman in 1986. In Figures 1 to 3, trial data indicate barley is more profitable than wheat at these sites despite the lower barley price. More widespread data do not always support this result. Yagan and Stirling barleys, Gutha, Millewa and Aroona wheats.

Solution: Sow the crop early to get rapid canopy cover and so minimize soil water evaporation. The crop will mature early and so not be stressed by a lack of stored soil moisture and rising evaporative demand. In addition, in the long term, improved soil structure from direct drilling will reduce evaporation (see “Tillage systems and soil stability” J. Agric. West. Aust. 29).

Time of sowing trials

In low rainfall areas both wheat and barley yields decline with delayed sowing; the difficulty lies in determining the ‘critical date’ before which there may be no reduction in yield, and the rate of decline (kg/ha/week) for every week sowing is delayed.

Barley does not suffer significant leaf disease after flowering in low rainfall areas and early sowing increases its yield. Results show that in all but the best seasons, yield declines from early May, at a rate of between 100 and 400 kg/ha/week, average about 200 kg/ha/week. Figures 1, 2 and 3 show this decline in yield for Stirling (late maturing) and Yagan (early maturing) barley sown at East Chapman in 1986 (good season), East Binnu in 1987 (dry season) and North Mullewa in 1988 (good season). The yield of Stirling was less than that of Yagan and may fall dramatically when sown in late June (Figure 3).

For wheat the link between time of sowing and yield is less clear. This may be due to differences in variety resistance to either Septoria or yellow spot or to the greater responsiveness of wheat development to seasonal temperatures (see “FLOWER: predicting flowering times of cereal crops” on page 35 of this Journal).

Figures 1 to 3 show that sowing wheat very late (for example after June 15) results in a yield loss in all years compared with early seeding, but the response to sowing from early May to mid June (the common practice) depends on the season. In most seasons, yields decline from an early critical date (for example, May 20) (Figure 1 and 2), but in some above average seasons, there may be no yield penalty from delaying sowing till about June 10 (Figure 3). At the North Mullewa site, a linear decline in yield would normally be expected, but in 1988, a favourable season, some varieties had higher yields from an early June sowing. Yield loss may vary from 30 to 200 kg/ha/week; in the northern wheatbelt, values tend to be above 100 kg/ha/week, but are usually below 100 kg/ha/week for the central wheatbelt.

Unfortunately, farmers can manage their cropping programme to account for the variable environment. Sowing early will not be possible every year because the season may not break until June. In such years, the crop should be sown as early as is practicable. In low rainfall areas, it is wise to sow as early as the seasonal break permits. Management must be flexible enough to allow an appropriate variety to be sown from early May onwards.
Some further gains may be made from changing crop establishment methods: from minimum tillage to direct drilling, using the ‘cultivation depth modified’ seeding techniques developed by Ron Jarvis (Jarvis, 1989). With this technique, the direct drilling seeder cultivates the soil deeper than seeding depth. In a trial at Wongan Hills Research Station, wheat yield increased by 80 kg/ha for each centimetre of depth of cultivation below the seed.

**Choice of variety**

The growth pattern of a wheat variety, its resistance to leaf diseases, its adaptation to soil type, and grain quality are all used to select the appropriate variety for a particular season.

Varieties differ markedly in both the time to flowering, and the responsiveness of development to temperature. A poor choice would be to sow an early maturing, temperature-responsive variety such as Bodallin or Gutha in early May in the northern wheatbelt (warm soils). The crop would develop rapidly, and flower early, in late July, without producing enough dry matter to ensure adequate yield potential. If leaf diseases were prevalent, the yield would be low.

Choosing a wheat variety is a case of ‘horses for courses’. When the flowering window is known, the most appropriate/suitable variety for any sowing date can be chosen. Although yield potential is not solely determined by development pattern, using the correct maturity is an effective way of minimizing risk and maximizing yield.

Growers should retain seed of more than one variety so that alternative varieties can be planted for various sowing dates. In low rainfall areas, they should keep enough seed of two varieties for each soil type; seed of three varieties may be useful in higher yielding environments.

Example: If two varieties are chosen for each soil type, farmers should store enough seed to sow 75 per cent of the cropping programme to each variety. This means that 150 per cent of normal seed requirements will need to be stored, at a cost of $2/ha. An increase in yield of less than 2 per cent from better variety management will cover this cost; long-term yield improvements of about 10 per cent should be reasonably expected.

**Conclusions**

For successful early sowing, water stress during grain filling must be reduced without substantially increasing the risk of crop failure because of other causes. It is an exercise in careful risk management of balancing water deficit against weeds, leaf disease and frost.

In the low rainfall wheatbelt, the dominant risk is that of water stress during grain filling because of inadequate rainfall and rapidly rising evaporative demand. The effects of a dry finish to the season can be minimized by sowing earlier, however, cereal crops should not be sown early unless all the risks have been carefully assessed and managed. Provided good management practices are used in both the previous season and current cropping year, and the appropriate variety is chosen, many cereal crops can be sown earlier than current practice to improve both average yield and its stability from season to season.

**Further reading**
