SUMMER FALLOWS AND THEIR MANAGEMENT FOR IMPROVED WINTER CROP PRODUCTION

SUMMARY OF 2007/08 RESULTS

Colin McMaster, NSW DPI Farming Systems Agronomist, Parkes Ph 02 6816 3300
Ken Motley, NSW DPI District Agronomist, Forbes Ph 02 6850 2926
Matt McRae, Walkers AgNVet, Field Marketing Agronomist Forbes Ph 02 6852 1333

Key points

- *The summer fallow period of 2007/08 was wetter than average and provided the opportunity to store summer fallow moisture for winter crops.*
- *The efficiency that summer fallow rainfall was stored for the following winter crop was measured at nine sites in the Parkes and Forbes district during the 2007/08 summer fallow period.*
- *Summer fallow efficiencies at these sites were generally found to be within the range of 20% to 30%. A few sites fell outside this range, with the lowest fallow efficiency being 14% and the highest result being 34%.*
- *The wetter than average conditions resulted in a significant proportion of the soil plant available water being stored deeper in the soil profile than might otherwise occur in summers characterised by low and less frequent rainfall. In such years it is thought that fallow efficiencies may be below that recorded in the 2007/08 summer fallow period.*
- *The effects of summer grasses and broadleaf weeds on soil plant available water were studied at 2 other local sites. Summer grasses and broadleaf weeds were found to use significant quantities of soil moisture (56 and 77mm of plant available soil water) and soil N that could otherwise be used for winter crops.*

Background

Improved fallow management is thought to be a potential area for improved winter crop performance. However, the recent rise in fallow maintenance costs due to the increased cost of fallow herbicides such as Glyphosate has placed increased scrutiny on the benefits of summer fallow maintenance for winter crops. In an effort to help provide objective information for farmers and agronomists the efficiency of summer rainfall storage for winter crops and the effect of management strategies on fallow efficiency were investigated in the summer of 2007/08. Detailed results of these studies have been published for those seeking further information or clarification. This paper provides a summary of those detailed results.

Fallow efficiency results

The plant available water (PAW) status of nine sites was monitored and measured over the 2007/08 fallow period. PAW at the beginning of May 2008 varied from 41mm to 110mm. The 2007/08 fallow period at most sites was generally wetter than the long term average across central west NSW. In these conditions the calculated fallow efficiencies generally fell within the accepted theoretical range used in water use efficiency (WUE) calculations of 20% to 30%. Some sites had high fallow efficiency (top result of 34%), while other sites were found to have a low fallow

efficiency (bottom result of 14%). One potential source of error in these results is that the on farm rainfall gauges used to calculate these fallow efficiencies were located at nearby houses and not right beside the soil testing site.

The wet summer conditions of the 2007/08 fallow period resulted in a significant proportion of the total PAW being pushed down into the sub soil. This effect was particularly evident on the soils with sandy top soils. However, even on the soils that had a heavy clay top soil, PAW was still found in the sub soil. It is postulated that the good rainfall conditions over the summer fallow of 2007/08 resulted in a greater proportion of PAW being moved down and stored in the sub soil, and that this helped to produce higher fallow efficiency figures than what might otherwise occur in drier summer fallows.

The highest fallow efficiency of 35% is thought to be due to that sites unique soil type that consists of a very sandy top soil over a clay sub soil. The sandy top soil is likely to have allowed good infiltration into the sub soil where the moisture is less susceptible to evaporation, while the clay sub soil provides good water holding capacity.

These results do not answer the important question of how management practices can improve fallow efficiency. To answer this important question, management comparisons need to be done on common sites where differences in soil type and rainfall are eliminated. Maintaining ground cover, minimising top soil compaction and controlling summer weeds are thought to be the key management issues that can improve fallow efficiency.

The fallow management results detailed below were done on common sites and highlight the potential impact of summer grasses and broadleaf weeds on PAW and nutrients for the following winter crops

Fallow Management results.
The effect of fallow management on PAW for winter crops was investigated over the 2007/08 summer fallow period. A pasture cropping situation was compared to a traditional spray fallow at Wirrinya and the effects of missing one summer fallow herbicide application in a summer fallow were investigated at Waroo.

The results from these two fallow management comparisons show that fallow management can have significant impact on the level of stored soil moisture for winter crops. Pasture cropping at Wirrinya was found to result in 77mm less PAW than a neighbouring conventional broadleaf fallow by the beginning of May. One application of fallow herbicide in late December 2007 and the resultant weed control at Waroo was found to result in 56mm more PAW by the beginning of May. This effect was most consistent and pronounced in the depth range of 30-60cm. In addition to the water conservation benefits at Waroo, the one application of the fallow herbicide resulted in an additional 25 kg N/ha in the top 60cm of soil.

Based on the results of these two fallow management comparisons, C4 summer grasses appear highly efficient users of soil water and nitrogen. Recent research has highlighted that sub soil moisture can potentially produce good cereal grain water use efficiencies in order of 20kg/mm. A simple calculation using this assumption suggests that 50mm of sub soil moisture could be worth approximately 1t/ha of grain and 75mm could be worth approximately 1.5t/ha. Fallow moisture and soil N are inherently linked through the biological process of mineralisation. Soil moisture is one of the key drivers of N mineralisation, an important process in conventional fallows. In addition to this effect, summer grasses are known to forage for soil N.

Research at Wellington has highlighted that N deficiency commonly limits winter cereal grain yields in pasture cropping systems.

The presence of summer grasses at both sites meant that much of the opportunity for storing soil moisture in the summer of 2007/08 was lost. The soil water loss was compounded by the additional loss in soil N. Suggestions that improvements in ground cover and soil biology from perennial C4 grasses outweighing their potential for water use, is not supported by the results reported in these studies. Rather these results suggest very much the opposite, in that summer active C4 perennial grasses appear to be highly effective at using summer fallow soil moisture and N.

This is not to discredit the potential of pasture cropping systems to benefit mixed farmers that have a significant livestock focus as part of their business and management that focuses on profiting from the additional summer dry matter a pasture cropping system produces. For these mixed farmers the additional livestock production obtained from the summer grasses and lack of herbicide expenditure over the summer period may go some way towards making up for the additional water use of the summer pasture (and thus reduced winter cereal grain yield potential). Pasture cropping is seen as a lower input / lower output system, where the addition of livestock adds diversity and reduces down side risk.

The impact of seasonal conditions is import when considering these results. The summer of 2007/08 was wetter than average. The combination of good rainfall and follow up events during the fallow period helped to push the soil moisture down deep into the soil profile, reducing the potential for evaporative losses. Summer fallow conditions of low and sporadic rainfall could very well reduce the ability to store moisture in the sub soil in traditional fallows and thus reduce the benefits of weed removal. It is hoped to continue these fallow management comparisons over the next few seasons to provide a more complete picture of seasonal effects.