

## **No-till adoption and cropping issues for Australian grain growers**

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### **Abstract**

Adoption of no-till sowing systems has increased rapidly in many Australian grain growing regions over the past decade. The extent of herbicide resistant weed populations has also increased over the same period. A survey of growers in the South and Western Australian cropping regions was conducted to characterise no-till adoption and determine growers' expectations of the long-term effects of no-till systems. Trends in sowing system use are determined, as are growers' perceptions of the long term effects of no-till on herbicide costs, herbicide resistance, glyphosate resistance and soil erosion. The results suggest a rapid expansion in the adoption of no-till sowing in South Australian cropping regions over the next five years, although growers expect increased herbicide costs in no-till systems and an increased risk of herbicide resistance. Herbicide resistance and/or weed control issues are the main reason given for reducing no-till use. A major research and extension challenge is the development of sustainable weed management strategies that are compatible with no-till systems.

### **Media summary**

No-till adoption to increase but growers recognise a major challenge from herbicide resistant weeds.

### **Key Words**

Adoption, herbicide resistance, tillage, perceptions, soil conservation

### **Introduction**

Australian grain growers are reducing their use of cultivation. In 2001 an estimated 41 % of the nation's crop area was sown with no prior soil disturbance (ABARE 2003). The adoption of minimum tillage, stubble retention, direct drill<sup>1</sup> and no-till<sup>2</sup> sowing systems has allowed greater cropping intensity and been associated with reduced risk of soil degradation (see McTainsh et al. 2001 and Chan and Pratley 1998). However, as expenditure on cultivation has fallen per unit area, expenditure on herbicides has increased (Hooper et al. 2003; Radcliffe 2002). The sustainability of current herbicide-reliant cropping systems is threatened by herbicide resistant weed populations. The majority of paddocks in many major cropping areas now contain a herbicide resistant weed population (Llewellyn and Powles 2001) with costlier forms of multiple resistance and glyphosate resistance becoming more common (Walsh et al. 2004; Powles et al. 1998).

The adoption of no-till practices has occurred at different rates across Australia. In some regions adoption has already reached high levels while in other regions there are few growers with experience in no-till systems (ABARE 2003). This paper examines the change in sowing systems from the perspective of growers from two states; Western Australia where no-till adoption is high, and South Australia where the rate of adoption has been slower. Levels of current and intended no-till adoption (and dis-adoption) are determined together with growers' reasons for their adoption decisions. Perceptions of the effect of no-till on soil and weed management are also examined. The main objective is to characterise the shift to no-till and identify the research and extension implications for no-till and other components of the cropping system, particularly weed management.

### **Methods**

A phone survey was conducted to elicit tillage practice use and perception data from 303 growers within major grain growing regions in South Australia (SA) and Western Australia (WA). These comprised 81 growers from the WA Shires of Mingenew, Morawa, Mullewa and Chapman Valley (Northern Wheatbelt); Quairading, Kellerberrin, Merredin and Bruce Rock (Central/Eastern Wheatbelt); and 222 growers from the SA District Councils of Lower Eyre Peninsula, Streaky Bay, Le Hunte, Kimba and Cleve (Eyre Peninsula); Port Pirie, Barunga West, Yorke Peninsula and Clare-Gilbert Valley (Mid-Upper North) and Southern Mallee, Loxton-Waikerie and Karoonda-East Murray (Mallee). Grain growers within each region were randomly selected and surveyed between March and October 2003, with an overall response rate of 61 %. In this paper the results are presented as state aggregates.

## Results

### *Farm characteristics*

Characteristics of the average farm sampled in Western Australia and South Australia are shown in Table 1. While the average cropping intensity was similar in SA and WA regions, the average arable area per farm was lower in SA. Soils are typically more acidic in Western Australia and herbicide resistance was more common in the WA regions (Table 1).

**Table 1. Average characteristics of farms in SA and WA sampled regions**

	Arable area (ha/farm)	Cropping intensity (% of arable land)	Herbicide resistance on farm* (% of respondents)	Average soil pH*
SA Regions	2003	66	38	7.2
WA Regions	3887	67	63	5.4

\* as stated by growers

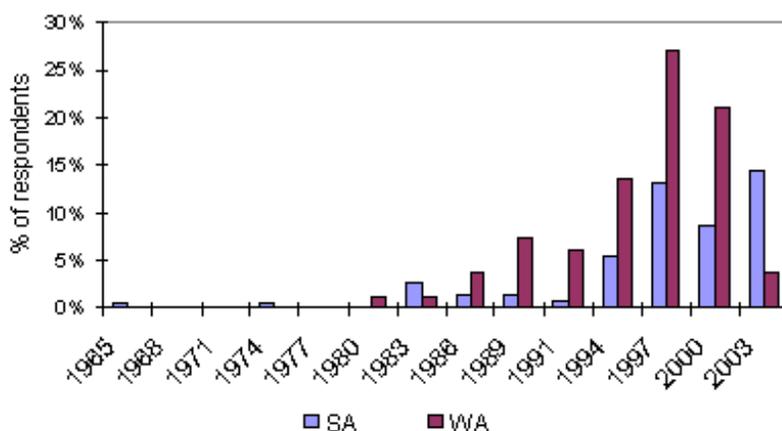
### *No-till adoption*

No-till was being used for a proportion of cropping by 86 % and 42 % of respondents in the WA and SA regions respectively, and was used for an average of 79 % of adopters' cropping programs in WA and 70 % of SA adopters' programs (Table 2). Around twice as many growers in SA were using direct drill with a full cut (cultivation) than in WA, with approximately one third of respondents in both states using some pre-seeding cultivation (which includes harrows or shallow cultivation with narrow points) on some area of cropping land prior to seeding with discs or knifepoints (Table 2).

**Table 2. Proportion of respondents (%) using various sowing methods in 2003, and planning to use no-till by 2008.**

	No-till	Direct drill with full cultivation	Low disturbance sowing with prior cultivation	Plan to use no-till by 2008
SA?Regions	42	61	30	70

Widespread adoption has occurred earlier in the WA regions than in SA (Figure 1), however no-till use is expected to become common in both states, with 70 % and 88 % of SA and WA respondents respectively planning to use no-till for a proportion of their cropping by 2008 (Table 2). Nonetheless, no-till adoption is still a fairly recent phenomenon in both states, with 85 % of those adopting no-till in WA doing so in the last 10 years, and 77 % of SA adopters taking up no-till since 1994.



**Figure 1. Stated time of first adoption of no-till by grain growers in South Australia and Western Australia.**

*Reasons for adoption, non-adoption and reduced use of no-till*

The predominant reason for growers adopting no-till was soil conservation. Other common reasons were reduced sowing time, stubble retention, timeliness of sowing (i.e. ability to sow with less opening rainfall, which can lead to better yields) and weed control (Table 3).

**Table 3. Reasons for adopting no-till (% of adopters citing reason\*).**

	Soil conservation	Reduced sowing time	Stubble retention	Sowing timeliness and better yields	Weed control	Soil structure, organic matter and moisture conservation	Input cost savings	Seed placement and seedbed preparation
SA?Regions	73	27	25	21	19	12	12	9
WA?Regions	48	9	11	11	11	16	15	10

\* Numbers add to over 100 % due to more than one reason being accepted. Observations: SA n=108; WA n=69.

Machinery cost was the main reason growers given by non-adopters for not adopting no-till (Table 4). Other common reasons were a perceived lack of convincing results and herbicide resistance and/or weed control concerns (Table 4).

**Table 4. Reasons for not-adopting no-till (% of non-adopters citing reason\*).**

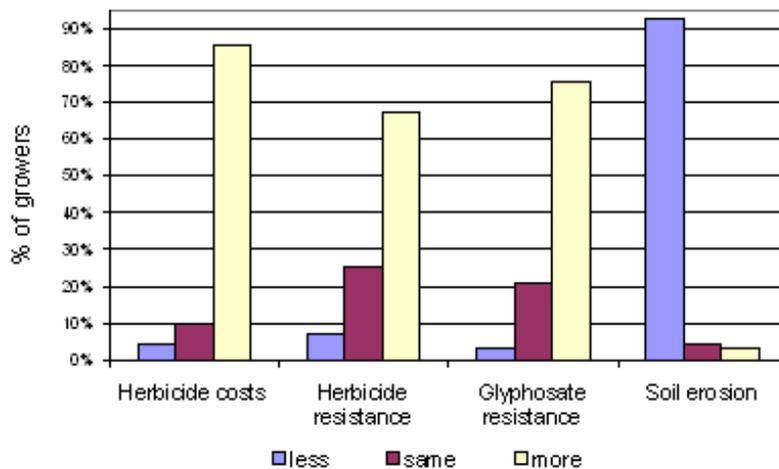
	Machinery costs	Not seen convincing results	Herbicide resistance and weed control	Soil constraints	Pasture rotations	Soil disease
SA?Regions	43	27	26	19	11	13
WA?Regions	50	50	25	-	-	17

\* Numbers add to over 100 % due to more than one reason being accepted. Observations: SA n=112; WA n=12.

Some adopters had either reduced or were planning to reduce their no-till cropping area, more so in WA (45 % - 31 growers reducing no-till use) than SA (28 % - 31 growers). The main reason for reducing no-till use was herbicide resistance and/or weed control issues (48 % in SA; 64 % in WA). Other reasons were physical soil constraints (13 % in SA; 36 % in WA) and pests (particularly snails) and soil disease (13 % in SA).

#### *Perceived effects of no-till*

Most growers in SA and WA believed that herbicide costs, herbicide resistance and, in particular, glyphosate resistance, would be higher under long-term use of no-till with stubble retention (NTSR) relative to sowing with a full cut cultivation and stubble removal (FCSR), and that soil erosion would be lower under long-term NTSR (Figure 2).



**Figure 2. Growers' perceptions of the long term effects of no-till with stubble retention relative to cultivation and full-cut sowing with stubble removal.**

#### **Conclusion**

Large increases in the use of no-till are expected in South Australian cropping regions over the next 5 years. The proportion of growers using no-till in the Western Australia regions is expected to remain high.

Machinery cost is the most commonly stated reason for non-adoption. Most growers perceive an increased risk of herbicide resistance under no-till systems, indicating that most no-till adoption decisions are being made with an awareness of herbicide resistance issues. Indeed, herbicide resistance and weed control issues are the major reason given by adopters for past or intended reductions in no-till use, particularly in Western Australia which has a longer history of extensive no-till use. However, the soil and seeding time benefits of no-till are widely recognised by growers and appear to be most salient in adoption decisions. As a result, the overall use of no-till is expected to increase. A key research and extension challenge is to develop weed management strategies that are able to sustain long-term no-till use in a cropping environment where over-reliance on herbicides can rapidly lead to resistance in major crop weeds.

## Acknowledgements

The authors acknowledge the support of the Cooperative Research Centre for Australian Weed Management, the interviewer team and the grain growers who took part in this study.

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<sup>1</sup> Direct drill is where crops are sown in one pass with no prior soil disturbance.

<sup>2</sup> No-till is where crops are sown in one pass with narrow 'knifepoints' or disc openers with no prior soil disturbance.