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PROJECT SUMMARY

The project aim was to compare 'new' disc sowing and stripper front harvesting to conventional tyne sowing and draper front harvesting, to see if the benefits being experienced in other regions (generally higher rainfall) of using strip & disc systems translated to the low rainfall environment of upper Eyre Peninsula. The benefits have been reported as less soil and stubble disturbance, improved water infiltration and availability, and improved harvest efficiency and timeliness of sowing. All of these, if realised in our environment, would have positive effects on farm resilience.

One of the barriers to retaining large amounts of stubble and using disc seeders is the potential for reduced herbicide efficacy: the herbicide can be 'tied up' or stuck on the taller stubbles before it hits the soil, and there is limited soil throw when using disc seeders, which can mean that herbicides remain close to the crop seed, potentially negatively impacting crop plant establishment.

Three herbicide spray coverage demonstration sites were established to provide a discussion point for growers about the pros and cons of adopting a strip and disc system compared to a conventional farming system. The sites were very effective in creating discussion and raising awareness within the local farming communities.

EXECUTIVE SUMMARY

Key messages:

- In the 2023, stubble treatments implemented at Cleve, Buckleboo and Minnipa resulted in stripper stubble of 64 +/- 4 cm high and conventional draper front stubble of 15 +/- 2 cm high.
- The stripper stubble unrolled had significantly more plants established at 72 plants/m² compared to the conventional stubble (unrolled) at 27 plants/m².
- One site (Minnipa) in a medic pasture showed a reduction in weed numbers in the stripper stubble (15 plants/m²) compared to the conventional stubble (22 plants/m²).
- In the 2023 growing season the Buckleboo site had 6% more in-season soil moisture content in September in the stripper system compared to the conventional draper system.
- There were no differences in % spray coverage at Cleve with the stripper stubble system and conventional stubble using a spray air system to improve penetration into the stubble canopy.

PROJECT BACKGROUND AND OBJECTIVES

A small handful of early adopter farmers have recently begun using disc sowing systems and stripper fronts for headers on Eyre Peninsula, with the aim of retaining soil water (less soil and stubble disturbance, more stubble residue retained at harvest, greater rainfall infiltration) to increase their resilience in dry conditions. Other benefits cited include increased harvest efficiency and improved timeliness of sowing.

During sticky beak days in spring 2021, several farmers using these systems were visited, and there was a high level of interest shown from attendees.

In order to determine the benefits in our environment, and to address questions around herbicide efficacy in a standing stubble situation, we proposed a series of three monitored demonstration sites across upper EP which could be visited by different farmer groups on sticky beak days (crop walks).

The objectives of the demonstration sites in upper EP low rainfall farming systems were to determine:

1. Can we measure increased stored soil water in strip/disc vs conventional no-till knife point systems?
2. Are there other measurable benefits to the farming system such as soil cover, nutrition, weeds, disease, yield, soil health measures?
3. Are there impacts on pre-sowing herbicide efficacy in a strip/disc system compared with a conventional system?

METHODOLOGY

The SARDI Minnipa Agricultural Centre team and growers delivered three demonstration sites at Cleve (Bammann's), Buckleboo (Vandeleur's) and Minnipa (Oswald's), to address the following research questions:

1. Does soil water increase in strip/disc systems compared to no-till knife point systems?
2. Do strip/disc systems confer other benefits to the farming system, such as increased soil cover, better nutrition, fewer weeds, less disease and pests, higher yields or better soil health?
3. Are there impacts on the efficacy of pre-sowing herbicides in strip/disc systems compared to a conventional system?

The tall stripper stubble from harvest 2022 was cut low for the conventional stubble system using the MAC Zurn small plot harvester at Cleve on 28 March, Buckleboo on 29 March and at Minnipa on 6 April 2023. The plot areas were replicated strips based on the width of growers seeding machinery (12 to 18 m wide). The growers disc seeding systems were used to sow at Cleve and Buckleboo.

The Cleve site (red loam) compared high stripper stubble and low-cut stubble all sown with the grower's disc seeding system, and stubble was either rolled or unrolled. Cleve was sprayed on 18 April and then sown with Hurricane lentils @ 45 kg/ha with 50 kg/ha of MAP, using a NDF SA650 single shoot low disturbance disc system with 24.1 cm row spacing. Some treatments were rolled using a 12.8 m steel roller post plant establishment.

The demonstration at Buckleboo (sandy loam, adequate moisture at seeding) compared a strip and disc system with a conventional knife point and press wheel seeding system. Buckleboo was sown on 4 May with Ballista wheat @ 60 kg/ha with 60 kg/ha of MAP on 4 May, using a 60-foot John Deere 1890 pro-series disc seeder with 19.1 cm spacing. The MAC small plot seeder was used as a conventional system with Harrington knife points and press wheels on a 22.5 cm row spacing as a comparison to the disc system. Both systems were sown on the same morning using the same seed and fertiliser rate.

Due to the dry start to the 2023 season the Minnipa site (red loam) was not sown to cereal and left to regenerate with medic pasture. With the different stubble systems implemented the opportunity was taken to measure medic regeneration and growth in the stubble. An electric fence was used to have ungrazed areas of both stripper and conventional stubble.

All growers prepared the demonstration sites prior to seeding with knockdown herbicides. Herbicide efficacy within the two different stubble systems was compared pre-sowing using a spray card and using the growers broadacre boom spray. Spray cards were placed within the different stubble treatments on the soil surface before spraying. The spray card coverage (%) was assessed using the SnapCard phone app at Cleve on 18 April, Buckleboo on 3 May and Minnipa on 31 July (grass weed control in pasture).

Initial soil sampling at the sites were taken in late March. Plant emergence counts were completed at Minnipa on 12 July, Cleve on 29 June and Buckleboo on 26 June 2023. Early dry matter (DM) cuts were completed on 27 July at Minnipa, and at Cleve 29 June and Buckleboo on 8 August, 2023. Late DM cuts and in-crop soil moisture were taken at Minnipa on 28 July, and Cleve and Buckleboo on 8 and 9 August, 2023 respectively.

Grain was harvested at Cleve on 17 October and Buckleboo on 25 October 2023, using the Zurn conventional front plot harvester with final soil moistures at Cleve and Buckleboo on 20 and 21 November, 2023 respectively.



Figure 1.



Figure 2.



Figure 3.



Figure 4.



Figure 5.

Figure 1: Implemented stripper stubble (high) and conventional (low) stubble at Buckleboo site.

Figure 2: Grower seeding with disc seeder at Buckleboo site.

Figure 3: MAC staff seeding with the conventional seeding points and press wheels using small plot equipment at Buckleboo site.

Figure 4 and 5: Amanda Cook; SARDI presenting the strip and disc farming systems project at the BFIG Crop Walk at Vandeleur's site. Photo F Tomney.

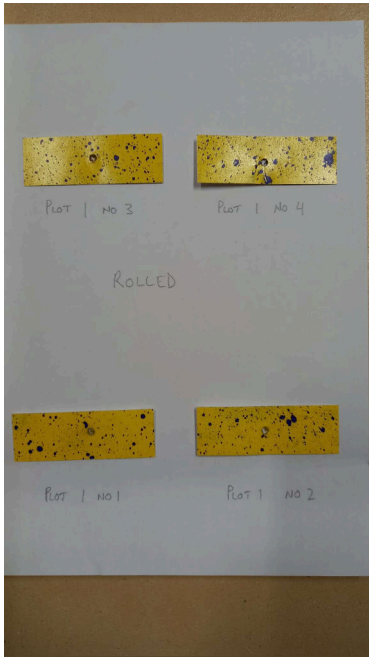


Figure 6:

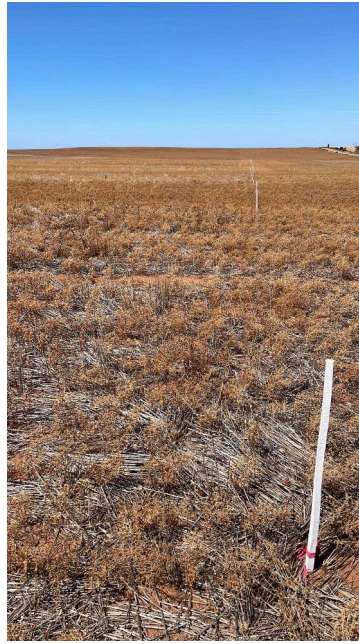


Figure 7:



Figure 8:

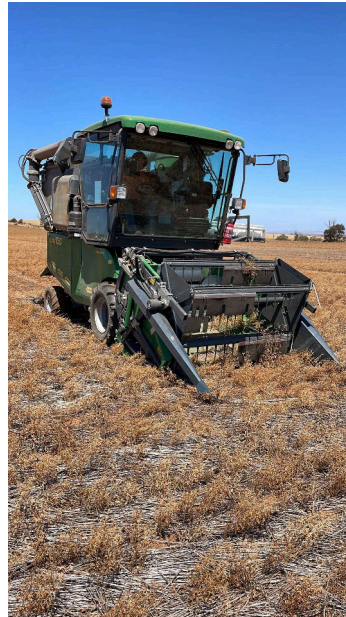


Figure 9:

Figure 6: Replicated spray cards from plot 1 at Cleve.

Figure 7: Cleve site at harvest. Closest plot shows the stripper unrolled stubble (high) straw.

Figure 8: Conventional (low) stubble unrolled at harvest.

Figure 9: SARDI MAC staff harvesting lentils at the Cleve site.



Figure 10.



Figure 11.

Figure 10 and 11: Minnipa Oswald's Strip and Disc self-regenerating medic site 2023.
Photo: A Cook

LOCATION

Where demonstration sites, field trials, events or other activities have been conducted, provide the following location details in the table below: latitude and longitude for field trials, or LGA for events and other activities. (Add additional rows as required.)

Site # and name	Latitude (decimal degrees)	Longitude (decimal degrees)	LGA
Trial Site #1 Cleve, Paul Bammann's	-33.71925	136.47136	Cleve
Trial Site #2 Buckleboo, Matt Vandeleur's	-32.9946745	136.0157100	Kimba
Trial Site #3 Minnipa, Clint Oswald's	-32.8556677	135.1831033	Wudinna

RESULTS

At Cleve, the stubbles implemented were standing stripper stubble height averaging 57 cm in rolled and 64 cm in unrolled treatments, and conventional stubble averaging 14 cm in rolled and 16 cm unrolled (Table 1). Replicated spray cards were placed within the different stubble treatments on the soil surface before pre-seeding herbicide application. The pre-seeding herbicide application did not show significant differences in % spray coverage between the stubble treatments (Table 1). The broadacre sprayer used was a Miller 7380 with spray air system to improve penetration into the stubble canopy with a water rate of 45 L/ha used.

Lentil establishment showed differences in plant numbers for stubble treatment with increased establishment in the stripper stubble unrolled (72 plants/m²) compared to the conventional stubble (unrolled (27 plants/m²) (Table 1). Early dry matter was not affected by differences in plant numbers with the conventional stubble system having greater dry matter on 29 June (Table 1). There were differences in broadleaved weed numbers (wild turnip, thistle, marshmallow, wards weed) between the stubble systems (Table 1), however there were more mice holes observed in the higher stubble system. The differences in dry matter were similar to final grain yield with the conventional stubble yielding higher than strip and disc stubble (Table 1).

Table 1: Stubble height (cm), spray coverage (%), Plant establishment (plants/m²), early dry matter (t/ha), NDVI, broadleaf weeds (plants/m²) and grain yield (t/ha) and harvest pod loss (per m²) of lentils sown in stripper and conventional stubble at Cleve, 2023.

Stubble Treatments	Stubble Height (cm)	% Spray coverage	Plant Establishment (plants/m ²)	Early Dry Matter (t/ha)	NDVI	Broad-leaf weeds (plants /m ²)	Grain Yield (t/ha)	Harvest pod loss/m ²
Stripper stubble (high) Rolled	57	6.0	63 b	0.62 b	38 ab	5 bc	0.71 b	22 ab
Stripper stubble (high) Unrolled	64	8.4	72 a	0.65 b	42 ab	7 ab	0.72 b	16 b
Conventional stubble (low) Rolled	14	8.7	20 c	1.15 a	32 b	13 a	1.2 a	25 a
Conventional stubble (low) Unrolled	18	5.6	27 c	1.17 a	45 a	2 c	1.1 a	28 a
LSD (P=0.05) Interaction (Stubble*Rolling)	ns	ns	ns	ns	ns	ns	ns	ns

<i>Stubble</i>	4.1	ns	8	0.27	8.6	ns	0.08	6
<i>Rolling</i>	4.0	ns	ns	ns	ns	7	ns	ns

The initial moisture content at Cleve was 137 mm of soil moisture in the profile (0-90 cm) at the end of March (data not shown). The in-crop soil moisture in August showed conventional stubble unrolled and stripper stubble unrolled had the highest gravimetric soil moisture content (%) compared to the two other treatments (Table 2). After harvest there was no difference in gravimetric soil moisture content (%) between the treatments (Table 2).

Table 2: Gravimetric soil moisture (%) in stripper and conventional stubble treatments at 0-90 cm in August and November at Cleve, 2023.

Stubble Treatments	Gravimetric Soil Moisture (%)	Gravimetric Soil Moisture (%)
	0-90 cm	0-90 cm
	August	November
Stripper stubble (high) Rolled	38.0	24.8
Stripper stubble (high) Unrolled	42.4	18.7
Conventional stubble (low) Rolled	32.3	23.2
Conventional stubble (low) Unrolled	45.2	20.9
<i>LSD (P=0.05)</i>	8.6	ns

At Buckleboo, the average stripper stubble height was 64 cm, and conventional stubble height was 14 cm (Table 3). The pre-seeding herbicide spray cards showed differences in % spray coverage between the stubble treatments with the conventional low cut stubble system having higher coverage than the stripper stubble (Table 3).

Wheat establishment showed no differences due to stubble treatment (Table 3). The growth in dry matter, both early and late, and NDVI were similar with both stubble systems (Table 3). Extra plant measurements were taken pre-harvest to determine if there were differences in plant growth and tillering in the different stubble systems potentially due to shading. There were no differences in tillers/plant or heads per plant measured in late September. There were low weed numbers and no differences in weed numbers between the stubble systems (data not shown).

There were no differences in grain yield or grain quality measurements except hectolitre (hL) weight (Table 3). The average grain quality measurements were protein 11.9 %, screenings 41%, 1000-grain weight 38 g and grain moisture 10.5%.

The initial soil moisture content in March was 145 mm in the soil profile (0-90 cm) at the end of March (data not shown). The in-crop soil moisture taken in September and after harvest showed no differences in soil moisture content (%) between the stubble treatments (Table 3).

Table 3: Stubble height, spray coverage, plant growth measurements of wheat seeded in stripper and conventional stubble at Buckleboo, 2023.

Stubble Treatments	Stripper stubble (high)	Conventional stubble (low)	LSD (P=0.05)
Stubble height (cm)	64	14	8
% Spray coverage	9 b	14 a	4
Plant Establishment (plants/m ²)	88	94	ns
Early Dry Matter (t/ha)	1.5	1.7	ns
NDVI	0.48	0.48	ns
Gravimetric Soil moisture (%) September	31	24	ns
Late Dry Matter (t/ha)	1.9	2.1	ns
Tillers/plant	3	3	ns
Heads/plant	3	3	ns
Grain Yield (t/ha)	1.8	1.8	ns

Grain weight (hL)	80.8	82.0	0.9
Gravimetric Soil moisture (%) post harvest	20	24	ns

At Minnipa, the average height of the stripper stubble was 68 cm, and conventional stubble was 13 cm (Table 4). Medic establishment showed differences in plant numbers with higher establishment in the conventional low stubble than high stripper stubble (Table 4). Early dry matter was not affected by differences in plant numbers (Table 4). There were differences in grass weed numbers with the low conventional stubble having higher weeds (mainly barley grass and ryegrass) at 22 plants/m² compared to 15 plants/m² in the stripper stubble treatment (Table 4). The soil moisture content (%) at medic plant senescence showed no differences between stubble treatments (Table 4).

Spray cards were placed within the different stubble treatments on the soil surface before grass weed spraying, with livestock having been in the paddock grazing. The herbicide application showed differences in % spray coverage between the stubble treatments, with the stripper stubble ungrazed having the highest % spray coverage, similar to the conventional low stubble grazed (Table 5).

Table 4: Stubble height (cm), plant establishment (plants/m²), early dry matter (plants/m²) and grass weed numbers (plants/m²) of self-regenerating medic pasture and final gravimetric soil moisture (%) in stripper and conventional stubble at Minnipa, 2023.

Stubble Treatments	Stubble Height (cm)	Plant Establishment (plants/m ²)	Early Dry Matter (t/ha)	Grass weeds (plants/m ²)	Final Gravimetric Soil Moisture (%)
Stripper stubble (high)	68 a	28	0.3	15 b	48.2
Conventional stubble (low)	13 b	44	0.4	22 a	45.1
LSD (P=0.05)	1.8	ns	ns	8	ns

Table 5: % Spray coverage in stripper and conventional stubble of self-regenerating medic pasture in unfenced and fenced areas at Minnipa, 2023.

Stubble Treatments	Spray Coverage (%)
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	Unfenced	Livestock exclusion (fenced)
Stripper stubble (high)	11.2 b	20.4 a
Conventional stubble (low)	16.0 ab	12.4 b
<i>LSD (P=0.05)</i>		5.7

CONCLUSION

Across all sites, the stubble treatments implemented resulted in stripper stubble of 64 +/- 4 cm high and conventional draper front stubble system with stubble of 15 +/- 2 cm high.

Lentil establishment increased in the stripper stubble than conventional stubble at Cleve, however, plant dry matter was higher in the conventional stubble system. The grower's disc seeder was used to sow into stripper stubble so the conventional system may have had lower seed soil contact.

There were differences in plant establishment at Cleve due to rolling. There were no differences in lentil grain yield due to rolling, however, the benefit at harvest of a flatter soil surface is important. The improved dry matter production of the lentils in the conventional low stubble system followed through to a yield improvement of 0.3 t/ha in 2023. There were no differences in % spray coverage with the different stubble systems using the Miller 7380 with spray air system with a water rate of 45 L/ha used with spray air system to improve penetration into the stubble canopy.

At Buckleboo, the pre-seeding herbicide application had higher spray coverage with the conventional low cut stubble system than the stripper stubble system. There were no differences in wheat establishment, growth, tiller number, grain heads or yield due to the different stubble systems.

Self-regenerating medic at Minnipa established better in the conventional stubble system than the stripper stubble, but there were no differences in dry matter production mid-season. There were more weeds present in the lower stubble system compared to the stripper treatment. Unexpectedly, the spray coverage was highest in the ungrazed high stubble compared to the other systems.

In the 2023, only Buckleboo and not Cleve nor Minnipa had differences with in-crop gravimetric soil moisture content with higher soil moisture in the stripper system compared to the conventional system. Ideally, to test the effect of the additional stubble retained in the stripper system on soil moisture this stubble treatment would have been established and monitored straight after harvest in 2022.

A new project, NGN project "Impact of stripper front and straw length on harvest efficiency, summer weed control, soil moisture retention and pest populations in the Upper Eyre Peninsula" has been funded by GRDC for two seasons. Stripper stubble and two heights of conventional stubble have been implemented directly after harvest in 2023 at Minnipa and Cleve and are ready for the 2024 growing season to monitor the effects of stubble and soil evaporation. This will provide detailed research on soil moisture, measured using in-situ 0-30 cm soil moisture probes over summer in different stubble systems.

REFERENCES

Stubble management and soil water in strip and disc systems, A Cook, et al. (2024) Eyre Peninsula Farming Systems 2023 Summary (to be published March 2024).

APPENDIX 1: MEL SUMMARY DATA

This section is compulsory for all projects that cover more than one reporting period.

This section provides a collation of all data reported on through the MEL reports submitted to the SA Drought Hub. This information will be used to confirm that all deliverables for your project have been completed as outlined in the Project Details (Annexure D) Form for your project and may be used to communicate the results of your project.

LEARNING ACTIVITY SUMMARY

Activity name	Type of activity	Location of activity (LGA)	Primary category of participants	No. of participants (by category)	Primary focus area	Delivery style	No. of products developed, adapted or used to support activity
<i>*To add more rows right click & select insert / insert rows below</i>	<ul style="list-style-type: none"> farm visits seminars Training workshop field days crop/pasture walk 		<ul style="list-style-type: none"> Farmers/Producers, Government extension officers, Private consultant or agribusiness agent, Businesses, Local farmer groups / networks 	<ul style="list-style-type: none"> Farmers/Producers, Government extension officers, Private consultant or agribusiness agent, Businesses, Local farmer groups / networks 		<ul style="list-style-type: none"> online face-to-face dual delivery 	<ul style="list-style-type: none"> decision tools information sheets fact sheets
EXAMPLE ROW: <i>Water management field day</i>	<i>Field day</i>	<i>Barossa</i>	<i>Farmers/Producers</i>	<i>Farmers / Producers x 16 Gov extension officers x 1 Private consultant or agribusiness agent x 3 Local farmer networks x 2</i>	<i>Managing risks around water security. Improve the management of water resources on farm.</i>	<i>Dual delivery</i>	<i>Fact sheets x 2</i>
Upper EP harvest report farmer meetings 2023	Seminar	Ceduna Streaky Bay Elliston Wudinna	Farmers	Farmers/Producers x 120 Local farmer groups x 8 Government extension officers: x 6	Retaining soil water in farming systems using strip/disc machinery	Face to face	Nil

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		Kimba Franklin Harbour Cleve Lock		Agribusiness reps & advisors: 20 Total 146			
Minnipa Sticky Beak Day 28 August 2023	Crop walk	Wudinna	Farmers	Farmers/Producers x 20 Local farmer groups x 1 Government extension officers: x 3 Agribusiness reps & advisors: 2 Total 25	Retaining soil water in farming systems using strip/disc machinery	Face to face	Nil
BFIG Crop Walk 30 August 2023	Crop walk	Kimba	Farmers	Farmers/Producers x 35 Local farmer groups x 1 Government extension officers: x 3 Agribusiness reps & advisors: 12 Total 50	Retaining soil water in farming systems using strip/disc machinery	Face to face	Nil
Minnipa Agricultural Centre Annual Field Day 13 September 2023	Field day	Wudinna	Farmers	Farmers/Producers x 86 Local farmer groups x 8 Government extension officers: x 33 Agribusiness reps & advisors: 30 Total 149	Retaining soil water in farming systems using strip/disc machinery	Face to face	Article in booklet
Roberts Verran Sticky Beak Day 22 September 2023	Crop walk	Cleve	Farmers	Farmers/Producers x 29 Local farmer groups x 1 Government extension officers: x 3	Retaining soil water in farming systems using strip/disc machinery	Face to face	Nil

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				Agribusiness reps & advisors: 8 Total 40			
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COMMUNICATION ACTIVITY SUMMARY

Category	Overview	No. issues/posts/? (i.e. how many generated/ produced)	No. of subscribers/ visitors/ followers	Feedback (if available)
<i>*To add more rows right click & select insert / insert rows below</i>				
EXAMPLE ROW: Newsletter	SA Drought Hub Monthly Newsletter	6 (Jan to July 2022)	592	Hub partners like receiving updates on the Hub and FDF opportunities that are promoted through the newsletter.
Newsletter				
Website	Overview of project Update of progress	1	428	
Social media				
Media				
Ad hoc communiques to partners				
Podcasts				
Other				

ON FARM TRIAL DEMONSTRATION SUMMARY

Project name	Activity (type and description)	Location of activity (LGA)	Number of visitors to trial/demonstration (please breakdown by stakeholder category if possible)	No. of farms participating in trial/demonstration
<i>*To add more rows right click & select insert / insert rows below</i>	<ul style="list-style-type: none"> • Demonstration Site • Trial Site 		<ul style="list-style-type: none"> • Farmers/Producers, • Government extension officers, • Private consultant or agribusiness agent, • Businesses, 	

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			<ul style="list-style-type: none"> Local farmer groups / networks 	
EXAMPLE ROW: Increasing soil water retention in cereal crop farming systems.	On-farm demonstrations of agronomic techniques to retaining soil moisture in the profile over Summer and Autumn to benefit early season crop establishment.	1 x Karoonda East Murray 1 x Loxton	<ul style="list-style-type: none"> Farmer / Producer x 30 Government extension officers x 5 Private consultant or agribusiness agent x 12 Local farmer Groups / networks x 3 	2 Farms participating, Management strategies differ on each farm
Retaining soil water in farming systems using strip/disc machinery	Demonstration site: pre-emergent herbicide spray coverage, soil water, weed, dry matter and yield differences between strip and disc compared to conventional (tyne and stripper front) farming systems. Wheat crop.	Kimba (Buckleboo site)	<ul style="list-style-type: none"> Farmer / Producer x 35 Government extension officers x 3 Private consultant or agribusiness agent x 12 Local farmer Groups / networks x 1 	1
Retaining soil water in farming systems using strip/disc machinery	Demonstration site: pre-emergent herbicide spray coverage, soil water, weed, dry matter and yield differences between strip and disc compared to conventional (tyne and stripper front) farming systems. +/- grazing in a regenerating medic pasture.	Wudinna (Minnipa site)	Nil	1
Retaining soil water in farming systems using strip/disc machinery	Demonstration site: pre-emergent herbicide spray coverage, soil water, weed, dry matter and yield differences between strip and disc compared to conventional (tyne and stripper front) farming systems. Lentil crop.	Cleve (Cleve site)	<ul style="list-style-type: none"> Farmer / Producer x 29 Government extension officers x 3 Private consultant or agribusiness agent x 8 Local farmer Groups / networks x 1 	1

DROUGHT RESILIENCE TOOLS AND PRODUCTS SUMMARY

Type of tool/product	Primary focus area	Overview and purpose	Promotion strategies	Extent of uptake (if available)
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<i>*To add more rows right click & select insert / insert rows below</i>				
EXAMPLE ROW: <i>Feed base calculator</i>	<i>To determine the amount of feed available to livestock in a paddock.</i>	<i>This tool has been developed using information from a number of existing calculators to compliment local conditions and livestock management systems. The calculator will assist in managing paddock stocking rates to maintain sufficient ground cover and livestock nutrition.</i>	<i>Through local producer group networks, at field days, via node coordinators</i>	<i>25 producers are currently trialing the calculator on their properties.</i>
Nil				

COMMERCIALISATION OPPORTUNITIES

Type of opportunities	Stage of commercialization	Comments
<i>*To add more rows right click & select insert / insert rows below</i>	<ul style="list-style-type: none"> • research and product development • on-farm demonstration/trial • market validation • commercialisation 	
Nil		