Impact of Planter Type on Crop Performance & Yield

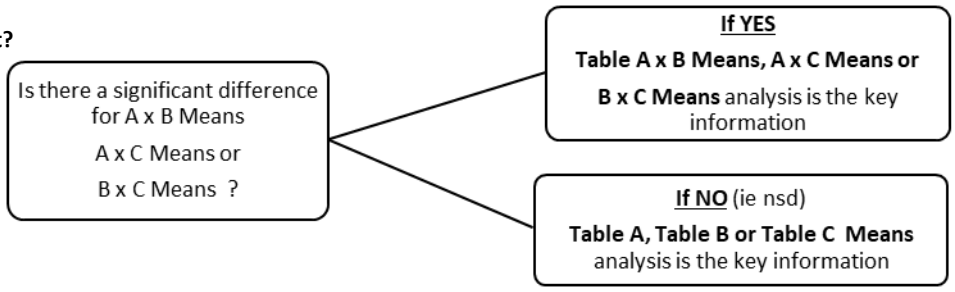
Trial ID: **LB1914** **Location:** **Kupunn** **Trial Year:** **2019**
Investigator: **Linda Bailey**

Objectives:	**2019: To evaluate the impact of planter type on yield of winter cereals and chickpeas** **2019/2020: To evaluate the impact of crop type and stubble amount on fallow moisture efficiency**
Crop Types:	**Barley, Durum, Wheat, Chickpea**
Planter Types:	**Boss Double Disc, Janke tyne with press wheel** **Both on 32 cm row spacing**
Target Populations:	**Low, Medium, Standard and High** **Cereals: 30, 60, 90 and 120 plants/m^2** **Chickpeas: 10, 20, 30 and 40 plants/m^2**
Planting Date:	**15/06/2019**
Harvest Date:	**21/10/2019**
Keywords:	**Wheat, barley, durum, chickpeas, disc, tyne, plant population, yield**

Trial designed and analysed as a Strip Plot

	In Simple Terms
Table of A Means:	Mean of 'Crop' performance with **ALL** 'Planter Type' treatments and 'Population' treatments
Table of B Means:	Mean of 'Planter Type' performance with **ALL** 'Crop' treatments and 'Population' treatments
Table of C Means:	Mean of 'Population' performance with **ALL** 'Crop' treatments and 'Planter Type' treatments
Table of A x B Means:	'Crop' performance with **EACH** 'Planter Type' treatment
Table of A x C Means:	'Crop' performance with **EACH** 'Population' treatment
Table of B x C Means:	'Planter Type' performance with **EACH** 'Population' treatment
Table of A x B x C Means:	'Crop' performance with **EACH** 'Planter Type' treatment and **EACH** population

How to interpret?



Key analyses highlighted in grey

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Assessment Date Assessment Type Assessment Unit Plant-Evaluation Interval ARM Action Codes		1/07/2019 EMERGENCE /m² 16 DP1 AS	4/09/2019 NDVI Ratio 81 DP1	21/10/2019 YIELD t/ha 128 DP1
Trt No.	Treatment			
TABLE OF A MEANS (Crop)				
1	Barley	79ta	0.69 a	1.87 a
2	Durum	69tb	0.62 b	1.76 a
3	Wheat	73tab	0.61 b	1.91 a
4	Chickpea	27tc	0.64 b	1.18 b
TABLE OF B MEANS (Planter Type)				
1	Disc	57tb	0.64 -	1.66 -
2	Tyne	62ta	0.64 -	1.71 -
TABLE OF C MEANS (Plant Population)				
1	Low	27td	0.61 b	1.59 b
2	Medium	54tc	0.65 a	1.71 a
3	Standard	74tb	0.65 a	1.72 a
4	High	96ta	0.66 a	1.70 a
TABLE OF A x B MEANS (Crop x Planter Type)				
1a	Barley, Disc	78t-	0.70 -	1.76
1b	Barley, Tyne	81t-	0.69 -	1.98
2a	Durum, Disc	64t-	0.64 -	1.78
2b	Durum, Tyne	74t-	0.61 -	1.74
3a	Wheat, Disc	69t-	0.61 -	1.89
3b	Wheat, Tyne	77t-	0.61 -	1.93
4a	Chickpea, Disc	26t-	0.63 -	1.19
4b	Chickpea, Tyne	27t-	0.64 -	1.17
TABLE OF A x C MEANS (Crop x Plant Population)				
1a	Barley, Low	37tfg	0.67 ab	1.82 ab
1b	Barley, Medium	69te	0.70 a	1.97 a
1c	Barley, Standard	96t bc	0.70 a	1.92a
1d	Barley, High	129t a	0.70 a	1.77ab
2a	Durum, Low	32tg	0.63 cde	1.83 ab
2b	Durum, Medium	66t e	0.63 de	1.71b
2c	Durum, Standard	82t d	0.62 e	1.80ab
2d	Durum, High	107t b	0.62 ef	1.70b
3a	Wheat, Low	31tg	0.58 f	1.84 ab
3b	Wheat, Medium	63t e	0.63 cde	1.96a
3c	Wheat, Standard	91t cd	0.62 e	1.93a
3d	Wheat, High	124t a	0.62 e	1.92a
4a	Chickpea, Low	12ti	0.54 g	0.88 e
4b	Chickpea, Medium	25t h	0.65 bcd	1.19d
4c	Chickpea, Standard	35t fg	0.66 bc	1.25cd
4d	Chickpea, High	40t f	0.69 a	1.41c

Means followed by same letter do not significantly differ (P=.05, LSD)
t=Mean descriptions are reported in transformed data units, and are not de-transformed.
Mean comparisons performed only when AOV Treatment P (F) is significant at mean comparison OSL.

Impact of Planter Type on Crop Performance & Yield

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Assessment Date Assessment Type Assessment Unit Plant-Evaluation Interval ARM Action Codes		1/07/2019 EMERGENCE /m² 16 DP1 AS	4/09/2019 NDVI Ratio 81 DP1	21/10/2019 YIELD t/ha 128 DP1
Trt No.	Treatment			
TABLE OF B x C MEANS (Planter Type x Plant Population)				
1a	Disc, Low	27t -	0.59 d	1.54-
1b	Disc, Medium	51t -	0.66 ab	1.69-
1c	Disc, Standard	70t -	0.66 ab	1.72-
1d	Disc, High	91t -	0.66 a	1.67-
2a	Tyne, Low	28t -	0.62 c	1.64-
2b	Tyne, Medium	57t -	0.64 ab	1.73-
2c	Tyne, Standard	77t -	0.64 bc	1.73-
2d	Tyne, High	100t -	0.65 ab	1.74-
TABLE OF A x B x C MEANS (Crop x Planter Type x Plant Population)				
1a	Barley, Disc, Low	39t-	0.68 -	1.88a-d
1b	Barley, Tyne, Low	36t-	0.66 -	1.76 b-e
1c	Barley, Disc, Medium	65t-	0.69 -	1.81 bcd
1d	Barley, Tyne, Medium	74t-	0.70 -	2.13 a
1e	Barley, Disc, Standard	90t -	0.70 -	1.73 b-e
1f	Barley, Tyne, Standard	102t -	0.70 -	2.11a
1g	Barley, Disc, High	130t -	0.71 -	1.62def
1h	Barley, Tyne, High	127t -	0.69 -	1.93abc
2a	Durum, Disc, Low	31t-	0.62 -	1.75b-e
2b	Durum, Tyne, Low	34t-	0.64 -	1.92 abc
2c	Durum, Disc, Medium	61t-	0.64 -	1.71 c-e
2d	Durum, Tyne, Medium	70t-	0.61 -	1.72 b-e
2e	Durum, Disc, Standard	78t -	0.64 -	1.89 a-d
2f	Durum, Tyne, Standard	86t -	0.59 -	1.70cde
2g	Durum, Disc, High	94t -	0.65 -	1.78bcd
2h	Durum, Tyne, High	120t -	0.60 -	1.62de
3a	Wheat, Disc, Low	29t-	0.55 -	1.72b-e
3b	Wheat, Tyne, Low	34t-	0.61 -	1.95 abc
3c	Wheat, Disc, Medium	62t-	0.63 -	1.94 abc
3d	Wheat, Tyne, Medium	63t-	0.62 -	1.99 ab
3e	Wheat, Disc, Standard	88t -	0.64 -	1.98 abc
3f	Wheat, Tyne, Standard	95t -	0.61 -	1.87a-d
3g	Wheat, Disc, High	115t -	0.62 -	1.93abc
3h	Wheat, Tyne, High	132t -	0.61 -	1.91abc
4a	Chickpea, Disc, Low	13t-	0.52 -	0.81 j
4b	Chickpea, Tyne, Low	11t-	0.57 -	0.94 ij
4c	Chickpea, Disc, Medium	22t-	0.66 -	1.31 gh
4d	Chickpea, Tyne, Medium	27t-	0.65 -	1.07 hij
4e	Chickpea, Disc, Standard	34t -	0.66 -	1.29 gh
4f	Chickpea, Tyne, Standard	36t -	0.65 -	1.21ghi
4g	Chickpea, Disc, High	41t -	0.68 -	1.34fg
4h	Chickpea, Tyne, High	40t -	0.71 -	1.48efg

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Assessment Type / Assessment Unit		PROTEIN %	MOISTURE %	TEST WEIGHT kg/hL	SCREENINGS %
Trt No.	Treatment				
TABLE OF A MEANS (Crop)					
1	Barley	13.6 c	10.6b	65.1 c	3.0t c
2	Durum	13.9 b	10.5b	80.0 a	2.0t d
3	Wheat	12.4 d	12.5a	79.8 a	4.5t b
4	Chickpea	25.6 a	8.5c	77.8 b	5.4t a
TABLE OF B MEANS (Planter Type)					
1	Disc	16.3 -	10.6-	75.6 -	3.5t -
2	Tyne	16.4 -	10.5-	75.8 -	3.6t -
TABLE OF C MEANS (Plant Population)					
1	Low	16.0 c	11.1a	75.3 -	3.3t b
2	Medium	16.3 b	10.5b	75.7 -	3.5t ab
3	Standard	16.5 ab	10.2c	76.0 -	3.7t a
4	High	16.7 a	10.2c	75.7 -	3.7t a
TABLE OF A x B MEANS (Crop x Planter Type)					
1a	Barley, Disc	13.7 -	10.6-	64.8 -	3.1t -
1b	Barley, Tyne	13.4 -	10.5-	65.4 -	2.0t -
2a	Durum, Disc	13.8 -	10.6-	80.0 -	4.5t -
2b	Durum, Tyne	13.9 -	10.5-	80.1 -	5.2t -
3a	Wheat, Disc	12.4 -	12.5-	79.9 -	3.0t -
3b	Wheat, Tyne	12.5 -	12.5-	79.7 -	2.1t -
4a	Chickpea, Disc	25.5 -	8.6-	77.7 -	4.5t -
4b	Chickpea, Tyne	25.7 -	8.4-	77.8 -	5.5t -
TABLE OF A x C MEANS (Crop x Plant Population)					
1a	Barley, Low	13.2 d	10.7e	65.8 d	3.1t -
1b	Barley, Medium	13.5 cd	10.6e	65.1 d	2.9t -
1c	Barley, Standard	13.7 c	10.5 ef	64.6 d	3.2t -
1d	Barley, High	13.9 c	10.5 e	65.1 d	3.0t -
2a	Durum, Low	13.2 d	11.4d	80.1 ab	1.6t -
2b	Durum, Medium	13.8 c	10.5 e	80.0 ab	2.1t -
2c	Durum, Standard	13.9 c	10.2 fg	80.5 ab	2.2t -
2d	Durum, High	14.6 b	10.0 g	79.6 b	2.4t -
3a	Wheat, Low	12.1 f	13.7a	77.7 c	4.4t -
3b	Wheat, Medium	12.4 ef	12.6 b	79.9 b	4.5t -
3c	Wheat, Standard	12.6 e	12.0 c	80.5 ab	4.5t -
3d	Wheat, High	12.7 e	11.7 d	81.1 a	4.6t -
4a	Chickpea, Low	25.6 a	8.6h	77.8 c	5.3t -
4b	Chickpea, Medium	25.6 a	8.4 hi	77.7 c	5.1t -
4c	Chickpea, Standard	25.6 a	8.3 i	78.4 c	5.8t -
4d	Chickpea, High	25.5 a	8.5 hi	77.2 c	5.3t -

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Assessment Type / Assessment Unit		PROTEIN %	MOISTURE %	TEST WEIGHT kg/hL	SCREENINGS %
Trt No.	Treatment				
TABLE OF B x C MEANS (Planter Type x Plant Population)					
1a	Disc, Low	16.0-	11.1 -	75.7-	3.5t-
1b	Disc, Medium	16.4-	10.6 -	75.3-	3.3t-
1c	Disc, Standard	16.3-	10.3 -	75.9-	3.6t-
1d	Disc, High	16.7-	10.2 -	75.6-	3.6t-
2a	Tyne, Low	16.0-	11.2 -	75.0-	3.2t-
2b	Tyne, Medium	16.3-	10.4 -	76.1-	3.6t-
2c	Tyne, Standard	16.6-	10.1 -	76.1-	3.8t-
2d	Tyne, High	16.6-	10.1 -	75.9-	3.7t-
TABLE OF A x B x C MEANS (Crop x Planter Type x Plant Population)					
1a	Barley, Disc, Low	13.1ijk	10.7 -	66.1g	3.4t-
1b	Barley, Tyne, Low	13.3 hij	10.7 -	65.4 gh	2.8t -
1c	Barley, Disc, Medium	13.8fgh	10.5 -	63.8h	2.6t-
1d	Barley, Tyne, Medium	13.3hij	10.6 -	66.3g	3.2t-
1e	Barley, Disc, Standard	13.9f	10.5 -	65.3gh	3.4t-
1f	Barley, Tyne, Standard	13.5f-i	10.4-	63.8h	2.9t-
1g	Barley, Disc, High	13.9ef	10.5-	63.9h	2.9t-
1h	Barley, Tyne, High	13.8fgh	10.5-	66.3g	3.1t-
2a	Durum, Disc, Low	13.1ijk	11.4 -	79.9ab	1.6t-
2b	Durum, Tyne, Low	13.3ghi	11.4 -	80.2ab	1.6t-
2c	Durum, Disc, Medium	13.9fg	10.6 -	79.6a-d	1.9t-
2d	Durum, Tyne, Medium	13.7fgh	10.4 -	80.3a	2.3t-
2e	Durum, Disc, Standard	13.7fgh	10.2 -	80.8a	2.0t-
2f	Durum, Tyne, Standard	14.0ef	10.2-	80.2ab	2.3t-
2g	Durum, Disc, High	14.5de	10.1-	79.8abc	2.4t-
2h	Durum, Tyne, High	14.7d	10.0-	79.5a-d	2.4t-
3a	Wheat, Disc, Low	12.0m	13.5 -	78.6b-e	4.5t-
3b	Wheat, Tyne, Low	12.2lm	14.0 -	76.8f	4.3t-
3c	Wheat, Disc, Medium	12.4lm	12.7 -	79.5a-d	4.7t-
3d	Wheat, Tyne, Medium	12.4lm	12.5 -	80.2ab	4.3t-
3e	Wheat, Disc, Standard	12.6kl	12.1 -	80.2ab	4.6t-
3f	Wheat, Tyne, Standard	12.6kl	11.8-	80.9a	4.4t-
3g	Wheat, Disc, High	12.7jkl	11.7-	81.1a	4.3t-
3h	Wheat, Tyne, High	12.6kl	11.6-	81.1a	4.9t-
4a	Chickpea, Disc, Low	25.7ab	8.6 -	78.1c-f	5.3t-
4b	Chickpea, Tyne, Low	25.4bc	8.6 -	77.5ef	5.2t-
4c	Chickpea, Disc, Medium	25.5bc	8.5 -	78.0def	4.9t-
4d	Chickpea, Tyne, Medium	25.8ab	8.3 -	77.4e	5.2t-
4e	Chickpea, Disc, Standard	25.0c	8.5 -	77.3ef	5.2t-
4f	Chickpea, Tyne, Standard	26.2a	8.1-	79.4a-d	6.5t-
4g	Chickpea, Disc, High	25.6b	8.6-	77.6f	5.4t-
4h	Chickpea, Tyne, High	25.4bc	8.4-	76.9f	5.3t-

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Trial ID: LB1914 **Location:** Kupunn **Trial Year:** 2019

COMPLETE SPLIT-PLOT AOV 1/07/2019 EMERGENCE /m² 16 DP1 AS						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	95	520.030204				
R	2	5.340676	2.670338	24.614	0.0004	
A	3	210.413690	70.137897	206.051	0.0001	0.4
ERROR A	6	2.042349	0.340391			
B	1	2.730940	2.730940	25.172	0.001	0.2
AB	3	1.022824	0.340941	3.143	0.0868	0.3
ERROR B	8	0.867915	0.108489			
C	3	270.833748	90.277916	425.381	0.0001	0.3
AC	9	14.055626	1.561736	7.359	0.0001	0.5
BC	3	0.603155	0.201052	0.947	0.4252	0.4
ABC	9	1.932324	0.214703	1.012	0.4442	0.8
ERROR C	48	10.186957	0.212228			

COMPLETE SPLIT-PLOT AOV 4/09/2019 NDVI Ratio 81 DP1						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	95	0.277019				
R	2	0.015489	0.007745	11.275	0.0047	
A	3	0.089320	0.029773	8	0.0161	0.04
ERROR A	6	0.02233	0.003722			
B	1	0.000519	0.000519	0.756	0.41	0.01
AB	3	0.005676	0.001892	2.755	0.112	0.02
ERROR B	8	0.005495	0.000687			
C	3	0.038669	0.012890	17.854	0.0001	0.02
AC	9	0.048706	0.005412	7.496	0.0001	0.03
BC	3	0.008355	0.002785	3.858	0.0149	0.02
ABC	9	0.007806	0.000867	1.201	0.3163	0.04
ERROR C	48	0.034653	0.000722			

COMPLETE SPLIT-PLOT AOV 21/10/2019 YIELD t/ha 128 DP1						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	95	12.546332				
R	2	0.264830	0.132415	5.202	0.0357	
A	3	8.284267	2.761422	49.039	0.0001	0.17
ERROR A	6	0.337865	0.056311			
B	1	0.064034	0.064034	2.516	0.1514	0.08
AB	3	0.263242	0.087747	3.447	0.0718	0.15
ERROR B	8	0.203629	0.025454			
C	3	0.267359	0.089120	3.203	0.0314	0.1
AC	9	0.910130	0.101126	3.635	0.0016	0.19
BC	3	0.032062	0.010687	0.384	0.7649	0.14
ABC	9	0.583470	0.064830	2.33	0.0287	0.28
ERROR C	48	1.335444	0.027822			

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COMPLETE SPLIT-PLOT AOV
PROTEIN %

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	95	2768.899583				
R	2	0.372708	0.186354	1.913	0.2094	
A	3	2748.864583	916.288194	9090.287	0.0001	0.2
ERROR A	6	0.604792	0.100799			
B	1	0.060000	0.060000	0.616	0.4551	0.1
AB	3	0.748333	0.249444	2.561	0.1279	0.3
ERROR B	8	0.779167	0.097396			
C	3	5.197917	1.732639	13.807	0.0001	0.2
AC	9	3.333750	0.370417	2.952	0.0072	0.4
BC	3	0.468333	0.156111	1.244	0.3042	0.3
ABC	9	2.446667	0.271852	2.166	0.0414	0.6
ERROR C	48	6.023333	0.125486			

COMPLETE SPLIT-PLOT AOV
MOISTURE %

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	95	222.921563				
R	2	0.229375	0.114687	2.491	0.1442	
A	3	194.917813	64.972604	727.815	0.0001	0.2
ERROR A	6	0.535625	0.089271			
B	1	0.210938	0.210938	4.581	0.0647	0.1
AB	3	0.086979	0.028993	0.63	0.616	0.2
ERROR B	8	0.368333	0.046042			
C	3	13.420313	4.473438	69.867	0.0001	0.1
AC	9	9.245104	1.027234	16.044	0.0001	0.3
BC	3	0.441146	0.147049	2.297	0.0895	0.2
ABC	9	0.392604	0.043623	0.681	0.7218	0.4
ERROR C	48	3.073333	0.064028			

COMPLETE SPLIT-PLOT AOV
TEST WEIGHT kg/hL

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	95	3803.932396				
R	2	2.645833	1.322917	1.575	0.2651	
A	3	3653.305313	1217.768438	3954.864	0.0001	0.4
ERROR A	6	1.8475	0.307917			
B	1	0.585937	0.585937	0.697	0.4279	0.4
AB	3	2.003646	0.667882	0.795	0.5303	0.9
ERROR B	8	6.721667	0.840208			
C	3	5.210312	1.736771	1.616	0.198	0.6
AC	9	44.335104	4.926123	4.583	0.0002	1.2
BC	3	7.008646	2.336215	2.173	0.1034	0.9
ABC	9	28.670104	3.185567	2.963	0.007	1.7
ERROR C	48	51.598333	1.074965			

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COMPLETE SPLIT-PLOT AOV SCREENINGS % AL						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	95	1.726946				
R	2	0.004587	0.002294	0.626	0.5589	
A	3	1.453752	0.484584	112.966	0.0001	0.0
ERROR A	6	0.025738	0.004290			
B	1	0.001732	0.001732	0.473	0.5111	0.0
AB	3	0.004619	0.001540	0.420	0.7435	0.1
ERROR B	8	0.029305	0.003663			
C	3	0.020954	0.006985	2.930	0.0429	0.0
AC	9	0.035687	0.003965	1.663	0.1244	0.1
BC	3	0.010274	0.003425	1.436	0.2438	0.0
ABC	9	0.025862	0.002874	1.205	0.3139	0.1
ERROR C	48	0.114435	0.002384			

Assessment Type
NDVI = Normalized difference vegetation index
ARM Action Codes
AS = Automatic square root transformation of X+0.5
AL = Automatic log transformation of X+1
DP1 = Days after Planting

Conclusions:

This trial was established to determine the impact of planter type on yield of barley, durum, wheat and chickpeas. The crops were planted with a both a Boss double disc and a Janke tyne planter with press wheels on 15/06/19 with 80 kg/ha Granulock Supreme Z. Crop establishment was assessed 16 days after planting and NDVI readings taken 81 days after planting. The trial was harvested 128 days after planting. Yield, EM38, stubble height and ground cover were assessed at this time. Data for EM38, stubble height and groundcover estimate is not presented in this summary.

SAGI (Statistics for Australian Grains Industry) analysis found a significant NDVI response in chickpea to plant population, but not for any of the cereal crops. There was a significant overall effect of crop type on NDVI, however the difference between durum and wheat was not significant.

SAGI analysis of the data showed there was a significant positive response to establishment in yield for chickpea, but not for any of the cereal crops. There was a significant difference in yield between the disc and tyne sowing types for Barley, but not for any of the other crop types.

Planter type had no impact on grain protein and moisture levels in any of the crops tested. However, the low plant populations trended to lower grain protein and higher grain moisture for all cereals. There were no significant differences for the test weight of barley, durum and chickpeas from planter type or plant population. In wheat, test weight appeared to be impacted by low plant populations but not planter type.

Stubble height and ground cover was primarily driven by crop, with the cereals having taller stubble and more ground cover than the chickpeas. As expected, the high plant population had more ground cover after harvest than the very low population. Analysis by SAGI found there was a significant overall positive response in groundcover to plant population. There was only a significant difference in ground cover between the two planter types for durum.

SAGI analysis found a significant overall negative response in soil water to 1.5m to plant population. There was also a significant mean difference in soil water to 1.5m between cereals and the pulse crop, with chickpea having a higher mean soil water remaining to 1.5m than cereals.

In this trial, the tyne planter did not appear to have an inherent yield advantage over planting with disc seeder for barley, durum, wheat or chickpeas. After harvest, although the cereals had more ground cover, the remaining soil moisture was ~10% less than after chickpeas for all three depths measured. Fallow efficiency will be determined at the end of summer.