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Any product referred to in this document must be used strictly as directed, and in accordance with all label or permit instructions. Always consult the label prior to use.

Wild Oat Management in Chickpeas: The Impact of Pre-Emergent Herbicides and Soil Levelling

Trial ID: LB2007 **Location:** Pittsworth **Trial Year:** 2020
Investigator: Linda Bailey

This trial was primarily designed to screen recent residual herbicide registrations in chickpeas for wild oat efficacy. The residual herbicides were evaluated in both the presence and absence of soil levelling, conducted shortly after planting. Soil levelling is a relatively common practice in chickpeas with potential benefits for both herbicide crop safety as well as for crop harvestability. Where chickpeas are planted in deep furrows, without levelling, pods may be produced too close to the actual ground level to be effectively harvested. The aim was to identify whether soil levelling had any impact on the residual herbicide wild oat efficacy.

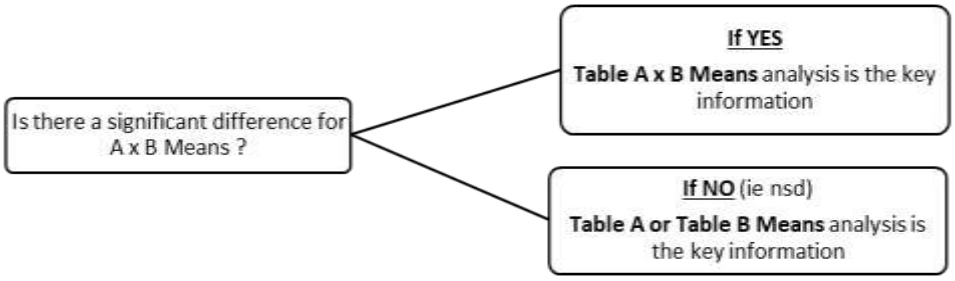
The trial design allowed for an analysis of the impact of the residual herbicide on efficacy of the post-emergent application. Unfortunately, the wild oat density was too low and variable to allow post-emergent evaluation.

Objective:	**To evaluate the combined impact of residual herbicides and soil levelling on wild oat efficacy**
Crop:	**Chickpeas**
Variety:	**PBA Hat Trick**
Planting Date:	**24/06/2020**
Planting Details:	**Direct drilled by disc seeder on 1m spacing**
Application:	**Incorporated by sowing (IBS)**
Application Date:	**23/06/2020**
Levelling:	**26/06/2020 (using inverted 2m wide fire harrows)**
Crop Growth Stage at Application:	**Pre-emergence**
Weed:	**Wild oats, feathertop Rhodes grass**
Weed Stage at Application:	**Pre-emergence**
Nozzles:	**AIXR110015**
Volume:	**100 L/ha**
Keywords:	**Wild oats, feathertop Rhodes grass, chickpeas, residual herbicides, soil levelling**

Trial designed and analysed as a Factorial

	In Simple Terms
Table of A Means:	Mean of 'Herbicide' treatments with **ALL** 'Levelling' performance
Table of B Means:	Mean of 'Levelling' performance with **ALL** 'Herbicide' treatments
Table of A x B Means:	'Herbicide' treatment with **EACH** 'Levelling' performance

How to interpret?



NB: Original protocol also included the impact of post-emergent knockdown treatments. The emerged counts of wild oats at this site was insufficient to warrant or allow useful comparison of post-emergent options.

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Please note: All named products below are registered for use in chickpeas at the rates applied.
Avadex Xtra and Rustler are registered for wild oat control, Sakura, TriflurX and Rifle 440 are registered for wild oat suppression.

Key analysis is highlighted in grey

Table 1 - Chickpea crop safety and wild oat emergence counts

Trt No.	Treatment	Product Rate	Chickpea PBA HatTrick		*Avena spp.* Wild Oats
Pest Scientific Name					
Pest Name					
Crop Name					
Crop Variety					
Assessment Date			14/07/2020	6/08/2020	6/08/2020
Assessment Type			EMERGENCE	NDVI	COUNT
Assessment Unit			/m²	Ratio	/m²
Crop Stage Majority			03 V1	06 V9	
Pest Stage Majority					13
Treatment-Evaluation Interval			21 DAA	44 DAA	44 DAA
Plant-Evaluation Interval			20 DAP	43 DAP	43 DAP
TABLE OF A MEANS (Herbicide)					
1	Untreated	-	23.5a	0.257a	0.30-
2	Sakura	118g/ha	23.3ab	0.248ab	0.12-
3	Boxer Gold	2500ml/ha	22.3a-d	0.250ab	0.06-
4	Experimental	1800ml/ha	20.1de	0.214d	0.06-
5	Avadex Xtra	1600ml/ha	22.9abc	0.256a	0.06-
6	TriflurX	1700ml/ha	20.9cde	0.234bc	0.04-
7	Avadex Xtra TriflurX	1600ml/ha 1700ml/ha	20.8cde	0.222cd	0.04-
8	Outlook	1000ml/ha	21.6a-e	0.233bc	0.04-
9	Rustler	1000ml/ha	22.5abc	0.256a	0.07-
10	Rifle 440	2500ml/ha	21.3b-e	0.242ab	0.05-
11	Ultro	1100g/ha	19.5e	0.246ab	0.07-
TABLE OF B MEANS (Levelling)					
1	Unlevelled		21.5-	0.239-	0.09-
2	Levelled		21.9-	0.244-	0.08-
TABLE OF A x B MEANS (Herbicide x Levelling)					
1	Untreated, Unlevelled	-	22.8-	0.250a-e	0.52-
1a	Untreated, Levelled	-	24.2-	0.264ab	0.07-
2	Sakura, Unlevelled	118g/ha	22.4-	0.253a-e	0.00-
2a	Sakura, Levelled	118g/ha	24.3-	0.244b-f	0.24-
3	Boxer Gold, Unlevelled	2500ml/ha	21.6-	0.234c-g	0.00-
3a	Boxer Gold, Levelled	2500ml/ha	23.0-	0.266ab	0.12-
4	Experimental, Unlevelled	1800ml/ha	19.6-	0.205h	0.00-
4a	Experimental, Levelled	1800ml/ha	20.6-	0.222fgh	0.12-
5	Avadex Xtra, Unlevelled	1600ml/ha	22.3-	0.244a-f	0.05-
5a	Avadex Xtra, Levelled	1600ml/ha	23.5-	0.269a	0.07-
6	TriflurX, Unlevelled	1700ml/ha	20.8-	0.235c-g	0.00-
6a	TriflurX, Levelled	1700ml/ha	21.0-	0.234c-g	0.07-
7	Avadex Xtra, Unlevelled TriflurX, Unlevelled	1600ml/ha 1700ml/ha	22.3-	0.229e-h	0.07-
7a	Avadex Xtra, Levelled TriflurX, Levelled	1600ml/ha 1700ml/ha	19.2-	0.214gh	0.00-
8	Outlook, Unlevelled	1000ml/ha	21.9-	0.236c-g	0.00-
8a	Outlook, Levelled	1000ml/ha	21.3-	0.229e-h	0.07-
9	Rustler, Unlevelled	1000ml/ha	22.8-	0.256a-d	0.14-
9a	Rustler, Levelled	1000ml/ha	22.2-	0.256a-d	0.00-
10	Rifle 440, Unlevelled	2500ml/ha	20.8-	0.252a-e	0.07-
10a	Rifle 440, Levelled	2500ml/ha	21.7-	0.232d-g	0.02-
11	Ultro, Unlevelled	1100g/ha	19.0-	0.235c-g	0.10-
11a	Ultro, Levelled	1100g/ha	20.1-	0.258abc	0.05-

Means followed by same letter do not significantly differ (P=.05, LSD)

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Table 2 – Wild oat and feathertop Rhodes grass counts at 72 DAA

Trt No.	Treatment	Product Rate	*Avena spp.* Wild Oats 3/09/2020 COUNT /m² 72 DAA	*Chloris virgata* Feathertop Rhodes grass 3/09/2020 COUNT /m² 72 DAA
TABLE OF A MEANS (Herbicide)				
1	Untreated	-	0.35-	2.42-
2	Sakura	118 g/ha	0.14-	0.01-
3	Boxer Gold	2500 ml/ha	0.07-	0.00-
4	Experimental	1800 ml/ha	0.05-	0.00-
5	Avadex Xtra	1600 ml/ha	0.11-	2.84-
6	TriflurX	1700 ml/ha	0.11-	0.00-
7	Avadex Xtra TriflurX	1600 ml/ha 1700 ml/ha	0.04-	0.00-
8	Outlook	1000 ml/ha	0.13-	0.00-
9	Rustler	1000 ml/ha	0.08-	0.02-
10	Rifle 440	2500 ml/ha	0.11-	0.00-
11	Ultro	1100 g/ha	0.11-	0.74-
TABLE OF B MEANS (Levelling)				
1	Unlevelled		0.13-	0.94-
2	Levelled		0.11-	0.16-
TABLE OF A x B MEANS (Herbicide x Levelling)				
1	Untreated, Unlevelled	-	0.57-	4.85-
1a	Untreated, Levelled	-	0.13-	0.00-
2	Sakura, Unlevelled	118 g/ha	0.05-	0.02-
2a	Sakura, Levelled	118 g/ha	0.23-	0.00-
3	Boxer Gold, Unlevelled	2500 ml/ha	0.02-	0.00-
3a	Boxer Gold, Levelled	2500 ml/ha	0.12-	0.00-
4	Experimental, Unlevelled	1800 ml/ha	0.00-	0.00-
4a	Experimental, Levelled	1800 ml/ha	0.11-	0.00-
5	Avadex Xtra, Unlevelled	1600 ml/ha	0.15-	5.43-
5a	Avadex Xtra, Levelled	1600 ml/ha	0.06-	0.25-
6	TriflurX, Unlevelled	1700 ml/ha	0.05-	0.00-
6a	TriflurX, Levelled	1700 ml/ha	0.17-	0.00-
7	Avadex Xtra, Unlevelled TriflurX, Unlevelled	1600 ml/ha 1700 ml/ha	0.06-	0.00-
7a	Avadex Xtra, Levelled TriflurX, Levelled	1600 ml/ha 1700 ml/ha	0.02-	0.00-
8	Outlook, Unlevelled	1000 ml/ha	0.02-	0.00-
8a	Outlook, Levelled	1000 ml/ha	0.23-	0.00-
9	Rustler, Unlevelled	1000 ml/ha	0.12-	0.02-
9a	Rustler, Levelled	1000 ml/ha	0.04-	0.01-
10	Rifle 440, Unlevelled	2500 ml/ha	0.15-	0.00-
10	Rifle 440, Levelled	2500 ml/ha	0.07-	0.00-
11	Ultro, Unlevelled	1100 g/ha	0.18-	0.00-
11a	Ultro, Levelled	1100 g/ha	0.05-	1.48-

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COMPLETE SPLIT-PLOT AOV
Chickpea cv. PBA HatTrick
14/07/2020
EMERGENCE /m² 20 DAP T1

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	64	311.850616				
R	2	32.111269	16.055634	4.547	0.0168	
B	1	2.710464	2.710464	1.173	0.3920	1.6
ERROR B	2	4.622633	2.311316			
A	10	103.691761	10.369176	2.937	0.0077	2.2
AB	10	31.000473	3.100047	0.878	0.5610	3.1
ERROR A	39	137.714015	3.531129			

COMPLETE SPLIT-PLOT AOV
Chickpea cv. PBA HatTrick
6/08/2020
NDVI Ratio 06 V9 43 DAP

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	64	0.028073				
R	2	0.001489	0.000744	3.351	0.0454	
B	1	0.000447	0.000447	8.098	0.1045	0.008
ERROR B	2	0.000110	0.000055			
A	10	0.012712	0.001271	5.721	0.0001	0.017
AB	10	0.004650	0.000465	2.093	0.0490	0.025
ERROR A	39	0.008666	0.000222			

COMPLETE SPLIT-PLOT AOV
***Avena spp.* - Wild Oats**
6/08/2020
COUNT /m² 13 44 DAA T2

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	64	2.182514				
R	2	0.096475	0.048237	1.523	0.2308	
B	1	0.001933	0.001933	0.329	0.6242	0.08
ERROR B	2	0.011750	0.005875			
A	10	0.343228	0.034323	1.084	0.3978	0.21
AB	10	0.493816	0.049382	1.559	0.1559	0.29
ERROR A	39	1.235312	0.031675			

COMPLETE SPLIT-PLOT AOV
***Avena spp.* - Wild Oat**
3/09/2020
COUNT /m² 72 DAA 72 DAA T3

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	64	2.089208				
R	2	0.080512	0.040256	1.462	0.2441	
B	1	0.003788	0.003788	1.016	0.4197	0.06
ERROR B	2	0.007460	0.003730			
A	10	0.413188	0.041319	1.501	0.1760	0.19
AB	10	0.510668	0.051067	1.855	0.0826	0.27
ERROR A	39	1.073593	0.027528			

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COMPLETE SPLIT-PLOT AOV *Chloris virgata* - Feathertop Rhodes Grass 3/09/2020 COUNT /m² 72 DAA T4						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	64	387.850746				
R	2	14.367618	7.183809	1.265	0.2937	
B	1	10.046402	10.046402	3.248	0.2133	1.86
ERROR B	2	6.186959	3.093479			
A	10	67.023578	6.702358	1.180	0.3334	2.78
AB	10	68.664270	6.866427	1.209	0.3157	3.93
ERROR A	39	221.561920	5.681075			

Assessment Type

NDVI = Normalized difference vegetation index

DAA = Days after Application
DAP = Days after Planting

Conclusions:

This was a complex trial evaluating pre-emergent herbicides and the impact of levelling on pre-emergent efficacy and crop safety. The planned evaluation of the impact of pre-emergent options on post-emergent efficacy could not be undertaken to low weed density. Pre-emergent herbicides were applied one day prior to sowing and three days prior to levelling. Levelling was conducted with inverted fire harrows. Harrows were inverted to reduce the amount of dragging and disturbance due to sorghum stubble.

Trial data generated only relates to the impact of residual herbicides and the levelling operation. Rainfall recordings of ~25 mm of rain occurred at 19-20 days after application (19-20 DAA), ~20 mm between 33-37 DAA and ~38 mm between 46-53 DAA.

Assessment of crop emergence at 20 days after planting (20 DAP) showed a number of treatments had significantly reduced establishment. There was no impact on emergence from the levelling operation and no interaction with the residual herbicides. The experimental product, TriflurX alone, Avadex Xtra + TriflurX, Rifle and Ultro all reduced establishment compared to the untreated by ~2-4 chickpeas/m^2.

NDVI readings at 43 DAP found that only the experimental option significantly reduced biomass compared to the untreated in the unlevelled plots. However, the experimental, TriflurX, Avadex Xtra + TriflurX, Outlook and Rifle all significantly reduced biomass compared to the untreated when levelled. Levelling only significantly impacted NDVI for Boxer Gold with significantly greater biomass when levelled.

Wild oat counts were taken at 44 DAA and 72 DAA. There was only a very small increase in wild oat counts at the 72 DAA assessment despite the rainfall between 46-53 DAA. Wild oat counts were very low with all herbicide treatments recording <0.3.m^2 at both assessments. Levelling did not have a significant effect on weed counts at either assessment. There was no significant difference in wild oat counts between any treatment and the untreated despite all herbicide treatments recording 60-85% lower numbers.

In this trial, the experimental product, TriflurX alone, Avadex Xtra + TriflurX, Outlook, Rifle and Ultro all resulted in significant crop safety issues, particularly when the soil was levelled after application. The weed counts were too low to provide good levels of confidence.

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Crop Description	
Crop:	*Cicer arietinum* Chickpea
Variety:	PBA Hatrick
Planting Date:	24/06/2020
Planting Method:	Direct Drilled
Planting Equipment:	Double Disc Planter
Row Spacing, Unit:	1m

Application Description	
Application Date:	23/06/2020
Application Start Time:	9:20 AM
Application Stop Time:	12:40 PM
Application Method:	SPRAY
Application Timing:	IBS
Application Placement:	SOIL
Air Temperature, Unit:	7.8 C
% Relative Humidity:	66.5
Wind Velocity, Unit:	9.8 km/h
Wind Direction:	W
Dew Presence (Y/N):	No
Soil Moisture:	DRY
% Cloud Cover:	5
Next Moisture Occurred On:	12/07/2020

Application Equipment	
Application Equipment:	Polaris
Equipment Type:	BOOM
Operation Pressure, Unit:	300 kPa
Nozzle Type:	AIXR
Nozzle Size:	110015
Nozzle Spacing, Unit:	50 cm
Nozzles/Row:	8
Boom Length, Unit:	4 m
Boom Height, Unit:	50 cm
Ground Speed, Unit:	7.2 km/h
Spray Volume, Unit:	100 L/ha

Rainfall:	
Closest Weather Station:	Gunbower (Stn No 41270)
Distance, Unit:	1km

Date	Amount	Unit
13/06/2020	3.6	mm
14/06/2020	28.0	mm
12/07/2020	22.8	mm
13/07/2020	2.2	mm
26/07/2020	12.6	mm
27/07/2020	3.6	mm
28/07/2020	0.7	mm
30/07/2020	2.9	mm
8/08/2020	15.1	mm
15/08/2020	23.1	mm
16/08/2020	0.4	mm
5/09/2020	0.1	mm
6/09/2020	0.2	mm