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

Trial ID: BD2002 **Location:** Bellata **Trial Year:** 2020
Investigator: Branko Duric

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 or crop safety.

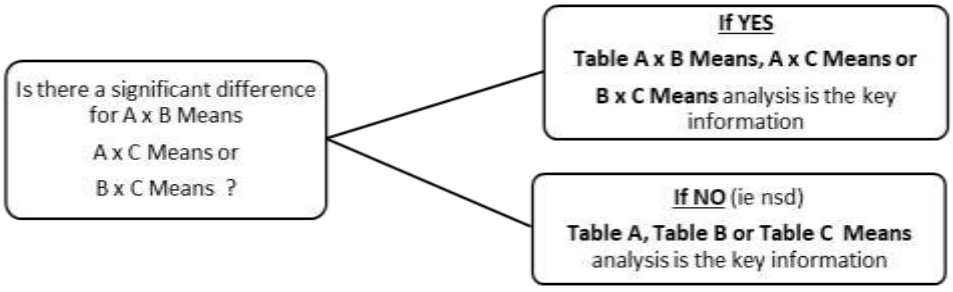
Industry observation has also indicated that wild oats surviving a residual herbicide treatment may be more difficult to control with post-emergent herbicides. The trial design allowed for an analysis of the impact of the residual herbicide on efficacy of the post-emergent application.

Objective:	**To evaluate the combined impact of residual herbicides, soil levelling and post emergent options for wild oat efficacy**		
Crop:	**Chickpeas**		
Planting Date:	**4/06/2020**		
Planting Details:	**60 kg/ha seed direct drilled using a disc planter on 37.5cm spacing Levelling conducted using Kelly chains**		
Application:	**A (IBS)**	**B (Early Post Emergent)**	**C (Late Post Emergent)**
Application Date:	**03/06/2020**	**13/08/2020**	**08/09/2020**
Crop Growth Stage at Application:	**Pre-Emergence**	**4 nodes**	**Pod initiation**
Weed:	**Wild Oats**		
Weed Stage at Application:	**Pre-Emergence**	**3 leaf**	**1 tiller**
Nozzles:	**AIXR110015**		
Volume:	**100 L/ha**		
Keywords:	**Wild oats, chickpeas, residual, soil levelling, post emergent**		

Trial designed and analysed as a Split Plot

	In Simple Terms
Table of A Means:	Mean of 'Pre-emergent' performance with **ALL** 'Levelling' and 'Post-emergent' treatments
Table of B Means:	Mean of 'Levelling' performance with **ALL** 'Pre-emergent' and 'Post-emergent' treatments
Table of C Means:	Mean of 'Post-emergent' performance with **ALL** 'Levelling' and 'Pre-emergent' treatments
Table of A x B Means:	'Pre-emergent' performance with **EACH** 'Levelling' treatment
Table of A x C Means:	'Pre-emergent' performance with **EACH** 'Post-emergent' treatment
Table of B x C Means:	'Levelling' performance with **EACH** 'Post-emergent' treatment

How to Interpret?



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Please note: All named products in the table below are registered for use in chickpeas at planting, 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.

There was no interaction between pre-emergent herbicide and soil levelling in this trial, so only the main effect treatments are shown in Table 1

Table 1 - Chickpea and wild oat emergence counts, prior to application of post-emergent treatments

Pest Scientific Name					***Avena spp.***
Pest Name					**Wild Oats**
Crop Name				**Chickpea**	
Assessment Date				**2/07/2020**	**13/08/2020**
Assessment Type				**EMERGENCE**	**COUNT**
Assessment Unit				**/m²**	**/m²**
Pest Stage Majority					**13**
Treatment-Evaluation Interval				**29 DAA**	**71 DAA**
Plant-Evaluation Interval				**28 DAP**	**70 DAP**
Trt No.	**Treatment**	**Product Rate**	**Appln. Code**		
TABLE OF A MEANS (Pre-emergent)					
1	Untreated	-	-	39-	0.04-
2	Sakura	118g/ha	A	42-	0.02-
3	Boxer Gold	2500ml/ha	A	41-	0.01-
4	Experimental 1	1800ml/ha	A	39-	0.03-
5	Avadex Xtra	1600ml/ha	A	40-	0.03-
6	TriflurX	1700ml/ha	A	40-	0.01-
7	Avadex Xtra TriflurX	1600ml/ha 1700ml/ha	A A	39-	0.02-
8	Outlook	1000ml/ha	A	41-	0.03-
9	Rustler	1000ml/ha	A	40-	0.01-
10	Rifle 440	2500ml/ha	A	40-	0.03-
11	Ultro	1100g/ha	A	38-	0.00 -
TABLE OF B MEANS (Levelling)					
1	Unlevelled			40-	0.04-
2	Levelled			40-	0.00-

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

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NB: Interaction only significant for pre-emergent x levelling treatments. For simplicity, only this interaction is presented.
Plots size were 4 m x 16 m. Surviving wild oat and panicle counts were conducted on a transect of 3 m x 14 m in each plot
Key analysis is highlighted in grey

Table 2 - Wild oat plant and panicle counts, following application of post-emergent herbicides

Pest Scientific Name				***Avena spp.***	
Pest Name				**Wild Oats**	
Crop Name				**Chickpea**	
Assessment Date				**16/10/2020**	
Assessment Type				**COUNT**	**PANICLES**
Assessment Unit				**/m²**	**/m²**
Pest Stage Majority				**63**	**63**
Treatment-Evaluation Interval				**135 DAA/ 64 DAB, 38 DAC**	**135 DAA/ 64 DAB, 38 DAC**
Trt No.	**Treatment**	**Product Rate**	**Appln. Code**		
TABLE OF A MEANS (Pre-emergent)					
1	Untreated	-	-	0.02-	0.07-
2	Sakura	118g/ha	A	0.02-	0.09-
3	Boxer Gold	2500ml/ha	A	0.01-	0.05-
4	Experimental 1	1800ml/ha	A	0.02-	0.08-
5	Avadex Xtra	1600ml/ha	A	0.01-	0.02-
6	TriflurX	1700ml/ha	A	0.02-	0.10-
7	Avadex Xtra TriflurX	1600ml/ha 1700ml/ha	A A	0.04-	0.13-
8	Outlook	1000ml/ha	A	0.03-	0.07-
9	Rustler	1000ml/ha	A	0.00-	0.00-
10	Rifle 440	2500ml/ha	A	0.02-	0.10-
11	Ultro	1100g/ha	A	0.01-	0.03-
TABLE OF B MEANS (Levelling)					
1	Unlevelled			0.03-	0.12-
2	Levelled			0.00-	0.01-
TABLE OF C MEANS (Post-emergent)					
1	Verdict 520 Status Uptake Liase	100ml/ha 500ml/ha 0.5% v/v 1% v/v	B B B B	0.00-	0.00b
2	Oatmaster Uptake	1875ml/ha 0.5% v/v	C C	0.03-	0.13a
TABLE OF A x B MEANS (Pre-emergent x Levelling)					
1a	Untreated, Unlevelled	-	-	0.02bcd	0.08-
1b	Untreated, Levelled	-	-	0.03bcd	0.06-
2a	Sakura, Unlevelled	118g/ha	A	0.03bcd	0.18-
2b	Sakura, Levelled	118g/ha	A	0.00d	0.00-
3a	Boxer Gold, Unlevelled	2500ml/ha	A	0.02bcd	0.10-
3b	Boxer Gold, Levelled	2500ml/ha	A	0.00d	0.00-
4a	Experimental 1, Unlevelled	1800ml/ha	A	0.03bcd	0.16-
4b	Experimental 1, Levelled	1800ml/ha	A	0.00d	0.00-
5a	Avadex Xtra, Unlevelled	1600ml/ha	A	0.01cd	0.04-
5b	Avadex Xtra, Levelled	1600ml/ha	A	0.00d	0.00-
6a	TriflurX, Unlevelled	1700ml/ha	A	0.04bcd	0.21-
6b	TriflurX, Levelled	1700ml/ha	A	0.00d	0.00-
7a	Avadex Xtra, Unlevelled	1600ml/ha	A	0.08a	0.27-
	TriflurX	1700ml/ha	A		
7b	Avadex Xtra, Levelled	1600ml/ha	A	0.00d	0.00-
	TriflurX	1700ml/ha	A		

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Table 2 - Wild oat plant and panicle counts, following application of post-emergent herbicides (continued)

Trt No.	Treatment	Product Rate	Appln. Code		
Pest Scientific Name				*Avena spp.*	
Pest Name				Wild Oats	
Crop Name				Chickpea	
Assessment Date				16/10/2020	
Assessment Type				COUNT	PANICLES
Assessment Unit				/m²	/m²
Pest Stage Majority				63	63
Treatment-Evaluation Interval				135 DAA/ 64 DAB, 38 DAC	135 DAA/ 64 DAB, 38 DAC
8a	Outlook, Unlevelled	1000ml/ha	A	0.05ab	0.14-
8b	Outlook, Levelled	1000ml/ha	A	0.01cd	0.01-
9a	Rustler, Unlevelled	1000ml/ha	A	0.00d	0.00-
9b	Rustler, Levelled	1000ml/ha	A	0.00cd	0.00-
10a	Rifle 440, Unlevelled	2500ml/ha	A	0.04abc	0.19-
10b	Rifle 440, Levelled	2500ml/ha	A	0.00d	0.00-
11a	Ultro, Unlevelled	1100g/ha	A	0.00cd	0.00-
11b	Ultro, Levelled	1100g/ha	A	0.01cd	0.05-

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

Mean comparisons performed only when AOV Treatment P (F) is significant at mean comparison OSL.

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COMPLETE SPLIT-PLOT AOV
Chickpea
2/07/2020
EMERGENCE /m² 02 VE 28 DAP

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	131	2366.663300				
R	2	9.380471	4.690236	0.292	0.7616	
B	1	0.407407	0.407407	0.030	0.8779	3
ERROR B	2	26.915825	13.457912			
C	1	10.939394	10.939394	0.680	0.4558	2
BC	1	7.437710	7.437710	0.463	0.5337	3
ERROR C	4	64.309764	16.077441			
A	10	170.922559	17.092256	0.911	0.5272	4
AB	10	219.851852	21.985185	1.172	0.3219	5
AC	10	126.505051	12.650505	0.674	0.7449	5
ABC	10	229.414141	22.941414	1.223	0.2893	7
ERROR A	80	1500.579125	18.757239			

COMPLETE SPLIT-PLOT AOV
***Avena spp* – Wild Oats**
13/08/2020
COUNT /m² 06 V(4) 13 71 DAA

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	131	0.211825				
R	2	0.007138	0.003569	5.731	0.0669	
B	1	0.034018	0.034018	9.352	0.0924	0.05
ERROR B	2	0.007275	0.003638			
C	1	0.000520	0.000520	0.834	0.4127	0.01
BC	1	0.000726	0.000726	1.166	0.3411	0.02
ERROR C	4	0.002491	0.000623			
A	10	0.016199	0.001620	1.250	0.2730	0.03
AB	10	0.013932	0.001393	1.075	0.3910	0.04
AC	10	0.012094	0.001209	0.933	0.5076	0.04
ABC	10	0.013777	0.001378	1.063	0.4001	0.06
ERROR A	80	0.103656	0.001296			

COMPLETE SPLIT-PLOT AOV
***Avena spp* - Wild Oat**
Chickpea
16/10/2020
SURVIVING /m² 63 135 DAA 64 DAB 38 DAC

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	131	0.254806				
R	2	0.011364	0.005682	1.227	0.3841	
B	1	0.020447	0.020447	4.324	0.1731	0.05
ERROR B	2	0.009457	0.004728			
C	1	0.035564	0.035564	7.682	0.0502	0.03
BC	1	0.019279	0.019279	4.164	0.1109	0.05
ERROR C	4	0.018519	0.004630			
A	10	0.013451	0.001345	1.376	0.2065	0.03
AB	10	0.019566	0.001957	2.002	0.0438	0.04
AC	10	0.011630	0.001163	1.190	0.3103	0.04
ABC	10	0.017333	0.001733	1.773	0.0790	0.05
ERROR A	80	0.078197	0.000977			

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COMPLETE SPLIT-PLOT AOV
***Avena spp*- Wild Oat**
PANICLE
16/10/2020
COUNT /m² 63 135 DAA 64 DAB 38 DAC

Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	131	4.321802				
R	2	0.173495	0.086748	1.334	0.3598	
B	1	0.426136	0.426136	4.697	0.1625	0.23
ERROR B	2	0.181432	0.090716			
C	1	0.535152	0.535152	8.231	0.0455	0.12
BC	1	0.368691	0.368691	5.671	0.0759	0.17
ERROR C	4	0.260067	0.065017			
A	10	0.195432	0.019543	1.037	0.4210	0.11
AB	10	0.294243	0.029424	1.561	0.1338	0.16
AC	10	0.145735	0.014573	0.773	0.6541	0.16
ABC	10	0.233208	0.023321	1.237	0.2808	0.22
ERROR A	80	1.508211	0.018853			

Pest Stage Majority
13 = 3 true leaves, leaf pairs or whorls unfolded
63 = 30% of flowers open

DAA = Days after Application A
DAB = Days after Application B
DAC = Days after Application C

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Conclusions:

This was a complex trial evaluating pre-emergent herbicides, the impact of levelling on pre-emergent efficacy and then the impact of pre-emergent on post-emergent herbicides.

Pre-emergent herbicides were applied one day prior to sowing with levelling three days later. Levelling was conducted using Kelly chains. The early post-emergent treatment, Verdict 100 mL/ha + Status 500 mL/ha + Liase 1% v/v + Uptake 0.5% v/v, was applied 70 days after planting (70 DAP), when wild oats were at the 3-leaf stage (~GS13). Oatmaster 1.875 L/ha + Uptake 0.5% v/v was applied at 96 DAP, when most wild oats were still tillering.

An emergence count was done 28 days after planting (28 DAA). There was no significant impact on chickpea establishment from the pre-emergent herbicides or from the levelling treatments.

A count of wild oats was made prior to application of the early post emergent herbicides. Very few wild oats had germinated. Differences between treatments were not significant.

A second count of wild oats and a wild oat panicle count was made in mid-October, 64 days after the Verdict + Status application and 38 days after the Oatmaster application. No surviving wild oat plants were found following the Verdict + Status treatment.

Although wild oat emergence in this trial was too low for confident outcomes, there was a significant interaction between levelling and residual herbicide. Avadex + TriflurX, Outlook and Rifle all had significantly improved control wild oat control when levelling was applied. No wild oat panicles were found following the knockdown of Verdict + Status with significantly higher panicle counts following Oatmaster.

The wild oat population in this trial was too low to provide sound conclusions.

Crop Description	
Crop:	***Cicer arietinum*** **Chickpea**
Planting Date:	**4/06/2020**
Planting Rate:	**60kg/ha**
Planting Method:	**Direct Drilled**
Planting Equipment:	**Disc**
Row Spacing Unit:	**37.5 cm**

Application Description			
	A	**B**	**C**
Application Date:	**3/06/2020**	**13/08/2020**	**8/09/2020**
Application Start Time:	**7:00 AM**	**12:00 PM**	**10:00 AM**
Application Stop Time:	**11:00 AM**	**2:00 PM**	**1:00 PM**
Application Method:	**SPRAY**		
Application Timing:	**IBS**	**EARLY POST-EM**	**LATE POST-EM**
Application Placement:	**SOIL**	**FOLIAR**	**FOLIAR**
Applied By:	**B Duric**		
Air Temperature, Unit:	**10.6 C**	**25 C**	**23 C**
% Relative Humidity:	**61**	**50**	**52**
Wind Velocity, Unit:	**0.5 m/s**	**1.6 m/s**	**1 m/s**
Wind Direction:	**SW**	**NW**	**NW**
Dew Presence (Y/N):	**No**		
% Cloud Cover:	**80**	**0**	**0**

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Crop Stage at Each Application					
	A	B		C	
Crop:	Chickpea				
BBCH Stage Scale Used:	GRDC				
Stage Majority, %:		06 V4	80%	13 R6	80%
Stage Minimum, %:		05 V3	20%	12 R5	20%

06 V3 = 3 nodes, 06 V4 = 4 nodes
12 R5 = corolla collapses, 13R6 = pod initiation

Pest Stage at Each Application					
	A	B		C	
Pest:	Avena spp Wild Oat				
Stage Majority, %:	Pre-emergence	13	70%	21	70%
Stage Minimum, %:		12	10%	16	20%

12 = 2 leaf
13 = 3 leaf
21 = 1st tiller

Application Equipment			
	A	B	C
Application Equipment:	Polaris		
Equipment Type:	BOOM		
Operation Pressure, Unit:	300 kPa		
Nozzle Type:	AIXR		
Nozzle Size:	110015		
Nozzle Spacing, Unit:	50 cm		
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:	Bellata post office 53003
Distance, Unit:	15 km

Date	Amount	Unit
10/08/2020	15.2	mm
11/08/2020	5	mm
17/08/2020	5.8	mm
1/09/2020	27	mm
11/09/2020	19.2	mm
21/09/2020	4.8	mm
22/09/2020	29	mm
1/10/2020	9.6	mm
13/10/2020	3.2	mm