2024 Snake River Weed Management Tour & Field Day

University of Idaho
College of Agricultural and Life Sciences

Kimberly Research & Extension Center

June 26, 2024

Weed Science Program Faculty and Staff

Albert Adjesiwor, Weed Scientist
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Albert Kwarteng, Graduate Research Assistant
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Adam Kennedy, Graduate Research Assistant
Shaila Antonio-Venegas, Research Assistant
Grace Buckley, Research Assistant
Sarah Beus, Research Assistant
Raleigh Bell, Intern
Ayden Carlson, Research Assistant

Please, scan for soft copy of the tour handout

Lunch sponsors

Syngenta

Gowan Chemical

The support and contributions by these lunch sponsors is greatly appreciated.

Table of contents

Registration begins at 8:00 am

8:40 to 8:55

- Greetings, introductions, and announcements

9:05 to 10:05

- Palmer amaranth and waterhemp updates – *Albert Adjesiwor*
- Cereal cover crops and herbicides for weed control in dry bean – *Prayusha Bhattarai*
- Wheat response to repeated weed competition – *Albert Kwarteng*

Stop 1 (West of Field 8N):

- Organic grains – *Linda Schott*

Stop 2 (East of Field 23S):

- Herbicide drift in sugar beet – *Albert Adjesiwor*

Step 3 (West of Field 28/29):

- Weed control demonstration in sugar beet – *Albert Adjesiwor*
- Volunteer wheat as cover crop for weed suppression in sugar beet– *Adam Kennedy*
- Group 15 herbicides for preemergence weed control in sugar beet – *Albert Adjesiwor*
- Management of sugar beet root maggot – *Beck Akhiwu*

10:05 to 11:05

Stop 4 (West of Field 11):

- Thrips and viruses in alfalfa – *Apekshya Senchuri*

Stop 5 (South of Field 3A):

- Using sprout inhibitors to reduce the risk of plant emergence in export potatoes – *Tyler Spence*

Stop 6 (North of Field 57B):

- Weed control in corn – *Albert Adjesiwor*

Stop 7 (North of Field 57D):

- Herbicide tolerance and weed control in garden bean – *Albert Adjesiwor*
- Reflex for weed control in dry bean – *Albert Adjesiwor*

11:05 to 12:05

Stop 8 (North of Field 60):

- IAMP (a.k.a. climate-smart) research updates – *Linda Schott*

Stop 9 (North of Field 7A/B):

- Insect pest management in potato – *Erik Wenninger*
- Management of Potato virus Y – *Kelie Yoho/ Erik Wenninger*
- Interseeding cover crops into silage corn – *Steve Hines*

12:05: Lunch (sponsored by Syngenta & Gowan)

Invasive Weed Identification Guide - Palmer Amaranth and Waterhemp

Palmer amaranth

Amaranthus palmeri S. Watson

Key Descriptors:

- Elongated seed head - up to 24" long
- Non-wavy, diamond-shaped leaves
- Petioles longer than leaf blades
- Smooth stem - thinner than Redroot pigweed
- Poinsettia-like leaf whorl
- Single plants can be more branched whereas monocultures tend to be single shoots
- Documented resistance to HRAC Groups 2, 3, 4, 5, 6, 9, 10, 14, 15, 27

Please report sightings to:
All ID: Dr. Albert Adjesiwor, University of Idaho; 208.490.3623; aadjesiwor@uidaho.edu
All OR: Dr. Joel Felix, Oregon State University; 208.739.2675; joel.felix@oregonstate.edu
All ID/OR: Clarke Alder, Amalgamated Sugar; 208.989.7400; calder@amalsugar.com
Sightings may also be reported to:
East ID: Pam Hutchison, University of Idaho; 208.397.4181; phutch@uidaho.edu
North ID: Joan Campbell, University of Idaho; 208.885.7730; jcampbell@uidaho.edu
WA: Dr. Rui Liu, Washington State University; 509.786.9354; rui.liu@wsu.edu

Invasive Weed Identification Guide - Palmer Amaranth and Waterhemp

Waterhemp

Amaranthus tuberculatus (Moq.) Sauer

Key Descriptors:

- Elongated seed head - 6-8" long
- Smooth, shiny oblong (oval-shaped) to lanceolate (narrow/boat-shaped) leaves
- Upper leaves thinner and more lanceolate than lower leaves
- Smooth stem - similar to Palmer amaranth
- Tend to be more branched overall than Palmer amaranth
- Documented resistance to HRAC Groups 2, 4, 5, 9, 14, 15, 27

Please report sightings to:

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Palmer Amaranth and Waterhemp in Idaho: Current Distribution and Glyphosate Resistance Confirmation

Albert T. Adjesiwor[1], Clarke Alder[2], André L. S. Araujo[3], Joel Felix[4], Todd A. Gaines[3]
[1]University of Idaho | [2]Amalgamated Sugar | [3]Colorado State University | [4]Oregon State University

INTRODUCTION

Palmer amaranth (*Amaranthus palmeri* S. Watson) and waterhemp (*Amaranthus tuberculatus* (Moq.) J. D. Sauer) are the two most troublesome pigweeds in crop production systems in the United States, mostly due to widespread herbicide resistance[1,2]. These pigweeds just started to appear in the Pacific Northwest (PNW). A coordinated extension and outreach effort among land-grant universities (University of Idaho and Oregon State University), Amalgamated Sugar, other commodity commissions, and industry was launched to track Palmer amaranth and waterhemp in the PNW.

Objectives:

- Identify the presence and distribution of Palmer amaranth and waterhemp in Idaho and Oregon.
- Screen Palmer amaranth and waterhemp samples for resistance to commonly used herbicides in the PNW.

SURVEY METHODOLOGY

Several agronomists and crop advisors were trained on the identification of Palmer amaranth and waterhemp. Identification brochures were also prepared and circulated among stakeholders. The GPS coordinates of suspected Palmer amaranth and waterhemp were sent to the survey team and the survey team visited all sites to confirm whether the suspected pigweeds were Palmer amaranth or waterhemp (Figure 1). Tissue and seed samples (where there were matured seeds) were collected for further testing.

In 2023, the tissue samples were sent to Colorado State University for KASP genotyping test to confirm if the species were Palmer amaranth or waterhemp. Since the majority of these pigweeds survived multiple applications of glyphosate, 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) gene duplication analysis were conducted to confirm possible glyphosate resistance in the Palmer amaranth and waterhemp populations.

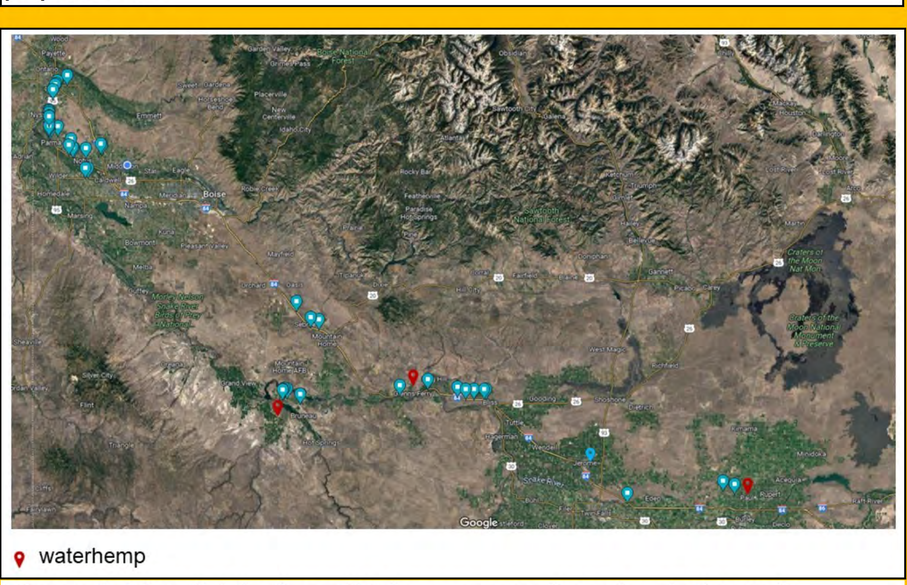

Figure 1: The distribution of Palmer amaranth and waterhemp in southern Idaho from the 2023 survey.

FINDINGS

- Palmer amaranth was found in several crops (corn, dry bean, hay, potato, small grains, sugar beet) as well as right-of-way, and private property (Figure 2).

Figure 2. Palmer amaranth found in multiple crops, right-of-way, and private property in Idaho

- Waterhemp was primarily found in sugar beet in southern Idaho (Figures 1 & 3).
- The KASP test confirmed that the suspected pigweeds were Palmer amaranth and waterhemp.
- About 70% (17 out of 23) of the Palmer amaranth tissue samples showed gene duplication of up to 184 EPSPS gene copies, indicative of glyphosate resistance (Figure 5).
- All three populations of waterhemp showed gene duplication of 5.7 to 9.2 EPSPS gene copies indicative of glyphosate resistance (Figure 6).
- This confirmed the pigweeds that escaped glyphosate applications (Figure 4) were glyphosate-resistant. These Palmer amaranth and waterhemp populations came from multiple counties in southern Idaho.

Figure 3. Waterhemp in sugar beet

Figure 4. Palmer amaranth (left) and waterhemp (right) that survived multiple glyphosate applications in sugar beet

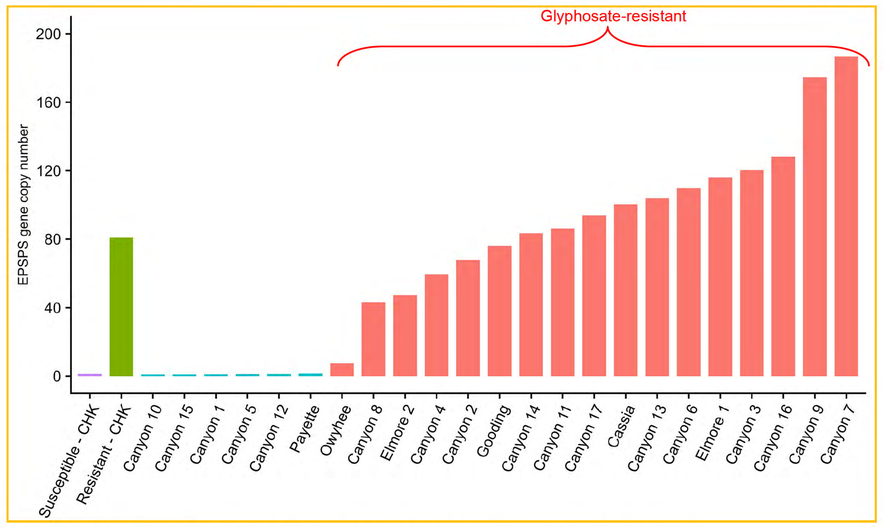

Figure 5. EPSPS gene duplication in Palmer amaranth tissue samples collected from Idaho

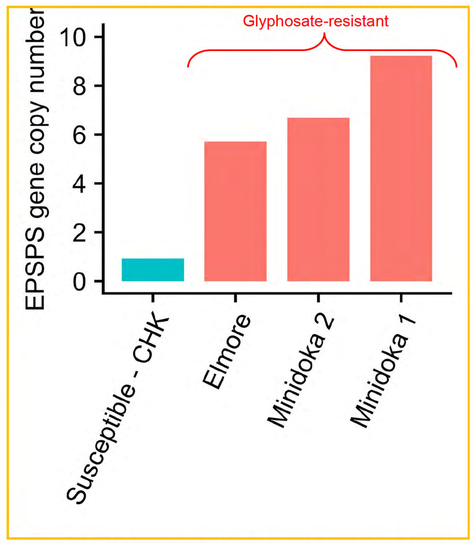

Figure 6. EPSPS gene duplication in waterhemp tissue samples collected from Idaho

FUTURE RESEARCH

- Expand the survey in 2024 to cover additional counties in Idaho, Oregon, and Washington.
- Screen samples for resistance to additional pre–and postemergence herbicides used in the PNW.

REFERENCES

1.Heap, I. 2024. The International Herbicide-Resistant Weed Database. Online. Monday, Jan. 15, 2024. Available www.weedscience.org

2. Ward, S., T. Webster, and L. Steckel. 2013. Palmer Amaranth (*Amaranthus palmeri*): A Review. Weed Technology, 27:12-27

University of Idaho | Oregon State University | Amalgamated Sugar | Colorado State University | NPWSRC

Integration of Fall-Planted Cereal Cover Crops and Herbicides for Weed Control in Dry Bean

Prayusha Bhattarai*, Albert T. Adjesiwor

Department of Plant Sciences, University of Idaho

Scan Me!

INTRODUCTION

Herbicide-resistant weeds are a growing concern in dry bean (*Phaseolus vulgaris*) production systems due to limited effective herbicide options and the highly susceptible nature of the crop to weed interference[1]. While herbicides will remain the primary control practice, non-chemical weed control practices are recommended to reduce the overreliance on herbicides. Cover crops are recognized as one of the most effective non-chemical weed management options, but they need to be integrated with other methods such as herbicides for effective weed control[2]. Cereals are among the best cover crops because of their competitiveness, easy availability and wide range of adaptation.

OBJECTIVES

- Evaluate how termination practice (chemical vs haying) affects weed suppression ability of fall-planted cereal cover crops in dry bean.
- Assess the impact of cover crop biomass on the efficacy of soil-applied herbicides.

HYPOTHESIS

Cover crop type, termination practice, and herbicide treatments will influence weed control efficacy and dry bean response.

MATERIALS AND METHODS

Study locations: University of Idaho Kimberly and Parma Research and Extension Centers

Study design: Split-plot randomized complete block design with 35 treatments and four replications (Figure 1)

Main plot (*Cover crop*): No cover crop, barley-hayed, barley-chemical termination, triticale-hayed, triticale-chemical termination, wheat-hayed, wheat-chemical termination. Chemical termination and haying were done 14 days before planting dry bean (Figure 2).

Subplot (*Herbicide*): Untreated, pendimethalin, pendimethalin + EPTC, dimethenamid-p + EPTC, bentazon + imazamox (POST)

Data collection: Cover crop height and biomass, weed density and biomass, dry bean stand density and seed yield

Data analysis: Linear mixed-effects ANOVA in R statistical language version 4.3.2 using the lmerTest package. Treatment means were separated using Tukey's HSD (α = 0.05).

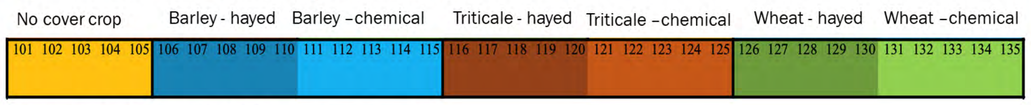

Figure 1: Layout of the first replicate

Figure 2: Haying and chemical termination 14 days before planting dry bean (A); Hayed plots sprayed with glyphosate on the day of dry bean planting (B)

RESULTS AND DISCUSSION

Table 1: Cover crop height, dry weight at termination and regrowth dry weight at dry bean planting.

Cover Crop	Height (cm)		Dry weight (kg ha^{-1})		Regrowth dry weight (kg ha^{-1})	
	Parma	Kimberly	Parma	Kimberly	Parma	Kimberly
Triticale	62 a	74 a	3128 a	1669 a	592 a	259 a
Wheat	43 b	52 b	2598 a	1136 b	872 a	267 a
Barley	45 b	38 c	2690 a	643 c	1142 a	477 a

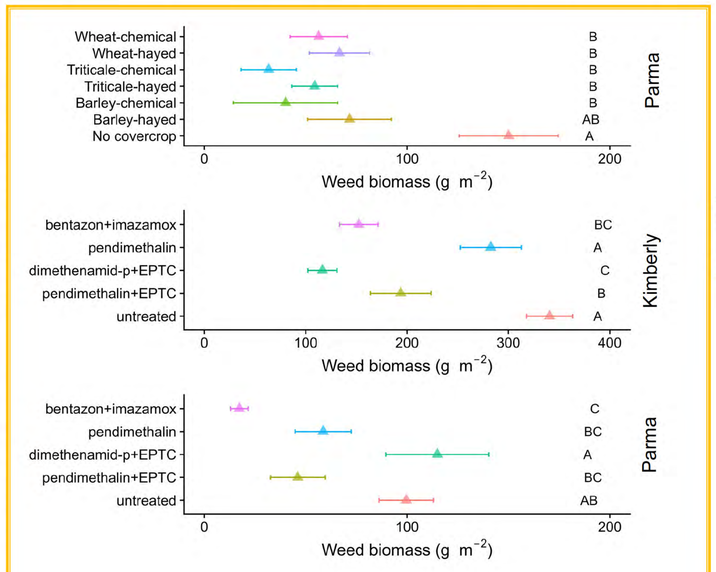

Figure 4: Effect of cover crops, termination methods, and herbicide treatments on weed biomass

- Harvesting cereal cover crops for forage before planting dry beans reduced stand density in Parma but had no effect in Kimberly (Figure 3).
- In Parma, cover crops reduced weed biomass by 52% to 79% mostly by outcompeting glyphosate-resistant kochia (Figure 6), while herbicide treatments reduced weed biomass by 41 to 83% (except for dimethenamid-p + EPTC). In Kimberly, herbicide treatments reduced weed biomass by 17 to 66% (Figure 4).
- Seed yield was primarily influenced by herbicide treatments and was reduced by 40 to 64% in Kimberly and 23 to 30% in Parma in untreated check (Figure 5).

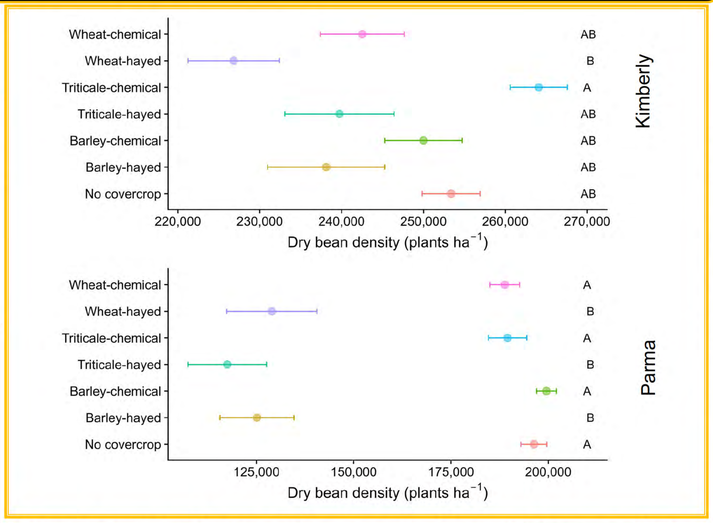

Figure 3: Effect of cover crops and termination methods on dry bean stand density in Kimberly and Parma

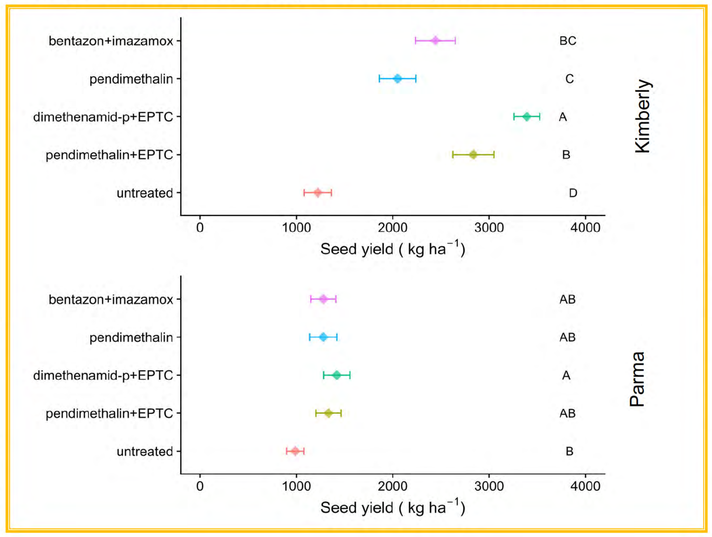

Figure 5: Effect of herbicide treatments on dry bean seed yield in Kimberly and Parma

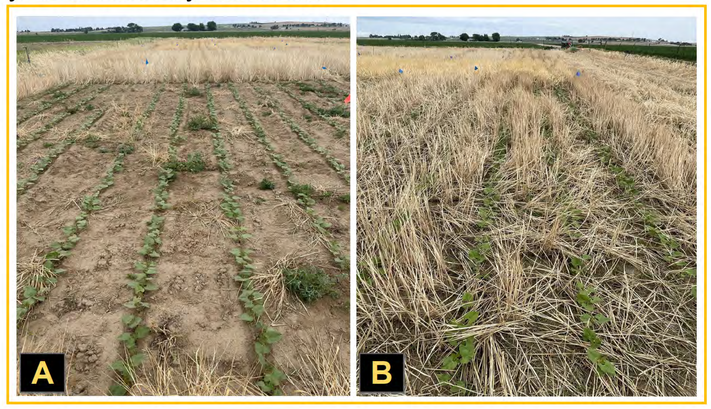

Figure 6: Glyphosate resistant kochia seen in no cover crop plots (A); reduced glyphosate-resistant kochia in cover crop plots (B)

CONCLUSIONS

- Cover crop biomass did not affect the efficacy of soil applied herbicides.
- Integration of cover crops and herbicides seem to be a promising strategy for effective weed control in dry bean.

FUTURE RESEARCH

The study will be repeated in 2024 to further understand the effect of integrating cover crops and herbicides on weed control in dry bean.

REFERENCES

1. Beiermann CW, Creech CF, Knezevic SZ, Jhala AJ, Harveson R, Lawrence NC. Influence of planting date and herbicide program on Amaranthus palmeri control in dry bean. Weed Technology. 2022;36(1):79-85.
2. Whalen DM, Shergill LS, Kinne LP, Bish MD, Bradley KW. Integration of residual herbicides with cover crop termination in soybean. Weed Technology. 2020;34(1):11-18.

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Integrating Cereal Cover Crops and Herbicides for Weed Control in Dry Beans

Trial ID: 2024_DB01_CoverCropHerb_Kimberly
Protocol ID: 2024_DB01_CoverCropHerb_Kimberly Location: Kimberly ID Trial Year: 2024
Project ID: 2023_DB02 Project ID 2: Project ID 3:
Study Director: Prayusha Bhattarai Sponsor Contact: ISDA - Idaho Bean Commission
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
1	CULT	No cover crop						A	PREPLA	101	225	314	434	
	CHK	untreated												
2	CULT	No cover crop						A	PREPLA	102	222	313	432	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
3	CULT	No cover crop						A	PREPLA	103	223	311	435	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
4	CULT	No cover crop						A	PREPLA	104	224	312	431	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
5	CULT	No cover crop						A	PREPLA	105	221	315	433	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	HERB	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					
6	CULT	Barley - Haying						A	PREPLA	106	228	318	407	
	CHK	untreated												
7	CULT	Barley - Haying						A	PREPLA	107	227	320	408	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
8	CULT	Barley - Haying						A	PREPLA	108	226	319	406	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
9	CULT	Barley - Haying						A	PREPLA	109	230	317	409	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
10	CULT	Barley - Haying						A	PREPLA	110	229	316	410	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	HERB	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					
11	CULT	Barley - Chemical termination						B	PREPLA	111	235	324	404	
	CHK	untreated												
12	CULT	Barley - Chemical termination						B	PREPLA	112	234	323	401	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
13	CULT	Barley - Chemical termination						B	PREPLA	113	232	325	403	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
14	CULT	Barley - Chemical termination						B	PREPLA	114	231	322	402	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
15	CULT	Barley - Chemical termination						B	PREPLA	115	233	321	405	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	HERB	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					
16	CULT	Triticale - Haying						A	PREPLA	116	210	326	420	
	CHK	untreated												
17	CULT	Triticale - Haying						A	PREPLA	117	209	328	417	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					

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Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
18	CULT	Triticale - Haying						A	PREPLA	118	206	330	416	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
19	CULT	Triticale - Haying						A	PREPLA	119	207	329	418	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
20	CULT	Triticale - Haying						A	PREPLA	120	208	327	419	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	HERB	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					
21	CULT	Triticale - Chemical terminat						B	PREPLA	121	203	331	412	
	CHK	untreated												
22	CULT	Triticale - Chemical terminat						B	PREPLA	122	204	334	414	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
23	CULT	Triticale - Chemical terminat						B	PREPLA	123	201	332	411	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
24	CULT	Triticale - Chemical terminat						B	PREPLA	124	202	333	413	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
25	CULT	Triticale - Chemical terminat						B	PREPLA	125	205	335	415	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	HERB	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					
26	CULT	Wheat - Haying						A	PREPLA	126	218	308	429	
	CHK	untreated												
27	CULT	Wheat - Haying						A	PREPLA	127	216	307	426	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
28	CULT	Wheat - Haying						A	PREPLA	128	219	306	427	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
29	CULT	Wheat - Haying						A	PREPLA	129	220	309	428	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
30	CULT	Wheat - Haying						A	PREPLA	130	217	310	430	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	HERB	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					
31	CULT	Wheat - Chemical termination						B	PREPLA	131	215	304	425	
	CHK	untreated												
32	CULT	Wheat - Chemical termination						B	PREPLA	132	213	305	421	
	CULT	No resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
33	CULT	Wheat - Chemical termination						B	PREPLA	133	212	302	422	
	CULT	Group 3 resistance						C						
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	C	PREPRE					
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	C	PREPRE					
34	CULT	Wheat - Chemical termination						B	PREPLA	134	211	303	423	
	CULT	Group 15 resistance						C						
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2	pt/a	C	PREPRE					

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Protocol ID: 2024_DB01_CoverCropHerb_Kimberly Location: Kimberly ID Trial Year: 2024
Project ID: 2023_DB02 Project ID 2: Project ID 3:
Study Director: Prayusha Bhattarai Sponsor Contact: ISDA - Idaho Bean Commission
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
35	CULT	Wheat - Chemical termination						B	PREPLA	135	214	301	424	
	CULT	Group 3 & 15 resistance						D						
	HERB	Varisto	4.187	LBA/GAL	SL	18	fl oz/a	D	POSPOS					
	ADJ	COC	100	%	SL	1	% v/v	D	POSPOS					
	ADJ	UAN (28-0-0)	100	%	SL	2.5	% v/v	D	POSPOS					

Sort Order: Treatment

Potential Impacts of Transgenerational Memory from Weed Competition on Spring Wheat

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Department of Plant Sciences, University of Idaho

Introduction

- Plants are often subjected to series of recurrent environmental stress that can affect their development and productivity.
- Competition for resources among plants has long been considered a stress-generating factor for plants.
- It has been shown that plants can store and recollect past stress events called **plant memory response or priming.**[1]
- Stress memories may either be advantageous or maladaptive.[2]

Objective

- Evaluate how multigenerational exposure of wheat to weed competition (stress) affects the competitive ability of wheat.

Hypothesis

- Transgenerational priming will influence the competitive ability of spring wheat.

Materials and Methods

Experiment 1: Greenhouse Transgenerational Stress Priming

- Experiments were conducted at the Kimberly Research and Extension Center from April 2021 to December 2022.

Experimental design: 4 treatments, completely randomized with 15 replications.

Fig. 1: Graphical representation of the 4 treatments

1. **Wheat-Italian ryegrass:** one wheat surrounded by 8 ryegrass.
2. **Wheat-Kochia**: one wheat surrounded by 8 kochia.
3. **Wheat-only:** one wheat plant per pot.
4. **Wheat-Wheat**: one wheat surrounded by 8 wheat.

***For the repeated generations of stress treatments*:**

- Seeds from 1st generation used to plant 2nd generation, process repeated to obtain 3rd, 4th and 5th generations.

Experiment 2: Common Garden Experiment

- The original seed (generation 0) and seeds from the 1st to 5th generations were grown in the greenhouse at the same time.
- Seeds from each treatment and generation were grown alone and under competition from either kochia, ryegrass, or wheat.

Management, Data Collection and Analyses:

- Data collected on central wheat plants at harvest include shoot biomass, number of seeds per plant, and seed weight.
- Gas exchange using LI-6400 (Li-COR Inc., NE).
- Data were analyzed using linear mixed-effects ANOVA in R language, and means separated using Tukey's HSD (α = 0.05).

Results and Discussion

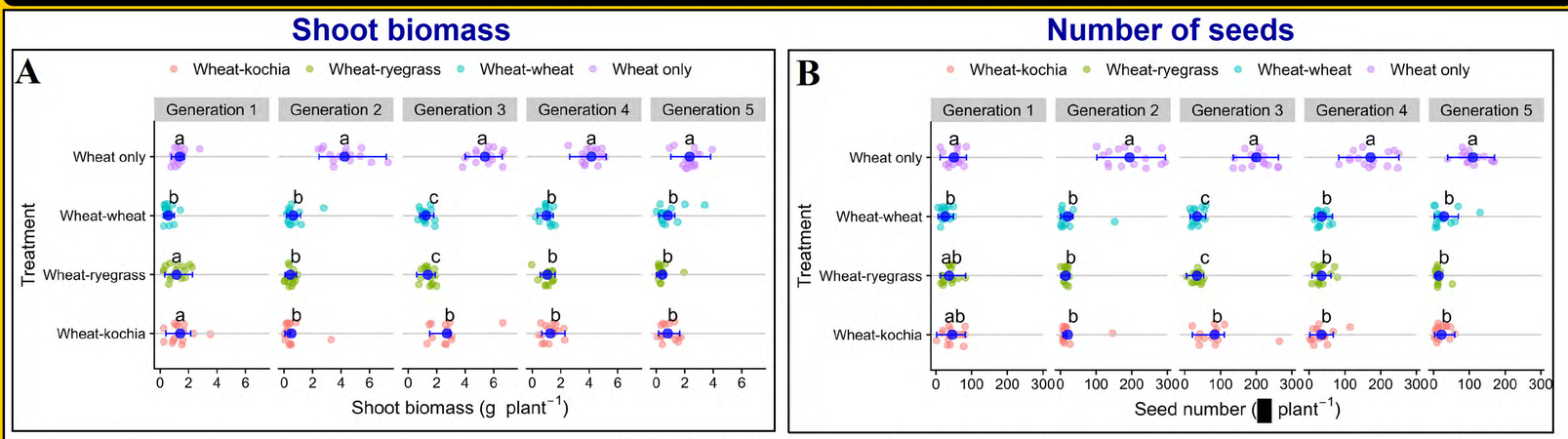


Fig. 2: Plots of shoot biomass (A) and number of seeds per plant (B) in each of the 5 generations of wheat-weed competition. *Letters represent the treatment groupings. Within each generation, bars with same letters depict no significant difference according to Tukey's HSD (α = 0.05).*

- Wheat grown in the absence of weed competition (wheat-only) showed a significant increase in shoot biomass and number of seeds in the 2nd, 3rd, 4th and 5th generations **(Fig. 2A and 2B)**.
- This superior performance of wheat-only however peaked in the 3rd generation, where the number of seeds per plant in generation 3 was three times that of generation 1.
- Thus, plant memory may have a beneficial impact on wheat grown without competition in subsequent generations.
- In generation 0, both photosynthetic and stomatal conductance rates of wheat-only were not significantly different from those of wheat-kochia, wheat-ryegrass or wheat-wheat **(data not presented)**.
- The same trend of no significant difference was observed in generations 1 to 5 for all the treatment combinations.
- Thus, photosynthesis in wheat may not be affected by weed stress memory.

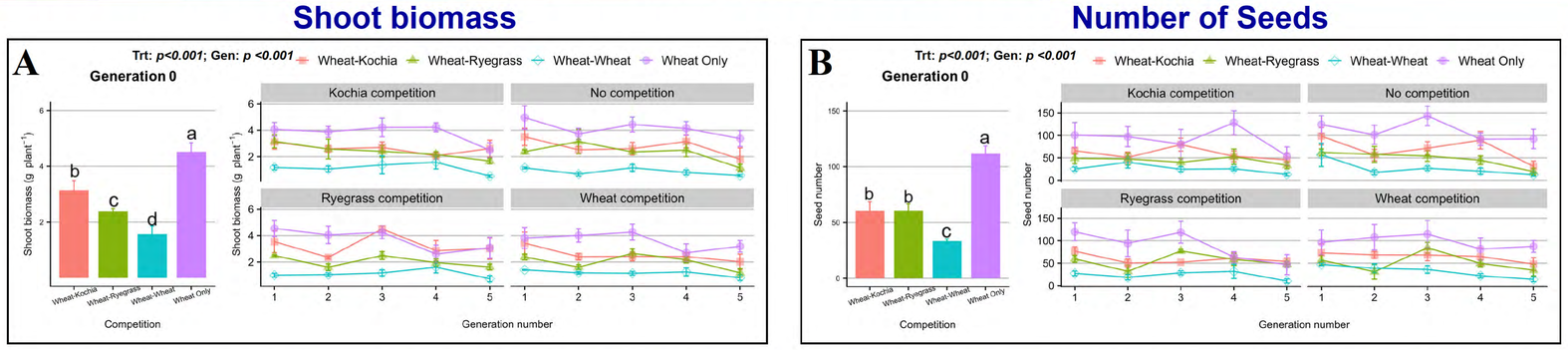


Fig. 3: Impact of transgenerational memory on shoot biomass (A) and seed number (B) in the original seed (Generation 0) compared to seeds from Generations 1 to 5 of wheat-weed competition.

- Wheat-wheat was the treatment with the most significant negative impact on the competitive ability of wheat **(Fig. 3A and 3B**), similar to what was observed in the prior transgenerational stress treatments **(Fig. 2)**.
- The wheat-only plants produced significantly higher shoot biomass and seed number **(Fig. 3A and 3B**), as observed earlier **(Fig. 2)**. Likewise, this superior performance of wheat-only plants peaked either in the 3rd or 4th generation, irrespective of whether they were grown alone or under kochia, ryegrass or wheat competition.

Conclusions

1. Potential **maladaptive** impact of transgenerational memory of weed competition was observed in wheat.
2. This maladaptive impact was heightened when wheat was under competition from other wheat plants.
3. Italian ryegrass competition generates a stronger potential maladaptive memory effect on wheat compared to kochia.
4. Plant memory may be beneficial for wheat grown in the absence of competition.

Future Research

1. RNA-Seq to study Differentially-Expressed Genes implicated in these observations.
2. Bisulfite sequencing to study DNA Methylation patterns under each condition.

- ***The goal is to identify genes involved in high competitiveness for breeding programs.***

References

1. Crisp et al., 2016. Sci. Adv., 2016, vol. 2, no 2, p.e1501340.
2. Iwasaki & Paszkowski, 2014. PNAS, 111(23), 8547-8552.

Funding

WSSA Weed Science Society of America
Idaho Wheat
University of Idaho Department of Plant Sciences

2024_SB06 Sugar beet response to herbicide drift

SPRAYING RECORD SHEET

		A
Date		5/16/24
Time Started		8:50 AM
Time Completed		10:30 AM
Appl. Method		Bicycle
Crop Stage		2-leaf beet
Air Temp (°F)		75
Rel. Humidity (%)		25
Wind Speed (MPH)		4
Wind Direction		WNW
Soil Temp (°F)	0"	72
	2"	70
	4"	67
Soil Moisture		Wet
Cloud Cover (%)		30

Sugar beet planting date: 4/12/2024

University of Idaho

Sugar beet respose to herbicide drift

Trial ID: 2024_SB06_SimulatedDrift
Protocol ID: 2024_SB06_SimulatedDrift Location: Kimberly ID Trial Year: 2024
Project ID: 2024_SB06_SimulatedDrift
Study Director: Albert Adjesiwor Sponsor Contact: Sugar beet Alliance
Investigator: Adjesiwor, Alder

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
1	CHK	nontreated								101	208	311	412	
2	HERB	Matrix	25	%	DF	0.047	oz wt/a	A	POSPOS	102	210	301	414	
3	HERB	Matrix	25	%	DF	0.094	oz wt/a	A	POSPOS	103	216	317	410	
4	HERB	Matrix	25	%	DF	0.1875	oz wt/a	A	POSPOS	104	217	313	409	
5	HERB	Matrix	25	%	DF	0.375	oz wt/a	A	POSPOS	105	202	309	403	
6	HERB	Harmony SG	50	%	SG	0.01875	oz wt/a	A	POSPOS	106	203	310	405	
7	HERB	Harmony SG	50	%	SG	0.0375	oz wt/a	A	POSPOS	107	201	308	411	
8	HERB	Harmony SG	50	%	SG	0.075	oz wt/a	A	POSPOS	108	214	305	407	
9	HERB	Harmony SG	50	%	SG	0.15	oz wt/a	A	POSPOS	109	212	314	402	
10	HERB	Starane Ultra	2.8	LBA/GAL	EC	0.2	fl oz/a	A	POSPOS	110	209	303	408	
11	HERB	Starane Ultra	2.8	LBA/GAL	EC	0.4	fl oz/a	A	POSPOS	111	215	316	404	
12	HERB	Starane Ultra	2.8	LBA/GAL	EC	0.8	fl oz/a	A	POSPOS	112	211	312	415	
13	HERB	Starane Ultra	2.8	LBA/GAL	EC	1.6	fl oz/a	A	POSPOS	113	204	306	416	
14	HERB	Tricor 4F	4	LBA/GAL	SC	0.5	fl oz/a	A	POSPOS	114	213	304	406	
15	HERB	Tricor 4F	4	LBA/GAL	SC	1	fl oz/a	A	POSPOS	115	206	315	401	
16	HERB	Tricor 4F	4	LBA/GAL	SC	2	fl oz/a	A	POSPOS	116	207	302	417	
17	HERB	Tricor 4F	4	LBA/GAL	SC	4	fl oz/a	A	POSPOS	117	205	307	413	

Sort Order: Treatment

2024_SB05 Weed control demonstration in sugar beet

SPRAYING RECORD SHEET

		A	B
Date		4/18/24	5/21/24
Time Started		4:30 PM	1:27 PM
Time Completed		4:45 AM	2:10 PM
Appl. Method		Bicycle 7.3'	Bicycle
Crop Stage		Pre-emerge	2-leaf beet
Air Temp (°F)		56	66
Rel. Humidity (%)		30	25
Wind Speed (MPH)		5	5.6
Wind Direction		E	NNE
Soil Temp (°F)	0"	59	70
	2"	54	72
	4"	51	68
Soil Moisture		Dry	dry
Cloud Cover (%)		0	5
Weed species & height		-	c. lambsquarters: 3"
			kochia: 2"
			barnyardgrass: 2"

Sugarbeet planting date: 4/17/2024

University of Idaho

Weed control demonstration in sugar beet

Trial ID: 2024_SB05_WeedControlDemo
Protocol ID: 2024_SB05_WeedControlDemo Location: Kimberly ID Trial Year: 2024
Project ID: 2024_SB05_WeedControlDemo
Study Director: Albert Adjesiwor Sponsor Contact: None
Investigator: Adjesiwor, Alder

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
1	CHK	nontreated								101	206	303	406	
2	HERB	Nortron	4	LBA/GAL	SC	3.75	pt/a	A	PREEM	102	203	301	410	
3	HERB	Goaltix Gold	700	g/L	SC	54	fl oz/a	A	PREEM	103	207	302	407	
4	HERB	Torero	500	g/L	SC	54	fl oz/a	A	PREEM	104	213	314	408	
5	HERB	Nortron	4	LBA/GAL	SC	3.75	pt/a	A	PREEM	105	209	311	412	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
6	HERB	Torero	500	g/L	SC	54	fl oz/a	A	PREEM	106	212	305	404	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
7	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	B	POSPOS	107	202	304	411	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
8	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	B	POSPOS	108	204	309	401	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
9	HERB	Warrant	3	LBA/GAL	CS	1.25	qt/a	B	POSPOS	109	208	307	402	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
10	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	B	POSPOS	110	214	310	409	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
11	HERB	Treflan HFP	4	LBA/GAL	EC	1.25	pt/a	B	POSPOS	111	205	313	414	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
12	HERB	Stinger	3	LBAE/GAL	EC	0.5	pt/a	B	POSPOS	112	210	308	405	
13	HERB	Upbeet	50	%	WDG	0.5	oz wt/a	B	POSPOS	113	201	312	403	
14	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS	114	211	306	413	
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					

Sort Order: Treatment

2024_SB03 Interseeding Cover Crops into Volunteer Winter Wheat for Weed Suppression in Sugar beet

SPRAYING RECORD SHEET

	D	G	H
Date	9/8/23	5/21/24	6/7/24
Time Started	5:30 PM	2:00 PM	9:00 AM
Time Completed	5:45 PM	3:00 PM	10:00 AM
Appl. Method	Bicycle 7.5"	UTV 7.3"	Bicycle 7.3
Crop Stage	Emerging wheat	3-leaf beet	8-leaf beet
Air Temp (°F)	78	66	88
Rel. Humidity (%)	41	25	31
Wind Speed (MPH)	1.5	5	1.5
Wind Direction	NNW	NW	WNW
Soil Temp (°F) 0"	80	70	78
2"	79	72	66
4"	76	68	64
Soil Moisture	variable	Dry	Dry
Cloud Cover (%)	80	5	2
Weed species & height	volunteer grain 2-3"	c. mallow: 1"	c. mallow: 3"
		downy brome: 3"	downy brome: 8"
		c. lambsquarters:1"	c. lambsquarters: 3"
		Flixweed: 4"	Flixweed: 7"

Cover crop (collards [6 lbs/A] and peas [50 lbs/A]) planting date: 8/23/23

Fall-wheat (100 lbs/A) planting date: 10/6/23

Sugarbeet planting date: 4/17/2024

University of Idaho

Interseeding Cover Crops into Volunteer Winter Wheat for Weed Suppression in Sugar beet

Trial ID: 2024_SB03_VolunteerWheat1
Protocol ID: 2024_SB03_VolunteerWheat Location: Kimberly, ID Trial Year: 2024
Project ID: VolunteerWheat
Study Director: Albert Adjesiwor Sponsor Contact: None
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
1	VAR	No cover crop						A		101	213	316	412	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
2	VAR	No cover crop						A		102	210	306	416	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	G	POSPOS					
	HERB	Nortron	4	LBA/GAL	EC	3.75	pt/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
3	VAR	No cover crop						A		103	214	310	406	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	H	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	H	POSPOS					
4	VAR	Volunteer wheat only						B		104	203	315	408	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
5	VAR	Volunteer wheat only						B		105	217	307	410	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	G	POSPOS					
	HERB	Nortron	4	LBA/GAL	EC	3.75	pt/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
6	VAR	Volunteer wheat only						B		106	201	303	407	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	H	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	H	POSPOS					
7	VAR	Volunteer wheat + cc mix						C		107	215	317	415	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
8	VAR	Volunteer wheat + cc mix						C		108	209	304	401	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	G	POSPOS					
	HERB	Nortron	4	LBA/GAL	EC	3.75	pt/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
9	VAR	Volunteer wheat + cc mix						C		109	211	308	403	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	H	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	H	POSPOS					
10	VAR	Volunteer wheat + cc mix						C		110	216	318	402	
	HERB	Select 2EC	2	LBA/GAL	EC	8	fl oz/a	D	EAPOWE					
	ADJ	Ultra Pro	100	%	SL	2.5	% v/v	D	EAPOWE					
	ADJ	COC	100	%	SL	1	% v/v	D	EAPOWE					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
11	VAR	Volunteer wheat + cc mix						C		111	207	314	413	
	HERB	Select 2EC	2	LBA/GAL	EC	8	fl oz/a	D	EAPOWE					
	ADJ	Ultra Pro	100	%	SL	2.5	% v/v	D	EAPOWE					
	ADJ	COC	100	%	SL	1	% v/v	D	EAPOWE					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	G	POSPOS					
	HERB	Nortron	4	LBA/GAL	EC	3.75	pt/a	G	POSPOS					
12	VAR	Volunteer wheat + cc mix						C		112	218	302	418	
	HERB	Select 2EC	2	LBA/GAL	EC	8	fl oz/a	D	EAPOWE					
	ADJ	Ultra Pro	100	%	SL	2.5	% v/v	D	EAPOWE					
	ADJ	COC	100	%	SL	1	% v/v	D	EAPOWE					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	H	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	H	POSPOS					
13	VAR	cc mix only						E		113	204	311	405	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					

University of Idaho

Interseeding Cover Crops into Volunteer Winter Wheat for Weed Suppression in Sugar beet

Trial ID: 2024_SB03_VolunteerWheat1
Protocol ID: 2024_SB03_VolunteerWheat Location: Kimberly, ID Trial Year: 2024
Project ID: VolunteerWheat
Study Director: Albert Adjesiwor Sponsor Contact: None
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
14	VAR	cc mix only						E		114	205	301	417	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	G	POSPOS					
	HERB	Nortron	4	LBA/GAL	EC	3.75	pt/a	G	POSPOS					
15	VAR	cc mix only						E		115	206	312	404	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	H	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	H	POSPOS					
16	VAR	Fall-seeded winter wheat						F		116	202	305	411	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
17	VAR	Fall-seeded winter wheat						F		117	208	309	414	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1.33	pt/a	G	POSPOS					
	HERB	Nortron	4	LBA/GAL	EC	3.75	pt/a	G	POSPOS					
18	VAR	Fall-seeded winter wheat						F		118	212	313	409	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	G	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	G	POSPOS					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	H	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	H	POSPOS					

Sort Order: Treatment

2024_SB02 Response of sugar beet to group 15 herbicides

SPRAYING RECORD SHEET

		A
Date		4/18/24
Time Started		5:43 PM
Time Completed		5:46 PM
Appl. Method		Bicycle
Crop Stage		PRE
Air Temp (°F)		56
Rel. Humidity (%)		20
Wind Speed (MPH)		3.5
Wind Direction		NE
Soil Temp (°F)	0"	61
	2"	60
	4"	58
Soil Moisture		Dry
Cloud Cover (%)		20
Weed species & height		-

Sugarbeet planting date: 4/17/2024

University of Idaho

Response of sugar beet to group 15 herbicides

Trial ID: 2024_SB02_Group15
Protocol ID: 2024_SB02_Group15 Location: Kimberly ID Trial Year: 2024
Project ID: 2024_SB02_Group15
Study Director: Albert Adjesiwor Sponsor Contact: Sugar beet Alliance
Investigator: Adjesiwor, Alder, Felix

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
1	SDTR	No seed treatment								101	215	306	419	
	HERB	Dual Magnum	7.62	LBA/GAL	EC	0.5	pt/a	A	PREEM					
2	SDTR	No seed treatment								102	217	304	416	
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1	pt/a	A	PREEM					
3	SDTR	No seed treatment								103	213	305	415	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
4	SDTR	No seed treatment								104	211	303	418	
	HERB	Outlook	6	LBA/GAL	EC	21	fl oz/a	A	PREEM					
5	SDTR	No seed treatment								105	219	308	414	
	HERB	Warrant	3	LBA/GAL	CS	1.25	qt/a	A	PREEM					
6	SDTR	No seed treatment								106	218	309	417	
	HERB	Warrant	3	LBA/GAL	CS	2	qt/a	A	PREEM					
7	SDTR	No seed treatment								107	214	302	420	
	HERB	Dual Magnum	7.62	LBA/GAL	EC	0.5	pt/a	A	PREEM					
	HERB	Nortron	4	LBA/GAL	SC	32	fl oz/a	A	PREEM					
8	SDTR	No seed treatment								108	216	310	411	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
	HERB	Nortron	4	LBA/GAL	SC	32	fl oz/a	A	PREEM					
9	SDTR	No seed treatment								109	212	307	413	
	HERB	Warrant	3	LBA/GAL	CS	1.25	qt/a	A	PREEM					
	HERB	Nortron	4	LBA/GAL	SC	32	fl oz/a	A	PREEM					
10	SDTR	No seed treatment								110	220	301	412	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					
11	SDTR	Concep III								111	202	318	405	
	HERB	Dual Magnum	7.62	LBA/GAL	EC	0.5	pt/a	A	PREEM					
12	SDTR	Concep III								112	203	319	404	
	HERB	Dual Magnum	7.62	LBA/GAL	EC	1	pt/a	A	PREEM					
13	SDTR	Concep III								113	205	316	402	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
14	SDTR	Concep III								114	209	311	406	
	HERB	Outlook	6	LBA/GAL	EC	21	fl oz/a	A	PREEM					
15	SDTR	Concep III								115	207	317	410	
	HERB	Warrant	3	LBA/GAL	CS	1.25	qt/a	A	PREEM					
16	SDTR	Concep III								116	210	313	401	
	HERB	Warrant	3	LBA/GAL	CS	2	qt/a	A	PREEM					
17	SDTR	Concep III								117	208	314	409	
	HERB	Dual Magnum	7.62	LBA/GAL	EC	0.5	pt/a	A	PREEM					
	HERB	Nortron	4	LBA/GAL	SC	32	fl oz/a	A	PREEM					
18	SDTR	Concep III								118	201	320	403	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
	HERB	Nortron	4	LBA/GAL	SC	32	fl oz/a	A	PREEM					
19	SDTR	Concep III								119	204	312	408	
	HERB	Warrant	3	LBA/GAL	CS	1.25	qt/a	A	PREEM					
	HERB	Nortron	4	LBA/GAL	SC	32	fl oz/a	A	PREEM					
20	SDTR	Concep III								120	206	315	407	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	POSPOS					
	ADJ	Class Act NG	100	%	SL	2.5	% v/v	B	POSPOS					

Sort Order: Treatment

2024_CN01: Weed control in corn with Surtain (BAS82100H)

SPRAYING RECORD SHEET

	A	B	C
Date	5/16/24	6/6/24	6/13/24
Time Started	11:15 AM	12:51 PM	10:40 AM
Time Completed	12:10 PM	12:55 PM	11:00 AM
Appl. Method	Bicycle 7.3'	Bicycle	Bicycle 7.3"
Crop Stage	PRE	V1 corn	V4 corn
Air Temp (°F)	72	88	75
Rel. Humidity (%)	40	18	30
Wind Speed (MPH)	5	2	2
Wind Direction	W	N	W
Soil Temp (°F) 0"	85	99	88
2"	66	97	82
4"	60	95	78
Soil Moisture	Dry	Dry	Dry
Cloud Cover (%)	0	5	0
Weed species & height	-	c. lamsbsquarters: 1"	c. lamsbsquarters: 3"
		Redroot pigweed: 0.5"	Redroot pigweed: 2"
		green foxtail: 0.5"	green foxtail : 2"

Corn planting date: 5/14/2024

University of Idaho

Weed control in corn with BAS 82100H

Trial ID: 2024_CN01_BAS82100H
Protocol ID: 2024_CN01_BAS82100H Location: Kimberly ID Trial Year: 2024
Project ID: BAS 82100H
Study Director: Albert Adjesiwor Sponsor Contact: Curtis Rainbolt
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Rep 1	2	3	4	Notes
1	CHK	Untreated							101	206	305	409	
2	HERB	Acuron	3.44	LBA/GAL	ZC	48	fl oz/a	A	102	208	307	411	
3	HERB	BAS 82100H	1.628	LBA/GAL	SC	11	fl oz/a	A	103	201	306	404	
4	HERB	BAS 82100H	1.628	LBA/GAL	SC	14	fl oz/a	A	104	203	311	403	
5	HERB	BAS 82100H	1.628	LBA/GAL	SC	14	fl oz/a	A	105	202	303	407	
	HERB	Atrazine 4L	4	LBA/GAL	F	32	fl oz/a	A					
6	HERB	BAS 82100H	1.628	LBA/GAL	SC	17	fl oz/a	A	106	210	302	401	
7	HERB	Verdict	5.57	LBA/GAL	EC	15	fl oz/a	A	107	205	310	405	
8	HERB	Prowl H2O	3.8	LBA/GAL	CS	32	fl oz/a	A	108	211	304	402	
	HERB	Outlook	6	LBA/GAL	EC	18	fl oz/a	A					
9	HERB	BAS 82100H	1.628	LBA/GAL	SC	14	fl oz/a	B	109	212	301	406	
	HERB	Clarity	4	LBA/GAL	SL	8	fl oz/a	B					
	HERB	Roundup PowerMax 3	4.8	LBA/GAL	SL	30	fl oz/a	B					
	ADJ	AMS	100	%	SG	8.5	lb/100 gal	B					
	ADJ	NIS	100	%	SL	0.25	% v/v	B					
10	HERB	Verdict	5.57	LBA/GAL	EC	15	fl oz/a	A	110	207	312	408	
	HERB	Status	56	%	WG	5	oz wt/a	C					
	HERB	Roundup PowerMax 3	4.8	LBA/GAL	SL	30	fl oz/a	C					
	ADJ	AMS	100	%	SG	8.5	lb/100 gal	C					
	ADJ	NIS	100	%	SL	0.25	fl oz/a	C					
11	HERB	BAS 82100H	1.628	LBA/GAL	SC	14	fl oz/a	A	111	204	309	412	
	HERB	Status	56	%	WG	5	oz wt/a	C					
	HERB	Roundup PowerMax 3	4.8	LBA/GAL	SL	30	fl oz/a	C					
	ADJ	AMS	100	%	SG	8.5	lb/100 gal	C					
	ADJ	NIS	100	%	SL	0.25	% v/v	C					
12	HERB	BAS 82100H	1.628	LBA/GAL	SC	14	fl oz/a	A	112	209	308	410	
	HERB	Status	56	%	WG	5	oz wt/a	C					
	HERB	Zidua SC	4.17	LBA/GAL	SC	2.5	fl oz/a	C					
	HERB	Roundup PowerMax 3	4.8	LBA/GAL	SL	30	fl oz/a	C					
	ADJ	AMS	100	%	SG	8.5	lb/100 gal	C					
	ADJ	NIS	100	%	SL	0.25	% v/v	C					

Sort Order: Treatment

2024_CN02: Anthem Maxx Corn Herbicide Options for Idaho

SPRAYING RECORD SHEET

	A	B
Date	5/16/24	6/6/24
Time Started	12:20 PM	12:56 PM
Time Completed	12:45 PM	1:07 PM
Appl. Method	Bicycle 7.3	Bicycle
Crop Stage	PRE	V1 corn
Air Temp (°F)	73	88
Rel. Humidity (%)	40	18
Wind Speed (MPH)	5	2
Wind Direction	W	N
Soil Temp (°F) 0"	87	99
2"	68	97
4"	60	93
Soil Moisture	Dry	Dry
Cloud Cover (%)	0	0
Weed species & height	-	c. lamsbsquarters: 1"
		redroot pigweed: 0.5"
		green foxtail : 0.5"

Corn planting date: 5/14/2024

University of Idaho

Anthem Maxx Corn Herbicide Options For Idaho

Trial ID: 2024_CN02_AnthemMaxx
Protocol ID: 2024_CN02_AnthemMaxx Location: Kimberly, ID Trial Year: 2024
Project ID: USA-24-749 Project ID 2: USA-24-749
Study Director: Albert Adjesiwor Sponsor Contact: FMC (Jared Unverzagt)
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Rep 1	2	3	4	Notes
1	CHK	UNTREATED CHECK							101	206	305	402	
2	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B	102	205	304	405	
	ADJ	AMS	100	%	SG	8.50	lb/100 gal	B					
	ADJ	INDUCE	100	%W/W	SF	0.25	% v/v	B					
3	HERB	ANTHEM MAXX	4.3	LB/GAL	SC	6	fl oz/a	A	103	207	306	403	
4	HERB	ANTHEM MAXX	4.3	LB/GAL	SC	6	fl oz/a	B	104	202	301	407	
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B					
	ADJ	AMS	100	%	SG	8.50	lb/100 gal	B					
	ADJ	INDUCE	100	%W/W	SF	0.25	% v/v	B					
5	HERB	ANTHEM MAXX	4.3	LB/GAL	SC	4	fl oz/a	A	105	204	303	401	
	HERB	ANTHEM MAXX	4.3	LB/GAL	SC	4	fl oz/a	B					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B					
	ADJ	AMS	100	%	SG	8.50	lb/100 gal	B					
	ADJ	INDUCE	100	%W/W	SF	0.25	% v/v	B					
6	HERB	ANTHEM MAXX	4.3	LB/GAL	SC	6	fl oz/a	A	106	201	302	406	
	HERB	Warrant	3	LBA/GAL	CS	2.75	qt/a	B					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B					
	ADJ	AMS	100	%W/W	GR	8.50	lb/100 gal	B					
	ADJ	INDUCE	100	%W/W	SF	0.25	% v/v	B					
7	HERB	Warrant	3	LBA/GAL	CS	2.75	qt/a	A	107	203	307	404	
	HERB	ANTHEM MAXX	4.3	LB/GAL	SC	6	fl oz/a	B					
	HERB	Roundup PowerMax	4.5	LBAE/GAL	SL	32	fl oz/a	B					
	ADJ	AMS	100	%W/W	GR	8.50	lb/100 gal	B					
	ADJ	INDUCE	100	%W/W	SF	0.25	% v/v	B					

Sort Order: Treatment

2024_DB03: Reflex for weed control in dry bean

SPRAYING RECORD SHEET

		A
Date		5/31/24
Time Started		10:00 AM
Time Completed		10:30 AM
Appl. Method		Bicycle
Crop Stage		PRE
Air Temp (°F)		65
Rel. Humidity (%)		29
Wind Speed (MPH)		2.4
Wind Direction		NW
Soil Temp (°F)	0"	68
	2"	70
	4"	71
Soil Moisture		Dry
Cloud Cover (%)		0
Weed species & height		-

Dry bean planting date: 5/30/2024

University of Idaho

Reflex for weed control in dry beans

Trial ID: 2024_DB03_Reflex
Protocol ID: 2024_DB03_Reflex Location: Kimberly, ID Trial Year: 2024
Study Director: Albert Adjesiwor Sponsor Contact: Syngenta (Letendre)
Investigator: Albert Adjesiwor

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Rep 1	2	3	4	Notes
1	CHK	nontreated								101	203	311	405	
2	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	102	207	310	407	
3	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	103	202	309	410	
	HERB	Dual Magnum	7.64	LBA/GAL	EC	1.33	pt/a	A	PREEM					
4	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	104	205	308	404	
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	A	PREEM					
5	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	105	210	312	406	
	HERB	Sonalan HFP	3	LBA/GAL	EC	2	pt/a	A	PREEM					
6	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	106	209	306	411	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
7	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	107	206	302	412	
	HERB	Prowl H2O	3.8	LBA/GAL	CS	2.5	pt/a	A	PREEM					
8	HERB	Reflex	2	LBA/GAL	SL	1	pt/a	A	PREEM	108	201	304	403	
	HERB	Chateau EZ	41.4	%	SC	2	fl oz/a	A	PREEM					
9	HERB	Sonalan HFP	3	LBA/GAL	EC	2	pt/a	A	PREEM	109	211	301	408	
	HERB	Eptam	7	LBA/GAL	EC	3.5	pt/a	A	PREEM					
10	HERB	Sonalan HFP	3	LBA/GAL	EC	2.5	pt/a	A	PREEM	110	204	303	401	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
11	HERB	Prowl H2O	3.8	LBA/GAL	CS	2.5	pt/a	A	PREEM	111	212	305	409	
	HERB	Outlook	6	LBA/GAL	EC	16	fl oz/a	A	PREEM					
12	HERB	Prowl H2O	3.8	LBA/GAL	CS	2.5	pt/a	A	PREEM	112	208	307	402	
	HERB	Dual Magnum	7.64	LBA/GAL	EC	1.33	pt/a	A	PREEM					

Sort Order: Treatment

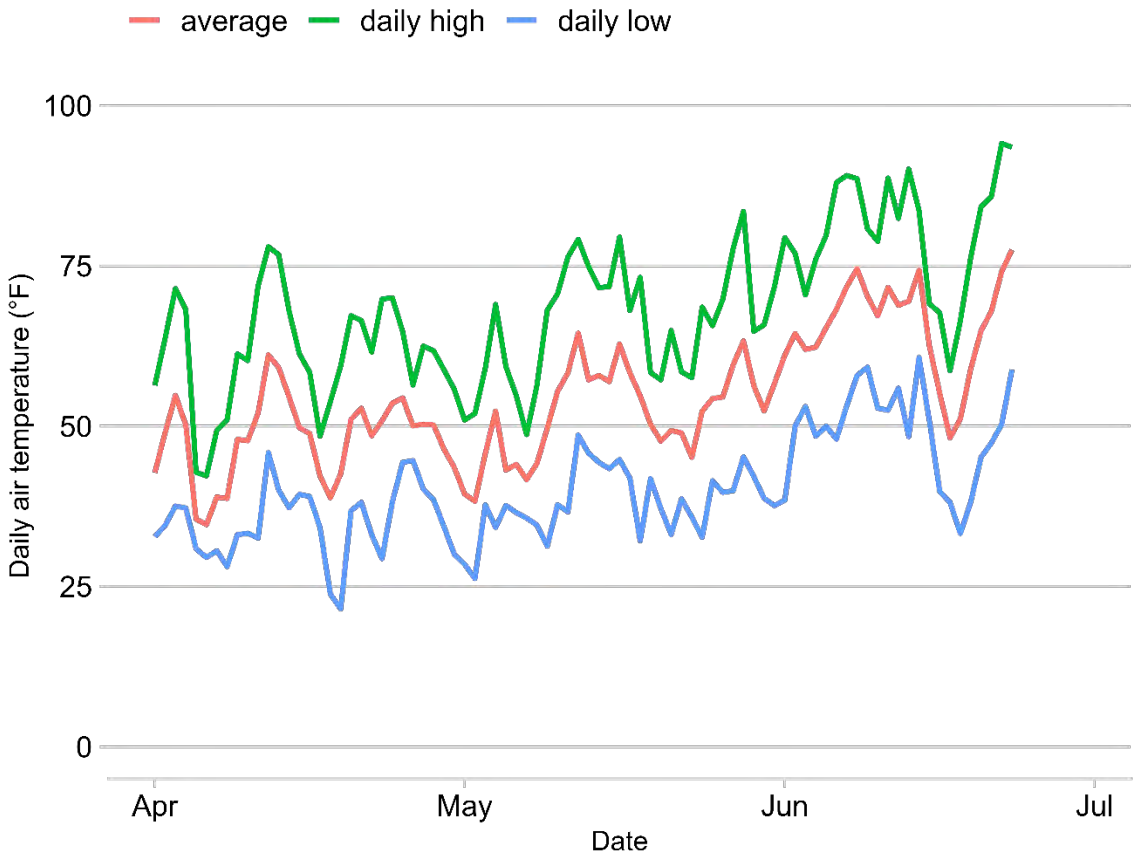
2024_GB01: Herbicide tolerance and weed control demonstration in garden bean

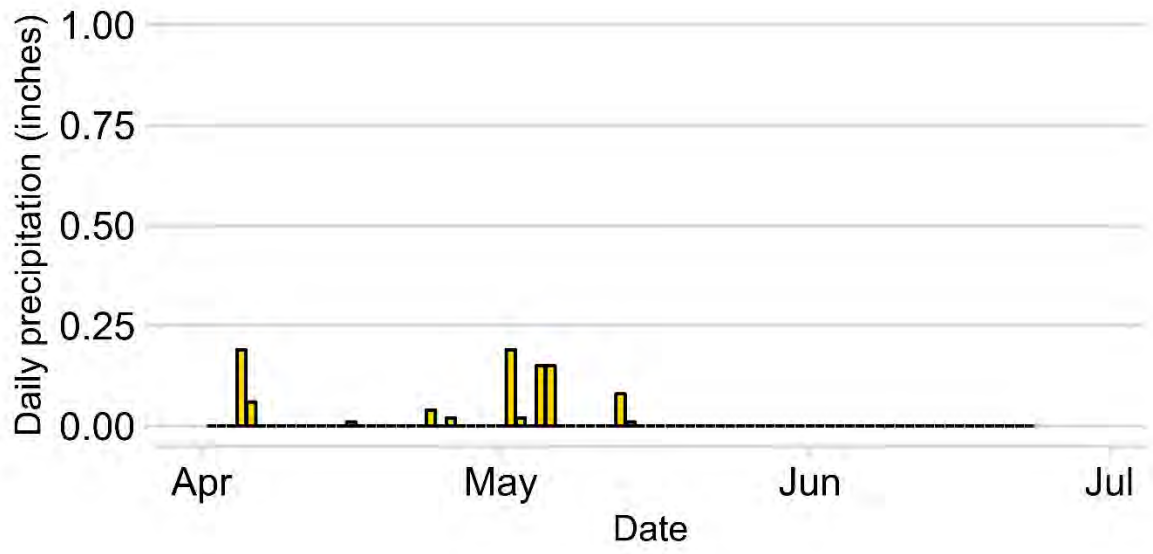
SPRAYING RECORD SHEET

	A	B
Date	5/31/24	6/2/24
Time Started	10:35 AM	12:20 PM
Time Completed	11:02 AM	12:28 PM
Appl. Method	Bicycle	Bicycle
Crop Stage	PRE	1st trifoliate
Air Temp (°F)	65	87
Rel. Humidity (%)	29	27
Wind Speed (MPH)	2.4	1.8
Wind Direction	NW	NNE
Soil Temp (°F) 0"	68	95
2"	70	93
4"	71	90
Soil Moisture	Dry	Wet
Cloud Cover (%)	0	0
Weed species & height	-	c. lamsbsquarters: 2.5"
	-	redroot pigweed: 2"
	-	green foxtail : 1.5"

Garden bean planting date: 5/30/2024

Summary of temperature and precipitation data In Kimberly from April 1, 2024 to June 23, 2024





Pesticides and adjuvants used in studies

Herbicides

Trade name	Common name
Anthem Maxx	fluthiacet-methyl + pyroxasulfone
Atrazine 4L	atrazine
Chateau EZ	flumioxazin
Clarity	dicamba
Dual Magnum	s-metolachlor
Eptam 7E	EPTC
Fierce EZ	flumioxazin + pyroxasulfone
Goaltix Gold	metamitron
Harmony SG	thifensulfuron methyl
Matrix	rimsulfuron
Nortron	ethofumesate
Outlook	dimethenamid-p
Prowl H2O	pendimethalin
Raptor	imazamox
Reflex	fomesafen
Roundup PowerMax	glyphosate
Sonalan HFP	ethalfluralin
Surtain (BAS82100H)	pyroxasulfone + saflufenacil
Starane Ultra	fluroxypyr
Status	dicamba + diflufenzopyr
Stinger	clopyralid
Torero	ethofumesate + metamitron
Treflan HFP	trifluralin
Tricor 4F	metribuzin
Upbeet	triflusulfuron methyl
Varisto	bentazon + imazamox
Verdict	dimethenamid-p + saflufenacil
Warrant	acetochlor
Zidua SC	pyroxasulfone

Adjuvants

Trade name	Ingredients/principal functioning agents
AMS	ammonium sulfate
Class Act NG	ammonium sulfate (AMS) and others
COC	crop oil concentrate
Induce	Nonionic Low Foam Wetter/Spreader Adjuvant
MSO® Concentrate with Leci-Tech	methylated seed oil (MSO)
Preference	nonionic surfactant (NIS)
NIS	nonionic surfactant
UAN (32-0-0)	urea ammonium nitrate 32%
Ultra Pro	ammonium sulfate

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Northwest Potato Research Consortium