

Grant Code: New

Title: Pre-plant burndown herbicide efficacy and wheat crop safety

Personnel:

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Justification/Rationale: No-till dryland wheat growers in Idaho are becoming increasingly reliant on glyphosate for pre-plant and post-harvest weed control. The repeated use of glyphosate as the main weed management tool could result in widespread glyphosate-resistant weed populations. To protect the value of glyphosate in wheat production systems, it is important to identify effective alternative herbicides and mixtures for weed control.

The value of glyphosate to growers practicing minimum or no-till has been primarily a function of three factors: improved weed control (especially grass weeds) with glyphosate compared to other herbicides; lack of residual effect or injury from glyphosate; and relatively cheap cost of glyphosate. Thus, any possible alternatives to glyphosate must satisfy at least some of these conditions if they were to be adopted by growers.

We are proposing to evaluate tank mixtures of herbicides with different sites of action including *Aim EC*[®] (Group 14), *Everest*[®] (Group 2), *Glyphosate*[®] (Group 9), *Gramoxone*[®] (Group 22), *Liberty*[®] (Group 10), *Reviton*[®] (Group 14), *Sharpen*[®] (Group 14), *Spartan charge*[®] (Group 14), and *Vida*[®] (Group 14). These herbicides are fast-acting and short-lived in the soil, making them ideal as pre-plant burndown herbicides. Most of these herbicides are not taken up or translocated in the plant, making it unlikely to have residues in grains. If proven to be safe on wheat and provide effective control of common and troublesome grass weeds in no-till systems, this will provide growers with alternative herbicides to glyphosate for weed control. This could reduce glyphosate use and preserve the value of glyphosate in wheat production systems.

Objectives: In order to provide the science-based guidelines growers need to make an informed management decision on effective alternative pre-plant burndown herbicides and mixtures, we will measure weed control and wheat crop injury. Specifically, we are proposing to:

1. Evaluate the efficacy of pre-plant burndown herbicides and mixtures,
2. Assess the safety of pre-plant burndown herbicides and mixtures on wheat, and
3. Economics of using alternative pre-plant burndown herbicides and mixtures on wheat

Procedures/Plan of work:

This field study would be established at four locations including the University of Idaho Kimberly Research and Extension Center, and three farms in Power, Bonneville, and Madison counties. Herbicide applications will be made within 14 days before winter wheat is planted (Table 1). Winter wheat will be planted in September/October 2021. Wheat will be managed (e.g. fertilizer application, disease control, etc.) following standard production practices. There will be 17 treatments arranged in a randomized complete block with four replications (Table 1). Each plot will be approximately 10 ft wide by 30 feet long.

Data collection and analysis: Crop injury and weed control (by each weed species) will be visually assessed at 7, 14, 21 days after treatment and in early spring on a scale of 0 to 100%, with 0% being no injury/control, and 100% being plant death. If there's high weed density in early spring, all plots except the untreated check will be sprayed with a post-emergence herbicide. At the end of the season, plots will be harvested to determine grain yield. Data will be analyzed following standard statistical procedures.

Table 1. Proposed herbicide treatments

No.	Treatment	Rate (oz/acre)
1	Untreated	
2	Gramoxone	32
3	Gramoxone	32
	Aim	2
4	Aim	2
	Roundup Powermax	32
5	Sharpen	2
	Roundup Powermax	32
6	Gramoxone	32
	Vida	2
7	Reviton	2
8	Reviton	2
	Gramoxone	32
9	Reviton	2
	Roundup Powermax	32
10	Spartan charge	3
11	Spartan charge	3
	Roundup Powermax	32
12	Everest ¹	2
13	Everest	2
	Roundup Powermax	32
14	Liberty ²	32
15	Liberty	32
	Sharpen	2
16	Liberty	32
	Reviton	2
17	Roundup Powermax	32

¹labeled for use in northern Idaho; ²currently not labeled for use in wheat

Duration: This is the first year of a 2-year study. We intend to pursue supplemental funding from Idaho Wheat Commission and other sources (including chemical companies) for the second year of the study.

Cooperation/Collaboration: Jonathan Hogge will assist with establishing the research plots and collecting data. Three growers: Cordell Kress (Power County), Gordon Gallup (Bonneville County), and Deloy Ward (Madison County) will provide land space and will assist with on-farm trials.

Anticipated Benefits, Expected Outcomes and Impacts, and Transfer of Information: This will provide science-based guidelines to growers to make an informed management decision on effective alternative pre-plant burndown herbicides and mixtures. This project will be shown at field days in Kimberly ID and results will also be discussed at the Cereal Schools. Results will also be presented at the Weed Science Society of America and Western Society of Weed Science annual meetings. Results will be published on the UI Weed Science website (www.uidaho.edu/weed-science; currently being developed) and results will be incorporated in the annually updated Pacific Northwest Weed Management Handbook. We intend to publish the results in the Weed Technology journal.

Literature Review:

The value of glyphosate to growers practicing minimum or no-till has been primarily a function of three factors: improved weed control with glyphosate compared to other herbicides; lack of residual effect or injury from glyphosate; and relatively cheap cost of glyphosate. It is widely known that repeated use of the same herbicide is the primary factor leading to herbicide resistance in weeds. To reduce the chances of resistance development to glyphosate, it is often recommended to alternate glyphosate with other effective herbicides or apply glyphosate in tank mixtures with effective herbicides. Herbicides such as *Aim EC*®, *Everest*®, *Gramoxone*®, *Liberty*®, *Sharpen*®, *Spartan charge*®, *Reviton*®, and *Vida*® are fast-acting and short-lived in the soil, making them ideal as pre-plant burndown herbicides.

Liberty® is a non-selective herbicide that is effective on a broad spectrum of weeds. However because *Liberty*® does not move well within plants, its efficacy is greatly affected by environmental factors such as temperature and humidity. A recent experiment found that in high humidity (70%), *Liberty*® provided complete control (100%) of pigweed. When humidity was reduced to 30%, pigweed control was only 60% (Takano et al. 2020). The effect of humidity on the effectiveness of *Liberty*® has limited the use of this herbicide in western United States. However, Takano et al. (2020) recently found that when *Liberty*® was mixed *Sharpen*®, it provided complete pigweed control. Thus, this positive interaction can be exploited for enhanced weed control with *Liberty*® in Idaho. Although *Liberty*® is currently not labeled for pre-plant burndown in wheat (Loux 2014), if pre-plant application of *Liberty*® doesn't injure emerging winter wheat, the data could be used to support a 24(c) Special Local Need (SLN) label application.

The United States Environmental Protection Agency has recently approved a new herbicide called *Reviton*® for use in four crops including wheat. *Reviton*® is a Group 14 herbicide, which is fast-acting and has 0-day rotation restriction to wheat (Helm Agro US Inc. 2020). *Reviton*® is being promoted as an effective herbicide for grass weed control, especially wild oat. If proven to be effective, it will be a useful additional herbicide for Idaho wheat growers.

References

- Helm Agro US Inc. (2020) Reviton Herbicide. URL: <https://www.discoverhelm.com/reviton-home/>
- Loux M (2014) Burndown herbicides for no-tillage wheat. C.O.R.N. Newsletter 2014-32. URL: <https://agcrops.osu.edu/newsletter/corn-newsletter/2014-32/burndown-herbicides-no-tillage-wheat>
- Takano HK, Beffa R, Preston C, Westra P, Dayan FE (2020) Glufosinate enhances the activity of protoporphyrinogen oxidase inhibitors. Weed Sci. 68: 324–332.

FY2022

IDAHO WHEAT COMMISSION - BUDGET FORM

Principal Investigator: Albert Adjesiwor

If applicable,	Allocated by	Idaho Wheat Commission	during FY 2020	\$	-
If applicable,	Allocated by	Idaho Wheat Commission	during FY 2021	\$	-

REQUESTED FY2022 SUPPORT:

Budget Categories	(10) Salaries (staff, post-docs, etc.)	(12) Temp Help	(11) Fringe	(20) Travel	(30) OE	(70) Graduate Tuition/ Fees	TOTALS
Idaho Wheat Commission	\$	2,400	\$ 190	\$ 3,300	\$ 1,400	\$ -	\$ 7,290

TOTAL BUDGET REQUEST FOR FY 2022: \$ 7,290

BREAKDOWN FOR MULTIPLE SUB-BUDGETS:

Budget Categories	Adjesiwor	Hogge	(Insert CO-PI Name)	(Insert CO-PI Name)
(10) Salaries	\$ -	\$ -	\$ -	\$ -
(12) Temp Help	\$ 2,400	\$ -	\$ -	\$ -
(11) Fringe Benefits	\$ 190	\$ -	\$ -	\$ -
(20) Travel	\$ 800	\$ 2,500	\$ -	\$ -
(30) Other Expenses	\$ 1,400	\$ -	\$ -	\$ -
(70) Graduate Student				
Tuition/Fees	\$ -	\$ -	\$ -	\$ -
TOTALS	\$ 4,790	\$ 2,500	\$ -	\$ -

Total Sub-budgets \$ 7,290

Brief Explanatory Comments: (see FY2022 RFP for guidance)

Temp help/fringe benefits, travel to field sites for planting, spraying, data collection, harvesting, plot charges, seeds chemicals, sampling bags, stakes and flags.

FY2022 Version