Proper Pre-harvest Glyphosate Timing in Wheat

Project #: 20110368 – Final report

Producer Group Sponsoring the Project:
Western Applied Research Corporation (WARC), Conservation Learning Centre (CLC) and Wheatlands Conversation Area Inc. (WCA). This final report is submitted on behalf of WARC, CLC and WCA.

Project locations:
Agriculture and Agri-Food Canada (AAFC) Scott Research Farm, Scott, Saskatchewan; Conservation Learning Centre, Prince Albert, Saskatchewan; and AAFC Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan.

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Objectives

The objective of this project is to demonstrate to producers the proper preharvest glyphosate timing in wheat.

Rationale

This project was implemented to demonstrate that the current recommended pre-harvest glyphosate timing is based on producing maximum yields and acceptable glyphosate residue levels in the seed. With the goal of reducing the risk of grade loss due to frost, producers may be applying preharvest glyphosate in wheat too early to terminate the crop. Issues that result from early pre-harvest glyphosate applications include loss of grain yield/quality and grain with glyphosate levels above the maximum residue limit (MRL) of 5 ppm. A glyphosate level above the MRL may cause rejection of wheat. It is currently recommended that producers apply pre-

harvest glyphosate at the hard dough stage.

Methodology

Field trials were located at Scott, Prince Albert and Swift Current, Saskatchewan. This demonstration was replicated four times at each site and was set up as a randomized complete block design. Plot size differed between sites but was approximately 4 x 5 m. Spring wheat (cv. Unity VB) was seeded into stubble at a rate of 300 seeds/m^2 at Scott and Swift Current and 350 seeds/m^2 at Prince Albert. Eight treatments were planted; seven for pre-harvest glyphosate applications and one control treatment with no glyphosate application. At all sites fertilizer was applied to the soil test recommended rate and herbicides were applied as necessary. Treatments were managed the same until wheat reached the early milk stage.

Pre-harvest glyphosate applications started when the wheat reached the early milk stage. Glyphosate was applied at a rate of 1 L/ac to treatments starting at the early milk stage and continuing every five days until the wheat reached physiological maturity (Table 1). The number of glyphosate treatments applied at each location differed depending on the environmental conditions at each site.

At Scott, treatments 2, 3 and 4 were harvested September 6. A hail storm significantly damaged the trial on September 10 and remaining plots were not harvested. At Swift Current, hot and dry weather conditions in July and August rapidly excelled the maturity of the wheat crop and pre-harvest glyphosate application timings were closer together to ensure that more treatments would be applied. Treatments 3 and 4 were three days apart and 4 and 5 were four days apart instead of the recommended five days between each. The remainder of the trial reached maturity and all plots were harvested on August 22. Plots were straight combined at physiological maturity and yields were calculated from clean seed weight. Grain samples were shipped to Scott for protein analysis. Composite samples from each pre-harvest glyphosate application were sent to a lab for residue analysis.

Table 1: Treatment list and date of pre-harvest glyphosate application at each site.

Trt	Timing	Scott	Swift Current	Prince Albert
1	Check (no glyphosate)	n/a	n/a	n/a
2	Early milk	Aug 7	Aug 1	Aug 7
3	Early milk + 5 days	Aug 12	Aug 7	Aug 12
4	Early milk + 10 days	Aug 17	Aug 10	Aug 17
5	Early milk + 15 days	Aug 23	Aug 14	Aug 22
6	Early milk + 20 days	Aug 27	N/A	Aug 27
7	Early milk + 25 days	Sep 1	N/A	Sep 3
8	Early milk + 30 days	Sep 6	N/A	Sep 8

Results

Swift Current

The earliest glyphosate treatment had a significantly lower yield, test weight (TW) and thousand kernel weight (TKW) than the no glyphosate treatment and all treatments applied after the early milk stage (Table 2). Yield and test weight did not differ between the no glyphosate treatment and all treatments applied after the early milk stage. TKW was highest for the no pre-harvest glyphosate treatment, but did not differ significantly from the last two pre-harvest glyphosate applications. Protein concentration was lowest for the no glyphosate treatment which was also the highest yielding treatment overall, indicating that the lower protein concentration may be due to the protein dilution effect.

Table 2: Treatment effects on wheat yield, test weight (TW), thousand kernel weight (TKW) and protein at Swift current. Protein concentration was measured on composite samples and therefore was not statistically analysed.

Treatment	Yield (kg/ha)	TW (kg/hL)	TKW (g)	Protein (%)
No glyphosate	2779a[y]	78.1ab	27.91a	13.9
Early milk	2108b	71c	21.49c	14.5
Early milk + 5 days	2556a	77b	26.28b	14.3
Early milk + 10 days	2671a	77.8ab	27.37a	14.2
Early milk + 15 days	2651a	78.1ab	27.65a	14.2
CV	*7.43*	*1.15*	*2.53*	-
LSD	*287.8*	*1.3*	*0.0037*	-

[y]Means within the same site year followed by the same letter within a column are not significantly different (P>0.05) according to Fischer's protected LSD.

Prince Albert

Yield increased as pre-harvest glyphosate application was delayed (Figure 1), but there was no significant difference between the three latest glyphosate treatments and the no glyphosate treatment (Table 3). The no glyphosate treatments and the pre-harvest glyphosate treatments applied 15 or more days after the early milk stage had the greatest TW and TKW. Yield, TKW and protein concentration were highest when pre-harvest glyphosate was applied 20 days after the early milk stage (Table 3).

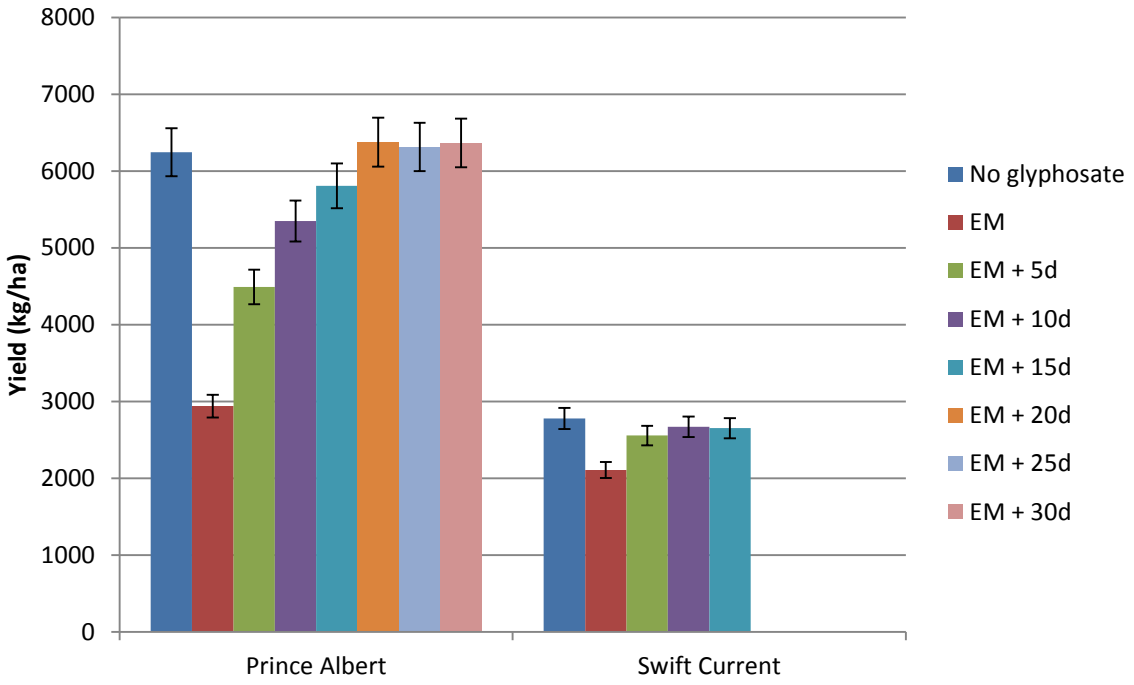

Figure 1: Spring wheat yields at Prince Albert and Swift Current.

Table 3: Treatment effects on wheat yield, test weight (TW), thousand kernel weight (TKW) and protein at Prince Albert. TW, TKW and protein concentration were measured on composite samples are therefore were not statistically analysed.

Treatment	Yield (kg/ha)	TW (kg/hL)	TKW (g)	Protein (%)
No glyphosate	6246ab[y]	77.6	15.10	13.9
Early milk	2939e	64.7	10.00	13.9
Early milk + 5 days	4490d	72.0	11.80	13.5
Early milk + 10 days	5348c	75.7	13.20	13.9
Early milk + 15 days	5807bc	78.1	14.90	13.7
Early milk + 20 days	6374a	78.3	16.00	14.2
Early milk + 30 days	6312ab	78.5	15.10	14.0
Early milk + 30 days	6365a	78.7	15.70	13.6
CV	*6.42*	-	-	-
LSD	*517.52*	-	-	-

[y]Means within the same site year followed by the same letter within a column are not significantly different (P>0.05) according to Fischer's protected LSD.

Scott

Although only the first three treatments were harvested, yield, TW and TKW increased with each glyphosate application made after the early milk stage (Table 4). Protein was greatest on the lowest yielding treatment, indicating a dilution of protein with greater yield.

Table 4: Treatment effects on wheat yield, test weight (TW), thousand kernel weight (TKW) and protein at Scott.

Treatment	Yield	TW	TKW	Protein
No glyphosate	-	-	-	-
Early milk	1331c[y]	61.9c	16.13c	14.7a
Early milk + 5 days	2542b	70.5b	18.94b	13.9b
Early milk + 10 days	3530a	76.3a	21.83a	14.1b
CV	*14.54*	*1.65*	*4.62*	*1.49*
LSD	*620.81*	*1.99*	*1.52*	*0.37*

[y]Means within the same site year followed by the same letter within a column are not significantly different (P>0.05) according to Fischer's protected LSD.

Conclusions and Recommendations

Results from this demonstration indicate that early applications of pre-harvest glyphosate have a negative effect on yield and quality of spring wheat. At each location greater wheat yields were achieved when pre-harvest glyphosate application was delayed. Yield increases are dependent upon the crop growth stage and the rate at which the crop is maturing. At Swift Current and Prince Albert the yield of the later pre-harvest glyphosate applications did not differ significantly from the unsprayed check. Applying pre-harvest glyphosate at the hard dough stage will assist in crop dry-down and weed control without negatively affecting grain quality. Sustained hot and dry conditions promote natural grain drying which can indicate to a producer that a pre-harvest glyphosate may not be required unless there is a significant weed population to control. It is recommended that producers follow the recommendations for pre-harvest glyphosate timing and apply glyphosate at the hard dough stage.

The 2012 Swift Current field day, held on July 12, had approximately 110 people in attendance. Although an official stop at this demonstration was not made, attendees were able to view the demonstration. Stops were made at the Swift Current site as part of the Patterson Grain field tour held on July 13 (25 people in attendance) and at the Viterra Diagnostic School held on July 17 and 23 (26 people in attendance). An official stop at this demonstration was not made at the Scott or Prince Albert field days due to flooding around the trial area. Results from this demonstration will be presented at the 2013 Crop Opportunity and Scott Research Update on March 7, 2013.

Acknowledgements

We would like to express our gratitude to the Ministry of Agriculture for the funding support for this project. To recognize the ADOPT program and the Ministry each organization had a sign in front of the plot demonstration. When this project is presented at meetings and included in newsletters the funding from the ADOPT program is acknowledged.

Abstract

This project was implemented to demonstrate that the current recommended pre-harvest glyphosate timing for spring wheat is based on producing maximum yields and acceptable

glyphosate residue levels in the seed. Producers may be applying preharvest glyphosate in wheat too early to terminate the crop. The current recommended timing of pre-harvest glyphosate application in wheat is at the hard dough stage. Early pre-harvest glyphosate applications may result in lost grain yield/quality and grain with glyphosate levels above the maximum residue limit. The objective of this project is to demonstrate to producers the proper preharvest glyphosate timing in wheat. Pre-harvest glyphosate applications started when the wheat reached the early milk stage and continued every five days until the wheat reached physiological maturity. Early applications of pre-harvest glyphosate had a negative effect on yield and quality of the spring wheat at all three locations. Greater wheat yields were achieved when pre-harvest glyphosate applications were delayed. It is recommended that producers follow the recommendations for pre-harvest glyphosate timing and apply glyphosate at the hard dough stage.

Expenditure Statement

Expenditure statement for the WARC project attached. CLC and WCA will send in their expenditure statements.