KING, STEVEN R.*. Montana State University, Southern Agricultural Research Center, 748 Railroad Highway, Huntley, MT 59037. **Weed control programs in glyphosate-resistant sugar beets.**

ABSTRACT

The recent development of glyphosate-resistant sugar beet varieties suitable for production in Montana and Wyoming offers growers the opportunity of broad spectrum weed control with postemergence (POST) applications of glyphosate that was previously not possible. Previous research has indicated that two or three POST applications of glyphosate controlled 95% or more of the total weed population in glyphosate-resistant sugar beets (Guza et al. 2002; Wilson et al. 2002). Little research, however, has been conducted in glyphosate-resistant sugar beets comparing total POST weed control programs that utilize only glyphosate to those that contain a preemergence (PRE) residual herbicide followed by POST glyphosate treatments.

In previous research in other glyphosate-resistant crops, PRE residual herbicides followed by glyphosate often increased weed control compared to control with glyphosate applied alone. For instance in glyphosate-resistant soybean (*Glycine max*), sulfentrazone followed by a single glyphosate application resulted in increased control of yellow nutsedge (*Cyperus esculentus*), common waterhemp (*Amaranthus rudis*), and ivyleaf morningglory (*Ipomoea hederacea*) compared to glyphosate applied alone (Krausz and Young, 2003). Weed control programs that included PRE sulfentrazone, however, resulted in reduced soybean yield compared to yield with glyphosate applied sequentially. VanGessel et al. (2001) reported increased control of common lambsquarters (*Chenopodium album*), fall panicum (*Panicum dichotomiflorum*), common ragweed (*Ambrosia artemisifolia*), and ivyleaf morningglory with clomazone plus imazethapyr applied PRE followed by a glyphosate application than control with glyphosate applied without a PRE herbicide.

The use a PRE herbicide may also reduce the number of POST glyphosate applications needed for effective weed control in glyphosate-resistant sugar beets. Previous research by Ellis et al. (2002) indicated that the utilization of PRE herbicides in glyphosate-resistant soybean reduced the number of glyphosate applications and extended the period between glyphosate applications compared to herbicide programs using only POST glyphosate. This system reduced the number of glyphosate applications to one compared to two applications when a residual herbicide was not utilized.

An additional benefit with the use of ethofumesate may be to reduce the potential for the development of glyphosate-resistant weed species. A few accepted methods of herbicide resistance management include rotation of herbicides with different modes-of-action and utilization of herbicide mixtures with different modes-of-action. Currently, there are twelve weed species that have been reported to be resistant to glyphosate (Heap 2007). The use of glyphosate only in glyphosate-resistant crops is likely to result in additional weed species that will no longer be controlled with glyphosate thus negating the desirability of the technology.

The primary goals of this experiment were: 1) Determine if there is an advantage to utilizing preplant incorporated (PPI) ethofumesate followed by glyphosate compared to glyphosate applied alone for weed control. 2) evaluate sugar beet yield and quality with the PPI herbicide program compared to weed control programs that do not include the PPI component.
This experiment was conducted at the Southern Agricultural Research Center in Huntley, Montana. The experiment consisted of a total of 22 treatments with four replications applied to a glyphosate-resistant sugar beet variety. The experimental design was a split-plot randomized complete block with the main-plot factors being either glyphosate or conventional herbicide

programs. Each herbicide program contained a PPI treatment of ethofumesate alone, and a hand-weeded and nontreated control. In the glyphosate-based herbicide program, glyphosate was applied 2 or 3 times with or without a PPI treatment of ethofumesate and with or without a layby treatment. In the conventional herbicide program, desmedipham plus phenmedipham plus triflusulfuron plus clopyralid was applied 2 or 3 times with or without a PPI treatment of ethofumesate and with or without a layby treatment. In the RR program, the first POST treatment was applied to sugar beets in the 2-leaf stage and subsequent applications were applied every 14 d. In the CONV program, the first POST treatment was applied to sugar beets in the cotyledon stage and subsequent applications were applied every 7 d.

Weed control by species was evaluated throughout the growing season. Weed control, sugar beet yield and quality were subjected to analysis of variance, and significance of main effects and interactions were determined. Means were separated using Fisher's protected LSD test at the 5% level of probability.

In the glyphosate-based program, weed control did not increase when treatments were preceded by ethofumesate applied PPI compared to glyphosate applied alone. In the conventional program, PPI ethofumesate generally increased the control of KCHSC, CHEAL, and POLCO at 109 days after planting (DAP) when treatments were applied either twice or twice plus the layby. Glyphosate alone applied twice controlled KCHSC, CHEAL, and POLCO 90, 91, and 99%, respectively, at 109 DAP. Conventional treatments applied alone twice controlled KCHSC, CHEAL, and POLCO 39, 54, and 84%, respectively, at 109 DAP. In the conventional program, weed control increased as the number of applications increased. Greater KCHSC control was achieved with the glyphosate-based program compared to the conventional program when the number of applications was equal. Equivalent CHEAL control between the two herbicide programs only occurred when treatments were applied three times followed by the layby treatment and preceded by the PPI application of ethofumesate. Generally, the glyphosate-based program regardless of the PPI application of ethofumesate produced greater yields than the conventional program when the number of applications was equal. Treatments within the convention program produced greater sugar beet yield when preceded by a PPI application of ethofumesate. Yield ranged from 26.4 to 31.9 tons/acre in the glyphosate-based program, while conventional treatments produced 18.3 to 26.5 tons/acre.

Literature cited:

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