Yield penalty due to delayed weed control in corn and soybean

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Abstract

With the widespread use of glyphosate resistant crops two common questions related to a weed control program have emerged: (1) when is the most appropriate time for a postemergence weed control operation and (2) what is the cost of a delayed weed control operation? The first question was addressed using the concept of critical period for weed control. Our field studies determined the effects of three N rates in corn and three row spacings in soybean on the critical time for weed removal. Critical period for weed control in corn ranged from V1-V11, V3-V10, V4-V9 and V6-V9 for N-rates of 0, 60, 120 and 240 kg/ha, respectively. The study in soybean suggested that the critical time for weed removal coincided with V3, V2 and V1 for soybean row spacing of 19, 38 and 76 cm, respectively. The second question was addressed by pooling yield loss data across locations and years from both studies and related to the extrapolated crop growth stage at the time of weed removal for both corn and soybean. A yield penalty of 2% for every crop leaf stage of delayed weed control past the critical time for weed removal is proposed as a reasonable prediction rule with moderate to heavy weed infestations in corn and soybean as the cost of delaying weed control. Full version of this paper was published in the Crop Management Journal online: http://www.plantmanagementnetwork.org/pub/cm/research/2003/delay/

Media summary

Critical period for weed control as affected by nitrogen in corn, and by row spacing in soybean was determined in Nebraska. The yield penalty due to delayed weed removal also was determined.

Key words

Glyphosate, corn, glyphosate-resistant soybean.

Introduction

Low commodity prices and high input costs force producers to explore ways to optimise their crop production systems. With the widespread use of glyphosate resistant crops in North America, especially soybeans, the two common questions that can help optimise the weed control program are: when is the most appropriate time for a post emergence weed control operation and what is the cost of a delayed weed control? One of the first steps in designing an optimised weed control system is to identify the critical period for weed control, the period in the crop growth cycle during which weeds must be controlled to prevent yield losses (Knezevic et al. 2002). In general, the critical period for weed control has a defined period, and weeds that emerge before or after the critical period for weed control may not represent a threat to crop yield. In addition, the beginning of the critical period for weed control is also commonly called “the critical time for weed removal”. Therefore, the objectives of this paper were: (a) to develop a simple decision aid concept for determining the best time for weed control and (b) to use data from the two previously published papers in order to provide the practical guide for determining the yield loss caused by delayed weed control in corn as affected by N level and in soybean as influenced by row spacing.

Methods

The data for this paper were from two separate studies previously published and conducted in eastern Nebraska on the effect of three N rates on the critical period for weed control in dryland corn (Evans *et al*. 2003) and of three row spacings on the critical time for weed removal in soybean (Knezevic *et al*. 2003). Data from both studies were combined and presented in the form of a decision guide for practitioners. Both experiments were a split-plot design with the N level as the main factor in corn, and row spacing in soybean, while the timing of weed removal were the sub-plots. There were four replications. The four N rates were 0, 60 and 120 and 240 kg N/ha in corn, while row spacings of 19, 38 and 76 cm were used in the soybean study. Weed removal in both studies was conducted by application of commercially formulated glyphosate at the labeled rate. If necessary an additional weeding was done by hoeing. The weed species composition and density were determined in both studies.

Results.

Critical period for weed control in corn as affected by N. We reported that the critical period for weed control in corn was influenced by the level of N fertilizer (Evans *et al*. 2003), which ranged from V1-V11, V3-V10, V4-V9 and V6-V9 for N-rates of 0, 60, 120 and 240kg/ha, respectively.

Critical time for weed removal in soybean as affected by row spacing. We reported the critical time for weed removal in soybean was influenced by the crop row spacing (Knezevic *et al*. 2003). The critical time for weed removal coincided with the V1 (1st trifoliate leaf), V2, and V3 stages of soybean in 19, 38 and 76 cm of row spacing, respectively.

Yield cost due to delayed weed control. An average 2% yield loss per every leaf stage of delay past the critical time for weed removal was determined as the cost of delaying weed control in both corn and soybean. For example, the critical time for weed removal in 19 cm rows soybean was the V3 (third trifoliate) stage. If weed control was delayed to the V4 (fourth trifoliate) the yield loss was about 7%, costing about 2 % in yield losses due to prolonged competition from weeds. The same was true if weed control was delayed past the recommended critical time in other row spacings in soybean (data not shown).

The determined 2% yield penalty is suggested for use as a general rule-of-thumb, in order to help producers make decisions on timing post emergence weed control to verify their own intuition. We believe that the 2% yield penalty for every crop leaf stage of delayed weed control past the critical time for weed removal is a reasonable prediction rule with moderate to heavy weed infestations.

Conclusion

Results presented confirm that crop row spacing and nutrient management can significantly influence crop-weed interference relationships. Obviously, the timing for weed removal was affected by N rate in corn and row spacing in soybean, while the 2% yield penalty remained relatively stable thereafter. The documented differences in the critical period for weed control in corn and critical time for weed removal in soybean highlight the importance of integrating decisions regarding cropping practices and the timing of weed control into integrated weed management programs. With the growing popularity of herbicide tolerant crops (HTC), total dependence upon post-emergence herbicide programs (POST) will likely become more prevalent in future cropping systems. Such a shift in cropping practices highlights the importance of appropriately timed weed control. Therefore from a practical standpoint, reducing N rate in corn and planting wider soybean rows may warrant more intensive weed management (for example, weed control measures applied several times). Since glyphosate-resistant crops, especially soybeans, have received high levels of acceptance, the concepts of critical period for weed control and critical time for weed removal are an important part of integrated weed management in answering a fundamental question “if” and “when” to apply POST herbicide. A generally sound strategy in glyphosate-resistant soybean would be to apply glyphosate tank-mixed with a residual herbicide at the critical time for weed removal, which should provide adequate weed control for the entire critical period.

References.

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