RETHINKING WEED CONTROL: RESISTANCE MANAGEMENT AND EMPHASIS ON THE SOIL SEEDBANK

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Abstract

Ten steps to reducing the risks of resistance are presented to aid producers with the ever-increasing occurrence of herbicide-resistant weeds. First, producers must start with clean fields and keep fields as free of weeds as possible throughout the growing season. To achieve clean fields, residual herbicides must be applied at planting and beyond until crop canopy formation, with sequential residual herbicides applied prior to loss of earlier applied residual herbicide. Once a residual herbicide has broken, it can be challenging to gain effective control, particularly control of glyphosate-resistant Palmer amaranth in cotton. Secondly, begin scouting soon after planting to know when to apply residual herbicides prior to them fully breaking. If weeds are present, they must be identified when small if postemergence herbicides are to be effective. For almost all herbicides, the control is a function of weed size at application. When applying a postemergence herbicide, tank-mix with a residual herbicide to reduce the number of weeds that must be controlled with later postemergence herbicides, which in turn will reduce selection for resistance to the postemergence herbicide. Thirdly, apply full (lethal) use rates of all herbicides. Spray coverage of postemergence herbicides is essential to ensuring that the full rate is applied. Instances in which spray coverage, and as result use rates, are less than adequate would include lower than recommended spray volumes, applications where there is a dense crop canopy with underlying weeds, and applications to dense, overlapping weed populations of differing age and size. When weed sizes are larger than those on a product label at application, the herbicide is essentially applied at a reduced rate, which can increase the likelihood of resistance. Fourthly, multiple modes of action must be used to control the most troublesome or resistant-prone weeds in a field. Sequential applications or tank mixtures can be used to apply multiple modes of action, but care must be given to ensuring that both herbicides are highly efficacious on the targeted weed. Also, use of glyphosate in combination with another herbicide does not constitute multiple modes of action when a glyphosate-resistant weed is present. Fifthly, producers must emphasize cultural and mechanical weed management. Cultural practices such as variety selection, narrow row widths (depending upon crop), increased seeding rates, proper soil fertility and fertilizer placement can be used to ensure optimum crop growth, which will increase crop competitiveness with escape or late-emerging weeds. Row cultivation in cotton can be used to reduce selection pressure on herbicides, and use of a moldboard plow in the fall followed by a fall-seeded cover crop on a small acreage that contains resistant weeds has been found to be very effective in reducing weed emergence, especially that of glyphosate-resistant Palmer amaranth. Sixthly, a goal of resistance weed management should be to prevent weed seed production. Survival of a single resistant weed can lead to long-term management difficulties as a result of significant increases in a non-controllable weed in the soil seedbank. Seventhly, prevent field to field and within field movement of weed seeds. Gin trash and animal manures that are used as fertilizer contain weed seeds, of which resistant weeds can be included. Furthermore, care should be given to preventing weed seed movement on equipment such as tillage, harvesters, mowers, etc. When using equipment, only enter infested areas after all other field work or harvesting has been completed to reduce the likelihood of seed movement. When irrigating a crop, surface water often contains weed seeds that readily float and can be introduced and disseminated across clean fields during the irrigation process. Care should also be given to managing weeds along field edges to prevent an influx of weeds into fields. Eighthly, weed seeds need to be managed at harvest or post-harvest. Stubble burning (not feasible in cotton) can be used to reduce the amount of viable weed seeds in the soil seedbank. Additional research is needed in this area to fully understand the impact of post-harvest management practices on loss of weed seeds from the soil seedbank. Ninthly, weeds that establish after crop harvest that have sufficient time to reproduce prior to a killing frost must be controlled. Corn is sometimes rotated with cotton, and a high level of control is often obtained in corn prior to harvest in early August in the Midsouth. Weeds emerging following corn harvest can produce viable seeds, actually leading to an increase in the soil seedbank and weed management difficulties the preceding year. Herbicides and or tillage can be used post-harvest to remove late-emerging weeds. Finally, a diversified approach to weed management is essential for reducing the risks of herbicide resistance or controlling an established resistant population. Through integration of the herein prescribed practices, it will be difficult for weeds to adapt to an ever-changing weed management program, especially when emphasis is placed on depletion of the soil seedbank – the annual reserve from which all weeds arise.