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My view

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Many weed scientists are struggling to develop a broader range of weed control tools and tactics. Current weed control technology has been highly successful and has made a major contribution to increased agricultural productivity. However, the system is not perfect and weeds continue to present significant challenges. Weed populations shift in response to herbicides and other production practices, herbicides are finding their way into unintended places, and soil erosion continues. Criticizing current weed control practices is easy, but the lack of viable alternatives makes many of these criticisms almost pointless.

Many potential approaches for the development of alternate weed management systems exist. Smother crops may be one viable area for research. Smother plants are specialized cover crops developed for their ability to suppress weeds. An effective smother plant system would control weeds, reduce soil erosion, and improve soil quality. The key to success will be our ability to understand and manage the biological interactions among the crop, weeds, and smother plants. A smother crop could take advantage of the ability of crops like corn and soybean to withstand early season competition. This is the same principle that is the basis for postemergence herbicide systems.

Using living vegetation to smother weeds is not a new concept. Weed-smothering cover crops have been used in crop rotations for centuries. Fall-seeded cover crops such as rye, vetches, and clovers have shown potential for controlling weeds in row crop systems. Probably the best example of a successful smother crop in agronomic systems is the use of a small grain as a companion crop for the establishment of perennial forage legumes. In this system, the small grain and forage legume are planted simultaneously. The small grain provides rapid early growth to protect the soil from erosion and compete with weeds while the slow-growing forage legume becomes established. Later in the growing season, the competition of the small grain is removed and the forage legume becomes the dominant plant. A spring-seeded smother crop system for corn and soybean might follow these same principles.

A model smother plant species for a spring-seeded system in corn and soybean would have rapid emergence, provide rapid soil cover, be of short stature, have a short life cycle, have a shallow rooting depth to reduce soil moisture competition, and produce nondormant seed to prevent it from becoming weedy. Spring-seeded smother crops may be easier to manage than the previously evaluated winter annual and perennial species because planting patterns and rates can be selected in the spring in response to environment and other factors. In addition, an ideal smother plant would have a life cycle such that it would mature and relieve the primary crop from competition before reducing crop yield.

Research at the University of Minnesota (i.e., DeHaan et al. 1994, Weed Sci. 42:35–43) offers a model for the development of a spring-seeded smother plant weed control system for corn and soybean. They first attempted to define the traits of a plant that could best function as a smother crop and then initiated a plant breeding program to develop a plant with these traits. The important new concept in this approach was that plants are bred specifically to function as a smother crop. The key is that plants are designed to match the system, rather than attempting to force a plant bred for grain or forage production into a smother crop system. This approach represents an interesting model for developing new weed control options through interdisciplinary research.

While smother crops will not solve all weed problems, they may provide new options for some growers. Management will present new challenges, but we may be able to replace weed populations with manageable smother crops. Smother crops could be combined with other control tactics in an integrated system to help reduce selection pressure on weeds by diversifying the cropping environment, occupying niches and consuming resources currently available to weeds, reducing soil erosion, and improving soil quality.

While interesting in theory, developing smother crop systems for corn and soybean will be no easy task. Cooperative efforts of weed scientists, plant breeders and geneticists, crop ecologists, and others will require the formation of new scientific linkages. Finally, alternate systems such as smother crops should not be viewed as a return to old technology. These systems must build on our past successes to expand weed management options and protect the resources on which our agriculture and society depend.