

## My view

Robert F. Norris

Weed Science Program, Department of Vegetable Crops, University of California, Davis, CA 95616

Does weed science do what is politically correct, or are we leaders who show the way? Do we follow the footsteps of others, or do we develop the trail? It is my view that we are currently following the footsteps of others and are being politically correct. I am referring to the adoption of the entomological concept of economic thresholds as the most appropriate paradigm for managing weeds. By not standing on sound ecology and economics, we are in fact serving our clientele poorly at best, and at worst, we are misleading their efforts. Adopting economic thresholds for weed management locks arable farming systems into high use of herbicides, as there is currently no feasible alternative to keep the competition from the inevitable weed populations from causing crop loss. If we are serious about reducing herbicide use, then we must adopt a weed management philosophy that recognizes and addresses the ecological consequences of the weed seedbank.

There is a problem with the way in which weed science has adopted the entomological concept of economic thresholds. Entomologists developed the concept of the economic injury level, or EIL, as that pest population density at which economic damage starts to occur. The economic threshold (ET) is defined as the pest population at which control action should be initiated in order to prevent the population from increasing to or exceeding the EIL. Control action must, therefore, be started before the EIL is attained. Weed science has adopted a definition of economic threshold that is the same as the entomological EIL. This means that treatment action is only taken once the EIL has been achieved. Adoption of the ET and EIL concept by weed science would recognize the long-term nature of weed population dynamics.

Additional reasons why adoption of economic thresholds do not make ecological sense for weed management include the trophic position of the two pest types in the food web, presence of the weed seedbank, lack of population "crashes" for weeds, and differing rates of population decline, fecundity per individual, and population increase per generation. More detailed analyses of these differences are presented elsewhere (Norris 1999 *in* Buhler, ed; Expanding the Context of Weed Management, New York: Food Products Press, The Haworth Press).

In the paper noted above, I proposed that weed science adopt the acronym NST, which is short for **no seed threshold**. This threshold implies that weeds should not be permitted to set seed. It is based on the rationale that the seed rain sustains the seedbank of most of our important weed species. Weeds that do not achieve reproductive status or do not compete with the crop would not need to be controlled using the NST philosophy.

On many occasions I have been told that the NST phi-

losophy is not feasible. In California we have anecdotal living proof that NST is achievable and is economically sound. The 60,000-ha Boswell Ranch in the San Joaquin valley has operated a policy for about 50 yr of not letting weeds set seed. The managers assert that the policy results in lower weed control costs than if they followed the ET concept of weed management. Louis Manzoni, a vegetable farmer in the Salinas valley, likewise does not let weeds set seed. He has virtually eliminated herbicide use from his vegetable production systems, while at the same time reducing his cost of weed control.

Another reaction that I get to implementation of an NST management philosophy is that it will result in increased use of herbicides and will make herbicide-resistant weed problems worse. The NST management approach cannot be achieved by simply increasing the use of herbicides. The NST philosophy will only be achieved with integration of weed management technologies and requires the use of hand labor for controlling low weed populations that have not succumbed to other management tools. Adoption of NST should lead to reduction in herbicide use and reduction in development of resistant weeds. I am often told that hand labor for weeding is not available. My response is that the situation reflects the level of wages, not the availability of labor. It is possible that an NST philosophy cannot be applied to low-value crops because of the cost of using hand labor.

The impact of an NST philosophy on ecosystem diversity is a question to which I see no easy answer. It is possible that NST should only be applied to "key" weeds and that less important weeds be managed with some type of threshold so that they can contribute to the diversity of a system. How the importance of a weed is determined poses a difficulty, as weediness is very much in the eye of the beholder.

The concept of ET is disastrous when applied to the spread of a weed species into a previously noninfested area. Unconscious adoption of ET, as defined by weed science, would appear to be the policy of most land managers. No action is taken against an invading weed species until its population has reached the EIL. This means that a seedbank has been established prior to the initiation of control action. The horse has long since bolted the barn.

By adopting the ET concept for weed management I argue that weed science is throwing in the towel. It is like saying that weed seedbanks cannot be manipulated. I am not willing to accept that. I believe that every land manager's philosophy should be to try and end each management cycle with at least a slightly less severe weed problem than when the cycle started. In my view NST should be the philosophy of any land manager who is looking at weed management from a long-term perspective.