There is an old saying that “One year’s seeding- seven years’ weeding.” Although one may not think of herbicide-resistant weeds while quoting this, the importance of this adage has increased with the advent of ‘herbicide resistance’ in weeds. It is very likely that herbicide-resistant weeds will produce seeds that will germinate and produce plants that are also herbicide-resistant. As we keep eliminating ‘susceptible’ plants, the population of the ‘resistant’ plants will increase. This may change the volume and diversity of the seed bank and call for a change in our current weed management strategies. This requires an understanding of ‘weed seed banks’.

For those growers who do not rely on chemical weed control, herbicide-resistant weeds may not be an issue. However, it is equally important for them to understand ‘weed seed banks’ because it is the main source of weeds in agricultural fields. Most weeds start their life cycle from a single seed in the soil. If these weeds escape control, they grow and produce thousands of seeds. These seeds are returned to the soil seed bank and become the source of future weed populations. Therefore, knowledge of seed return and seed bank dynamics is essential for weed management.

The soil weed seed bank

Soil weed seed banks are reserves of viable seeds present on the surface and in the soil. The seed bank consists of enormous numbers of new seeds recently shed by a plant and older seeds that have persisted in the soil for several years. Many of these seeds die within a few years or are removed from the seed bank by other processes. However, some seeds can remain viable for decades and produce new plants and new seeds. It has been estimated that only 1-9% of the viable seeds produced in a given year develop into seedlings; the rest remain viable and will germinate in subsequent years depending on the depth of their burial. The majority (about 95%) of the seeds entering the seed bank are from annual weeds. Similarly, 70-90% of the seeds will be of few dominant species adapted to the current cropping system.

Fate of seeds in the seed bank

Several things can happen to these weed seeds in the seed bank (Figure 1). They may be preyed upon by insects or other vertebrates; die due to physiological reasons; be attacked by pathogens; get buried too deep in the soil preventing emergence; become dormant due to physiological reasons; be physically damaged by agricultural implements; or germinate, emerge, grow and produce more seeds.
Limiting the weed seed bank

Preventing weeds from setting seeds may not benefit the current crop but will pay-off in the long term. Any seed that is produced will only add to the seed bank and contribute to future weed populations. Several approaches can work to reduce the seed bank:

- Minimize weed escapes in the field. Post-harvest management helps prevent seed set by weeds that continue to grow after crop harvest.
- Bury seeds deep into the soil profile to prevent them from germinating. Conversely, if seeds in the shallow zone are stimulated to germinate, for example by pre-irrigation, the emerged seedlings can be controlled and prevented from producing seeds.
- Prevent weed seeds from entering the fields by keeping canal banks and irrigation systems weed free, install screens on inlets.
- Clean equipment properly after use in a weedy field.
- Apply caution when applying manure as it can contain viable weed seeds.
- Rotate crops and herbicides because this can help in changing the composition of the seed bank from undesirable to desirable species.
- Manipulate cropping systems (e.g., row spacing, plant population, time of planting etc) to make the environment unfavorable for the weed to complete its life cycle.
- Encourage processes that cause loss of seeds from the seed bank (Figure 1).
- Identify species of weed seeds that require disturbance (tillage) and those that do not and make management decisions to limit seed return.
- Manage weeds along field edges and headlands because seeds produced by these plants can be dragged on to the field by machinery or irrigation water.
- Avoid livestock movement from weed infested areas to crop lands.

Studies from Nebraska suggest that preventing weed seed production can cause a reduction of weed seeds from the soil at a rate of 25% per year in cultivated soils and 12% per year in undisturbed soil.

In summary, weeds should be prevented from producing seeds. Doing so will limit future weed populations and addition of ‘herbicide resistant’ weed seeds to the seed bank, treating the cause rather than just the symptoms of weed infestations. “An ounce of prevention is worth a pound of care.”
Figure 1. The seed bank cycle (inputs to the seed bank are shown with black arrows and losses in white arrows).

References:
Wilson, R. G. and J. Furrer. 1996. Where do weeds come from? University of Nebraska-Lincoln Cooperative Extension (http://www.ianr.unl.edu/pubs/weeds/g807.htm)