

Tips to manage weed seed bank under Conservation Agriculture-based farming systems in drylands

Weed management in the drylands is complex because of heterogeneous soil conditions, increasing frequency of extreme events (drought, torrential rainfall, and extreme temperatures), a wide range of environmental requirements of botanically diverse weed species, and limited farmers' resources. Weeds can survive under adverse conditions, as they extract more water and nutrients from the soil, thereby reducing crop yield by 37 to 79% in dryland agriculture. Weeds are the most detrimental factor in decreasing the water availability to growing crops in dryland, where weeds alone can reduce more than 50% of crop yield competition for moisture in moisture-limited conditions.

The severity of weed infestation and its management during the transition phase from conventional agriculture to Conservation Agriculture (CA), is one of the bottlenecks for wider adoption of CA in the Middle East and North Africa (MENA) region. More aggressive, adaptive, and persistent characteristics of weeds pose a serious threat to crop production and are difficult to control below the economic threshold level with single weed management practice. Managing weed seed banks is an important component of integrated weed management for CA.

Soil weed seed bank: A single unwanted weed plant can add thousands of seeds to the soil and can remain alive in the soil for several years as a "seed bank". The seed bank is the storage and resting place of weed seeds and a source of future weed populations of annual and perennial species. If the field is contaminated with a certain weed seed, it takes at least 3-5 years to control this weed given a 100% seed set control achieved every year. High weed infestation not only increases the weed management cost but also reduces the crop yield and quality.



Fallow weed infestation in CA field



Uniform crop establishment under CA



Forage mixture under conservation agriculture



High weed infestation at later crop growth stage

- Weeds must be removed/chemically controlled at its early growth stage.
- Do not Spray herbicides when the soil is very dry.

Strategies to minimize weed seed bank

- Control weeds before they set seed (before flowering) as some weeds can mature seeds from flowers.
- Remove creeping perennial weeds before they set seeds, new rhizomes, tubers, or other propagules.
- Adopt good management practices to keep crops ahead of the weeds---small weeds overshadowed by a good crop canopy may have less than 1% of the seed-setting capacity of vigorous individuals freely growing in full sun.
- Regularly monitor the field and remove large weed escapees before they flower. Getting the largest 10% of weed individuals can reduce seed production by 90% or more.
- Adopt a wide range of crops in the crop rotation. For example, including early forage crops and mixture in rotation and graze/harvest biomass before weed seeds mature.
- Control weed at the later stage of crop growth, especially in case of late-season rainfall.
- Do not leave non-cropped spaces in the field and use correct seed densities as well as row-spacing.
- Control weeds in bunds, ditches, patches, and field-bordering areas to minimize seed setting by weed species that have the potential to invade adjacent fields.
- Maintain as much as possible an adequate level of crop residues/stubble to suppress weed infestation.
- In orchards, especially olives, it is recommended to swath/graze weeds before flowering and seed setting.
- Adopt good sanitation practices to prevent the introduction of new weed species into the field and remove new invasive before they propagate.

In-season weed management tips under CA-based systems

The judicious and right use of a different combination of herbicides as pre-plant (non-selective knockdowns) as a blanket or spot spray, pre-emergence (soil-applied residual herbicides), and post-emergence application can provide effective and efficient weed control under CA system.

- Dry seeding for cereals and uniform crop establishment using appropriate no-till seeder and adopt East/West sowing if practical.
- Reduce row spacing where possible and increase seeding rates with high weed burden areas.
- Excess nitrogen can stimulate weed germination and growth. Use split nitrogen fertilizer applications and slow-releasing forms of nitrogen fertilizer to make nit availability patterns over the season match the N needs of the crop rather than the weeds.
- Apply the selective herbicides based on the grown crop, crop stage, and dominant weeds.
- Post-emergence herbicide should be applied as per the product label. Delayed applications reduce efficacy and may compromise crop yield.
- To prevent problems of resistance it is important to avoid the use of the same herbicide repeatedly and year after year.
- Ensure the use of adequate, fully functional, and well-serviced sprayers.
- Use safety measures (protective clothes, glasses, boots, gloves, masks, etc.) while spraying herbicides and other chemicals.
- Avoid spraying during inversions (from evening through to early morning), in high temperatures, frost and dew conditions, and when the wind speed is below 5km/h or above 20km/h.

- **Integrated weed management is more effective in managing weeds than a single effort.**
- **Once you manage weeds properly in the first 2-3 years of conversion to conservation agriculture, weed pressure declines, and minimizes the herbicide application compared to the conventional systems.**

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