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Weed management principles for maize

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Weed control is essential to achieve optimal maize yields. The first crucial period for weed control is from planting to six weeks of growth. At planting, it is recommended that the seedbed must be weed-free. The maize will generally germinate after five to seven days, during which time the seedlings are very vulnerable to weed competition. Weeds compete with the maize for nutrients, water and space. They are more adapted to competition and, if not controlled, the maize yield will decline.

Weed management mainly focuses on annual weeds than perennial weeds. Annuals complete their life-cycle from seed to seed in less than one year or in one growing season. They produce an abundance of seeds, grow quickly and are usually, but not always, easy to control, e.g. pigweed, common blackjack and gallant soldier.

FIGURE 1 Common blackjack as an example of an annual weed.

Perennials are divided into two groups, creepers and simple perennials. Simple perennials spread only by seed. If the shoot is injured or cut off, it may generate a new plant vegetatively, but reproduction is normally done by seeds.

FIGURE 2 Dandelion as an example of a simple perennial that reproduces by seeds.

Creeping perennials reproduce by seed and vegetative plant parts. These include above-ground stems (stolons), below-ground stems (rhizomes), tubers, aerial bulblets and bulbs, e.g. yellow nutsedge.

FIGURE 3 Kweek as an example of a creeping perennial.

Make use of an integrated weed management programme, combining cultural, mechanical and chemical methods.

Cultural methods

Ask your local seed distributor for maize cultivars that are adapted to your region. Using high-quality maize seed will aid in reducing weed competition. Healthy, vigorous crops are always more competitive than slow-growing crops or those with poor stands. Changing planting dates can be implemented to avoid weeds germinating at certain times. If maize is planted in narrow rows (0.75 m), quicker canopy closure is promoted which will reduces weed growth and water loss. Increasing plant populations can often decrease weed densities and growth.

Gaps in the field provides weeds with an opportunity to establish and spread. If grasses tend to be the most dominant weeds, rotate the maize with a broadleaved crop such as soyabeans. More grass herbicides are registered on soyabeans than on maize and this will allow better grass control.

Mechanical methods

Tillage controls weeds by burying them, separating shoots and exhausting the carbohydrate reserves of perennial weeds. Killing the initial flush of weed seedlings can make further weed control much easier to achieve. Maximum control is achieved when cultivation takes place after weeds have germinated but before they emerge, because best results from cultivation are obtained with small weeds. Larger weeds are difficult to bury and have sufficient roots to escape total separation from the soil. Effective cultivation needs dry soil, both at the surface and below the depth of cultivation. Dry soil promotes desiccation of the uprooted weeds. Cultivation while the soil is too wet will simply transplant weeds, especially the vegetative reproductive organs of perennial weeds.

Mulching excludes light and prevents shoot growth. Weed seedlings emerging from the soil are killed through starvation from a lack of photosynthesis. Light-promoted weed-seed germination may also be inhibited under mulch. Thick, wide mulches are required to control perennials that creep to the edge of a mulch and emerge. Mulches decrease soil temperature and may promote better plant growth.

In no-tillage production systems, weed control with cultivation is not possible. The stubble left on the soil surface can be regarded as a mulch, but it needs to be spread evenly.

Chemical control

A greater reliance on herbicides requires close attention to the types of weeds, weather patterns, cropping systems and soil types. In order to decide what herbicides to use, a few factors need consideration.

a) Weeds present

Various weed characteristics influence the effectiveness of herbicides. Younger plants have more penetrable leaves and usually have a higher metabolism than older plants. It is therefore essential to control weeds as seedlings and not as mature plants. Plants under stress are usually less susceptible to herbicides and weed control will be reduced. If the weeds have narrow leaves or leaves with hairs, thorns or a waxy surface, less herbicide will be absorbed.

b) Registered herbicides

USE ONLY REGISTERED HERBICIDES. Herbicides can broadly be divided into two groups, (1) soil-acting herbicides and (2) foliar-applied herbicides. The soil-acting herbicides are taken up by germinating seeds, while the foliar herbicides will be taken up by the leaves and the stems. The susceptibility of both crops and weeds to herbicides is related to the time of application. It is important to remember to use the chemical at a time when the crop is at its most resistant and the weeds are at their maximum susceptibility. Timing of applying herbicides can be grouped into four categories:

- Burndown: Burndown herbicides control emerged weeds before or just after planting, but prior to crop emergence.

  The weed species present and their size and life cycle, will determine the dosage rates. This application is important for no-till farmers.
- Pre-plant: The herbicides are applied to the soil any time before crop planting and persist in the soil. The main objective is to prevent early weed growth.
- Pre-emergence:These herbicides are applied shortly after crop planting but before the weeds emerge. Unfortunately, rain is needed for washing them into the soil and triggering their activity.
- Post-emergence: These herbicides are applied after the crop has emerged and are therefore not strongly influenced by the soil environment as they act on the above-ground plant parts.

c) Factors affecting herbicide choice

1. Effects of soil

Organic matter content is of particular importance because it is the main factor controlling adsorption and hence availability in the soil. It also affects microbial activity and has an influence on microbial degradation of herbicides. Herbicides may vary greatly in water solubility and absorptivity to soil colloids. This may explain why some herbicides work well in one situation and poorly in another. Herbicides that are low in water solubility are strongly adsorbed on soil particles, have shortened persistence and are less likely to leach.

This also serves, in part, to explain crop injury under heavy rainfall conditions. Soils with high clay content tend to adsorb herbicides more strongly and thus may lead to a decrease in their availability for degradation.

2. Persistence

The length of time in which a herbicide remains active or persists in the soil is extremely important, because it will determine the length of time that weed control can be expected, or the time a chemical is present in the environment. Residual persistence is also important, because it leads to phytotoxic effects that may prove injurious to subsequent crops. This can restrict crop rotation options available and cause environmental contamination. Persistence is dependent on the herbicide, soil and environmental characteristics.

3. Crop Rotation

Crops may be damaged by herbicide residues applied the previous season. Producers need to know the different waiting periods before planting susceptible crops. Crop failure may require a change in crops for specific fields. Some herbicides limit replant options. When an herbicide tank mixture is applied, the most restrictive label must be observed.

4. Tillage practice

In a no-tillage situation, both simple and creeping perennial weeds can increase. Seed burial is reduced and the reservoir of dormant seed serves as a continuous source of weed infestations. Plant residues can intercept soil-applied herbicides and reduce the amount reaching the soil. Herbicides can be degraded by sunlight and may be lost before rain washes them into the soil. Soil-incorporated herbicides such as EPTC cannot be used with no-till because the herbicide needs to be incorporated into the soil.

5. Application equipment

Safe and effective use of herbicides require proper calibration and operation of the application equipment. The selection of the type of equipment depends primarily on the weed history of the field, the crop to be planted, herbicide choice and herbicide formulation. Herbicides, formulated as solutions, emulsions and wettable powders, are usually applied to the soil or plants as sprays, with water as diluent or carrier. Granules are applied by mechanical spreaders similar to those used for fertilizer. Pre-emergence

herbicides are usually applied through a boom attached to the planter.

6. Climatic factors

If rainfall occurs too soon after a post-emergence herbicide was applied, the effectiveness can be reduced. Herbicides vary in their time requirements for rain-free periods after application. The exact time required to protect herbicide activity will vary with target species and environmental conditions.

d) Tank Mixtures

Only registered mixtures should be used. In many instances these consist of herbicides produced by the same manufacturer. On every herbicide label the herbicides recommended for mixtures are displayed. Every time a mixture is made up it is advisable to add the products in the same order and proportion as planned, shake it well and leave it. If any flocculation, coagulation or precipitation occurs, the specific mixture cannot be used. When mixing chemicals prior to spraying, half fill the spray tank with water and commence agitation. Add the formulations in the order specified on the labels, creaming them first in a little water, and then adding at least 10% of the total volume of water before each chemical is added.

Summary

Weed interference is a given in any crop production situation, leading to potentially high yield losses if seeds are not adequately controlled. Reliance on chemical control only has drawbacks, such as the development of herbicide resistance, the potential negative impact on food and environmental safety and the failure to control weeds due to adverse climatic conditions or application errors. Therefore, weed management should focus not only on curative methods but instead on combining different cultural methods to prevent and manage weed populations.

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