



INTEGRATED WEED MANAGEMENT

THE WAY AHEAD IN WEED CONTROL



WHY IS IT IMPORTANT TO CONTROL WEEDS?

- Weeds compete with crops for water, light and nutrients.
- Weeds are constantly adapting to their environment and tend to develop resistance if farmers rely on the same chemistry.
- Weeds decrease economic returns from the agricultural land as they impact yields.
- Weeds set seeds and augment the soil seed bank year after year if they are not effectively controlled.



Worldwide,
 30,000 weeds
 compete with crops for
**space, nutrients,
 water and light**



Source: Crop Life International

WHAT IS AN INTEGRATED WEED MANAGEMENT APPROACH?

IWM involves combining chemical and non-chemical weed control methods from a diverse toolbox of products and practices. The fundamental principle is based on diverse practices such as broadening crop rotation, implementing soil tillage or plowing, using herbicides with different modes of action, tank mixtures and cover crops.

WHAT ARE THE OBJECTIVES OF A SUSTAINABLE WEED MANAGEMENT APPROACH?

- Suppress the growth of weeds and limit their ability to decrease yield.
- Minimize weed seed production to reduce the return of seeds into the soil seed bank and their germination in subsequent years.
- Protect the farmer's profitability and the value of his or her land over time.
- Contribute to the surrounding communities and preserve the landscape and the environment.

Without weed control measures

farmers
 would lose
 over 1/3 of their
 income



Source: Oerke, E.-C. (2006), Crop losses to pests

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WHAT ARE THE CHALLENGING WEEDS IN THE FARM?

- Weeds are specific to different crops and adapt to their environment.
- It's important to know their biological cycle in order to adapt the weed control strategy.
- Weed scouting is an important activity for the farmer to identify the species, their density and their distribution in the field.



On the farm the driver weed is *Chenopodium* spp.

WHAT ARE THE WEED CONTROL PRACTICES AT A GLANCE IN HOF TEN BOSCH?

NON-CHEMICAL MEASURES

- Soil tillage
- Extensive soil preparation before planting sugar beet and potatoes
- Stale seed bed prior to winter crops
- Cover crop (yellow mustard) sown at end of summer
- The cover crop is destroyed by frost but continues to protect the soil from erosion
- Soil cultivation done just prior to planting a spring crop
- Extended crop rotation including winter and spring crops which allow more chemical diversity

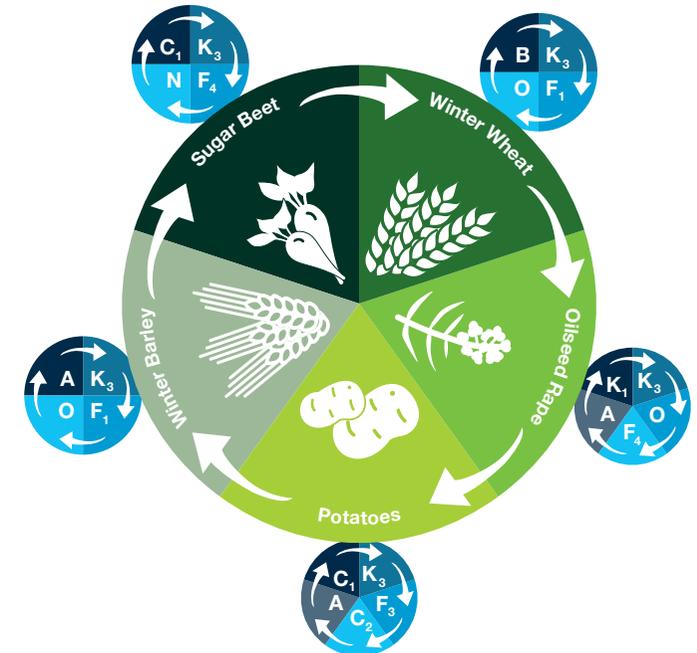
CHEMICAL MEASURES

- 12 modes of action across the entire crop rotation
- 4 to 6 different modes of action are used per crop
- In some crops, such as potatoes and sugar beet, more than 4 modes of action are used.
- The introduction of spring crops in the rotation allows the use of more diverse modes of action.

CROP ROTATION	HERBICIDE CLASS (HRAC)
Sugar beet	C ₁ /N; C ₁ ; C ₁ ; F ₄ ; A
Winter wheat	B; B; K ₃ /F ₁ ; O/O
Oilseed rape*	K ₁ ; K ₃ ; O; F ₄ ; A
Potatoes	C ₁ ; K ₃ ; F ₃ ; C ₂ ; A; F ₄
Winter barley	K ₃ /F ₁ ; O/O; A

*or chicory or corn (with associated herbicide chemical classes)

Example of 5-year crop rotation on the farm with correlated modes of action. Alternatively to oil seed rape, corn or chicory are grown. This means that the same crop is grown only every 5 years on the same field, allowing extra chemical classes to be used in the crop rotation.





FOCUS ON SOIL MANAGEMENT

Soil tillage plays a decisive role in Integrated Weed Management and the risk of erosion is minimized at the farm by using cover crops. Shallow soil tillage is used to stimulate weed seed germination and is applied in stale seedbed systems.

At the ForwardFarm, the soil is ripped twice a year and seed beds are prepared with a power harrow. Cover crops fill the gap between soil preparation and planting the next crop, preventing erosion. The soil is only bare 4 % of the total time. This is a good strategy for soil conservation.



FOCUS ON CROP ROTATION

Including a variety of crops and alternating between winter and spring crops in the rotation disrupts weed population dynamics and provides the following benefits:

- Avoids selection of crop-specific weeds.
- Breaks the biological cycle of weeds.
- Maintains diversity of modes of action.
- On the farm, winter crops in counter season to the life cycle of the main spring crop broadleaf weed (*Chenopodium* spp.) were conducted in 50 % of the seasons, or once every 2 years.



FOCUS ON COVER CROPS

Cover crops help disrupt the life cycle of weeds by suppressing weed biomass, germination and seed production. They also improve soil structure and prevent soil erosion. The Belgian ForwardFarm cropping system integrates yellow mustard as a cover crop.

The cover crop protects the soil for approximately 6 months in winter before spring crops, 25 % of the total time in the rotation. The soil is bare only 2 months out of 48.



FOCUS ON TANK MIXTURES

The use of herbicide mixtures and/or sequences plays a major role in maintaining the efficacy of chemical tools over time. Spraying a mixture of products with different modes of action targeting the same weed reduces the selection pressure for resistance on any of the mixture partners.

At the ForwardFarm:

- 100 % of herbicide applications were mixtures of at least two modes of action.
- On average, 4.6 different modes of action are used per crop.



WHAT ARE THE RESULTS AT HOF TEN BOSCH?

By incorporating IWM measures, Josse and Jan Peeters have been able to sustain their weed control systems over time, keep weed populations low, delay the potential evolution of resistant populations and maintain the farm's productivity.



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