Institut Technique de la Betterave

Combined weed control, french experiences

Date 13 May 2011

Brief return on trials

- After a joint meeting Mechanisation and Weed control group in Bergen op Zoom (2003), ITB decided to evaluate new machines to control weeds between and on the rows and preserve sugar beet,
- 2004-2006: we tested cultivator with stars and rotative hoe in different conditions to evaluate:
  - Efficacy on different weeds,
  - Risks for sugar beet,

Experimental machine 2005

Rotative hoe 2006

Different types of machines

Cultivator with stars

Rotative hoe

Chain harrow

Boom for band spraying

Mechanical work on the row

Rotative hoe (Yetter)

With speed, the hoe projects soil and weeds

The machine works on all the width,
High speed (18 km/h)
Depth 2 to 3 cm
9 cm between 2 spoons
Wheels installed on 2 independent arms
It's possible de adapt the pressure of ressort

Cultivator with stars (Kress)

Stars installed on a classical cultivator

2 plastic stars by row

The rotation is assured by metallic stars by the movement of the machine

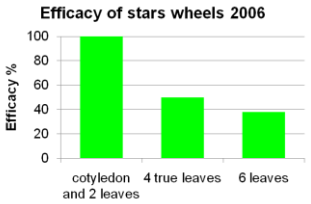
"Desherbineuse"

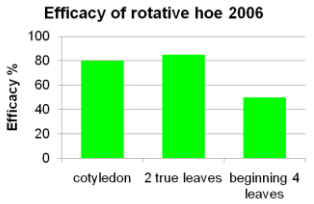
- This machine combine spray of herbicides on the row and mechanical weed control between the rows,
- Guidance by wheel
- Advantage: 1 machine to spray and hoe, spraying and hoeing in same time,
- Disadvantage: working speed is low and size limited to 12 rows,

5 IIRB Seminar Advances in combined weed control 13 May 2011

Results efficacy

- As chemical weed control, the efficacy of stars or rotative hoe is better o young plants, before 4 true leaves of weeds,
- The graphics present results of 2 trials with 1 machine according with the stage of weeds





6 IIRB Seminar Advances in combined weed control 13 May 2011

Results selectivity

- To avoid too important losses of plants of sugar beet, it's necessary to realise first mechanical passage after 4 true leaves of beets

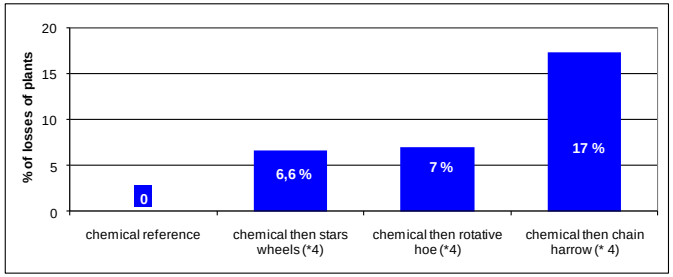
7 IIRB Seminar Advances in combined weed control 13 May 2011

Results selectivity

- To avoid too important losses of plants of sugar beet, it's necessary to realise first mechanical passage after 4 true leaves

8 IIRB Seminar Advances in combined weed control 13 May 2011

Losses of plants in percentage of chemical reference 2009



- 2 chemical interventions before mechanical passage
- **Losses of plants are too important with chain harrow**

Synthesis after some years of tests

	Cultivator with stars	Rotative hoe
Common results	2 chemical applications necessary at first stage of crop Work on young weeds	
Stage to obtain good results	from 4 leaves to 10-12 leaves of the crop	
Characteristics	Classical cultivator + stars wheels No problem on interrow	Poly crop Independent of rows, Working seed: 15 to 18 km/h

Synthesis after some years of tests

Some possibilities exist :

- It's not possible to skip completely chemical weed control by mechanical tools,
- Because it's necessary to obtain a difference of stage between sugar beets and weeds,
- As with chemical herbicides, the control of young weeds, maximum 2 true leaves, is better with rotative hoe or star wheels
- **Efficacy against grass or perennial weeds is poor,**

- Some possibilities exist to control more developed weeds in interrow with blades of cultivator,
- Other axis of work: associate band spraying application herbicide and mechanical weed control.

Reduction of herbicides use

- The objective is to reduce, if possible, by 50 % the use of herbicides,
- The indicator is TFI, Treatment Frequency Index,
- TFI is ratio between applied rate/registration rate,

Guidance system

Objectives :

✓Optimise position of blades and respect totally the rows without intervention of driver,
✓Minimise the non cultivated zone, around 10 cm,
✓Make easier the work of driver and increase speed and size of machines without loss of precision even in uneven field,

Guidance system

- **Guidance with mark realised during sowing:**
  A tine installed on sowing machine realise a trace, this trace is followed by a wheel installed with parallelogram on cultivator or band sprayer applicator,

Advantages: sure, simple system,
Disadvantages: traces can disappear on certain soils,

- **Guidance by camera:**
  A camera film 1 or 2 rows .
  A monitor of control command necessary corrections.

Advantages: no trace during sowing,
Disadvantages: difficulties of detection of rows if numerous weeds,

- **Guidance by GPS RTK :**
  Installed on guidance system of tractor, GPS permit to guide the cultivator with high precision,

Advantages: precision,
Disadvantages: more expansive if surface is low.

Advantages / Disadvantages

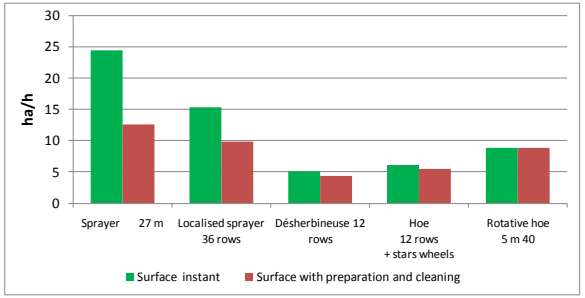
	+	-
Cultivator with wheeling stars	✓ Efficacy known in interrow ✓ Reduction of herbicides ✓ Possibility of adjustment	✓ Aggressively on sugar beet before 4 leaves stage ✓ Inefficient on grass ✓ Lifespan of star wheels unknown
Rotative hoe	✓ Usable on others crops ✓ Work rate ✓ Reduction of herbicides	✓ Aggressively on sugar beet before 4 leaves stage ✓ Inefficient on grass ✓ No adjustment
Band spraying	✓ Good control of weeds ✓ Reduction of herbicides	✓ High number of elements
"Désherbineuse"	✓ Good control of weeds on the row ✓ Reduction of herbicides	✓ how find good compromise between optimal conditions for chemical and mechanical weed control ✓ Work rate limited
Chain harrow		✓ Not adapted to weed control on sugar beet

Evaluation of time

➢How much time is it necessary to achieve mechanical weed control in comparison with chemical, large sprayer (28-36m)?
➢What is the cost of combined weed control: herbicide, engineering, working force?

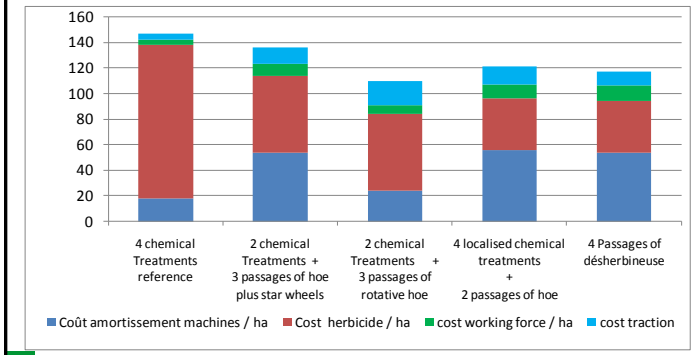
Evaluation of working time

- For the time, we must compare for chemical: time of application, but also time of preparation and cleaning sprayer,

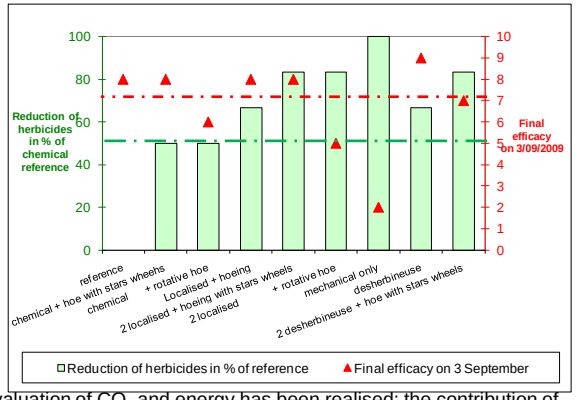


Costs comparison

- Cost of herbicides represent a large part of the total cost, for reference, around 30 €/ha/passage for a B0,6T0,15G0,3V0,1h for example,
- Cost of working force and traction are lower,

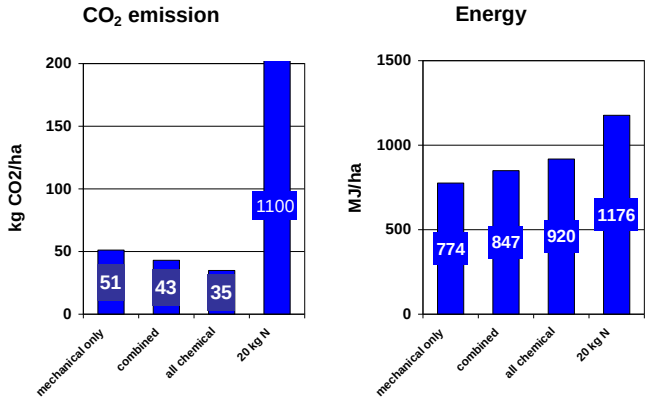


Some strategies of weed control



- Evaluation of CO_2 and energy has been realised: the contribution of mechanical weed control is very low in comparison with fertilizer, especially nitrogen

Environmental evaluation



Some axes of reflexion

- Complete mechanical weed control is not possible in our context,
- Some possibilities exist to reduce use of herbicides and maintain quality of weed control,
- New interest for localised application and hoeing,
- The economy of herbicides can be invested in equipment or manpower,
- Is it possible to engage manpower in situation with few persons in farm,
- An estimation of possible time is necessary to choice most adaptable strategy, crops, workforce, ...
- Each grower must estimate what is the strategy most suitable to his farm,
- Different situations were followed in 2010 and 2011, dry conditions. Hoeing allowed to control developed weeds, more 4 leaves stage, when chemical herbicides have low efficacy due to these conditions.

Many thanks for your attention!