



Indirekta kontrollåtgärder

- växtföljd
- gröda (konkurrensförmåga, sortval)
- såsteknik (utsädesmängd)
- jordbearbetning
- jordförbättrande åtgärder (dränering, kalkning..)
- spridningshämmande åtgärder

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Exempel: växtföljdseffekt på åkerven

Andel höstsäd	Fält med åkerven (%)	
	Totalt	Stora populationer
1 år av 8	10	5
2 år av 8	22	11
3 år av 8	40	27
4 år av 8	70	47

Fogelfors, 2001

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Direkta kontrollåtgärder

- falsk såbädd
- ogräsharvning
- radhackning
- stubbearbetning
- plöjning
- övriga mekaniska åtgärder (flamning etc.)
- biologisk bekämpning
- behovsanpassad kemisk bekämpning
 - Tröskelvärde, dosnyckel, punktbekämpning

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Försäljning av kemiska ogräspreparat 2010

- 1200 ton verksamt ämne
 - Varav glyfosat 657 ton
- 2,1 milj hektardoser
- 1,65 normaldos/ha åkermark (vall och ekologisk odling borträknat)

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Trend 1

- Ökad andel höstsådd areal – växtföljdsproblematik
- Ökad andel reducerad jordbearbetning – problem med fleråriga ogräs och ettåriga gräsogräs (renkavle, åkerven, sandlosta)
- Ökat prisgap mellan kemisk och mekanisk kvickrotsbekämpning

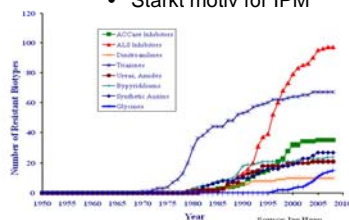
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Trend 2

Ökad risk för herbicidresistens

- Kräver högre doser
- Starkt motiv för IPM



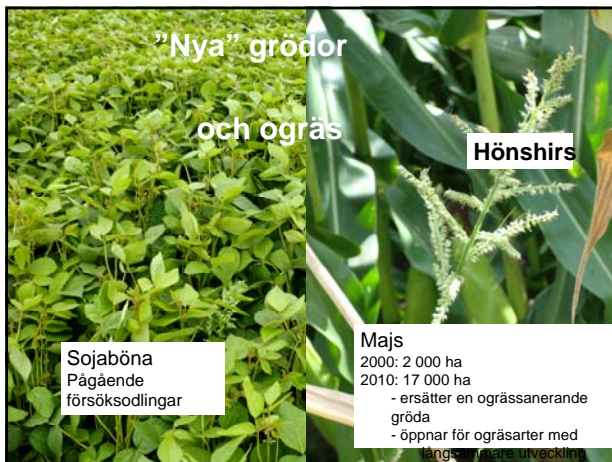
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Trend 3

- Klimatförändring – pågående och framtida
 - nya grödor med sämre konkurrensförmåga
 - ökad andel höstsådda grödor
 - fler specialgrödor (små arealer)

Nya ogräsarter och -problem



Vad behövs för framgångsrik integrerad ogräsbekämpning?

- Information, utbildning och motivering
 - Miljömässiga och ekonomiska risker med ensidig kemisk bekämpning
 - Möjligheter och framgångsrika exempel på IPM
- Forskning
 - Optimering av åtgärder utifrån biologisk kunskap
 - Underlag för resurseffektiva strategier
 - Riskanalyser utifrån förändringar i klimat och odlingsystem
- Växtförädling
 - Konkurrensstarka grödor och sorter
- Teknisk utveckling
 - Alternativ avsättning för vallskörden
 - Precisionsstyrd mekanisk kontroll
 - Behovsanpassad och precisionsstyrd kemisk bekämpning

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Exempel: Resurseffektiv kontroll av kvickrot

- Konkurrens
- Mekanisk kontroll
- Minskat näringsläckage

Foto Erik Ekre

Exempel: Strategi mot renkavle

- Varierad växtföljd med stor andel konkurrenskraftiga vårsådda grödor
- Behovsanpassad kemisk bekämpning med preparat omväxlande från olika herbicidgrupper
- Anpassad jordbearbetning
 - Liten till måttlig fröbank, stor fröproduktion i årets gröda: Plöjning för att vända ner fröna.
 - Stor fröbank: Reducerad jordbearbetning under år med liten till måttlig fröproduktion, gärna i kombination med sen sådd för att fröna ska hinna gro innan sådd ("falsk såbädd"). Plöjning med längre intervall.

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Exempel: Platsspecifik ogräskontroll

Bildanalys + tröskelvärde
styr bekämpningen.

Berge et al., 2010

Testing image-based site-specific weed control in cereals

Introduction

The robot Weeder (Berge et al., 2010) was used to test site-specific weed control in cereals. The robot was equipped with a high-resolution camera and a laser range finder. The robot was used to detect and remove weeds in a field of winter wheat. The robot was used to detect and remove weeds in a field of winter wheat. The robot was used to detect and remove weeds in a field of winter wheat.

Map-based trials (trials nos. 1-3)

Map-based trials were conducted in winter wheat. The trials were conducted in winter wheat. The trials were conducted in winter wheat. The trials were conducted in winter wheat. The trials were conducted in winter wheat.

Real-time trials (trials nos. 4-6)

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Conclusion

The trials showed that site-specific weed control is possible in winter wheat. The trials showed that site-specific weed control is possible in winter wheat. The trials showed that site-specific weed control is possible in winter wheat. The trials showed that site-specific weed control is possible in winter wheat.

Acknowledgment

The project was supported by the Norwegian Research Council. The project was supported by the Norwegian Research Council. The project was supported by the Norwegian Research Council. The project was supported by the Norwegian Research Council.

Map-based trials (trials nos. 1-3) Mean RWC and RMC per management unit Berge et al., 2010

(winter wheat), RWC was a better yield loss predictor than RMC. Data of this trial

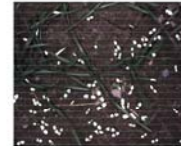


Fig. 1. Left: Weeds detected by Weeder in white. Right: The robot performing real time patch spraying.

Indicated that a biological threshold (BT; x) based on mean 0.015. Result of trial no. 0005 (Table 1). The this trial, RWC = 0.027, was in agreement with the indicated value of trial no. 1 (Table 1). In spring

barley (trial no. 3), a higher RWC based BT was indicated; RWC = 0.057 (Table 1). The resulting mean summer weed densities of the unsprayed management units were statistically higher or equal as the sprayed units, but still reasonably low (Table 2).

Table 1. Estimated thresholds and corresponding herbicide savings (%) in winter wheat. SB = spring barley; SW = spring wheat.

Trial	Threshold values RWC	RMC	Herbicide savings (%)
1 (RW)	0.015	0.015	27 (18*)
2 (RW)	0.027	0.027	41
3 (SW)	0.057	0.057	22
4 (SB)	0.027	0.027	85
5 (SB)	0.027	0.027	92

Table 2. Mean weed density (plants m⁻²) after varying herbicide treatments.

Patch sprayed	Summer weed density (July)		Weed density at harvest (September)	
	Unsprayed	Sprayed	Unsprayed	Sprayed
1 (RW)	1.0	0.8	1.0	0.8
2 (RW)	3.4	0.1	6.3	0.1
3 (SW)	4.6	0.1	-	-
4 (SB)	-	-	8.1	13.6
5 (SB)	-	-	12.1	8.9
6 (SB)	-	-	5.1	5.3

* Extension RWC per image. ** Savings when RMC applied.

Real-time trials (trials nos. 4-6)

Trials were conducted with the robot and tribenuron-methyl (Fig. 1). Sprayed management units were 3.5 m x 3 m and unsprayed units 3.5 m x 0.5 m. There was no difference in mean yield between patch sprayed management units and units with broadcast application in any of the

trials. The tested threshold, a weighted moving average of RWC per image = 0.042, seemed appropriate for spring barley (trials no. 4 and 6). The threshold should probably be lower in spring wheat, as indicated by the relatively high weed density at harvest (Table 2; trial no. 5).

Conclusion

- Herbicide savings were substantial (Table 1; last column)
- The indicated thresholds were generally in agreement with each other and with established knowledge that barley is more competitive than wheat
- The thresholds need further validation and testing

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