



Grassland yield response to knife/tine slurry injection equipment – benefit or crop damage?

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Background

- Injection of slurry into grassland is recommended in order to minimize ammonia emissions.
- In spite of saved ammoniacal nitrogen ($\text{NH}_4\text{-N}$), no clear yield increase have been seen (Smith *et al.*, 2000; Rodhe & Etana, 2005).
- Absent of yield increase with injection compared to surface spreading of slurry may be explained by crop damage made by the injector (Rodhe et al., 2005).
- On the other hand, knife equipments are recommended in order to improve grass swards, e.g. golf courses.



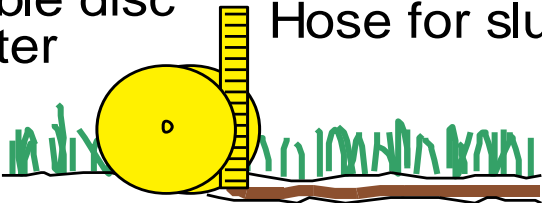
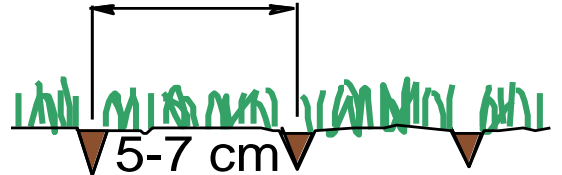
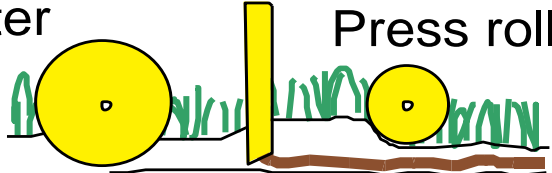

Objectives



- Evaluate the influence of different kinds of knife/injector tines on grassland yield
- Study the effect of time of injection (spring or after first cut) on yield
- Determine the sensitiveness of different grassland species when using knife/tines
- The influence of crop conditions (no N/optimal N) on yield decrease
- Determine the usefulness of different methods to predict yield and detect crop damage

Definition 'shallow injection' - incorporation of slurry in the upper soil level to a depth of < 0.10 m



<p>Shallow injection Open-slot injection</p>	<p>Double disc coultter</p>  <p>Hose for slurry</p>	<p>20 -30 cm</p>  <p>5-7 cm</p>
<p>Shallow injection Closed-slot injection</p>	<p>Single disc coultter</p>  <p>Slurry tine Press roller</p>	<p>20 -30 cm</p>  <p>5-8 cm</p>

Material and methods

Split-split-plot design, knife/injector tine (sub-sub-treatment) grassland swards (sub-treatment), with or without added N (main treatment).



Spring

Summer

Species

(No slurry applied)



Perennial ryegrass

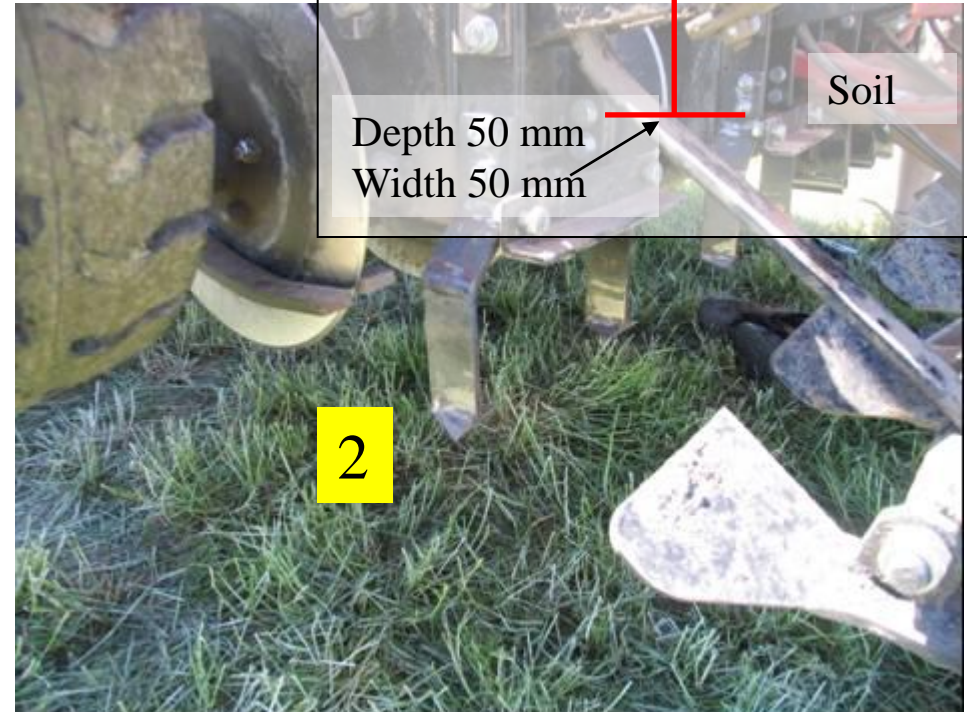
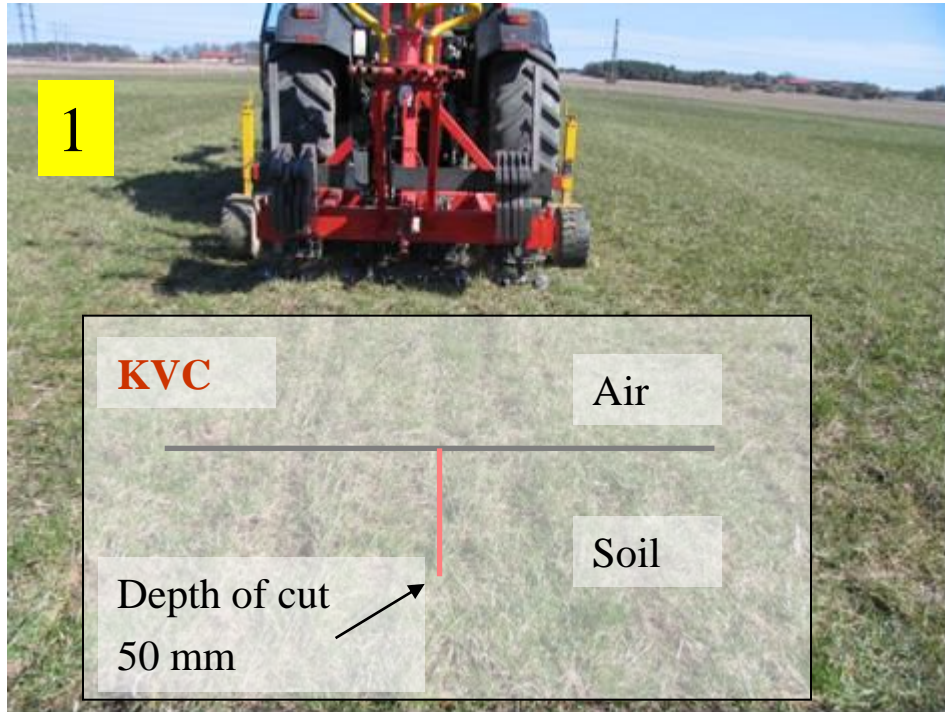


Red clover



Red fescue

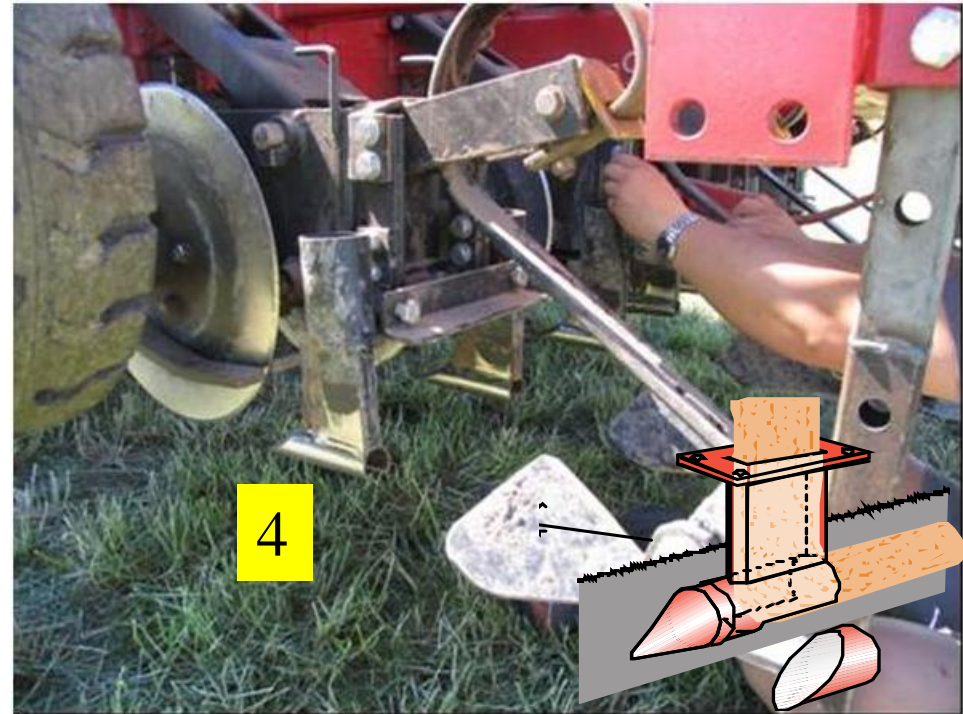
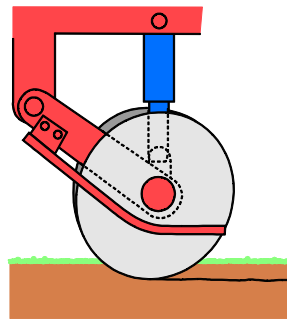
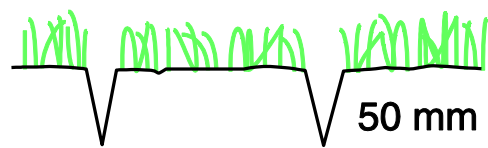
(25 cm between knives)



1. Vertical cut made by a plain disc coulters (KVC),
2. Vertical and horizontal cuts (KVHC)

Material and methods – tines

(25 cm between tines)



3. Injector with two angled discs (DD)

4. Tubulator tine with slot closer (TT)



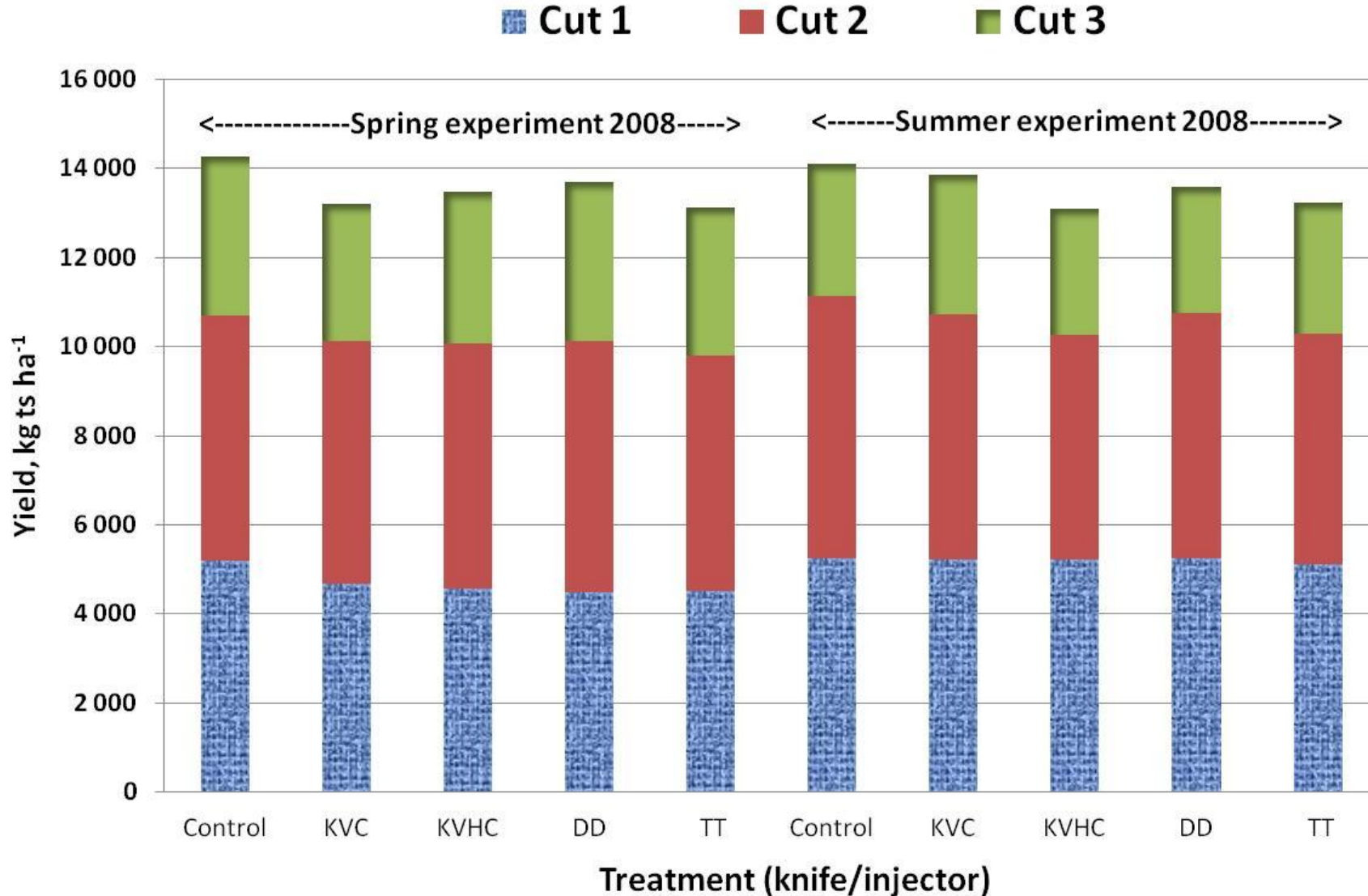
RESULTS: Sum of two years dry matter yields, without and with kniv/injector treatment (average for N fertilising and species)

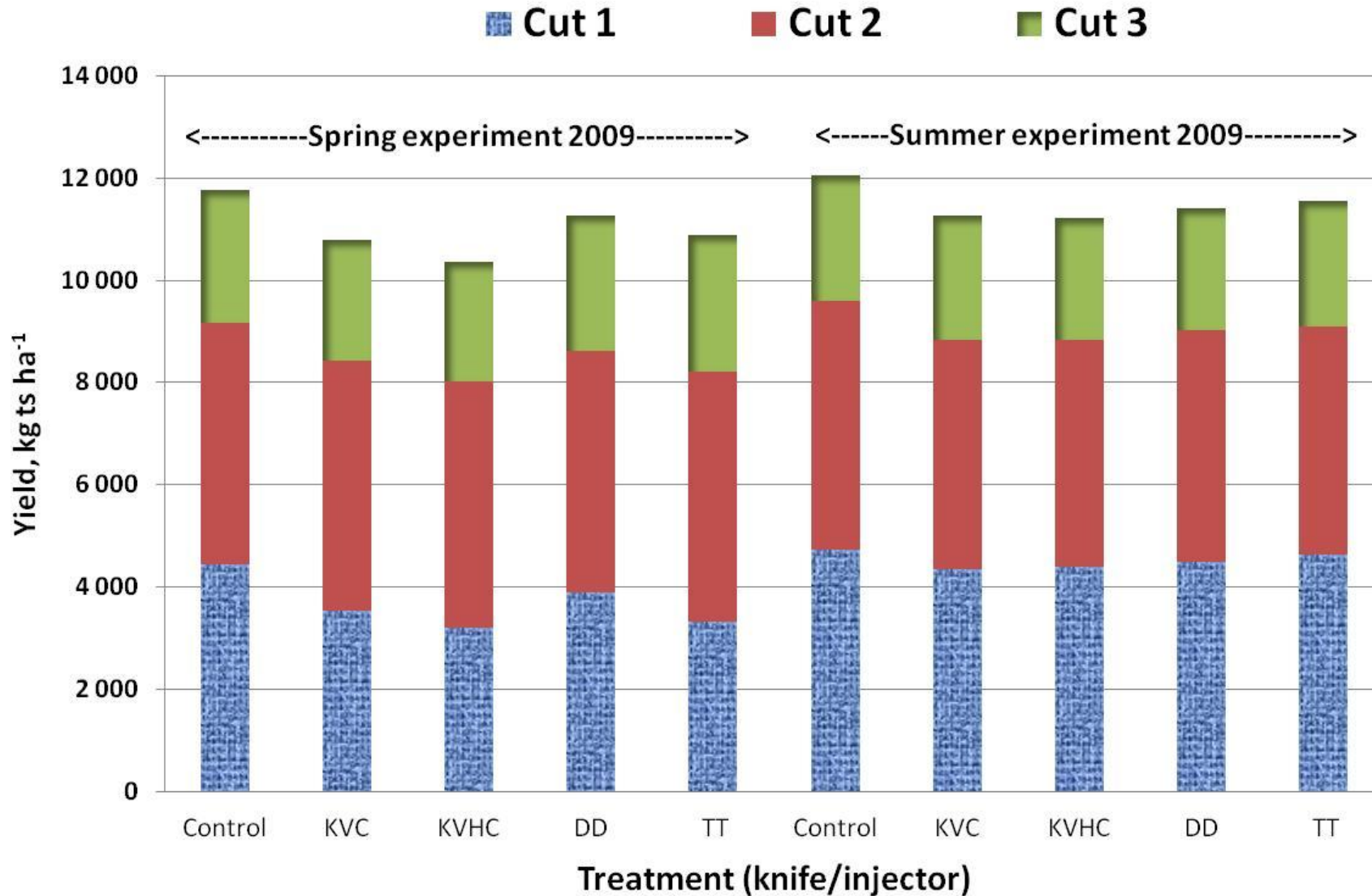


Knife/tine equipment	Accumulated 2008-09	
	Spring	Summer
1. Control	21 723 ^a	21 916 ^a
2. Vertical cutter (KVC)	20 191 ^b	21 383 ^a
3. Vertical and horizontal cutter (KVHC)	19 977 ^b	20 687 ^b
4. Injector with two angled discs (DD)	20 748 ^b	21 414 ^a
5. Tubulator tine (TT)	20 258 ^b	20 651 ^b
Mean	20579	21210
<i>P</i>	0.0002	0.0022
LSD	692	653

^{a, b}LSM with different letters within each column are significantly different ($P < 0.05$)

Yield 2008 – N-fertilised crops





- Use of knife/tines in grassland often reduces total yield
- Application in early spring causes larger damages than after first cut
- The yield reduction was mainly seen in the following cut after injection
- Red fescue was most damaged by application
- N-fertilisation amplifies the negative effect of application in last cut, mainly in red clover and red fescue
- LAI, crop temperature and sward assessment can predict yield reduction relative to no treatment (or detect crop damages)

References

- Rodhe L. & Etana A., 2005. Performance of slurry injectors compared with band spreading on three Swedish soils with ley. *Biosystems Engineering* 92(1), 107-118.
- Rodhe, L, Pell, M. and Yamulki, S. 2006. Nitrous oxide, methane and ammonia emissions following slurry spreading on grassland. *Soil Use and Management* 22, 229-237.
- Smith, K.A., Jackson, D.R., Misselbrook, T.H., Pain, B.F. & Johnson, R.A. 2000. Reduction of ammonia emission by slurry application techniques. *Journal of Agricultural Engineering Research* 77(3), 277-287.



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Web: <http://www.lantbruksforskning.se>