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BIOECONOMY RESEARCH

THE RELATIONSHIP BETWEEN PHENOLOGICAL DEVELOPMENT OF RED CLOVER AND ITS FEED QUALITY IN MIXED SWARDS

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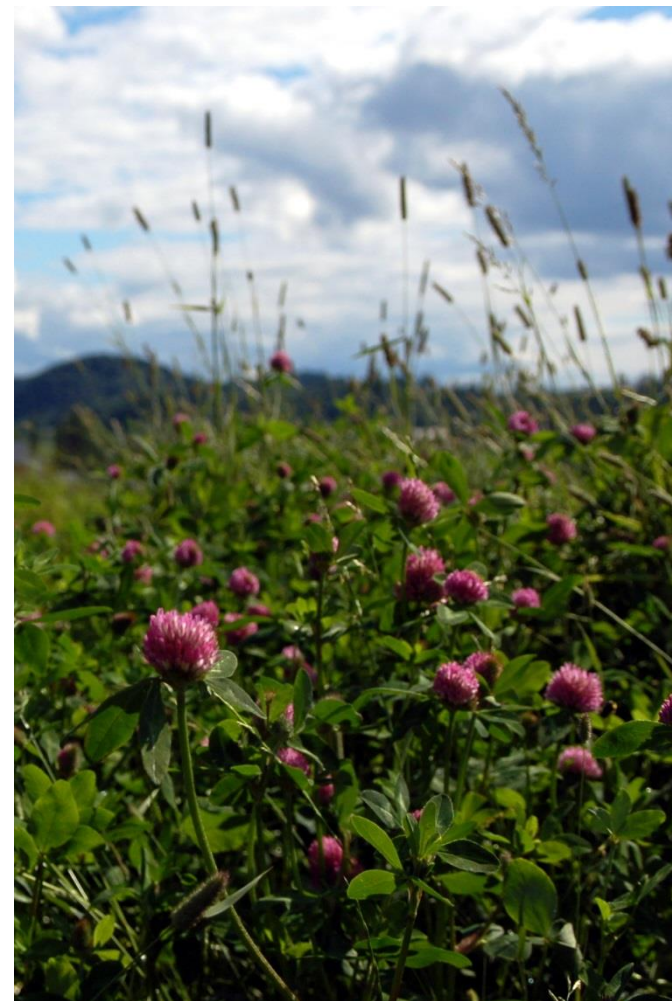
RED CLOVER IN MIXED SWARDS

Contributes (Advantages)

- Nitrogen-fixation
- High Protein
- Higher yield potential
- Higher Digestibility

Challenges (at high latitude)

- Slower growth than grass in spring
- Low clover proportion in spring
- Persistency



HOW TO AVOID THE CHALLENGES RELATED TO DISPROPORTIONAL CONTENT OF RED CLOVER BETWEEN SPRING AND SUMMER GROWTH?

- More competitive red clover varieties (in spring)
- Less competitive grass species

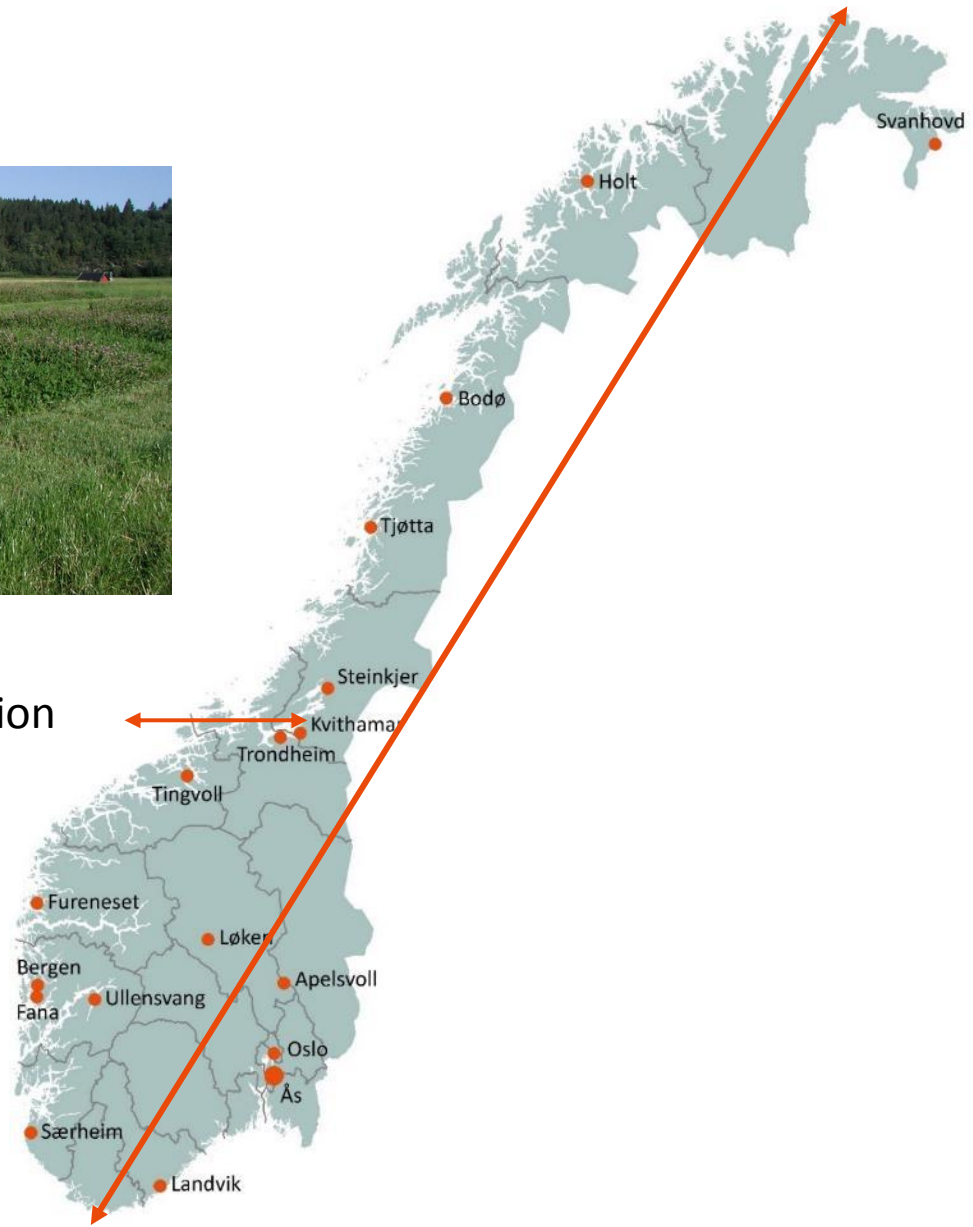
- Red clover varieties
 1. Betty (Swaløf Weibull AB, Sweden)
 2. Atlantis (Norddeutsche Pflanzenzucht Hans-Georg Lembke (NPZ))

- Grass species
 1. Perennial ryegrass
 2. Timothy + meadow fescue

Field experiment established at Kvithamar research station (NIBIO), central Norway (160 kg N/ha)



Kvithamar Research Station



QUESTIONS

- To what extent do red clover varieties vary in phenological development?
- Is there a relationship between phenological stage of development and red clover proportion in mixed swards?
- Does higher phenological stage of development of red clover have implications for feed quality characteristics?

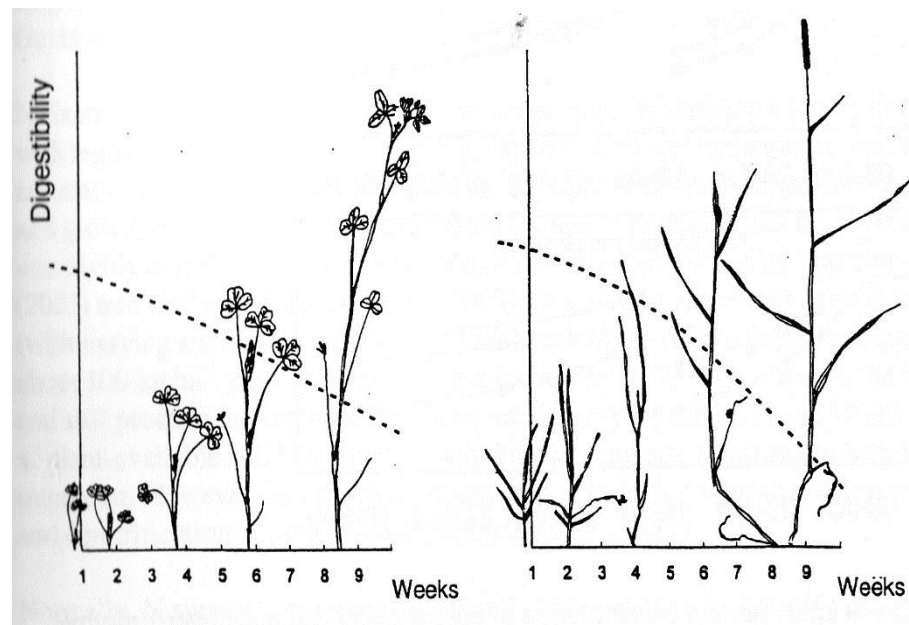
PHENOLOGICAL DEVELOPMENT

What is phenology?

Study of periodic plant phenomena
induced by environmental factors

Factors regulating growth and
development

- Temperature
- Day length
- Moisture
- Nutrients
- Radiation



Gustavsson ()

- Determines morphology
- Important guideline for timing of management

INDICES TO EXPRESS PHENOLOGICAL DEVELOPMENT

- Mean stage by count (MSC)
- Mean stage by weight (MSW)
- Distribution graphs with statistics

All need registration of vegetative, elongative and reproductive stages of plants



NUMERICAL INDICES OF PHENOLOGICAL STAGE

Phenological stage	Code	Description	Numerical value
Leaf stage	V0	First leaf visible	1.00
	V1	First leaf fully developed	1.07
	V2	Second leaf fully developed	1.23
	V3	Third leaf fully developed	1.40
	V4	Fourth leaf fully developed	1.57
	V5	Fifth leaf fully developed	1.73
	V6	Sixth leaf fully developed	1.90
Stem elongation stage	E0	Stem elongation started	2.00
	E1	First internode longer than 1 cm	2.10
	E2	Second internode longer than 1 cm	2.30
	E3	Third internode longer than 1 cm	2.50
	E4	Fourth internode longer than 1 cm	2.70
	E5	Fifth internode longer than 1 cm	2.90
Reproductive stage	R0	Bud emergence	3.00
	R1	First bud visible	3.10
	R2	First flower stalk emergence	3.30
	R3	Pollen visible on first flower	3.50
	R4	First flower	3.70
	R5	Second flower	3.90
Seed formation stage	S0		4.00

Calculated MSC after Moore et al (1991)

DIFFERENCE IN PHENOLOGICAL STAGE OF DEVELOPMENT

MSC

	Betty	Atlantis
1st harvest	1.62	1.66
2nd harvest	1.63	2.53
3rd harvest	1.42	2.06

- Early variety at higher phenological stage of development than late variety only in regrowth

CLOVER PROPORTION OF DM YIELD

	Betty	Atlantis
1st harvest	8%	14%
2nd harvest	32%	54%
3rd harvest	53%	59%

- Early red clover variety contributed a higher proportion of yield than the late one at all harvests
- But could not overcome the challenge of red clover disproportionality between the harvests

LEAF PROPORTION (G/KG OF TOTAL PLANT WEIGHT)

	Betty	Atlantis
1st harvest	850	780
2nd harvest	900	590
3rd harvest	980	610

- Late variety had higher leaf to stem ratio than the early variety
- Early variety invested more energy on stem elongation to be competitive in mixed swards

FEED QUALITY (G/KG)

	<u>CP</u>		NDF		NDFD	
	Betty	Atlantis	Betty	Atlantis	Betty	Atlantis
1st	260	210	350	360	770	690
2nd	190	170	380	410	550	500
3rd	220	210	350	380	590	550

- Early variety had lower crude protein than the late one
- Early variety had higher NDF concentrations
- Early variety had NDF that was less digestible

CONCLUSION

1. Rate of phenological development differed only during the regrowth
2. Rate of phenological development showed a positive correlation with clover proportion
3. Rate of phenological development showed a negative correlation with forage feed quality
4. The disproportionality in clover content between harvests was high for both varieties

We need to explore more varieties which are earlier in spring than the one investigated here to overcome the issue of disproportionality between the harvests

Thanks for your attention



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