European Maize Meeting

France, 6 – 7th September 2016

Rudolf Thøgersen, Team Manager

rut@seges.dk

FEED VALUE OF SILAGE MAIZE FOR DAIRY COWS

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NorFor
Nordic Feed Evaluation System

FEED EVALUATION BASED ON NORFOR - A RATION FORMULATION SYSTEM

Based on:

- Nordic research data
- Dutch net energy system
- French growth system
- US-recommendations for minerals and vitamins

http://norfor.info/

NorFor -
The Nordic feed evaluation system
EAAP Scientific Series – Volume 130
ISSN: 0071-2477
edited by: Harald Volden

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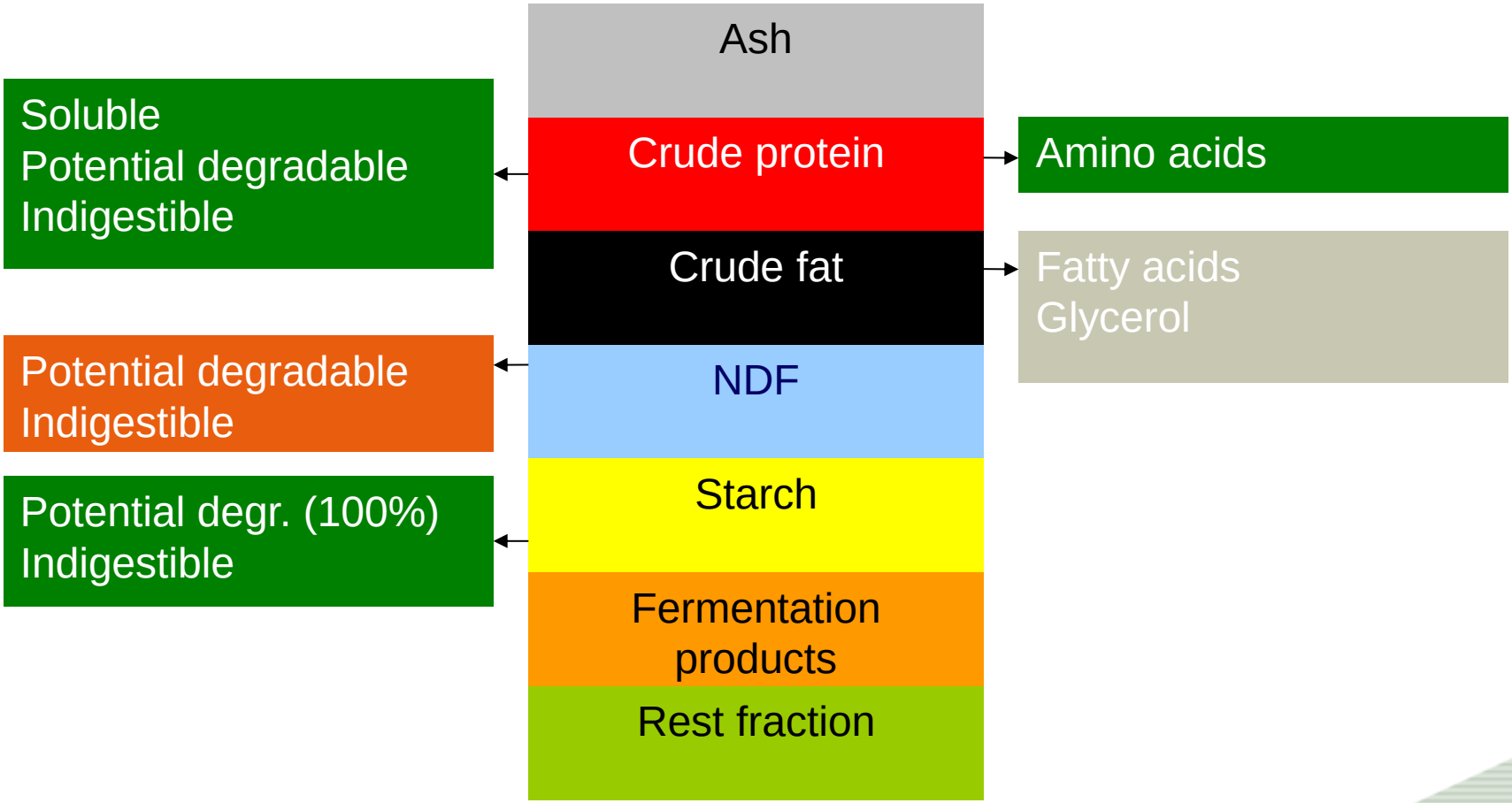
FEED FRACTIONS IN NORFOR



DEGRADATION CHARACTERISTICS OF MAIZE SILAGE

Parameters	Values
Starch	
Indigestible starch	38 g/kg starch
Degradation rate in rumen	44,7 %
aNDFom	
Potential degradable NDF	Variable, calculation from OMD analyzed by NIR
Degradation rate in rumen	Variable, backward calculation from OMD
Crude protein	
Soluble crude protein (sCP)	Variable, analyzed by NIR
Potentially degradable protein	360 g/kg crude protein
Indigestible crude protein	140 g/kg crude protein
Degradation rate of sCP	150%
Degradation rate of pdCP	4,6%

CALCULATED DIGESTION OF MAIZE SILAGE STARCH IN NORFOR

	Grams per day	Percent
Intake (only maize silage)	4902	100
Degraded in the rumen	4347	88,7
Digested in the small intestine	279	5,7
Digested in the large intestine	94	1,9
Excreted in feces	182	3,7

TEST OF STARCH DIGESTIBILITY IN 11 DANISH DAIRY HERDS IN NOVEMBER, JANUARY AND MAY 2014

Sample of maize silage

45 pct. of dry matter and 81 pct. of starch from maize silage

Sample of TMR

Fecal samples of 8 cows approx. 100 DIM

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SUBDIVISION OF SAMPLES

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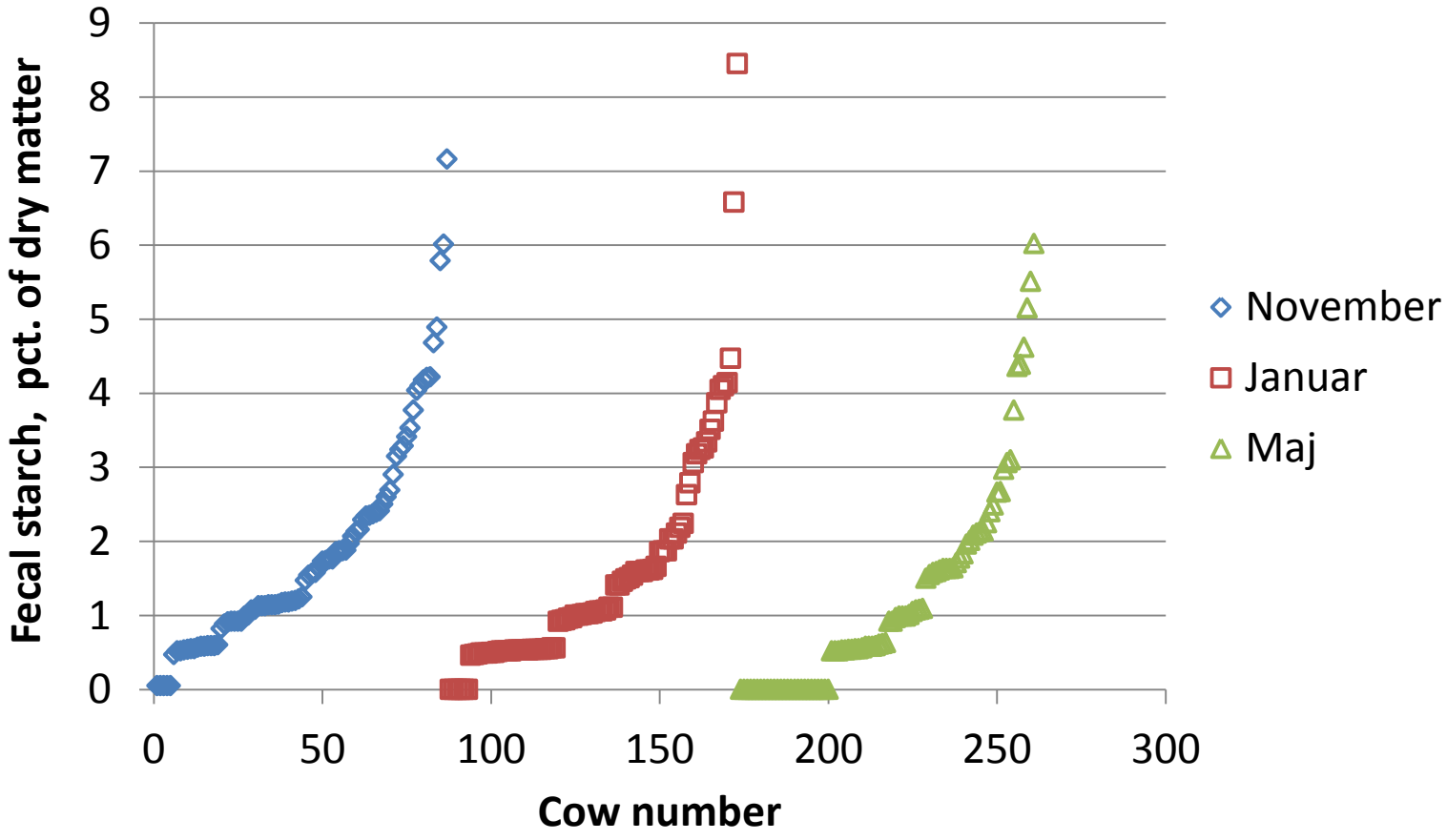
VARIATION IN FECAL STARCH ON COW LEVEL



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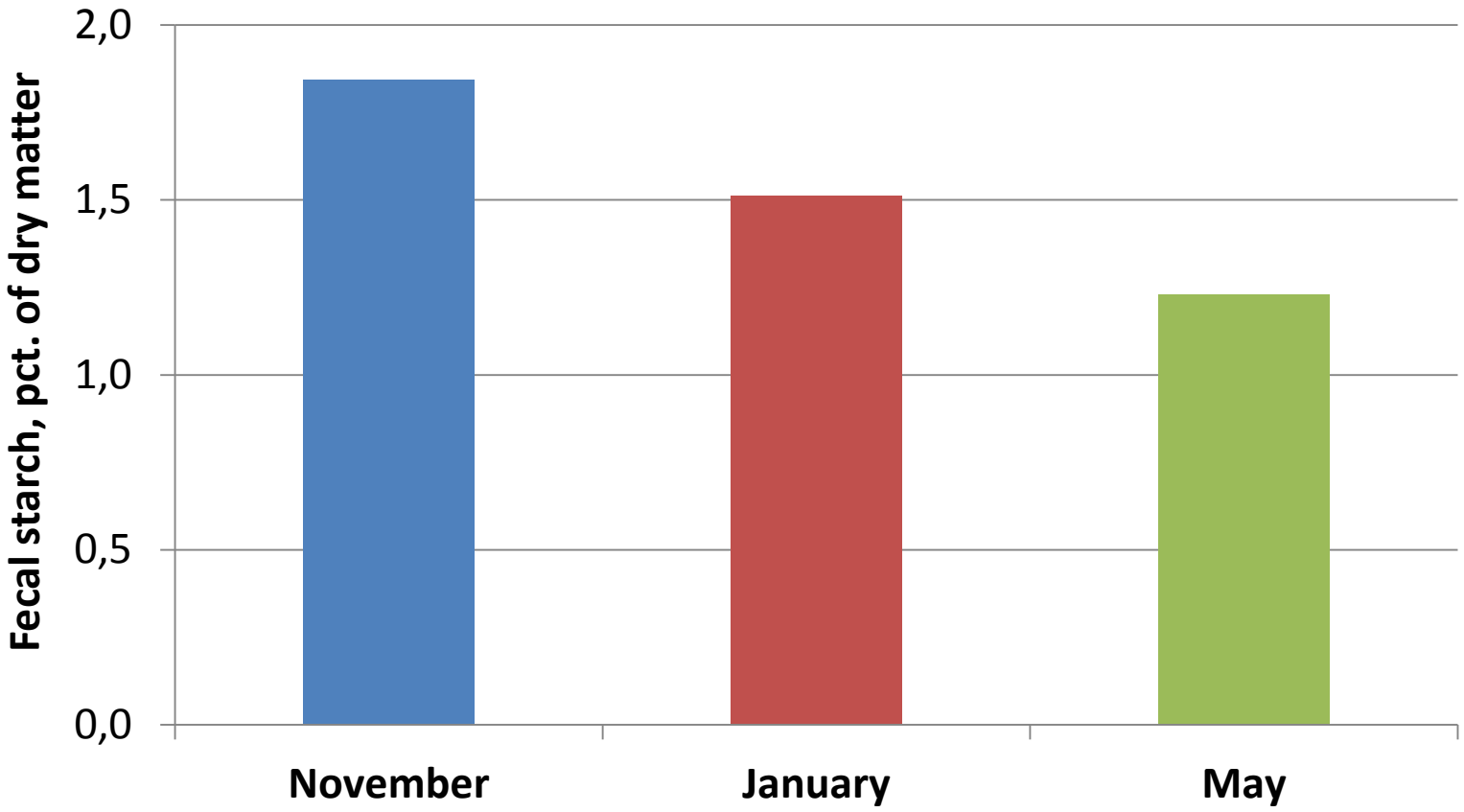
DECREASE IN FECAL STARCH OVER TIME



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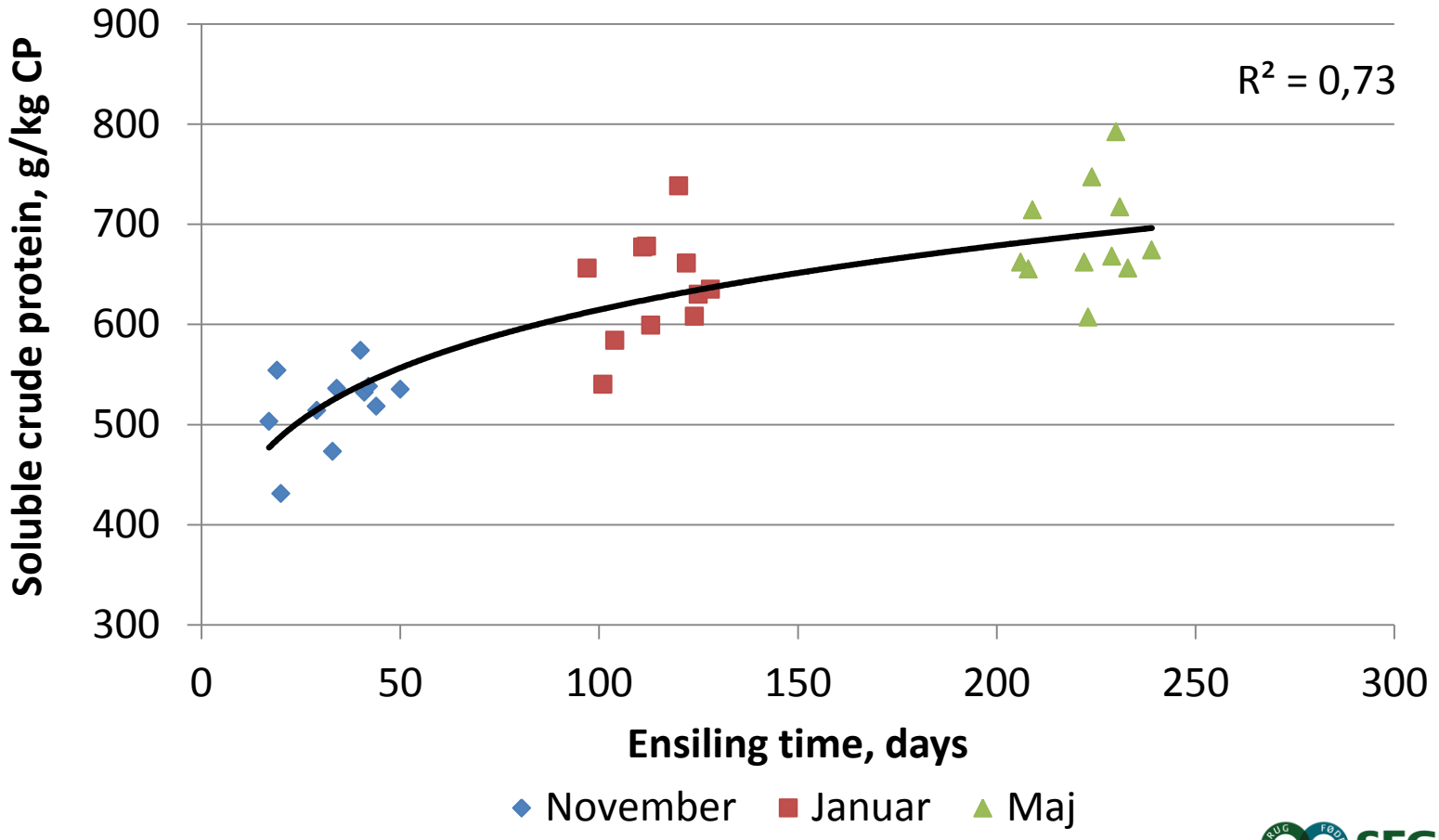
SOLUBLE CRUDE PROTEIN IN MAIZE SILAGE IS INCREASING OVER TIME



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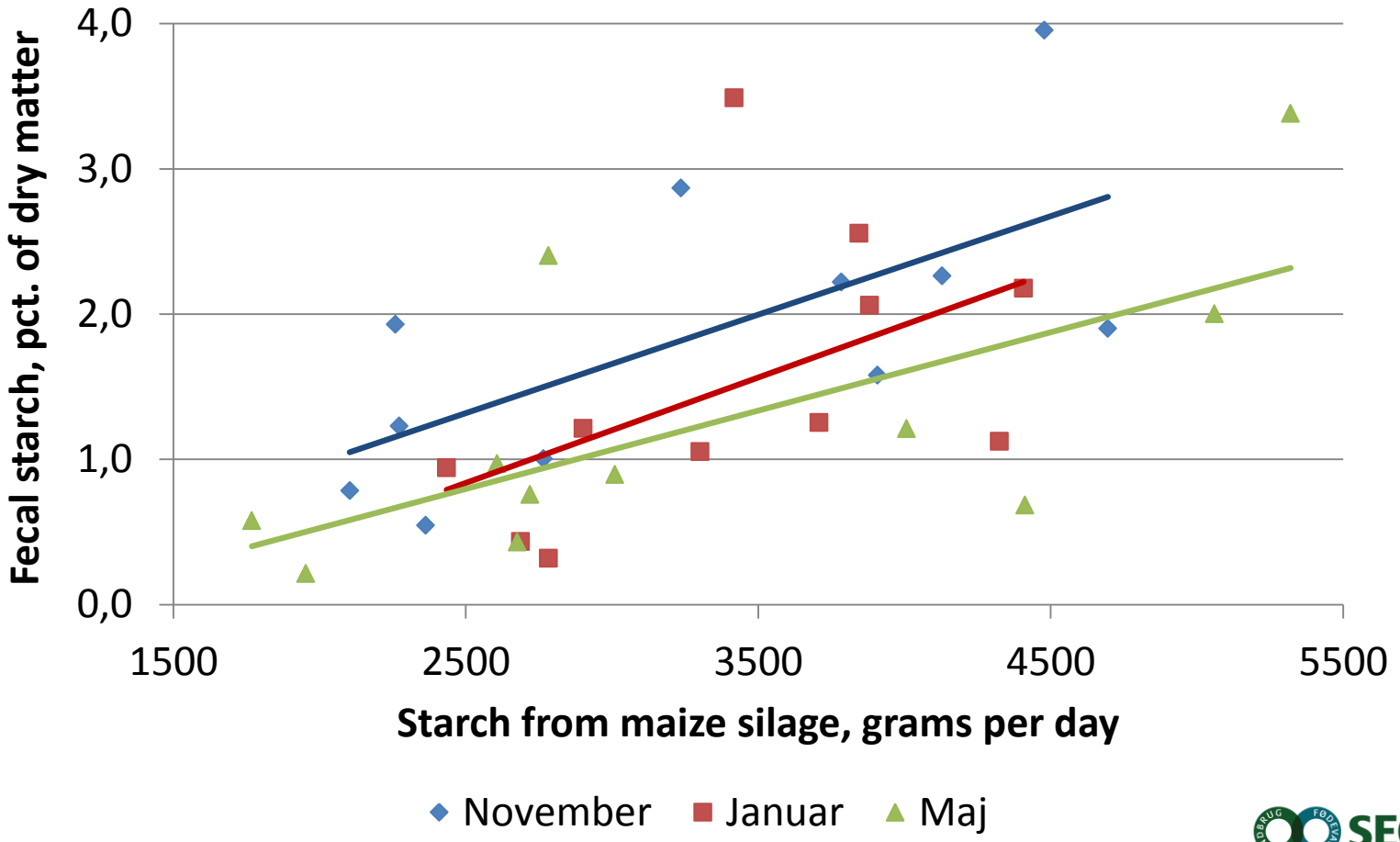
INCREASING LEVEL OF FECAL STARCH BY AMOUNT OF STARCH FROM MAIZE SILAGE



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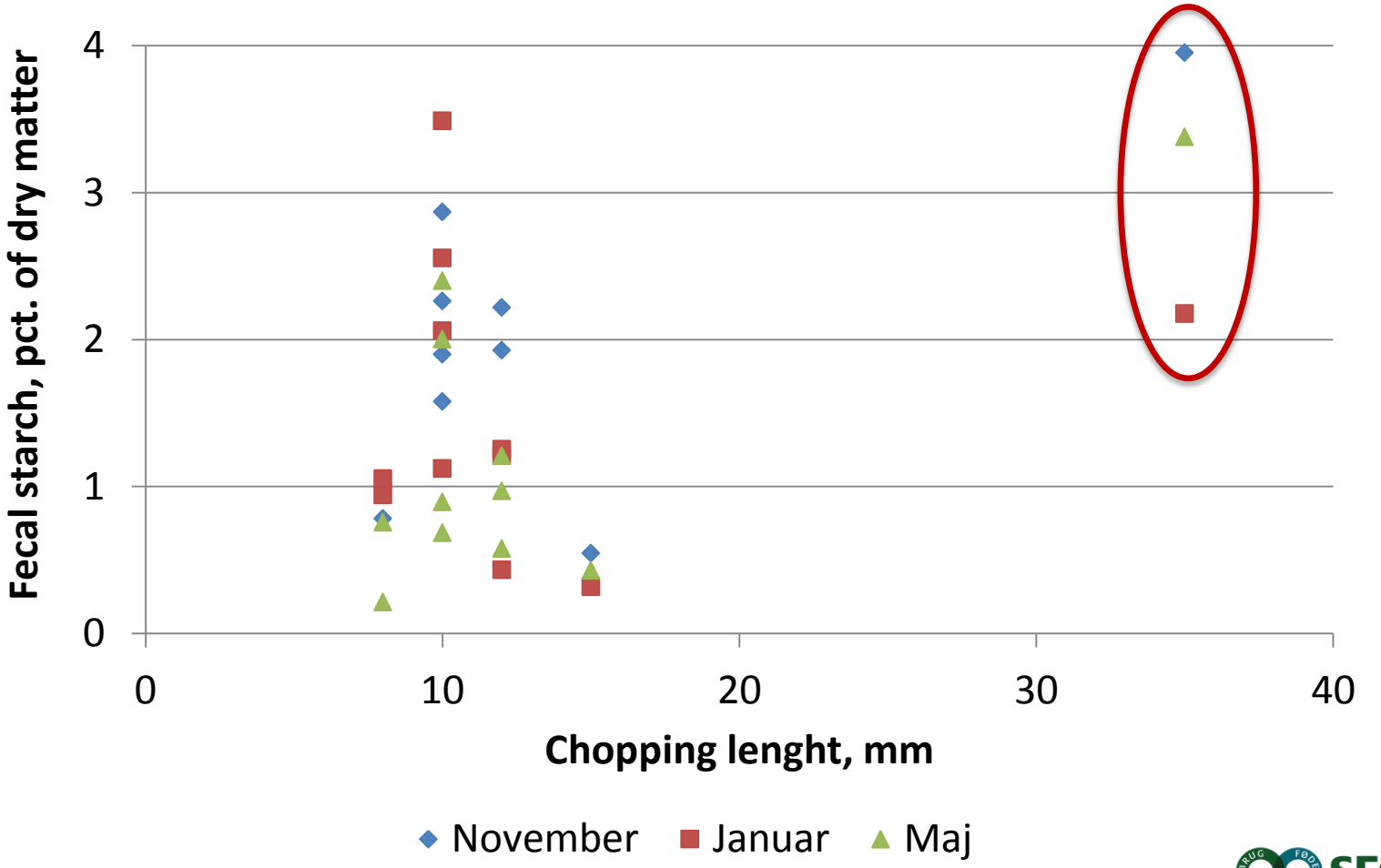
FECAL STARCH IN RELATION TO THEORETICAL CHOPPING LENGTH



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NDF DIGESTIBILITY OF SILAGE MAIZE HYBRIDS IN UK FROM THE 1990S WERE LOWER THAN OF HYBRIDS FROM 1970S AND 1980S

		Older hybrids 1970s & 1980s	Newer hybrids 1990s
Dry matter	g/kg	257	300
NDF	g/kg DM	488	463
Starch	g/kg DM	199	268
Organic matter digestibility	% of DM	66,0	67,6
NDF digestibility	**% of NDF**	**63,7**	**50,8**

Conclusion: Plant breeding objectives should include cell wall digestibility in the rumen

Givens & Deaville (2001)

EFFECTS OF DIGESTIBILITY OF NDF ON DRY MATTER INTAKE AND MILK YIELD

NDF digestibility	54,5	62,9
pH in the rumen	6,36	6,33
Dry matter intake, kg/d	21,8	23,2
Milk, kg/d	29,9	31,8
4% FCM, kg/d	26,8	28,9
Milk fat, %	3,35	3,43
Milk protein, %	2,90	2,93
BW, kg/d	0,14	0,37

13 sets of forage comparisons reported in the literature

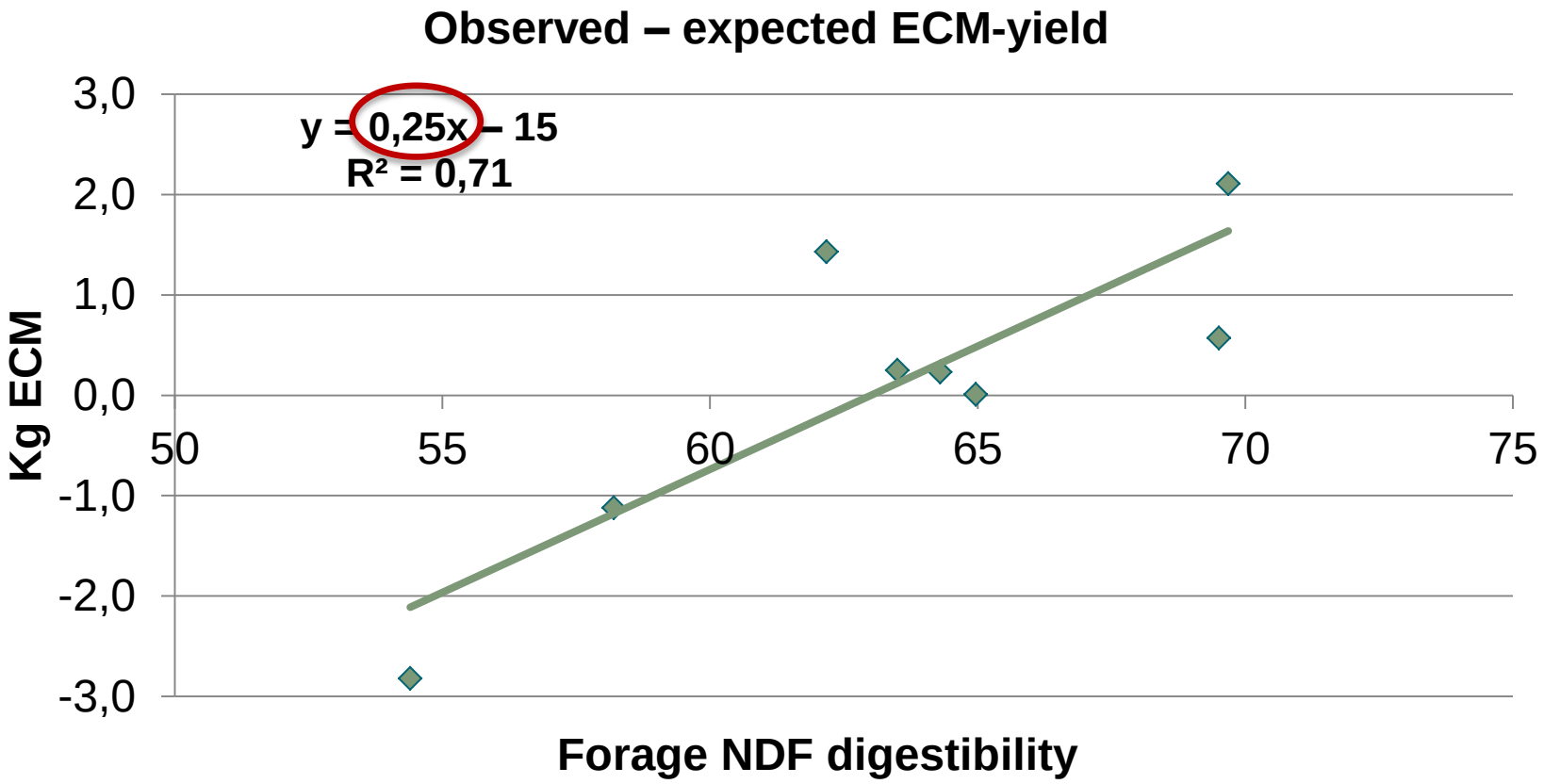
Oba & Allen, 1999

EFFECTS OF NDF DIGESTIBILITY

- One-unit increase in NDF digestibility:
  - => +0,17 kg dry matter intake per cow per day
  - => +0,25 kg 4% fat corrected milk per cow per day
  - No significant effect of forage proportion
  - No significant effect af total NDF i forage

Oba & Allen, 1999, JDS 82:589-596

EFFECT OF FORAGE NDF DIGESTIBILITY IN A DANISH TRIAL WITH MAIZE AND GRASS SILAGE



Lehmann et al. (2010)

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EFFECT OF NDF DIGESTIBILITY ON MILK YIELD AND LWG IN VARIOUS LITERATURE STUDIES

	Oba & Allen (1999)	Oba & Allen (2005)	Weisbjerg et al. (2014)
Articles	28	9	19
Treatments	104	24	93
Forage types	Several	Maize & sorghum	Maize
Dry matter intake, kg/d	+0,17	+0,12	+0,02
FCM/ECM, kg/NDFD unit	+0,25	+0,21	+0,07
Live weight gain, kg/NDFD unit	-	-	+0,012

EFFECT OF MAIZE SILAGE HYBRIDS ON LACTATION PERFORMANCE

	CONS	BMR	HFD	LFY	P-value
Number of treatments	53	39	9	12	
Dry matter intake, kg/d	24,0^{b}	24,9^{a}	24,6^{a}	23,7^{b}	0,001
Milk, kg/d	37,2^{c}	38,7^{a}	38,2^{ab}	37,3^{bc}	0,001
Milk fat, %	3,63^{a}	3,52^{b}	3,63^{ab}	3,67^{a}	0,01
Milk fat, kg/d	1,34	1,36	1,37	1,37	0,30
Milk protein, %	3,06	3,07	3,09	3,06	0,42
Milk protein, kg/d	1,13^{c}	1,18^{a}	1,17^{ab}	1,13^{bc}	0,001

Hybrids selected for high fiber digestibility (BMR and HFD) increased milk and protein yield due to higher dry matter intake

Ferraretto & Shaver (2015), J. Dairy Sci. 98, 2662-2675

DETERMINATION OF NDF DIGESTIBILITY IN DANISH TESTS OF MAIZE SILAGE HYBRIDS

- Analysis of organic matter digestibility by EFOS (in vitro Enzyme Digestible Organic Matter)
- Calculation of NDF digestibility in NorFor for a standard dairy cow (20 kg dry matter intake)

MAIZE HYBRID SELECTION IN DENMARK IS BASED ON ECONOMIC EVALUATION

The most important quality parameters of whole crop maize:

- Net energy yield (NEL20/hectare)
- Net energy value (NEL20 MJ/kg DM)
- Digestibility of NDF
  - One-unit of NDF digestibility => + 0,25 kg ECM/day

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EXAMPLE OF ECONOMIC EVALUATION OF MAIZE SILAGE HYBRIDS

Hybrids	NEL20 MJ/kg DM	NDF digestibility	NEL/hec. Relative	Kg DM/d	Maize area, hec./cow
Mixture	6,03	58,5	100	9,9	0,294
Atrium	6,15	60,6	102,5	10,4	0,306
Alfastar	6,08	59,1	105,5	10,2	0,288

Hybrids	Production costs	Protein costs	Grain costs	Value of NDF digestibility	Total profit
	Difference to Mixture, DKK per cow per year				
Atrium	-112	22	257	214	**382**
Alfastar	62	20	133	64	**280**

Positive figure means an increased earning or saved cost
Negative figure means an increased cost or lost earning

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HIGHER NDF DIGESTIBILITY OF MAIZE SILAGE IN DENMARK THAN IN GERMANY AND THE NETHERLANDS (2013 HARVEST)

		The Netherlands	Germany	Denmark
Dry matter*	g/kg	315	314	313
Ash	g/kg DM	37	36	32
Org. matter digestibility	% af OM	76,3	76,0	77,6
Crude protein	g/kg DM	72	73	77
NDF	g/kg DM	379	387	387
NDF digestibility	% of NDF	53,7	53,6	57,8
Starch	g/kg DM	344	330	324
Sugar	g/kg DM	14	13	14

* Results for samples with comparable dry matter content

Abbink et al., 2014 (BLGG AgroXpertus)

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