Maize/Bean Mixture Cropping

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Maize Growers Conference

Reading University

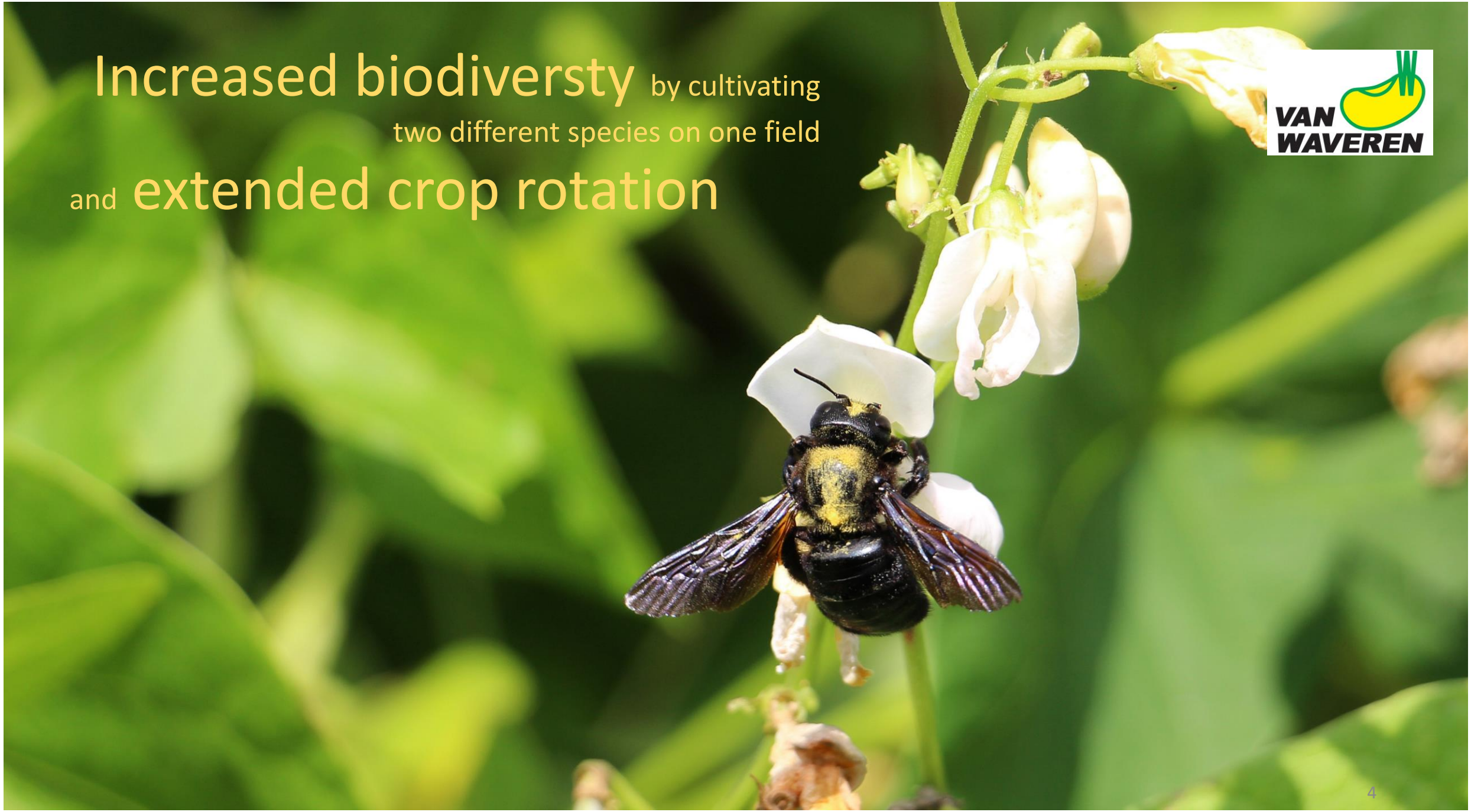
8th February 2023

Overview

- What is maize/bean mixture cropping?
- Good to know for cultivating the maize/bean mixture cropping
  - Sowing date/depth/density
  - Germination rate
  - Weed control
  - Optimum harvest
  - Silage procedure and quality
  - Feeding aspects
- Outlook

Maize/bean mixture cropping

- One of the oldest production systems worldwide: Cropping MAIZE, BEANS and pumpkin together, known as the „three sisters“
- MAIZE was once isolated from the system and now, the two big sisters in terms of height are brought together again
- MAIZE benefits from beans as beans fix nitrogen
- BEANS use maize as a climbing pole


Increased biodiversty by cultivating
two different species on one field
and extended crop rotation
VAN WAVEREN

Reduced N-demand

pure maize vs. **mixture cropping**

under low input conditions


Natural weed control and decreased soil erosion through ground cover of the climbing beans
and the mixture of roots from maize and beans improves the soil fertility and tilth

Increased protein content through climbing beans rich in protein


Support of
bees,
bumble bees
and
other insects
VAN
WAVEREN

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Good to know – Sowing:

DATE

- frost free period
- in GER around 15th of May after „Ice Saints“
- Soil temperature should be 12°C

DEPTH

- depending on spring drought stress
- Bird feed up to 6 cm possible
- 2 cm usually, compromise is 4 cm

DENSITY

- 8 maize/ 4 bean plants

Good to know – Sowing:

DENSITY

- 8 maize/ 4 bean plants
- Beans produce biomass of about 200 dt/ha at the end of the season
- density vs. germination rate
  - Germination rate not 100 % thus, 5 beans should be used to be sure to have 4 plants/sqm.
  - by having the same amount of maize plants as it is demonstrated in exact trials

Good to know – Germination

Effects on the germination rate

- Cold and wet period after sowing - beans too long in the soil - start to mold
- Dumping height less responsible at farms when mixing seeds
- Germination rate vs. field emergence

Seedlings die because of

…waterlogging

…(chemical) weed control?



Good to know – weed control

Breeding station, Rosdorf
Sowing date 11/12th of May 2022
Very dry sowing conditions
Spectrum Plus 5 days after sowing

Good to know – weed control

Product	Company	Active agents	Climbing beans
Dual Gold	Syngenta	S-metoachlor	
Claymore*	BASF	Pendimethalin	(x)
Basagran SG	BASF	Bentazone	
Lentragran WP	Crop protion Limited	Pyridate	
Stomp Aqua	BASF	Pendimethalin	x
Spectrum	BASF	Dimethenamid-P	x
Spectrum Plus	BASF	Pendimethalin + Dimethenamid-P	x

*allowed in UK for climbing beans?

Good to know – harvest

- Optimal harvest point depends on maize maturity
- 2 considerations:
  - Choose earlier maize because of later sowing date and shorter season
  - Choose earlier maize as beans make the chopped material wet and to avoid silage effluent

Chopped material of maize mono-cropping

Chopped material from maize/beans

Good to know – silage procedure

Quality of silage after 90 days, n = 3

Feed	pH-Value	Lactic acid	Acetic acid	ASTA59*
Maize/bean silage	3,7	62,7	13,2	82
Maize silage	3,6	76,2	14,8	57

*Test of stability

Jilg et al. (2020). https://www.lksh.de/fileadmin/PDF_Downloadcenter/Bauernblatt/2020/BB_17_25.04/34-37_Jilg_Kopie.pdf

Good to know – silage quality

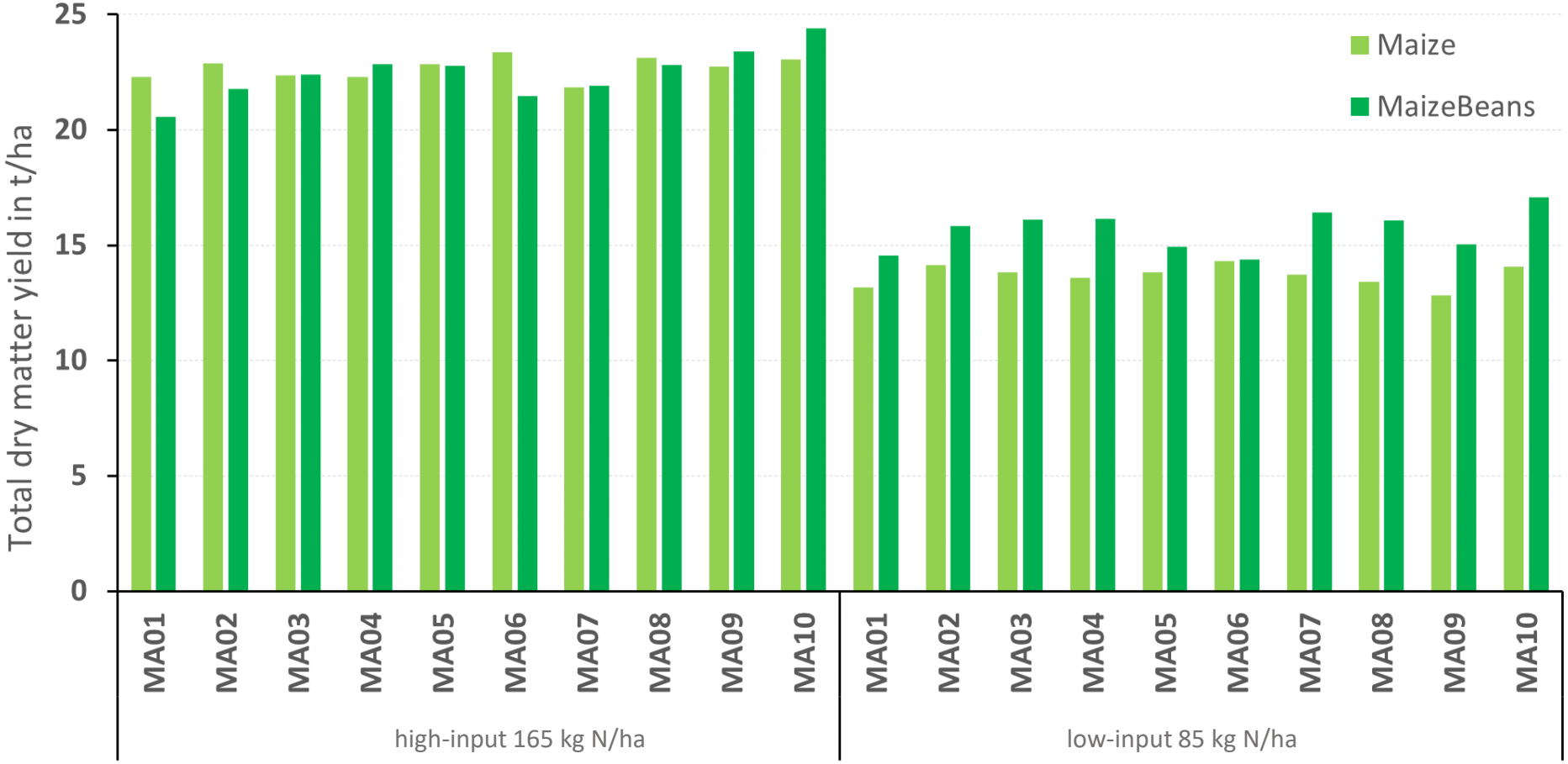
Nutrient content of feed

Feed	XP (g/kg)	Ca (g/kg DM)	NEL (MJ/kg TM)	nXP (g/kg TM)
Maize silage	72	2	7,2	138
Maize/bean silage	81	3,5	7	139

Jilg et al. (2020). https://www.lksh.de/fileadmin/PDF_Downloadcenter/Bauernblatt/2020/BB_17_25.04/34-37_Jilg_Kopie.pdf

Good to know – silage quality

10 maize genotypes with 1 bean variety



Leiser et al. 2022

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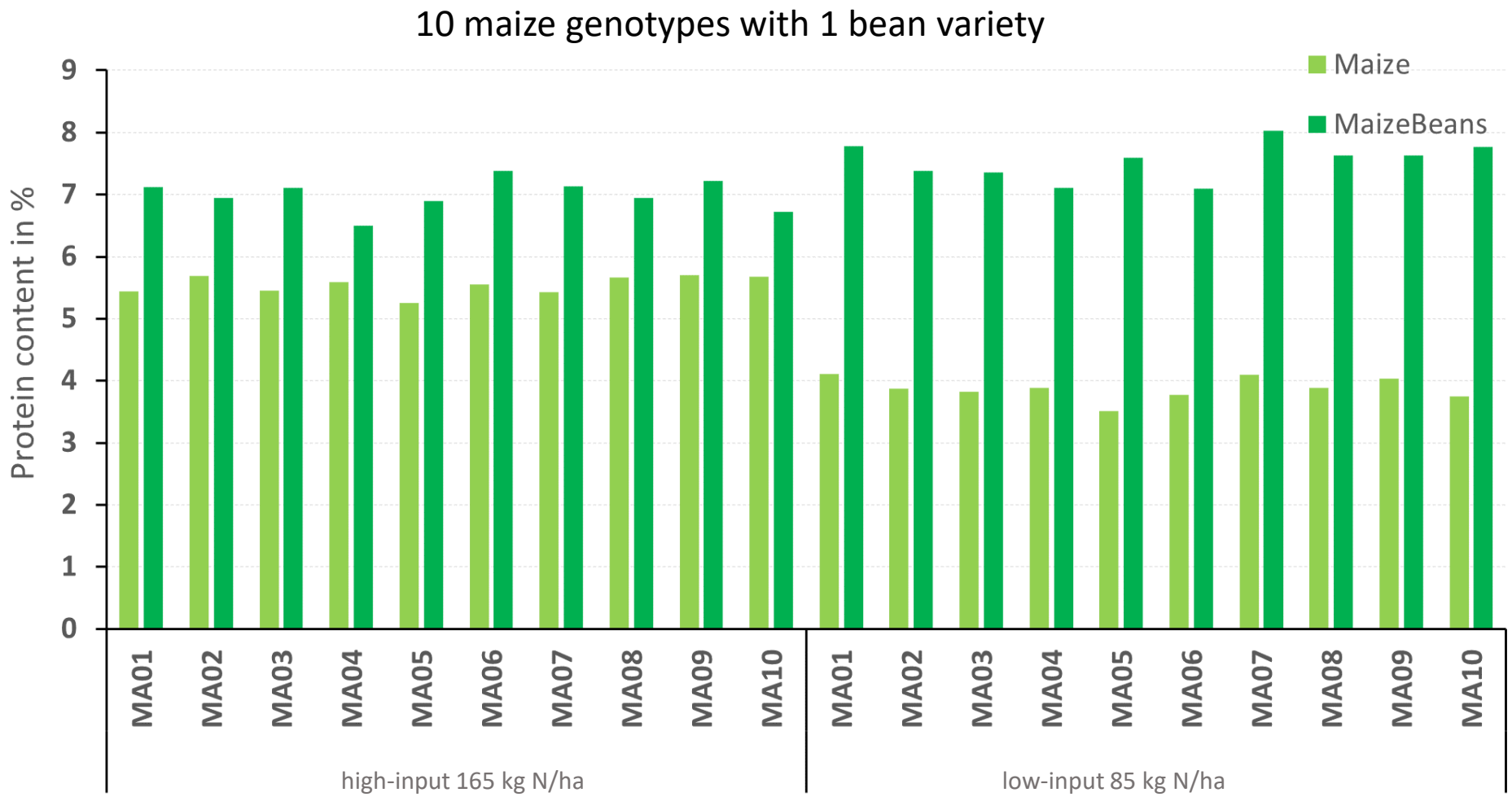

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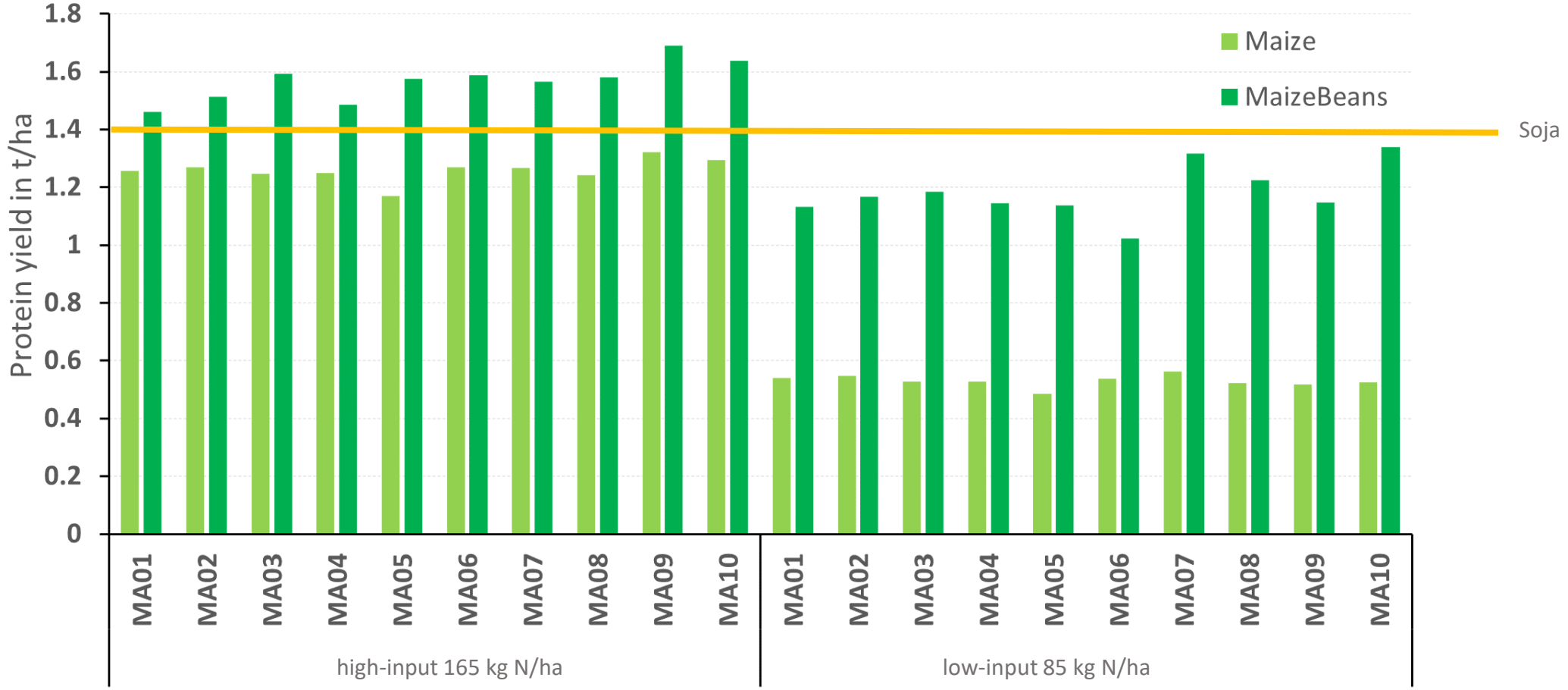

Leiser et al. 2022

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Outlook

nitrogen fixation rate
between
20 and 40 kgN/ha

varietal differences?

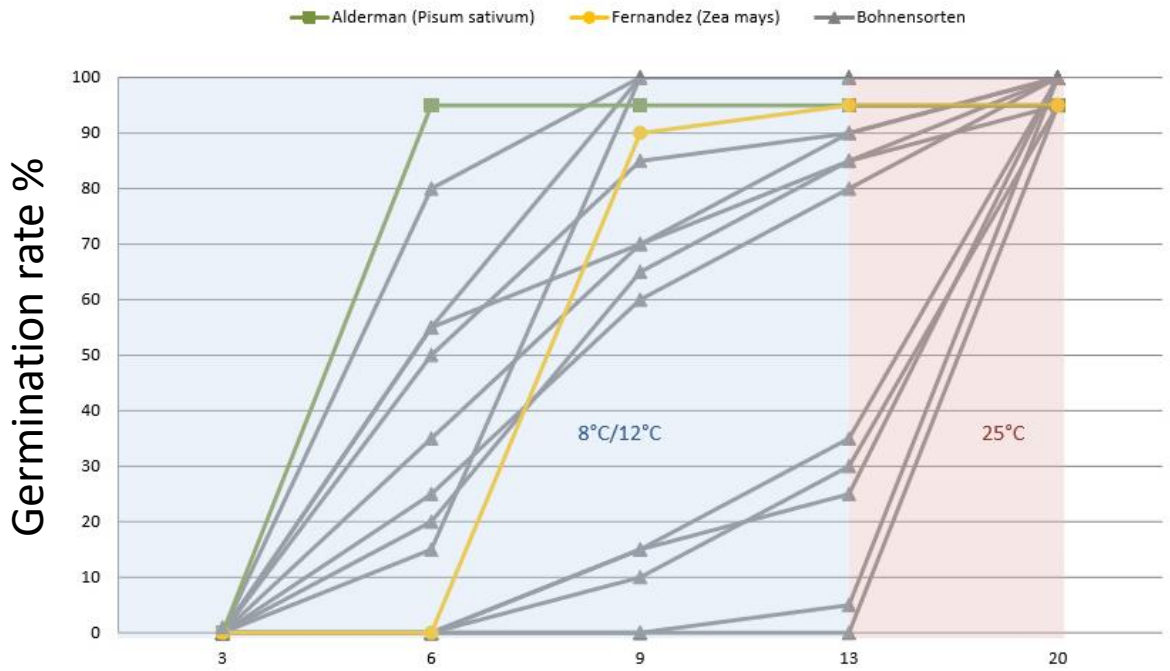
Outlook – mineral feed

Nutrient content of feed

Feed	XP (g/kg)	**Ca** (g/kg DM)	NEL (MJ/kg TM)	nXP (g/kg TM)
Maize silage	72	2	7,2	138
Maize/bean silage	81	**3,5**	7	139

Outlook – frost tolerant genotypes

Germination of 207 bean genotypes under sub-optimal temperature (8°C/12°C day/night)



example of Matthias Starke

Outlook – early mature types

Landwirtschafts-kammer Schleswig-Holstein

						mais /Parz.	Pfl/Parz. insg.	Grün-masse dt/ha (abs)	TS Ges. pflanze %	TS Ges. pflanze % (rel)	Gesamt-TM dt/ha (abs)	Gesamt-TM dt/ha (rel)	Freie Bonitur *	Wüchsig-keit der Bohne **
						80		**441**	**25,6**	**25,6**	**112,8**	**112,8**		
						78	78	422	26,0	102	110,0	97		
						90	90	413	25,2	98	104,1	92		
						80	80	441	25,6	100	112,8	100		
						90	90	443	26,5	104	117,4	104		
						55	64	344	25,1	98	86,4	77	2	
						66	78	380	25,6	100	97,8	87	2	
						55	69	379	25,8	101	97,8	87	2	
							76	402	26,9	105	108,1	96	2	
						53		377	25,7	100	97,1	86	2	5
						62	89		25,8	101	101,6	90	3	6
						52	72	371		97	91,7	81	2	6
						62	89	389	25,3	99	98,3	87	3	4
						63	81	379	27,1	106		91	2	2
						62	87	409	25,2	98	103,0	91	3	5
						60	85	389	25,3	99	98,5	87	2	5
						62	88	375	25,2	99	94,8	84	3	5
+ Stangenbohne6, 11 Pfl/m², VA/NA	2	195	3	25		61	86	403	24,3	95	97,7	87	3	7
+ Stangenbohne7, 11 Pfl/m², VA/NA	3	198	3	23		58	82	404	24,9	97	100,6	89	3	6
+ Stangenbohne8, 11 Pfl/m², VA/NA	2	203	3	27		60	87	409	25,4	99	103,6	92	2	7
+ Stangenbohne9, 11 Pfl/m², VA/NA	3	198	3	22		63	86	420	25,5	99	106,6	95	3	5
+ Stangenbohne1+9, 11 Pfl/m², VA/NA	2	187	4	24		60	84	393	25,2	98	99,0	88	2	5
11 Pfl/m², VA/NA	2	247	2			91	91	449	31,1	121	139,9	124		
+ Stangenbohne1, 11 Pfl/m²,VA/NA	2	238	2	23		66	89	405	30,3	118	122,5	109	2	5
+ Stangenbohne1+9, 11 Pfl/m², VA/NA	2	240	2	20		62	82	391	30,3	118	118,5	105	3	5
									1,3	**5**	**12,9**	**11**		

Thank you!

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